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NATIONAL SECURITY AGENCY

MILITARY CRYPTANALYTICS

Part II

INTERIM EDITION
(Third Section)

By
LAMBROS D. CALLIMAHOS
and
WILLIAM F. FRIEDMAN

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Office of Training Services
National Security Agency
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APPENDIX 4

APPLICATIONS OF ELECTRICAL
TABULATING EQUIPMENT IN CRYPTANALYSIS

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**APPLICATIONS OF ELECTRICAL
TABULATING EQUIPMENT IN CRYPTANALYSIS**

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1. Introduction. Electrical tabulating machines are widely used in commerce and industry to reduce the labor involved in processing or analyzing a large volume of data, or in performing a large number of manipulations or tests on a limited amount of data, or both. The fundamental idea inherent in tabulating equipment such as that developed by the International Business Machines Corporation is the recording of data in the form of holes punched in a card; the holes are used to establish timed electrical circuits which control the functions of the various machines through which the cards are fed. The cards are stacked in a hopper of an IBM machine and made to pass between a set of wire brushes and a brass roller; the presence of a hole in a column of the card permits the brush pertaining to that column to make contact with the roller, thus completing a circuit and operating an electromagnet. This closing of an electrical circuit at a definite time during the passage of a card through a machine and from a fixed position on the card is the basis upon which the various electrical tabulating machines function. The great flexibility of treatment afforded by the IBM system lies in the ability to arrange and rearrange the basic data in a form convenient for study, or to associate the basic data with other units of information on the same or different cards for the purpose of printing the data, comparing items, accumulating totals, etc.

2. The IBM card. The cards used in the IBM system are 3 1/4" x 7 3/8" and are made of specially prepared paper stock, strong in wearing quality and free from foreign particles which might act as conductors of electricity; moreover, the edges have been impregnated with a hardening composition which retards fraying of the edges under use, and thus makes for longer life of the card. Each card has 80 numbered columns in each of which may be punched a single item of alphabetical or numerical information in either plain or coded¹ form. The columns contain 12 punching levels or positions; of these, 10 are indicated by the printed digits 0 to 9 in the horizontal lines on the card.

¹ By "coding" in this connection is meant a conventional representation of data that may readily be adapted to IBM techniques. For example, the numbers 01 to 48 in a specified pair of columns could be used to represent the 48 States; or the letters "M", "P", "C", or "T" in a particular column might stand for "monoalphabetic", "polyalphabetic", "code", and "transposition", respectively.

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The 11th and 12th punching positions, commonly referred to as the "x" and "y" punches, respectively, are at the top of the card and are not indicated by printed numerals. A hole in one of the levels from 0 to 9 results in the recording of that particular numerical datum, whereas a hole in an "x", "y", or 0 punch (called "zone punches") in conjunction with a numerical punch in the same column results in the coding of one of the 26 letters of the alphabet. The "x" and "y" punches by themselves have control functions in certain machine operations; furthermore, these punches are also used for the coding of special characters on the Tabulator such as a comma, an asterisk, or other symbols. In Fig. 1, below, is illustrated an IBM card,² slightly reduced, with alphabetical and numerical data punched in specific groups of columns

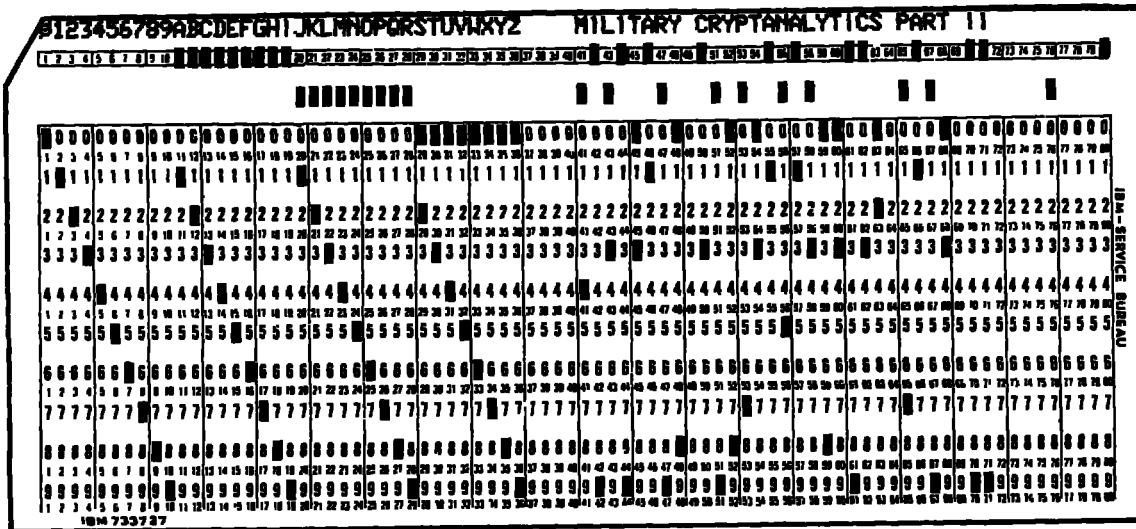


Figure 1.

designated as "fields."³ Often it is convenient to use cards specially printed with vertical lines to indicate the fields; in addition, the designation of the field may be printed on the card. Each field defines a section of the card in which one particular type of information will always appear, and it is assigned a sufficient number of columns to include the largest number of alphabetical or numerical units which it will be called upon to accommodate.

3. Functions of the punched card. The IBM system, employing a number of different machines taken collectively to constitute a working unit, makes possible multiple uses of a record in the form of a punched hole or a set of holes in the IBM card. A symbol punched in a card can be processed through many operations successively, since the functions of the various machines are rearranged for those operations through proper wiring of their control panels. Specifically, a single punched hole in a card may cause one or more of such operations as the following:

² The printing at the top of the columns was performed simultaneously with the punching by a particular type of a card punch equipped with this capability; in normal practice, punched cards do not contain such printing. The student may find it instructive to cover the printing above cols. 41-71 and read the information with the help of the IBM coding shown in cols. 1-40.

³ Note in this case the field comprised by cols. 1-40, and that comprised by cols. 41-75; also note the "x" punch in col. 76, and the "y" punch in col. 80.

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- a. It may add the data represented by it to some other data;
- b. It may subtract the data represented by it from some other data;
- c. It may multiply the data represented by it by some other data;
- d. It may divide the data represented by it into some other data;
- e. It may cause the data represented to be listed (i.e., printed);
- f. It may cause the data represented to be suppressed;
- g. It may reproduce the data represented into a different field of the same card, or on a different card;
- h. It may cause the data represented to be classified, or to be sorted;
- i. It may cause the data represented to be selected;
- j. It may cause the data represented to be printed on the IBM card;
- k. It may cause the data represented to produce an automatic balance forward;
- l. It may cause the data represented to be filed properly among other data;
- m. It may cause a paper form to feed to a predetermined position or to be ejected automatically, or to space from one position to another; or
- n. It may cause a total to be printed at the end of a group or class of data.

4. The machines in the IBM system.--a. The principal machines which constitute the IBM system are the following:

- (1) The Card Punch, with which the cards are punched with the information to be recorded;
- (2) The Verifier, which verifies the accuracy of the previously punched cards through an operation similar to key punching;
- (3) The Sorter, which sorts the cards in any groupings or classes desired (referred to as "major", "intermediate", and "minor" sorts);
- (4) The Reproducer, which reproduces extra copies of a deck of cards, with a rearrangement or selection of the punched data as desired;
- (5) The Collator, which performs various operations of merging, filing, matching, and selection of cards, and which may also be used to check the sequence of a sorted deck of cards;

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- (6) The Calculating Punch, which performs operations of multiplication and division, and punches the result directly on the card from which it senses the data, or on a designated following card;
- (7) The Interpreter, which prints recorded data directly on the card from which it "reads" the information, as an aid in certain manual filing operations; and
- (8) The Tabulator (also called the Printer), which performs accounting operations of various classes of totals, and lists the data on continuous forms known as "IBM runs" or "IBM listings."

b. In addition to the foregoing standard machines there are special machines for specific purposes, e.g., a card-operated electric typewriter, machines for converting the punched holes of IBM cards into teleprinter tape punched with the coding of the Baudot code or vice versa (for use in certain semi-automatic procedures), etc. Moreover, each of the standard machines has available a number of extra devices which may be incorporated for specialized operations, according to the needs of the problems at hand.

5. General cryptologic applications of the IBM system.--a. Since electrical tabulating equipment is primarily designed as data processing machinery, we may use IBM machines in cryptanalysis to facilitate and expedite the examination of a large amount of traffic, in order to isolate homogeneous cryptosystems, or to prepare a group of homogeneous messages in many ways suitable for studying the patent or latent phenomena in the traffic and thus assist us in arriving at some conclusions regarding its cryptographic aspects, etc. All the manual work incidental to the solution of a cryptosystem could be performed by machine methods, but it must be emphasized that by no means can we assume that the era of clerical work is a thing of the past. Feasibility, practicability, and efficiency are the points which will determine what part of the work, or whether all of it, or none of it, should be done by machine techniques, and it is the IBM crypto-technician (i.e., an IBM expert with a broad background in cryptology) who is best qualified to advise in this respect. Although many phases of analysis are possible with machines, sometimes a judicious proportion of machine work plus manual clerical labor will permit the solution of a particular problem in the least possible time--certainly an important consideration in practical operational cryptanalysis.

b. The preliminary groundwork that was necessary in the cryptanalysis of the various types of cryptosystems covered in Military Cryptanalytics, Parts I and II, may be done by machine methods. For example, we can find all repetitions within a message or among a set of messages and indicate by an asterisk those polygraphic repetitions which exceed a prescribed length; we can prepare message prints or work sheets arranged in proper groupings of characters (e.g., by period-lengths in the case of repeating-key ciphers, by digraphs in the case of digraphic systems, etc.); we can obtain frequency counts for single letters, digraphs, etc., of the over-all text, or columnar frequency counts of the text considering it to be written

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out on various trial widths; we can search for specified idiomorphs and print only those sequences corresponding to the specified patterns together with their location in the traffic, or we can search for isomorphic sequences and list their location; we can complete the plain-component sequence, both in monoalphabetic and polyalphabetic ciphers, and print the scores only of those generatrices which equal or exceed a certain predetermined threshold on the basis of two-category, arithmetic, or logarithmic weights; we can perform the ϕ test on distributions and print only those results which meet with pre-established minimum standards; we can match distributions on the basis of the χ or other tests; we can, once an additive has been recovered, remove the additive from superenciphered text and convert a message into monoalphabetic terms; and finally, having recovered all the keys to one message or a few messages in a particular cryptosystem, we can decrypt by machine methods the rest of the traffic in that same cryptosystem.

c. In the cryptanalysis of the more complex cryptosystems, there exist many advanced machine methods and techniques, some of which involve the applications of specialized equipments. A discussion of these methods will be reserved for subsequent volumes in this series.

d. IBM techniques are admirably suited to assist in traffic analysis studies. Traffic analysis is so closely affiliated with operational (as distinguished from academic) cryptanalysis that it is sometimes difficult to define where the one leaves off and the other begins--in present-day practice, these two fields of communication intelligence are complementary. In time of war when there is available for study a large volume of traffic emanating from many stations allocated into a plurality of radio nets, the data from intercept logs and other traffic analysis records may be rearranged in various major, intermediate, and minor sorts on elements such as the transmitting and receiving call signs, the file date and time, the group count, the external message numbers, indicator groups (if these be in the clear), priority or secrecy classifications, etc. The use of IBM runs for such studies greatly facilitates the grouping of stations which belong to the same net, selecting traffic that is cryptographically homogeneous, identifying and locating duplicate messages or isologs, finding communication "service" messages⁴ which are so important to the cryptanalyst, identifying proforma messages or messages containing stereotyped reports, etc.

e. In the compilation of codes and ciphers, IBM methods furnish invaluable assistance. Through the use of machine techniques, code books are easily compiled several editions in advance of current needs; random alphabets for strip systems may be generated; and random keys for various cipher systems may be produced with facility and in volume. The use of IBM equipment eliminates the large expenditure of time and labor that is concomitant with the production of cryptosystems by manual methods.

⁴ A service message is a message between communications personnel pertaining to any phase of traffic handling, cryptographic operations, communication facilities, or circuit conditions.

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6. Application in a typical example in cryptanalysis.--a. Let us assume we have available for study the following five messages,⁵ intercepted on the same day on a low-echelon ground net:

Message No. 1

RNZ DE LBF 5980KCS 180730Z

NRFWH	FNDWU	RMBNO	KBFMJ	WGHWM	WEZLV	UDOLN	FJPGK	DLASW	HHHZN
INUFP	EQWVB	RSEMQ	HKEWN	UQKIH	ZHBHD	NVREE	ESZEN	WRHEZ	TIDTX

Message No. 2

UZK DE RNZ 5980KCS 180855Z

OWYUW	ZNDQI	AHIWB	RRSJK	IGHXN	LCNFL	THINJ	FJRZT	WUZSF	OJWVE
TQBAP	TGNEJ	KQADP	GZBLI	LXMQX	EJHOK	BPTRJ	GDYIS	NRLKQ	RLRRU
RZIEPB	IVCMC	ENEAX	MIZQL	KDRAS	WTNGK	BNNUZ	JXCJQ	WIBGQ	EZPTZ
IOMPE	HNEJK	QRXKF	ENBQD	XZFPV	HLQDT	YAVRE	ZAPQF	FOJJQ	KWCMK
EZHBB	DNVR								

Message No. 3

ZVH DE UZK 5980KCS 180920Z

MSHZH	LASWH	FGPEB	ABJEX	JKMLP	MCIRE	NWPJI	RLMXY	WBESC	SACJA
TLFXV	FGZUJ	YMLJX	CJYWK	MCHAF	BPZAH	QNWJE	WRBIQ	XJQVD	LLRQU
WJKKN	KBGAE	JUDEL	WCMYG	QDRA					

Message No. 4

RNZ DE VGM 5980KCS 181000Z

KCEWN	UNDRS	JZYHF	MSFLC	BNHBE	BKJWG	KDIRH	QVNVQ	PQIMQ	IASJB
LLLOT	NWZKB	YQRJJ	QVDDI	YTLFM	ECWKS	XJPGK	ZZFMJ	IKEEE	SALTJ
ZDIPL	RLMUC	WLJZW	DTPFH	JJFWQ	JGCCB	EBRIQ	ZAFUH	LWFGT	ALJUT
ZRCSR	EJQXM	WRIAG	UGFYQ	BJIGN	DLLFC	H			

Message No. 5

RNZ DE LBF 5980KCS 181145Z

DQEW	UKBFM	JWGHV	MNQSJ	CEBER	DTEQV	SPBIA	ADQC	JLKQP	TWZU
LGIFO	NLXHX	XPBPE	ZEBWX	BAMRH	YQZLS	XMQXZ	ULSPQ	XMGKP	ZHSBD
RDHXX	RIQZN	JMLLL	INODL	KQ					

⁵ In actual practice, it would hardly be worth while to process five short messages by machine methods. It will be understood that this exposition applies to a larger volume of traffic.

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The first thing to be determined is whether or not the messages are cryptographically homogeneous, i.e., in the same general system and specific keys. In the absence of indicators from which conclusions could be drawn, we must search for repetitions between messages, as well as for repetitions within individual messages; this is accomplished by preparing an IBM index, to be described below.

b. We will begin by punching each message on cards. The intercept data (and preamble information, if any), together with a sequential number (often called the "worksheet number") assigned to each message, are punched on a single card known as a "heading card."⁶ The message text⁷ is punched on "line cards" containing a predetermined maximum number of text characters per card; in this case, the line cards will contain 25 letters, except for possibly the last line card. (In addition to the message text, line cards will contain a reference line-letter or number, as well as the message number to which the line cards pertain.⁸) Thus, in recording the data from the five messages, we will have a total of 5 heading cards and 31 line cards; these cards are then checked for accuracy of punching on the Verifier.

c. Next, by means of a process known as "offset gangpunching" involving the use of the Collator and the Reproducer, the 31 line cards are expanded into a deck of 736 cards, representing one card for each letter of the five messages. For instance, cols. 21-45 of the first line card of Message No. 1 contain the first 25 letters of the cipher text, viz.,

NRPFHFDWURMBNCKBFAJWGHNM

while in the following "detail card" generated from the foregoing line card (including picking up the 26th letter of the cipher text from the second line card), we shall have⁹

RPFHFDWURMBNCKBFAJWGHNM

in cols. 21-45. The next detail card after that, picking up two cipher letters from the second line card, will contain the following letters in cols. 21-45:

FHFHFDWURMBNCKBFAJWGHMNE

⁶ These heading cards are used for traffic analysis studies. It is customary to mark heading cards with an "x" punch in a specified column, in order to distinguish them from line cards in various machine processing operations.

⁷ Indicators, if any, might be punched on the heading card; in any case, indicator groups would be deleted in the subsequent indexing procedure.

⁸ Information common to several line cards is punched automatically in the line cards from a prepunched master card inserted in the "duplicating rack" of the Card Punch.

⁹ Note how each letter is offset one position to the left.

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Thus for the 100 ciphertext letters of Message No. 1 we shall have generated 100 cards, each letter of the message appearing in col. 21 of a particular card. In addition to the letters of the cipher text, each card will contain further data as to the message number, and also the position in the message occupied by the letter appearing in col. 21 of the card.¹⁰ There are further processing symbols incorporated into the cards, as an aid to subsequent machine treatment.

d. Using the Sorter, the 736 offset cards from the five messages are now put into alphabetical order according to tetragraphs. This operation takes four alphabetic sorts¹¹ on four consecutive columns going from right to left, as for example cols. 24-23-22-21. In other words, a "minor" sort is done on col. 24, "intermediate" sorts on cols. 23 and 22, and a "major" sort on col. 21. When this is finished, the sorted deck is put into the hopper of the Tabulator, the control panel of which has been properly wired for this particular processing operation. The listing which results is known as an "IBM single-position index", or, more simply, an "IBM index"; the first page of this index is illustrated in Fig. 2. Every letter of the five messages appears as the first letter (called the "control letter") of the trigraphs in the column labeled "d"; the message number and the position of the control letter in the message are found in the columns labeled "a" and "b", respectively. The 7 letters which precede the control letter are listed in the column labeled "c", while the 15 letters which follow the control trigraph are listed in the column labeled "e". In order to facilitate examination of the IBM run, the control letter and the two following letters are here separated as an independent trigraph from the line of 25 letters; this, however, is an arbitrary convention in this particular case, since any spacing could be used as desired in the listing, the spacing not being in any way dependent upon the arrangement of the punched data on the card.¹² The digraphic and trigraphic frequencies ("intermediate totals" and "minor totals", respectively) are here printed at the right on the listing, in columns "f" and "g", respectively, whereas the uniliteral frequencies ("major totals") are recorded at the end of each grouping of A's, B's, etc., of the control letter.¹³ For example, it will be seen in the run that there are 25 A's in the five messages; there are five cases of digraphic repetition in the "A" block with two occurrences each, as well as one case in which a digraph (\overline{AS}_c) occurs four times; and there are three occurrences of the trigraph ASW_c . An asterisk (*) in the column labeled "h" is here employed to indicate a tetragraphic or longer repetition, as may be seen in the case of the sequence $ASWH_c$.

¹⁰ The message number from the line cards is gangpunched in all the detail cards; the position number is punched in the cards by an automatic numbering device in the Reproducer.

¹¹ In sorting alphabetical information, it is necessary to sort each column twice, once for the numerical punch and once for the zone punch; in numerical sorting a single sort per column suffices. Thus a tetragraphic sort on literal text requires 8 successive sorting operations.

¹² It will be recalled that the cipher letters are punched in a solid block of 25 columns; the spacing desired is accomplished through proper wiring of the Tabulator control panel. It is of course also possible to rearrange the data punched on the cards in various ways in the listing; this again is dependent upon the wiring of the control panel.

¹³ The kinds of totals, as well as the particular location in the printed listing of these totals, are governed by the wiring of the Tabulator control panel.

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(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
03	124	CMTGQDR	A				
03	045	BOVSPBT	AAD	QOCJLKQPTNWZULG			
03	019	WHFGPEB	ABJ	SXJKMLPMCIRENWP			
03	047	YWBESCS	ACJ	ATLFXYFGZUJYMNJ			
02	063	TGNHJKQ	ADF	GZBLLXXMQXEJHOK			
05	036	QVSPBIA	ADQ	OCJLKQPTNWZULGI	2		
03	109	JKKNKBG	AEJ	UDLLWCMTGQDRA			
03	074	JYWKMCH	AFB	PZAHQNWJEWRAIQX			
04	137	BEBRIGZ	AFU	HLWFGTALJUTZRCS	2		
04	164	JQXMWRI	AGU	GFYQBJIGNDLLFCH			
02	011	WUZNDQI	AHI	WBRRSJGIGHXNLCN			
03	079	CHAFBPZ	AHQ	NWJEWRAIQXJQVDL	2		
03	088	QNWJEWRA	AIQ	XJQVOLLRQUWJKKN			
04	146	UHLWFGT	ALJ	UTZRCSREJQXMWRI			
04	097	JIKEEES	ALT	JZDIPLRLMUCWIJZ	2		
05	072	EZEHWXB	AMR	HYQZLSXMQXZULSP			
02	187	TYAVREZ	APQ	FFOJJQKWCМКHЗНВ			
02	054	JWVHTQB	APT	GNHJKQADFGZBLL	2		
04	047	QPQIMQI	ASJ	BLLLOTNWZKBYQRJ			
01	043	FJPGKDL	ASW	HHHZNINUFPEQVWB			
03	007	MSHZHL	ASW	HFGPEBABJSXJKML			*
02	124	IZQLKDR	ASW	TNGKEWNUZJXCJQW	4	3	
03	050	ESCSACJ	ATL	FXYFGZUJYMNJXGJ			
02	182	PHLQDTY	AVR	EZAPQFFOJJQKWCМК			
02	114	VCMCENH	AXM	IZQLKDRASWTNGKE			
			25				
03	015	SWHFGPE	BAB	JSXJKMLPMCIRENWP			
05	071	PEZEHWX	BAM	RHYQZLSXMQXZULS			
02	053	OJWVHTQ	BAP	TGNHJKQADFGZBLL	3		
05	099	MGKPZHS	BDR	DHHXRIQZNJMLLLI			
04	024	SFLCBNH	BEB	KJWGKDRHQVNVQP			
04	130	PWQJGCC	BEB	RIQZAFUHLWFGTAL			
05	022	WMNQSJC	BEB	RDTBQVSPBIAADQO		3	*
03	042	IRLMWYW	BES	CSACJATLFXYFGZU	4		
05	008	DQEEWUK	BFM	JWGHWMNQSJCBEBR			
01	017	URMBNOK	BFM	JWGHWMWEZLVUDOI	2	2	*
03	107	UWJKKNK	BGA	EJUDLLWCMTGQDRA			
02	143	JXCJQWI	BGQ	EZPDZIQMPEHNNJK	2		
01	078	UQXKHZH	BHD	NVREEESZBWWRHEZ			
02	204	WCMKHZH	BHD	NVR	2	2	*
05	033	DTBQVSP	BIA	ADQOCJLKQPTNWZU			
02	105	RRURZEP	BIV	CMCENHAXMIZQLKD	2		
04	171	AGUGFYQ	BJI	GNDLLFCH			
03	017	HFGPEBA	BJS	XJKMLPMCIRENWPJ	2		
04	026	LCBNHBE	BKJ	WGKDRHQVNVQPQI			
04	050	IMQIASJ	BLL	LOTNWZKBYQRJJQV			
02	068	KQADFGZ	BLL	LXMQXEJHOKBPTRJ	2	2	*
01	063	EQVWBR	BMQ	HKEWNUQXKHZHBHD			
04	021	HFNSFLC	BNH	BEBKJWGKDRHQVN			
01	013	FNDWURM	BNO	KBFMJWGHWMWEZLV	2		
05	063	NLXHXP	BPE	ZEHXWBAMRHYQZLS			
02	081	QXEJHOK	BPT	RJGDYISNRLKQRLR			
03	076	WKMCHAF	BPZ	AHQNWJEWRAIQXJQ	3		
02	168	QRTKFEN	BQD	XZFPVPHLQDTYAVRE			
05	028	CBEBRDT	BQV	SPBIAADQOCJLKQP	2		
05	024	NQSJCBE	BRD	TBQVSPBIAADQOCJ			
04	132	QJGCCBE	BRI	QZAFUHLWFGTALJU			
02	015	DQIAHIW	BRR	SJGIGHXNLCNFLT			
01	060	UFPEQVW	BRS	BMQHKEWNUQXKHZH	4		
01	089	VREEESZ	BWW	RHEZTTDTX			
04	060	LOTNWZK	BYQ	RJJQVDDIYTLRMEC			

Figure 2.

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e. At this stage the IBM single-position index would be sent to the cryptanalyst, who would study it to see what he could see.¹⁴ He would note that there are many polygraphic repetitions between messages, many more than would be expected by mere chance; this is proof that the traffic is homogeneous, supporting the probability of homogeneity that was implied from traffic analysis information. He would also note that there is a pentagraphic repetition in Message No. 2, at an interval of 99 (obtained from the run by subtracting the numerical position of the first occurrence from that of the second occurrence), suggesting factors of 3, 9, or 11. On examining the intervals of the repetitions between messages, he would find that 9 is a factor common to all the repetitions, proving that the messages are in flush depth¹⁵ and indicating that the cryptosystem is probably a polyalphabetic cipher of 9 alphabets.

f. With the periodicity established as 9, work sheets of the messages are prepared according to this period; this step may be performed by IBM if the number of messages warrants, without the necessity for further manual card punching. The first over-all IBM index has served its purpose, that of aiding the cryptanalyst in locating repetitions and diagnosing the cryptosystem; so now a new index is prepared, to assist in solution of the plain text. This second run (the first page of which is illustrated in Fig. 3) is an index by alphabet prepared by first sorting the cards back into their original sequence in each message, collating these cards cyclically into 9 blocks (each containing all the cards belonging to one particular alphabet), and performing a tetragraphic sort on the blocks;¹⁶ the deck is then listed on the Tabulator, yielding what amounts to an elaborate trilateral frequency distribution showing many prefix and suffix letters of the control trigraph, in addition to the frequencies by alphabet of the single letters, digraphs, and trigraphs. This

¹⁴ It may be pointed out that the cryptanalyst at this time is really not sure of what he expects to see in this first index. The index was ordered as a means of examining the over-all immediate phenomena associated with the uniliteral, digraphic, and trigraphic frequencies, as well as finding all polygraphic repetitions present in the cipher text; i. e., the cryptanalyst hopes by this first index to find evidence of nonrandom characteristics in the cipher text or in its over-all frequencies. In addition to these obvious elements (which constituted the main reason for which the index was ordered), any other characteristics which appear to be nonrandom would be searched for by the cryptanalyst. For example, in a particular case he might note that polygraphic repetitions occur in the main only between messages originating from the same transmitting station, or between messages transmitted within certain periods of time, or between messages having identical or nearly identical elements in the preamble such as serial numbers or other groups, etc.

All of this emphasizes the first two of the three basic procedures in cryptanalysis as set forth in footnote 2 on p. 18 of Military Cryptanalytics, Part I, viz.: (1) arrangement and rearrangement of data to disclose nonrandom characteristics or manifestations (i. e., in frequency counts, repetitions, patterns, symmetrical phenomena, etc.); (2) recognition of the nonrandom characteristics or manifestations when disclosed; and (3) explanation of the nonrandom characteristics when recognized.

¹⁵ If the messages had been offset on a keying cycle of 9, the intervals of repetitions between messages could have been factored to 9 if a constant equal to the offset were first subtracted from the interval; this could have been noted from multiple repetitions between two messages.

¹⁶ The appropriate alphabet number is gangedpunched in each block; this alphabet number is listed in the column labeled "1" of the run.

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(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
03	109	JKKNKBG	AEJ	UDLLWCMTGQDRA				1
05	028	CBEBRDT	BQV	SPBIAADQOCJLKQP				1
02	064	GNHJKQA	DFG	ZBLLLXMQXEJHOKB				1
05	001		DQE	EWUKBFMJWGHWMNQ				1
05	037	VSPBIAA	DQO	CJLKOPTNWZULGIF	2			1
05	100	GKPZHSB	DRD	HXRIRIQZNMJLLLIW				1
02	190	VREZAPQ	FFO	JJQKWCМКHZHBDN				1
04	127	HJJPWQJ	GCC	BEBRIQZAFUHLWFG				1
04	181	GNDLLFC	H					1
03	073	GJYWKMC	HAF	BPZAHQNWJEWRAIQ				1
03	010	HZHLASW	HFG	PEBABJSXJKMLPMC				1
01	046	GKDLASW	HHH	ZNINUFPEQVWBRBS				1
04	163	EJQXMWR	IAG	UGFYQB JIGNDLLFC				1
02	010	YWUZNDQ	IAH	IWBRRSJGIGHXNLC				1
04	046	VQPQIMQ	IAS	JBLLLLOTNWZKBYQR	3			1
04	091	GKZZRWJ	IKE	EESALTJZDIPLRLM				1
03	028	JKMLPMC	IRE	NWPJIRLMWYWBECS				1
02	019	HIWBRRS	JGI	GHXNLCNFLTHTNJF				1
04	172	GUGFYQB	JIG	NDLLFCH				1
04	064	WZKBYQR	JJQ	VDDIYTLRMECWKSX				1
04	082	MECWKSX	JPG	KZZRWJIKEEESALT				1
01	037	VUDOINF	JPG	KDLASWHHZNINUF	2	2	*	1
02	037	LHTNJF	JRZ	TWUZSFOJWVHTQBA				1
04	028	BNHBEBK	JWG	KDTRHQVNVQPQIMQ				1
03	064	GZUJYMN	JXC	JYWKMFHAFBPZAHQ				1
02	136	GKEWNUZ	JXC	JQWIBGQE ZPDZIQM	2	2	*	1
04	100	EEESALT	JZD	IPLRLMUCWIJZWDT				1
04	001		KCE	WNUNDRSJZYHNSF				1
04	019	ZYHFNSF	LCB	NHBEBKJWGKDRHQ	2			1
03	037	ENWPJIR	LMW	YWBESCSACJATLFX				1
04	073	QVDDIYT	LRM	ECWKSXJPGKZZRWJ				1
02	109	ZEPBIVC	MCE	NHAXMIZQLKDRASW				1
05	010	EEWUKBF	MJW	GHWMNQSJCBEBRDT				1
01	019	MBNOKBF	MJW	GHWMWEZLVUDOINF	2	2	*	1
02	199	OJJQKWC	MKH	ZHBHDNVR				1
01	064	QVWBRBS	MQH	KEWNUGXKHZHBDN				1
02	073	GZBLLLX	MQX	EJHOKBPT RJGDYIS				1
05	082	HYQZLSX	MQX	ZULSPQXMGKPZHSB	3	2		1
05	073	ZEHWXBA	MRH	YQZLSXMQXZULSPQ				1
03	001		MSH	ZHLASWHFGPEBABJ				1
03	118	JUDLLWC	MTG	QDRA				1
			10					

Figure 3.

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index shows, for example, that there are 10 J's in the first alphabet, and indicates two sets of polygraphs that begin with the letter J in Alphabet 1. With this second run the cryptanalyst can proceed to locate all the causal repetitions in the five messages--information which, when coupled with the statistical information given in the index, will considerably simplify solution of the cryptosystem.

7. Further remarks.--a. In case the cryptanalyst is interested only in totals of various classes (uniliteral, digraphic, etc.), condensed listings showing only such data may be prepared by a process known as "tabulating" at twice the speed of ordinary listing. If, on the other hand, the condensed data are to be arranged in, let us say, descending order of frequency, a procedure known as "summary punching" is employed. In this case a Reproducer is connected electrically to the Tabulator; totals accumulated (and perhaps printed) by the Tabulator are punched by the Reproducer on "summary cards", together with the information associated with the totals. This technique is often employed when certain information is desired without the volume of data that normally goes along with the usual IBM index.

b. If there are a large number of messages to be indexed, and if all the cryptanalyst desires is to find all repetitions of a specified length or longer, it is possible to obtain a condensed run giving only the necessary information, suppressing the large volume of unwanted data. For example, let us say that in the first listing (Fig. 2) all we wish to find are tetragraphic repetitions or longer; such a listing is illustrated in Fig. 4, wherein are shown all repetitions of the specified lengths for the set of five messages. Note that four of the asterisked repetitions shown in Fig. 2 have been suppressed in Fig. 4; only the long repetitions which begin in the column of the control letter are included in the listing of Fig. 4--this of course cuts down on redundant information, and simplifies even more the examination of the run.¹⁷

c. The examples shown of IBM indexes have been single-position indexes. Where the cryptographic unit consists of two or more characters, indexes are modified accordingly. For example, if a cryptosystem involved a four-letter code, then a four-position index would be made of the traffic, showing a control column of four-letter code groups with one or more preceding and following four-letter groups.

d. In some cases, it might be advisable to prepare indexes with the major sort on message number; in other cases, an index might be prepared of a number of messages grouped together by indicator relationships, or grouped

¹⁷ The way in which this run was prepared may be of interest. The tetragraphically sorted deck is passed at tabulating speed in the Tabulator, without printing. Whenever a tetragraphic coincidence is noted by the comparison brushes in the Tabulator, the machine senses the letter immediately to the left of the control letter of the two tetragraphs; if these letters are identical, it shows that the repetition extends in that direction, and will therefore be picked up again at an offset; but if these letters are different, it shows that the repetition begins in the control column, and the Tabulator will print the lines belonging to this tetragraphic repetition. Another way in which this could be accomplished is by using the Collator to remove cards with the proper coincidences from the sorted deck, and then listing only these cards on the Tabulator; this latter procedure might be used in situations involving a large volume of cards, to take advantage of the high speed of operation of the Collator.

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(a)	(b)	(c)	(d)	(e)
04	050	IMQIASJ	BLL	LOTNWZKBYQRJJQV
02	068	KQADFGZ	BLL	LXMQXEJHOKBPTRJ
04	129	JPWQJGC	CBE	BRIQZAFUHLWFGTA
05	021	HWMNQSJ	CBE	BRDTBQVSPBIAADQ
01	084	HBHDNVR	EEE	SZBWRHEZTTDTX
04	093	ZZRWJIK	EEE	SALTJZDIPLRLMUC
04	082	MECWKSX	JPG	KZZRWJIKKEESALT
01	037	VUDOINF	JPG	KDLASWHHHZNINUF
04	065	ZKBYQRJ	JQV	DDIYTLRMECWKSXJ
03	092	EWRAIQX	JQV	DLLRQUWJKKNBGA
03	064	GZUJYMN	JXC	JYWKMCHAFBPZAHQ
02	136	GKEWNUZ	JXC	JQWIBGQEZPDZIQM
05	007	DQEEWU	KBF	MJWGHWMNQSJCBE
01	016	WURMBNO	KBF	MJWGHWMWEZLVUDQ
01	067	BRSBMQH	KEW	NUQXKHZHBHDNVRE
02	130	RASWTNG	KEW	NUZJXCJQWIBGQEZ
01	074	KEWNUQX	KHZ	HBHDNVREEESZBWW
02	200	JJQKWC	KHZ	HBHDNVR
03	006	MSHZH	LAS	WHFGPEBABJSXJKM
01	042	NFJPGKD	LAS	WHHHZNINUFPEQVW
02	058	TQBAPTG	NHJ	KQADFGZBLLLXMQX
02	157	ZIQMPEH	NHJ	KQRTKFENBQDXZV
05	106	BDRDHHX	RIQ	ZNJMLLLIWODLKQ
04	133	JGCCBEB	RIQ	ZAFUHLWFGTALJUT
05	046	OCJLKQP	TNW	ZULGIFONLXHXXPB
04	055	SJBLLLO	TNW	ZKBYQRJJQVDDIYT
02	072	FGZBLLL	XMQ	XEJHOKBPTRJGDYI
05	081	RHYQZLS	XMQ	XZULSPQXMGKPZHS

Figure 4.

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by date or period of transmission, etc. When a comparison is made between all messages in a large volume of traffic to determine possible homogeneity or relationships, the index resulting from this operation is known colloquially as a "brute force." Such an index makes exorbitant demands on available machine time with standard machines; but on the other hand, in extremis it might be the only guarantee of solution in a complex cryptosystem.

e. Examples of IBM listings for traffic analysis studies are included in the Zendian Problem in Appendix 8.

f. In conclusion, it is hoped that the student has gained an appreciation of the nature of the aid that can be given by IBM techniques in cryptanalysis; but at the same time he should also realize that there may be a delicate point of transition where manual methods leave off and IBM methods begin, or vice versa. This is especially true when the volume of messages or other data to be examined is small.

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APPENDIX 5

INTRODUCTION TO THE SOLUTION OF TRANSPOSITION CIPHERS

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INTRODUCTION TO THE SOLUTION OF TRANSPOSITION CIPHERS

	Paragraph
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Solution of messages enciphered with completely filled rectangles.....	2
Solution of messages enciphered with incompletely filled rectangles.....	3
Solution of messages with similar beginnings.....	4
Solution of messages with similar endings.....	5
Reconstruction of literal keys from numerical keys.....	6
Solution of messages of identical length and in the same key.....	7
Concluding remarks on transposition ciphers.....	8

1. General remarks.--a. Transposition ciphers are like jigsaw puzzles in that all the pieces of which the whole original is composed are present but are merely disarranged. The pieces of the picture forming a jigsaw puzzle are irregular in size and shape, but the pieces of the plain text forming a transposition cipher must be much more regular, for the sake of practicality. They must be either single letters or pairs of letters, or sets of letters in regular groupings, or, in an exceptional case, whole words. Most transposition methods, however, deal with individual plaintext letters and are therefore termed monographic methods; when the methods involve the transposition of plaintext units greater than single letters, they are called polygraphic methods.

b. Practically all monographic or polygraphic transposition ciphers involve the use of a design or of a geometric figure (such as a square, rectangle, triangle, or trapezoid) in which the letters of the plain text are first inscribed or written according to a previously agreed-upon direction of writing and then transcribed or rewritten according to another and different, previously agreed-upon direction to form the text of the cryptogram. In nearly all cases the specific key controls (1) the use of designs of a specific nature and dimensions, and (2) variation in the direction or manner of inscription or transcription, or both. When a transposition cipher involves only a single process of inscription, followed by a single process of transcription, the system may be referred to as monophase transposition, commonly called single transposition. When, however, one or more of these processes intervene between the original inscription and the final transcription, the system may be referred to as polyphase transposition.

c. Among the most elementary forms of transposition ciphers are those known as route transpositions, which involve the inscription of the plain text into a square or rectangle by one prearranged route, and the transcription of the cipher text by following any other prearranged route. The principal routes are shown in the diagrams below, wherein, for the sake of ease in following the route, the plain text is assumed to be merely the sequence of letters ABC...X, inscribed into a 6x4 rectangle.

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(1) Simple horizontal:

ABCDEF	FEDCBA	STUVWX	XWVUTS
GHLJKL	LKJIHG	MNOPQR	RQPONM
MNOPQR	RQPONM	GHLJKL	LKJIHG
STUVWX	XWVUTS	ABCDEF	FEDCBA

(2) Simple vertical:

AEIMQU	UQMLEA	DHLPTX	XTPLHD
BFJNRV	VRNJFB	CGKOSW	WSOKGC
CGKOSW	WSOKGC	BFJNRV	VRNJFB
DHLPTX	XTPLHD	AEIMQU	UQMLEA

(3) Alternate horizontal:

ABCDEF	FEDCBA	XWVUTS	STUVWX
LKJIHG	GHLJKL	MNOPQR	RQPONM
MNOPQR	RQPONM	LKJIHG	GHLJKL
XWVUTS	STUVWX	ABCDEF	FEDCBA

(4) Alternate vertical:

AHLPQX	XQPIHA	DELMTU	UTMLED
BGJORW	WROJGB	CFKNSV	VSNKFC
CFKNSV	VSNKFC	BGJORW	WROJGB
DELMTU	UTMLED	AHLPQX	XQPIHA

(5) Simple diagonal:

ABDGKO	OKGDBA	GKOSVX	XVSOKG
CEHLPS	SPLHEC	DHLPTW	WTPLHD
FIMQTV	VTQMIF	BEIMQU	UQMLEB
JNRUWX	XWURNJ	ACFJNR	RNJFCA

(6) Alternate diagonal:

ABFGNO	ONGFBA	GNOUVX	XVUONG
CEHMPU	UPMHEC	FHMPTW	WTFMHF
DILQTV	VTQLID	BEILQS	SQLEIB
JKRSWX	XWSRKJ	ACDJKR	RKJDCA

ACFJNR	RNJFCA	JNRUWX	XWURNJ
BEIMQU	UQMLEB	FIMQTV	VTQMIF
DHLPTW	WTPLHD	CEHLPS	SPLHEC
GKOSVX	XVSOKG	ABDGKO	OKGDBA

ACDJKR	RKJDCA	JKRSWX	XWSRKJ
BEILQS	SQLEIB	DILQTV	VTQLID
FHMPTW	WTFMHF	CEHMPU	UPMHEC
GNOUVX	XVUONG	ABFGNO	ONGFBA

(7) Spiral, clockwise:

ABCDEF	LMNOPA	DEFGHI	IJKLMN
PQRSTG	KVWXQB	CRSTUJ	HUVWKO
OXWVUH	JUTSRC	BQXWVK	GTSRQP
NMLKJI	IHGFEF	APONML	FEDCBA

KLMNOP	XLIJKLM	STUVWX	PQRSTU
JABCDQ	WHABCN	REFGHI	ODEFGV
IHGFER	VGFEDE	QDCBAJ	NCBAHW
XWVUTS	UTSRQP	PONMLK	MLKJIX

(8) Spiral, counterclockwise:

APONML	FEDCBA	NMLKJI	IHGFEF
BQXWVK	GTSRQP	OXWVUH	JUTSRC
CRSTUJ	HUVWKO	PQRSTG	KVWXQB
DEFGHI	IJKLMN	ABCDEF	LMNOPA

PONMLK	MLKJIX	XWVUTS	UTSRQP
QDCBAJ	NCBAHW	IHGFER	VGFEDE
REFGHI	ODEFGV	JABCDQ	WHABCN
STUVWX	PQRSTU	KLMNOP	XLIJKLM

d. One of the very common types of transposition ciphers is that known as numerically-keyed columnar transposition, or, as it is more often called, keyed columnar transposition. In this type, the letters are usually written in a geometric design, most often a rectangle, by inscribing them in the ordinary manner, i.e., in horizontal lines from left to right and from the top downwards; the letters are then transcribed by taking off the columns in the sequence determined by the numerical key. If the cryptosystem stipulates a completely filled rectangle, enough dummy letters or nulls are added at the end of the message to fill the last line of the rectangle. For example, given the prearranged key word WASHINGTON from which is derived a numerical key, the text of the message is written in regular lines beneath the numerical key, thus:

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W	A	S	H	I	N	G	T	O	N
10	1	8	3	4	5	2	9	7	6
S	I	X	P	R	I	S	O	N	E
R	S	C	A	P	T	U	R	E	D
T	H	I	S	M	O	R	N	I	N
G	N	E	A	R	N	E	W	T	O
N	B	Y	O	N	E	O	F	O	U
R	P	A	T	R	O	L	S	E	O

The cryptogram produced by taking off the columns in key order would be as follows:

ISHNB PEURE OLPAS AOIRP MRNRI TONEO EDNOU ONEIT OEXCI EYAOB
 NWFSS RTGNR

In decipherment, a rectangle with the proper number of cells, determined by the length of the message and the length of the key, must first be prepared. In the foregoing example, since the cipher text consists of 60 letters and the key length is 10, an appropriate diagram is made and the cipher text is inscribed vertically down the columns according to the order of the elements of the numerical key. Thus the first two cipher groups when inserted into the rectangle would look as follows:

10	1	8	3	4	5	2	9	7	6
I						S			
S						U			
H						R			
N						E			
B									
P									

When all of the columns have been inscribed, the entire plain text of the cryptogram will reappear.

e. It is not necessary that the transposition rectangle be completely filled, as in the foregoing case; in fact, the security of the system is augmented if the rectangle is not completely filled. The same general procedure for encipherment and decipherment applies in this case, with perhaps a stipulation that if the end of the plaintext message fills the last line of the rectangle, nulls are to be added to make the last line incomplete.

f. In this Appendix we shall treat only monographic, monophase transposition of plain text (excluding code text or other intermediate text), and we shall limit our exposition of solution in the main to those systems involving rectangles (both completely and incompletely filled) for the transposition matrices.

2. Solution of messages enciphered with completely filled rectangles.

--a. In solving a cryptogram known or assumed to have been enciphered by keyed columnar transposition with a completely filled rectangle, the cryptanalyst first factors the number of letters in the message as a means of deter-

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In Fig. 1, since there are 9 letters in each row, the expected number of vowels is $9 \times .40 = 3.6$; in Fig. 2, with 17 letters in each row, the expected number of vowels is $17 \times .40 = 6.8$. Fig. 1 manifests striking variation in the range of 1-7 vowels from the mean of 3.6 vowels in the 9-letter rows, while Fig. 2 exhibits a consistency of smaller variation in the range of 5-8 vowels from the mean of 6.8 vowels in the 17-letter rows; therefore the rows of Fig. 2 are more like what we would expect in a rectangle of the correct dimensions. As further demonstration, we might examine the column labeled "b" at the right of each diagram; this column contains the deviations of the number of vowels in each row from the expected number, with the sum of these deviations at the bottom of the column. For Fig. 1, the average of the deviations is $\frac{20.8}{17} = 1.22$, while for Fig. 2 the average is $\frac{8.4}{9} = .93$; this demonstrates more clearly that the rectangle of Fig. 2 has a greater probability of being of the correct dimensions.²

c. In solving transposition ciphers, advantage is taken of all the characteristics and idiosyncrasies which are applicable to the language of the enemy, because they often afford clues of considerable assistance to the cryptanalyst. Firstly, in all languages there are certain letters, usually of medium or low frequency, which combine with other letters to form digraphs of high frequency. For instance, in English the letter H is of medium frequency, but it also combines with T to form the digraph TH, which is of highest frequency in literary text; it also combines with C, a letter of medium frequency, to form the fairly frequent digraph CH. The letter V is almost in the low-frequency category, yet it combines with E to form the digraph VE, which in military text is the 14th in frequency. Consequently, in working with transposition ciphers in English, when there is an H, attempts should be made to combine it first with a T or with a C; a V should be combined first with an E; a K should be combined first with a C; and so on. Secondly, there is usually in every language at least one letter which can be followed only by certain other letters, forming what may be termed an obligatory sequence, or an invariable digraph. In all European languages having the letter Q, the combination QU constitutes such an invariable digraph. In bona fide words of German, the letter C is never used by itself; when present, the letter C is invariably followed by an H, except on rare occasions when the digraph CK is employed. In English, the letter J can be followed only by a vowel; the letter X can be preceded only by a vowel and, except at the end of a word, can be succeeded only by a vowel, or by one of a limited number of consonants (C H P T), and so on. Letters which behave in this manner, that is, letters which have what may be called a limited affinity in combining with other letters to form digraphs,

² A more precise method of discriminating among various trial rectangles is to square the average of the deviations, and obtain a ratio of this square to the expected number of vowels in the rows; the higher the ratio, the more likely it is indicative of the correct case. Thus for Fig. 1, we get $\frac{3.6}{(1.22)^2} = 2.4$, whereas for Fig. 2 we get $\frac{6.8}{(.93)^2} = 7.9$.

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constitute good points of departure for solution and are therefore of sufficient importance to warrant their being designated by the more or less descriptive name of pilot letters. The presence of pilot letters in a transposition cipher often forms the basis for the assumption of probable words. Obviously, a special lookout should be kept for words of rather high frequency in military correspondence which contain letters of low or medium frequency. For example, the important word ATTACK suggests itself if the cryptogram has a K, a letter of low frequency, and a C, one of medium frequency.

d. We now look for a start in the anagramming process. We note the J in col. 8; this should be followed by a vowel, preferably a U. Columns 5 and 13 have a U in the corresponding position, so we juxtapose col. 8 against each of the two columns in turn, weighting the digraphs thus produced in order to be able to select the pair that has the highest probability of being correct.³ This is shown below:

8 5		8 13	
P U	33	P A	61
J U	25	J U	25
A F	38	A R	82
O I	42	O A	48
E R	94	E E	81
G R	42	G E	61
E R	94	E N	99
W N	25	W O	67
N S	<u>71</u>	N T	<u>93</u>
	464		617

The high score of 617 as compared with 464 attests to the correctness of the choice of cols. 8 and 13 to be paired together. The digraph JU should be followed by a consonant, preferably N or S; these letters are contained in cols. 15 and 11. We now juxtapose cols. 15 and 11 in turn against our 8-13 pair, and, in the absence of available trigraphic weights, we weight the digraphs formed by the combination of col. 13 with the new trial columns, as follows:

8 13 15		8 13 11	
P A N	89	P A T	83
J U N	68	J U S	58
A R C	53	A R D	64
O A G	45	O A D	73
E E E	81	E E S	86
G E M	61	G E O	58
E N E	87	E N E	87
W O T	67	W O O	45
N T T	<u>67</u>	N T A	<u>74</u>
	618		628

³ The weights used here are the centiban weights given in Table 15 of Appendix 2, Military Cryptanalytics, Part I.

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The combination of cols. 13-11 yields a higher score than does the combination 13-15; moreover, the trigraphs formed by cols. 8-13-11 look more like plaintext trigraphs than do those formed by cols. 8-13-15. From here on the anagramming progresses very rapidly, without the use of weights, by expanding the trigraphs into the words which have begun to manifest themselves, such as PATROL, JUST, ROAD, etc. The completion of the solution is shown below, together with the recovered transposition key:

3	6	17	7	16	8	13	11	2	14	9	10	1	12	4	5	15
E	N	E	M	Y	P	A	T	R	O	L	E	N	C	O	U	N
T	E	R	E	D	J	U	S	T	T	H	R	E	E	H	U	N
D	R	E	D	Y	A	R	D	S	S	O	U	T	H	O	F	C
R	O	S	S	R	O	A	D	S	S	E	V	E	N	E	I	G
H	T	T	H	R	E	E	S	T	O	P	A	F	T	E	R	E
X	C	H	A	N	G	E	O	F	S	M	A	L	L	A	R	M
S	F	I	R	E	E	N	E	M	Y	W	I	T	H	D	R	E
W	I	N	T	O	W	O	O	D	S	A	N	D	F	U	R	T
H	E	R	C	O	N	T	A	C	T	W	A	S	L	O	S	T

3. Solution of messages enciphered with incompletely filled rectangles.--a. The next case to be considered is that of keyed columnar transposition with an incompletely filled rectangle. This case is not appreciably more difficult than that of a completely filled rectangle; solution may be achieved by one of several methods, e.g., assuming a probable word, assuming the length of the transposition key, and by a general method of anagramming without regard to the key length, among others. For this particular demonstration it will be assumed that the enemy has been using transposition keys from 10-15 elements in length, with 13 being the mode or most frequent length. The following cryptogram is available for study:

AFOOR QYSHO SDIERN XCRDA VAONM EORFS RIYRW SEKIT AFOOI TEONC
 ESTH VIFSE UFIGU RXPLS ELAIO LIHUM CTREP IMNS TIENP RHERO

Since the message is 100 letters long, this means that for a rectangle of a width of 13 there will be 9 long columns of 8 letters each and 4 short columns of 7 letters each. If the long columns comprise the first 9 columns of the transposition rectangle, we will have the diagram as illustrated in Fig. 3a, below; and since the column "breaks" (i.e., the points where one column ends and the next begins) are in this case known, the columns could be anagrammed from this diagram without any trouble. If, however, the first 9 columns are not all long columns, an adjustment must be made to account for the possibility that some of the first 9 columns are short columns; this may be compensated for by constructing what is known as a hat diagram (also called a crown diagram), illustrated in Fig. 3b. In this latter diagram, it may be seen that if the first column is a short column, the second column will begin with an S, not an H; if both cols. 1 and 2 are short, col. 3 will begin with the letter N; and if only one of cols. 1 and 2 is a short

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the already established pair 1-8, as shown in Figs. 4b-g. It can be seen that there are "impossible" trigraphs in Figs. 4b, d, e, and f, leaving only Figs. 4c and g to be considered; of these two, Fig. 4c yields better looking trigraphs. The anagramming process continues, until the following final diagram is reached (shown here with all the elements of the hat diagram, for purposes of comparison with Fig. 3b):

```

11 13 1 8 5 4 6 3 2 12 7 10 9
      f e i
      t s a e t u
      i r o i n e l f
i h i n t x s p o s i
h e A v Y M A C H i N e g
u N F I R E F R O M C L U
M P O F W O O D S N E A R
C R O S S R O A D S S I X
T H R E E F I V E S T O P
R E Q U E S T A R T I L L
E R Y F I R E O N T H I S
P O S I T I O N X E V H E
I G U L

```

c. In the preceding subparagraph we took the U in col. 8 to be matched with the Q in col. 1. Note in Figs. 5a and b, below, that the other two U's in the cipher text could not possibly go with the Q. The U in col. 9 is more than (4 + 1) rows removed from the Q, so that if it is juxtaposed against

1 9	1 10	1 8 4	1 8 6	1 8 8	1 8 9	1 8 12
A	A I	A v	A v F	A v h	A v R	A v N
F u	F O	F I a	F I O	F I v	F I X	F I S
O f	O L	O F o	O F O	O F I	O F P	O F S
O i	O I	O S n	O S I	O S F	O S L	O S T
R g	R H	R E M	R E T	R E S	R E S	R E T
Q U	Q U	Q U E	Q U E	Q U E	Q U E	Q U E
Y R	Y	Y F O	Y F O	Y F U	Y F L	Y F
S X	S	S I R	S I	S I F	S I	S I
(a)	(b)	(c)	(d)	(e)	(f)	(g)

Figure 5.

the Q it will leave the first digraph, A-, incomplete; and the U in col. 10 is at the end of the column, so that only 6 digraphs are formed by the combination when we expect either 7 or 8 digraphs in each pair of columns, depending on whether they are short or long. It was also noted that only 6 of the 11 E's in the cipher text could possibly go with the established QU in the pair of columns 1 and 8. In Fig. 5e, col. 8 for the E has already been used for the U, so this figure is impossible. In Fig. 5c, col. 4 is short by one letter at the top, whereas in Fig. 5g, col. 12 is short by at least one letter at the bottom, so these figures are also rejected.

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Fig. 5f is rejected because the E is 10 letters away from the U (as may be seen from Fig. 3a), and Fig. 5d is rejected because the Q in col. 1 is 41 away from the E, since neither 10 nor 41 can be made up by any combination of integral multiples of 8 and 7, the lengths of the columns in this example.

d. The simplest solution of keyed columnar transposition with an incompletely filled rectangle has just been demonstrated, viz., by the method of assuming the length of the transposition key and anagramming as has been treated in the foregoing subparagraphs. It was indicated at the beginning of subpar. a that there was also a general method of anagramming without regard to the key length. This amounts to nothing more than searching in the cipher text for a pilot letter such as Q, writing several of the preceding letters of the cipher text in a column over this letter, and several of the following letters below this letter; then a letter which is usually associated with the particular pilot letter is located and placed next to the pilot letter, again recording the preceding and following cipher letters in a column as before. The resultant digraphs are then examined for possible delineation of the upper and lower limits of the columns, based on finding "impossible" digraphs which would indicate these limits, and the digraphs are expanded into trigraphs and longer polygraphs until the solution is complete. In the absence of pilot letters, we might use the first few letters of the cipher text (which must have come from column 1 of the transposition rectangle), or the last few cipher letters (which must have come from the end of the last column), comparing these segments both as preceding and following letters of other segments taken progressively throughout the cipher text, and weighting the digraphs thus formed as a measure of the validity of the matching; where tabulating machinery is available, this method constitutes an important and effective analytical approach.

4. Solution of messages with similar beginnings.--a. It is not unusual in military communications that two messages will begin with exactly the same words, so that the first two, three, or so lines of the enciphering rectangle of a transposition cipher are exactly the same in the two messages. When a single columnar transposition method using incompletely filled rectangles is being employed, the finding of two such messages will very greatly hasten the solution because the identical portions in the two messages enable the cryptanalyst to divide up the cipher text into the exact columns of the enciphering rectangle, thus eliminating the doubts concerning the long and short columns that would otherwise hinder him in effecting a solution.

b. Note the following two messages, with the underlined common polygraphic segments; the fact that there are 12 such segments indicates that the transposition rectangle has 12 columns.

Message "A"

N	O	S	M	O	B	O	O	O	I	T	E	A	R	S	P	R	D	E	O	E	P	O	O	L	G	N	T	I	F
<u>E</u>	<u>U</u>	<u>U</u>	<u>N</u>	<u>S</u>	<u>I</u>	<u>L</u>	<u>A</u>	<u>T</u>	<u>T</u>	<u>A</u>	<u>T</u>	<u>O</u>	<u>D</u>	<u>O</u>	<u>L</u>	<u>Y</u>	<u>I</u>	<u>B</u>	<u>R</u>	<u>A</u>	<u>R</u>	<u>L</u>	<u>I</u>	<u>M</u>	<u>C</u>	<u>T</u>	<u>I</u>	<u>M</u>	<u>C</u>
T	T	R	S	E	E	M	E	A	A	Y	E	N	C	O	F	B	P	I	O	N	Y	I	I	C	N	D	S	R	Y
<u>C</u>	<u>C</u>	<u>F</u>	<u>A</u>	<u>D</u>	T	U	G	S	E																				

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Message "B"

NOSEA CLITC OITFD NLEAI NDEOI LLWEC
 SDGNT ILALN EKNSI TETST EFETO DOMLS
 BSGOA RLCTT ERTOR MCTFI BTPRE JMEAE
 AAIOA SUOFB PMNUE EORIC NVYEI DAICF
 AEOA RPRI

These messages are now rewritten so as to bring identical portions all on the same lines, as is shown in Fig. 6, below:

Message "A"

Message "B"

1 2 3 4 5 6 7 8 9 10 11 12
 NODGNTAMMOIC
 OIENSORCEFCF
 STOTIDLTABNA
 MEEILOITAPDD
 OAPFALMRYIST
 BROETYCSEORU
 OSOUTITENNYG
 OPLUABIECYCS
 R R I E

1 2 3 4 5 6 7 8 9 10 11 12
 NODGNTAMMOIC
 OIENSORCEFCF
 STOTIDLTABNA
 EPIITOCFEPVE
 ADLLEMTIAMYE
 CNLATLTBANEQ
 LLWLSBSETIUIA
 IEENTBRPOEDR
 TACEESTRAEAP
 CISKFGOESQIR
 ND EORJURI

Figure 6.

It is clear from a comparison of these diagrams, and consideration of the fact that the long columns must of necessity go on the left-hand side of the rectangle, that the numbers 2, 6, 10, and 12 occupy the first four positions of the key, and that the numbers 1, 4, and 11 occupy the last three positions of the key. By anagramming columns 2, 6, 10, and 12 and columns 1, 4, and 11 we easily determine the exact order of these numbers, as shown in Fig. 7, below:

Message "A"

Message "B"

6 10 12 2 11 1 4
 TOCO ING
 OFFI CON
 DBAT NST
 OPDE DMI
 LITA SOF
 YOUR RBE
 INGS YOU
 BYSP COU
 RIER

6 10 12 2 11 1 4
 TOCO ING
 OFFI CON
 DBAT NST
 OPEF VEI
 MMED YAL
 LNON ECA
 SUAL ILL
 BERE DIN
 SEPA ATE
 GORI ICK
 ORIN

Figure 7.

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The rest of the solutions follows quickly, and the transposition key is determined to be 6-10-12-2-8-9-7-5-3-11-1-4. The final transposition rectangles are shown below:⁵

6 10 12 2 8 9 7 5 3 11 1 4
TO COMMANDING
OFFICERSECON
DBATTALIONST
OPDETAILEDMI
LITARYMAPSOF
YOURSECTORBE
INGSENTTOYOU
BYSPECIALCOU
RIER

6 10 12 2 8 9 7 5 3 11 1 4
TO COMMANDING
OFFICERSECON
DBATTALIONST
OPEFFECTIVEI
MMEDIATELYAL
LNONBATTLECA
SUALTIESWILL
BEREPORTEDIN
SEPARATECATE
GORIESOFSICK
ORINJURED

5. Solution of messages with similar endings.--a. In the preceding paragraph it was shown that the solution of two keyed columnar transposition messages having similar beginnings is an easy matter. The case of a pair of messages having similar endings is even simpler; the identical plain text contained in the bottom lines of the rectangle will afford clues to a direct reconstruction of the transposition key, without the necessity for any anagramming whatsoever.

b. Let us examine the following two messages. We find between these messages 14 sets of digraphic or longer repetitions; these repetitions do

Message "A"

CYMRS TUHIT OOANB EODHE DYTSD ETEOV
 1 2 3 4 5
SBERH EAVUE EOIED DDCRE IALEN SRLOG
 6 7 8 9
MSRFH RENAS URAPN NAGIE SFEHN RICNC
 10 11 12 13 14

Message "B"

MTIUS RLROM IHEAE NPJSU RYSNS REIEE
 1 2 3 4
ONAGR BTTOI EEMDN RFHHE EOCNC SCVIF
 5 6 7 8
EHFFG STSDE ROTOV SNEUS OOAI I PODHN
 9 10 11 12 13
NORST
 14

⁵ Note that the last letter of the common polygraphic segment GNTI in col. 4 is a chance coincidence, and does not belong to the identical beginnings of the two messages. Such coincidences are frequent in this method of analysis and must sometimes be taken into consideration when allocating the text into the columns.

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not occupy corresponding sequential positions as was the case in the messages in the previous paragraph. In order to facilitate our study, we number the common segments serially in each message, as is shown above.

c. We note that segment No. 1 (RST) in Message "A" corresponds to segment No. 14 in Message "B"; likewise, segment No. 2 (OOA) in Message "A" corresponds to segment No. 12 in Message "B". If we set forth the positional equivalencies between the segments in Message "A" against their identities in Message "B", we will have the following:

```

"A":  1  2  3  4  5  6  7  8  9 10 11 12 13 14
"B": 14 12 13 10 11 2  6  4  1  7  3  5  9  8

```

Message "A" contains 90 letters, which means that for a transposition rectangle of 14 columns there will be 6 long columns of 7 letters each, and 8 short columns of 6 letters each; Message "B" contains 95 letters, which means that there will be 11 long columns of 7 letters and 3 short columns of 6 letters. Relative to the position the last letter in each rectangle occupies in the bottom row of the rectangle, it is obvious that the final letter of Message "B" is five columns to the right of the final letter of Message "A". Using this difference, viz., 5, we can build up a key sequence from the series of equivalencies given above. Thus, the equivalent of segment No. 1 of Message "A" is segment No. 14 of Message "B", so we place 14 five spaces to the right of the number 1 which was arbitrarily placed at the left; the equivalent of No. 14 in Message "A" is No. 8 in Message "B", so we place 8 five spaces to the right of the 14 just entered a moment before, as is shown below:

```

 1  2  3  4  5  6  7  8  9 10 11 12 13 14
 1                                14      8

```

The equivalent of segment No. 8 of Message "A" is No. 4 of Message "B", so a 4 is placed five spaces to the right of the 8 in the diagram above, treating the sequence cyclically. This process is continued, until we have constructed the following complete sequence:

```

 1  2  3  4  5  6  7  8  9 10 11 12 13 14
 1  4  6  5 13 14 10 2 11 9  8  7 12  3

```

This sequence, 1-4-6-5..., is either the transposition key itself, or a cyclic permutation of the transposition key.

d. The underlined segments of the messages in subpar. b indicate the end of the columns of the transposition rectangle, since the identical plaintext portions are located in the final rows of the rectangle; for example, the first column of Message "B" must contain 7 letters, ending in SRL. Since we know that Message "B" has three short columns of 6 letters each, we can look for these columns delineated in the cipher text by the ending segments;

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we find these to be col. 5 (EBONAG), col. 13 (IIPODH), and col. 14 (NNORST).⁶ Since these short columns must be at the right of the transposition matrix, the actual transposition key must then be 10-2-11-9-8-7-12-3-1-4-6-5-13-14. The cipher texts of the two messages are now inserted into the appropriate rectangles, and the plain texts emerge as is shown in the illustration below:

Message "A"

10 2 11 9 8 7 12 3 1 4 6 5 13 14
 O U R A D V A N C E B E I N
 G H E L D U P B Y D E T E R
 M I N E D E N E M Y R E S I
 S T A N C E N O R T H O F C
 R O S S R O A D S S E V E N
 F O U R E I G H T D A S H C
 H A R L I E

Message "B"

10 2 11 9 8 7 12 3 1 4 6 5 13 14
 F R E S H E N E M Y R E I N
 F O R C E M E N T S B E I N
 G M O V E D U P I N T O P O
 S I T I O N S J U S T N O R
 T H O F C R O S S R O A D S
 S E V E N F O U R E I G H T
 D A S H C H A R L I E .

6. Reconstruction of literal keys from numerical keys.--a. If the enemy is using numerical keys which have been derived from literal keys, it goes without saying that the cryptanalyst should try and reconstruct these literal keys as the last step in the solution. This reconstruction may be of more than academic interest, since the original literal keys may furnish clues as to the enemy's thinking and its possible influence on his cryptographic habits or idiosyncracies. For example, if the cryptanalyst determined that the enemy used the names of flowers for the derivation of keys for five successive days, on the sixth day the cryptanalyst would probably consult a botanical anthology and perhaps guess the probable key for the day; this method of cryptanalysis is very rewarding when it works--and it does.

b. When numerical keys are derived from literal keys in the usual manner, i.e., by assigning numbers to the letters in accordance with their relative positions in the normal alphabet,⁷ the sequence of key numbers forms the basis for a keyword reconstruction diagram. The diagram for the key derived in subpar. 2c is shown in Fig. 8a, in which the individual key numbers are written from left to right on different levels so that each level contains only numbers normally in sequence.

⁶ Note that the third column of Message "B" must end in TSD, and not TSDE; the extra "E" at the end of this segment in the two messages was a fortuitous coincidence, as pointed out in the preceding footnote.

⁷ See in this connection par. 38 of Military Cryptanalytics, Part I.

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	11	13	1	8	5	4	6	3	2	12	7	10	9
1			1						2				
2								3					
3						4							
4					5		6				7		
5				8									9
6												10	
7	11									12			
8		13											

Figure 8a.

On the first level, the number 1 represents a letter near the very beginning of the alphabet, and is most likely an A; the number 2 also represents a letter near the very beginning of the alphabet, and this too is quite probably an A, although it might be a B or C. On the second level, the equivalent of 3 must be at least one letter to the right in the normal sequence after whatever letter the 2 represents; likewise, on the third level, the equivalent of 4 must be at least one letter after the equivalent of the digit 3. It is also clear that the number 11 must represent a letter in the last half of the alphabet, and that 12 might be this same letter, or one further to the right in the alphabet; the number 13 must of course represent a letter after that represented by 12. The probable ranges of the various numbers of the key are thus recorded in the keyword reconstruction diagram, as shown in Fig. 8b, below. If desired, the ranges of the letters comprising

	11	13	1	8	5	4	6	3	2	12	7	10	9
1			1 A-C						2 A-C				
2								3 B-E					
3						4 C-G							
4					5 D-I		6 D-I				7 H-M		
5				8 H-M									9 L-S
6												10 N-T	
7	11 P-T									12 R-U			
8		13 R-W											

Figure 8b.

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the equivalents of the key numbers might be listed as shown in Fig. 8c, below, which some students will find to be a more convenient diagram for selecting combinations of "good" letters forming fragments of the literal key:

11	13	1	8	5	4	6	3	2	12	7	10	9
P	R	A	H	D	C	D	B	A	R	H	N	L
Q	S	B	I	E	D	E	C	B	S	I	O	M
R	T	C	J	F	E	F	D	C	T	J	P	N
S	U		K	G	F	G	E		U	K	R	O
T	W		L	H	G	H			L	S	P	
			M	I		I			M	T	R	
											S	

Figure 8c.

c. The next step is to find a good word (or word fragments, if the numerical key has been derived from two or more words) from among the many possibilities; in this step we may be aided by the relative frequency of initial and final letters of words in the language.⁸ If we study the ending, we can see that ION is a possibility, which is then expanded progressively into TION, ATION, and CATION. At this point we might consult a list of words arranged in rhyming order according to word length,⁹ or we might make trials for various possible beginning digraphs (which must be followed by A, since the fifth letter from the end has been established as an A); when QUA is tried, the word QUALIFICATION emerges, without any inconsistencies. It must be pointed out that if the numerical key is rather short, there may be multiple possibilities for the choice of literal keys. With numerical keys of 10 or more numbers, it is usually possible to reconstruct the original literal key used; furthermore, the longer the numerical key, the easier it is generally to recover the literal key. As an exercise for the student, it is left to him to reconstruct the literal keys from the rest of the numerical keys in this Appendix.

7. Solution of messages of identical length and in the same key.--a. In the mechanics of transposition ciphers, the essential feature lies in the changes in positions of the letters constituting the plaintext message, the changes being determined by a key. It follows, therefore, that the letters of two or more messages of exactly the same length, when enciphered by the same key, will undergo exactly the same changes in positions. If we have several such messages, solution may be achieved by writing them under one another and anagramming the columns thus formed;¹⁰ this method holds true regardless of the size or shape of the transposition matrix, or whether the transposition involves monophase or polyphase transposition.

⁸ Cf. Tables 2-D and 2-E of Appendix 2, Military Cryptanalytics, Part I.

⁹ Cf. Section B of Appendix 3, Military Cryptanalytics, Part I.

¹⁰ This process is known as multiple anagramming.

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b. Let us assume that we have intercepted four 50-letter messages on the same day, and that there is reason to believe that the same transposition system and specific keys might have been used for all four messages. These four messages are superimposed as follows, together with a notation of the positions the cipher letters occupy in the messages:

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Msg No. 1:	N	U	R	I	L	O	R	R	H	M	H	T	D	T	E	E	O	T	G	A	R	U	U	D	E	I	D	I	N	O
Msg No. 2:	I	P	S	L	T	O	L	L	N	O	X	T	R	E	I	U	R	N	H	L	Y	S	T	E	N	A	O	T	T	A
Msg No. 3:	T	Y	T	P	O	I	E	R	R	I	E	E	N	R	U	N	S	P	N	R	O	N	H	B	A	I	R	G	O	A
Msg No. 4:	F	T	N	O	I	T	N	E	S	E	E	M	S	R	V	A	E	I	N	T	A	I	N	A	I	C	E	I	M	F
	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50										
Msg No. 1:	H	N	V	D	M	E	Z	I	I	N	A	C	A	E	T	A	T	S	E	R										
Msg No. 2:	E	R	U	C	S	C	I	E	Q	E	H	E	E	O	I	L	R	Y	I	T										
Msg No. 3:	E	T	S	W	G	N	R	S	L	E	E	K	P	O	N	T	A	A	O	T										
Msg No. 4:	P	I	E	I	I	R	A	S	R	T	R	P	O	N	E	W	O	M	T	O										

In Message No. 2 we are fortunate in having a Q; this should be paired with one of the two U's in the message, as shown in Figs. 9a and b, below. Since Fig. 9b produces better digraphs, we conclude that the pair of columns (39,33)

39 16	39 33	39 33 43	39 33 15	39 33 49
I E	I V	I V A	I V E	I V E
Q U	Q U	Q U E	Q U I	Q U I
L N	L S	L S P	L S U	L S O
R A	R E	R E O	R E V	R E T
(a)	(b)	(c)	(d)	(e)

Figure 9.

is more likely to be correct than is the pair (39,16). The QU should be followed by a vowel; if the vowel is E, the only column which does not produce an impossible trigraph with the combination (39,33) is col. 43, as shown in Fig. 9c; if the vowel is I, the only possible combinations are shown in Figs. 9d and e. Of the foregoing three possibilities for trigraphs, the best looking set is that in Fig. 9e. On trying various continuations of QUI, we arrive at the following fragment:

	39	33	49	43	12		
Msg No. 1:	...	I	V	E	A	T	...
Msg No. 2:	...	Q	U	I	E	T	...
Msg No. 3:	...	L	S	O	P	E	...
Msg No. 4:	...	R	E	T	O	M	...

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After a little further experimentation, all four messages are completely anagrammed, yielding the following:

41 10 35 23 1 4 14 26 17 29 45 7 20 38 32 48 42 11 36 24 2 5 15 27 18 30 46 8 21 39
 Msg No. 1: A M M U N I T I O N T R A I N S C H E D U L E D T O A R R I
 Msg No. 2: H O S T I L E A R T I L L E R Y E X C E P T I O N A L L Y Q
 Msg No. 3: E I G H T P R I S O N E R S T A K E N B Y O U R P A T R O L
 Msg No. 4: R E I N F O R C E M E N T S I M P E R A T I V E I F W E A R

33 49 43 12 37 25 3 6 16 28 19 31 47 9 22 40 34 50 44 13
 Msg No. 1: V E A T Z E R O E I G H T H U N D R E D
 Msg No. 2: U I E T I N S O U T H E R N S E C T O R
 Msg No. 3: S O P E R A T I N G N E A R N E W T O N
 Msg No. 4: E T O M A I N T A I N P O S I T I O N S

c. The key recovered in the diagram above, 41-10-35-23..., represents the order in which we must read the elements of 50-letter messages so as to yield the original plain text; in other words, this is the cipher-to-plain (abbr. C→P) sequence for messages of this length. If we examine this sequence, we will note a pattern repeated at an interval of 16. Let us copy this sequence in lines of 16 under each other, as shown in Fig. 10a, below.

41 10 35 23 1 4 14 26 17 29 45 7 20 38 32 48
 42 11 36 24 2 5 15 27 18 30 46 8 21 39 33 49
 43 12 37 25 3 6 16 28 19 31 47 9 22 40 34 50
 44 13

Figure 10a.

If we now assign numbers to the columns of Fig. 10a in the order of the ascending series of elements in the columns, as shown in Fig. 10b, we will

14 4 12 8 1 2 5 9 6 10 15 3 7 13 11 16
 41 10 35 23 1 4 14 26 17 29 45 7 20 38 32 48
 42 11 36 24 2 5 15 27 18 30 46 8 21 39 33 49
 43 12 37 25 3 6 16 28 19 31 47 9 22 40 34 50
 44 13

Figure 10b.

have the actual transposition key. The transposition rectangle for Message No. 1 is therefore as follows:

14	4	12	8	1	2	5	9	6	10	15	3	7	13	11	16
A	M	M	U	N	I	T	I	O	N	T	R	A	I	N	S
C	H	E	D	U	L	E	D	T	O	A	R	R	I	V	E
A	T	Z	E	R	O	E	I	G	H	T	H	U	N	D	R
E	D														

With the transposition key recovered, we will be able to read any further messages in the same key, without regard to the length of the messages.

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d. The foregoing method of multiple anagramming constitutes a general solution for all transposition ciphers, and is one of the reasons that transposition of plain text is not often encountered in actual operations. Moreover, after the C→P sequence has been recovered, it is possible to reconstruct the transposition matrix, regardless of shape or design, as well as the transposition key or keys involved; these topics will be reserved for extensive treatment in Military Cryptanalytics, Part IV.¹¹

8. Concluding remarks on transposition ciphers.--a. We have seen how easy it is to solve keyed columnar transposition ciphers using rectangular matrices. It might be mentioned that the security of such ciphers is enhanced if nulls are incorporated into the matrix; these nulls are arbitrary letters (usually high- or medium-frequency letters) inserted in certain cells designated for this purpose, with the intent to confuse the cryptanalyst in the anagramming process, causing him to discard combinations of columns which might actually be correctly matched. An even more effective measure for augmenting the cryptosecurity of transposition ciphers is the incorporation of blanks in the matrix, i.e., certain designated cells which are left unoccupied; this usage greatly impedes the cryptanalyst in ascertaining the lengths of the columns and considerably complicates the anagramming process.

b. We have shown the value of special solutions in dealing with transposition ciphers, taking advantage of special circumstances such as cases of messages with similar beginnings or endings. In transposition ciphers, perhaps even more so than in substitution ciphers, special solutions are of exceptional importance; sometimes the only possibility of solution of a difficult system lies in finding a message or a pair of isologs manifesting an untoward situation, correctly interpreting the phenomena, and capitalizing on the cryptographic idiosyncracies exhibited. Almost any kind of an isolog situation, and especially one in which some kind of cryptographic error has been committed which is then followed by the corrected version, may be of inestimable value to the cryptanalyst in leading him to a quick solution.

c. The solution of route transposition ciphers such as those illustrated in subpar. 1c is merely a matter of experimenting with rectangles of various dimensions suggested by the total number of letters in the message, and then inspecting these rectangles, searching for portions of words by reading horizontally, diagonally, vertically, spirally, and so on. In many of the routes no experiment is even necessary to determine the dimensions of the rectangle in order to get a starting point. For example, consider the following message:

FISBT	VEARA	DCDKP	REATT	SUTWI	YNISI	SOOON	WEIPE	NPNON	YAEOA
TS'TSL	USTEE	RSRCR	ELOFO	RSAOT	LPATC	NEAAG	EOLTW	TELDO	N

¹¹ It should be noted that the simple characteristics present in the diagram in Fig. 10a are typical only of monophasic keyed columnar transposition involving rectangular matrices. Other types of transposition ciphers yield C→P sequences of much greater complexity, and may pose considerable difficulties in the way of solution.

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If we start off by assuming an alternate diagonal route for the transposition, the first two groups yield good fragments, as is shown in Fig. 11a. We continue the method until there are conflicts, as in Fig. 11b; this in-

FIVE	FIVEPRISN	FIVEPRISONER
STA	STAKENIO	STAKENINYEST
ER	ERDAYSN	ERDAYSPATROL
A	ACTIOP	ACTIONESCAPE
	DTWON	DTWOHOURSAGO
	STOH	STOPALERTALL
	UNP	UNITSLOCATED
	WI	WESTOFNEWTON
	E	

Figure 11a.

Figure 11b.

Figure 11c.

icates that the method, which worked for columns of 8 letters, does not work for 9. We therefore assume columns of 8 letters and go back to the point where the sense broke; from Fig. 11c it can be seen that the alternate diagonal route was the one followed in the transcription, and that a 12 x 8 rectangle was used. Of course the cryptanalyst might not hit upon the correct method until after he had tried several other routes, but such trials take only a very few minutes. It is to be noted that large rectangles of this type have not often been used because in many of the routes whole plaintext words show up in the cipher text.

d. A type of transposition that has occasionally been encountered is that involving the use of a square sheet of paper or cardboard, called a grille, in which small square cells have been cut out in definite but irregular positions; the letters of the plain text are inscribed on a sheet underneath the perforated design. Usually, the grille is revolved 90° in four successive operations so that the resulting square of letters inscribed beneath the grille is completely filled, and then the letters are taken out in groups of five, reading horizontally or otherwise according to agreement. The perforations in the grille must, of course, be correctly disposed on the grille so as to produce the result that every space on the sheet over which it is placed in inscribing the letters shall be filled after the four turns of the grille have been completed. Techniques exist for solving even single messages in such ciphers; where several messages of identical length have been intercepted, the general solution given in par. 7 may be applied. The grille may then be reconstructed by an analysis and comparison of the cipher text with its corresponding plain text.

e. Monophase transposition is characterized by a relative simplicity of the methods of analytical attack, as has been demonstrated in the preceding paragraphs. Polyphase transposition, on the other hand, produces ciphers of formidable complexity, which under certain circumstances may defy solution. The most frequently encountered form of polyphase transposition is the double transposition cipher employing rectangles for the matrices; after the plain text has been inscribed in the first rectangle, the letters of the columns (taken in the order of the numerical key) are inscribed horizontally into a second rectangle (based upon the same or a different key), from left to right and from the top downwards; the cipher text is then taken

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7	1	6	3	2	8	5	9	4
F	I	R	S	T	R	E	G	I
M	E	N	T	C	O	M	M	A
N	D	P	O	S	T	H	A	S
M	O	V	E	D	T	O	N	E
W	L	O	C	A	T	I	O	N
S	O	U	T	H	O	F	N	E
W	T	O	N					

Figure 12a.

7	1	6	3	2	8	5	9	4
I	E	D	O	L	O	T	T	C
S	D	A	H	S	T	O	E	C
T	N	I	A	S	E	N	E	E
M	H	O	I	F	R	N	P	V
O	U	O	F	M	N	M	W	S
W	R	O	T	T	O	G	M	
A	N	O	N					

Figure 12b.

off from the columns of the second rectangle in the order of the second key. In the illustration above, Fig. 12a is the first transposition, Fig. 12b the second. The final cipher text would read as follows:

E	D	N	H	U	R	N	L	S	S	F	M	T	O	H	A	I	F	T	N	C	C	E	V	S	M	T	O	N	N
M	O	D	A	I	O	O	O	O	I	S	T	M	O	W	A	O	T	E	R	N	T	T	E	E	P	W	G		

Although such a double transposition cipher is theoretically extremely difficult to solve, nevertheless there are certain disadvantages to the system when used in military cryptography. The greatest danger is the failure on the part of careless clerks to execute both transpositions. The interception and solution of a single message which has undergone but one transposition will immediately provide the key for the solution of all the other messages even though they have been correctly enciphered. Again, the interception of two or more messages of exactly the same length will provide material for an effective solution. Again, the interception of a message which is based upon a perfect square, even though both transpositions have been effected properly, will enable solution; and the solution of completely filled matrices, though they may not be perfect squares, is also possible. Other special solutions have been devised, to take advantage of certain circumstances.

f. In cases of transposition ciphers which employ a more or less irregular geometric design accomodating exactly n letters, a long message may be split up into sections of n letters and then these identical-length sections may be attacked simultaneously by the multiple anagramming method. This possibility should not be forgotten in dealing with a transposition system that is known or assumed to incorporate a matrix of fixed dimensions.

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APPENDIX 6
CRYPTOGRAPHIC SUPPLEMENT

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CRYPTOGRAPHIC SUPPLEMENT

	Paragraph
Introductory remarks.....	1
Combination systems.....	2
Fractionating systems.....	3
Cipher devices and elementary cryptomechanisms.....	4
The Wheatstone cipher device.....	5
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1. Introductory remarks. In the formal portions of Military Cryptanalytics, Parts I and II, the exposition of the details of solution of various monoalphabetic and periodic polyalphabetic substitution systems was preceded by a discussion of the cryptographic aspects of these systems, much in the same way that anatomy and physiology precede more formal medical and diagnostic studies. Further cryptographic treatment was included in this present text: in par. 99 a brief introduction to the basic principles of aperiodic substitution systems was presented, and in Appendix 5 the mechanics of transposition systems were outlined. However, the student has not yet been introduced to the nature of code systems or machine systems, nor has he encountered in his studies thus far certain other systems which are representative of important types of cryptography. In the paragraphs which follow these additional aspects of cryptography will be treated, so that the student may round out his perspective and education in general cryptography, in order to provide a steppingstone to further advanced cryptologic studies.

2. Combination systems.--a. Some cryptosystems involve superencipherment, i.e., the plain text of a message undergoes a first or primary encipherment and the resulting cipher text then undergoes a second or secondary encipherment, for the purpose of augmenting the degree of cryptosecurity. If the two processes are well selected, the objective is actually reached,¹ and the resulting cryptograms present a relatively great degree of cryptosecurity; but sometimes this is not accomplished and the augmented security is of a purely illusory character.² The final encipherment may, in fact, be no greater in degree than

¹ Cf. additive encipherment of underlying dinome and monome-dinome text treated in Chapters XI and XII, which encipherment represents a considerable sophistication over the basic system of the first substitution.

² Cf. the discussion on repetitive encipherment in subpar. 84d of Military Cryptanalytics, Part I.

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if a single encipherment had been effected, and in unusual cases it may even be less than before. It is impossible to describe all the combinations of systems that might be employed; only a very few typical cases can here be considered, and these will be selected with a view to illustrating general principles. A cryptosystem incorporating superencipherment may involve 2, 3, ... successive processes of substitution; or it may involve 2, 3, ... successive processes of transposition; or substitution may be followed by transposition, or vice versa.³ These cases will be taken up in the subparagraphs below.

b. Monoalphabetic substitution followed by another monoalphabetic substitution obviously does not make any contribution to cryptosecurity; the transformation ${}_sC_1 \rightarrow {}_sC_2$ still remains monoalphabetic in character. Monoalphabetic substitution followed by polyalphabetic substitution, or vice versa, likewise does not add anything more to cryptosecurity than is already inherent in the polyalphabetic system. If periodic polyalphabetic substitution is followed by polyalphabetic substitution of the same period, no increase is made to cryptosecurity; if, however, the key for the secondary encipherment is of a different length from that for the primary encipherment, the results are quite different, in that the period of the resultant cryptogram becomes the least common multiple of the two key lengths. For example, if the length of the key for the primary encipherment is 4, and that for the secondary is 6, the result is the same as though a key of 12 elements had been employed in a single encipherment. If the key lengths selected are relatively prime to each other, the method may give rise to cryptogram of considerable security; this is the principle of the two-tape cipher teleprinter discussed in par. 97.

c. Combinations of substitution and transposition methods can take many forms. It is possible, of course, to apply substitution first, then transposition; or transposition first, then substitution. The most commonly encountered systems, however, are of the former type, i.e., ${}_sC_1 \rightarrow {}_sC_2$. Furthermore, it can be stated that as a rule practicable systems in which both processes are combined use methods that are relatively simple in themselves, but are so selected as to produce cryptograms of great security as a result of the combination. To give a very rough analogy, in certain combinations the effect is much more than equivalent to the simple addition of complexities of the order x and y , giving $x + y$; it is more equivalent of the order xy , or even $(xy)^2$. Some of the most effective combined substitution-transposition systems make use of multiliteral substitution for the first encipherment, followed by a transposition of the multiliteral elements so as to separate these elements and distribute them throughout the cipher text; that is, the fractional parts of the cipher equivalents are thoroughly disarranged and distributed evenly or irregularly throughout the text. Such systems are known as

³ It will be convenient to adopt the symbol C to represent the cipher text produced by any unspecified process of encipherment. The symbols C_1, C_2, C_3, \dots will then represent the successive texts produced by successive processes in superencipherment. The subscript letter s or t may be prefixed to the C to indicate that a given process is one of substitution or transposition. Thus, the steps in a system where a first substitution is followed by a second substitution can be represented symbolically by ${}_sC_1 \rightarrow {}_sC_2$. In a similar manner, ${}_tC_1 \rightarrow {}_tC_2$ represents a double transposition. The notation ${}_sC_1 \rightarrow {}_tC_2$ means that the text from a first process of substitution undergoes transposition as a second process.

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fractionating systems; these will be treated in the next paragraph.

3. Fractionating systems.--a. All fractionating systems have inherent in their cryptography a substitution phase in which each plaintext letter is replaced by a cipher equivalent composed of two or more elements or "fractions", and then these elements are subjected to a further encipherment, usually transposition, in a second phase. This latter may be followed by a third phase, recombination of transposed elements, and a fourth phase, the replacement of the recombined elements by single ciphertext letters; thus such a system may embrace a first substitution, a transposition, a recombination, and a second substitution.

b. Let us consider the following example of a fractionating system. In Fig. 1a there is illustrated a bipartite square which is used to encipher a message as shown in Fig. 1b; the bipartite cipher elements have been recorded as vertical dinomes underneath their plaintext equivalents. The two

	1	2	3	4	5
1	H	Y	D	R	A
2	U	L	I	C	B
3	E	F	G	K	M
4	N	O	P	Q	S
5	T	V	W	X	Z

Figure 1a.

O	N	E	P	L	A	N	E	R	E	P	O	R	T	E	D	L	O	S	T
4	4	3	4	2	1	4	3	1	3	4	4	1	5	3	1	2	4	4	5
2	1	1	3	2	5	1	1	4	1	3	2	4	1	1	3	2	2	5	1

Figure 1b.

44	34	21	43	13	44	15	31	24	45
Q	K	U	P	D	Q	A	E	C	S
21	13	25	11	41	32	41	13	22	51
U	D	B	H	H	F	H	D	L	T

Figure 1c.

rows of θ_c^1 and θ_c^2 elements are now recombined horizontally in pairs, and the pairs are reconverted into single-letter cipher equivalents using the same bipartite square; this is shown in Fig. 1c.

c. It will be noted that there are four basic steps involved in the foregoing encipherment: (1) a process of decomposition, substitutive in character, in which each θ_p is replaced by a bipartite θ_c , composed of two parts, θ_c^1 and θ_c^2 ; (2) a process of separation, transpositive in character, in which each θ_c^1 is separated from the θ_c^2 with which it was originally associated; (3) a process of recombination, also transpositive in character, in which each θ_c^1 is combined with a θ_c^2 with which it was not originally associated; and finally (4) a new process of recomposition, substitutive in character, in which each new $\theta_c^1\theta_c^2$ combination is given a letter value according to a bipartite alphabet. In the foregoing example the alphabet for the recomposition was the same as that for the decomposition; this, of course, is not an inherent necessity of the system--the decomposition and recomposition alphabets may be entirely different.

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d. Another method for recombining the bipartite elements is by a diagonal relationship, as shown by the arrows in Fig. 1d, below; every θ_c^2

```

O N E P L A N E R E P O R T E D L O S T
4 4 3 4 2 1 4 3 1 3 4 4 1 5 3 1 2 4 4 5(4)
  / / / / / / / / / / / / / / / / / / / / / /
2 1 1 3 2 5 1 1 4 1 3 2 4 1 1 3 2 2 5 1
  C D R F U X D H P R K U S D H F C C Z R

```

Figure 1d.

is recombined with the θ_c^1 of the following plaintext letter, until the end of the message is reached, at which time the last θ_c^2 is recombined with the very first θ_c^1 . The first several recombined pairs are 24 13 14 32 21..., which becomes CDRFU... when converted into single letters by means of the bipartite square in Fig. 1a. The last θ_c^2 , 1, is combined with the first θ_c^1 , 4, to yield an R for the last letter of the final cipher. Another way of accomplishing this method is to set down the bipartite equivalents horizontally and recombine them as shown below:

```

  O   N   E   P   L...
  42  41  31  43  22
   \ / \ / \ / \ /
    C   D   R   F   ...

```

The results are identical with those obtained in Fig. 1d.

e. The systems shown in subpars. b and d are aperiodic in nature, since the fractionating treatment is applied to the message as a whole. It is also possible to apply these processes to groupings of fixed length, resulting in a periodic fractionating system.⁴ For example, let the message and the bipartite square be the same as before, and let the unit of encipherment be five letters. The letters of the plain text are written in groups of five, and the bipartite cipher elements are written as vertical diacomes below their plaintext equivalents; this is shown in Fig. 1e, below. In the

```

O N E P L   A N E R E   P O R T E   D L O S T
4 4 3 4 2   1 4 3 1 3   4 4 1 5 3   1 2 4 4 5
2 1 1 3 2   5 1 1 4 1   3 2 4 1 1   3 2 2 5 1
Q K L H F   R E M H N   Q A G C H   Y Q W L T

```

Figure 1e.

recombination process, the bipartite elements in this case are taken horizontally within the periodic groupings; thus the elements of the first five plaintext letters are read as 44 34 22 11 32, yielding QKLF as the final

⁴ The invention of periodic fractionating systems is commonly attributed to the French cryptologist F. Delastelle, who described them in his excellent treatise, Traité élémentaire de cryptographie, Paris, 1902.

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cipher. The same treatment is applied to each succeeding group of five plaintext letters, until the entire message is encrypted.

f. In the foregoing examples, the fractionating schemes involved bipartite alphabets. Higher orders of multilateral alphabets may also be used, as is shown in the periodic fractionation system below:

H 111	B 211	P 311	O N E P L	A N E R E	P O R T E	D L O S T
Y 112	E 212	Q 312	2 2 2)3 1	1 2 2)1 2	3 2 1)3 2	1 1 2)3 3
D 113	F 213	S 313	3)3 1 1)3	2)3 1 2)1	1)3 2 2)1	1)3 3 1)2
R 121	G 221	T 321	3 2)2 1 1)	2 2)2 1 2)	1 3)1 1 2)	3 1)3 3 1)
A 122	J 222	V 322	J S P Z B	A A Q A E	T T V D Y	Y X X M X
U 123	K 223	W 323				
L 131	M 231	X 331				
I 132	N 232	Z 332				
C 133	O 233	. 333				

The multilateral cipher elements are written as vertical trinomes underneath the plaintext letters, and then these elements are recombined as horizontal trinomes within the periodic grouping, as shown by the parentheses in the illustration above; thus the elements of the first five plaintext letters are read as 222 313 311 332 211, yielding JSPZB as the final cipher. If in the recombination process a 333 is produced, this may either be represented by a 27th cipher character, which is impractical, or else a convention must be agreed upon such as that 332 will always be represented by $\bar{Z}A$ and 333 will always be represented by $\bar{Z}B$; the deciphering clerk will then take the next letter into account upon encountering a Z, before he decomposes this cipher letter.

g. Fractionation may be combined with keyed columnar transposition; such a system was used with considerable success by the German Army in 1917-1918 as its high-command cipher. This system was known to the Allies as the ADFGVX system, because only these letters appeared in the cipher text of the messages. Essentially, it involved a 6x6 bipartite matrix, the coordinates of which were the letters ADFGVX (chosen because their Morse equivalents are easily distinguishable from one another), the interior of

	A	D	F	G	V	X
A	G	7	E	5	R	M
D	A	1	N	Y	B	2
F	C	3	D	4	F	6
G	H	8	I	9	J	0
V	K	L	O	P	Q	S
X	T	U	V	W	X	Z

Figure 2a.

O	N	E	P	L	A	N	E	R	E
VF	DF	AF	VG	VD	DA	DF	AF	AV	AF
P	O	R	T	E	D	L	O	S	T
VG	VF	AV	XA	AF	FF	VD	VF	VX	XA

Figure 2b.

D	E	U	T	S	C	H	L	A	N	D
3	5	11	10	9	2	6	7	1	8	4
V	F	D	F	A	F	V	G	V	D	D
A	D	F	A	F	A	V	A	F	V	G
V	F	A	V	X	A	A	F	F	F	V
D	V	F	V	X	X	A				

Figure 2c.

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the matrix containing a keyword-mixed sequence comprising the 26 letters and 10 digits. The bilateral cipher equivalents from the primary encipherment were inscribed into a rectangular transposition matrix, and the columns were taken off according to the numerical transposition key; this accomplished an effective fractionation of the primary encipherment. In Fig. 2a, above, is shown a sample bipartite matrix; in Fig. 2b, the bilateral encipherment of a message; and in Fig. 2c, the transposition rectangle. The final cipher text, transmitted in groups of five letters, is VFFFA AXVAV...

4. Cipher devices and elementary cryptomechanisms. Simple devices have been used in cryptologic practice which produce periodic polyalphabetic encipherment; we have already seen typical examples of these, such as the primitive disc cipher device described in par. 10, and the rudimentary strip device described in par. 76. There are certain cipher devices, however, which operate in such a manner that periodicity is avoided or suppressed. Among them the most interesting of these are the Wheatstone cipher device, cylindrical cipher devices, and the Kryha machine; these will be discussed in greater detail in the succeeding paragraphs. As a rule, however, cipher devices, by their very nature, can hardly avoid being cyclic in operation, thus causing some kinds of manifestations of periodicity to be exhibited in the cryptograms.

5. The Wheatstone cipher device.--a. This device, invented by Sir Charles Wheatstone⁵ in 1867, is a little more than four inches in diameter, and consists of a dial with two hands, as shown in Fig. 3, below:

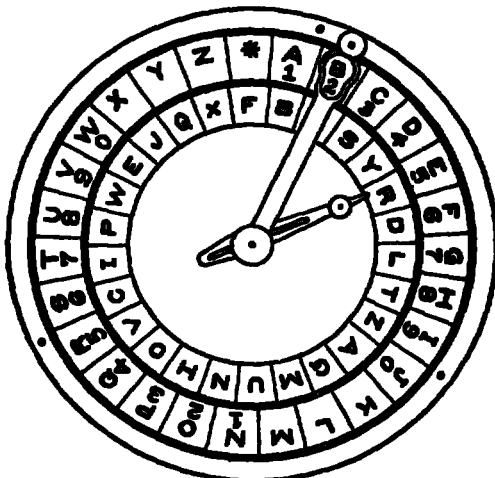


Figure 3.

⁵ Credit for the invention of the device and system described in this paragraph belongs not to Sir Charles Wheatstone, as is commonly thought, but to an American, Decius Wadsworth, who in 1817 constructed a device identical in principle with that described on pp. 342-348 of the Scientific Papers of Sir Charles Wheatstone, published by the Physical Society of London in 1879. The Wheatstone device used a 27-element outer alphabet and a 26-element inner alphabet; the Wadsworth device used a 33-element outer alphabet (26 letters and the digits 2-8, inclusive) and a 26-element inner alphabet. Furthermore, whereas in the Wheatstone device only the cipher component could be varied, in the Wadsworth device both components could be varied according to identical or nonidentical mixed sequences. Wadsworth later became Chief of Ordnance of the U. S. Army; Wheatstone, it will be recalled from footnote 11 on p. 138 of Military Cryptanalytics, Part I, was the man who did not invent the Wheatstone bridge.

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The dial is composed of two independent circles of letters. In the outer circle, which constitutes the plain component, the letters progress clockwise in normal alphabetic sequence, but there is an extra character between the Z and the A which is used as a word separator, making a total of 27 characters; furthermore, the digits 1-9 are inscribed together with the letters A-J and also N-W, for enciphering numbers. In the inner circle, which constitutes the cipher component, the letters are arranged in a mixed sequence and are inscribed either on a surface which permits of erasure, or on a detachable cardboard circle which can be removed and replaced by another circle bearing a different sequence.

b. The two hands are pivoted concentrically, after the fashion of the hour and minute hands of a clock. In a clock, when the minute hand makes a complete revolution, the hour hand makes only 1/12 of a complete revolution; the action in the case of this device, however, is somewhat different. The short hand is free to be set independently of the long one, although the motion of the latter affects the former. Since the outer circle has 27 spaces and the inner one only 26, by a simple gear assembly each complete revolution of the long hand causes the short hand to make 1 1/26 revolutions, thus causing the short hand to point one place in advance of where it pointed at the end of the preceding revolution of the long hand. For example in Fig. 3, when the long hand is over B of the outer circle and the short hand points to R of the inner circle, if the long hand is pushed clockwise around the dial, making a complete revolution, the short hand will also make a complete revolution clockwise plus one space, thus pointing to D.

c. To encipher a message, the long hand and the short hand are first set to prearranged initial positions, or set according to an indicator procedure; furthermore, by previous agreement, the long hand is invariably to be moved in the same direction, usually clockwise. Suppose the message to be enciphered is SEND AMMUNITION. The long hand is moved clockwise until it is directly over S on the outer sequence; the letter to which the short hand points is the cipher equivalent of S and is written down. Then the long hand is moved clockwise to a position over E, and the letter to which the short hand points is noted and written down; the next two letters are enciphered in the same manner. After the encipherment of each word, the long hand is moved clockwise to the asterisk, and the cipher equivalent of this word separator is recorded; when a doubled letter occurs in the plain text, as in the case of the doubled M of AMMUNITION, some infrequently used letter such as Q_p must be substituted for the second occurrence of the letter, and encipherment proceeds as before. To decipher a message, the hands are first set to their prearranged initial position, and then the long hand is moved clockwise until the short hand points to the first cipher letter; the long hand is then directly over the plaintext equivalent. The process is continued until the message is completely deciphered.

d. The same results as are obtained by using the Wheatstone device can be obtained by using sliding alphabet strips, providing that the operator will bear in mind that every time a Q_p on the plain component is situated to the left of the preceding Q_p, he must displace the cipher component

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one position to the left, if the correspondents have agreed upon a clockwise movement of the long hand, or the right, if they have agreed upon a counterclockwise movement of the long hand. What makes the Wheatstone device particularly interesting is that the motion of the cipher component is highly irregular and unpredictable, depending as it does upon the plain text being enciphered and upon the arrangement of the letters in the plain component; at the time of its invention, the Wheatstone device was considered by the cryptologic world as "absolutely indecipherable." The student is used to such appraisals by now--the cryptanalysis of this device will be treated in the next text.

6. Cylindrical cipher devices; strip systems.--a. In 1891 the noted French cryptologist Captain Etienne Bazeries invented⁶ an ingenious (for its day) cipher device which he called the "cylindrical cryptograph." Bazeries proposed this system to the French General Staff, which turned it down along with previous proposals of his; Bazeries was considerably piqued, and in 1901, now a major, he gave vent to his feelings in his book, "Les Chiffres Secrets Dévoilés,"⁷ in which he described fully his "chiffre indéchiffable."⁸ Because the principle upon which the cipher system is based was first described in print by Bazeries, it is usually referred to in the literature as the Bazeries principle; for the sake of historical accuracy, however, it should properly be called the Jeffersonian principle. The device was independently invented for the third time in 1914 by Captain Parker Hitt, U. S. Army; and since then, it has been invented several more times.

b. Essentially, the Bazeries device, illustrated in Fig. 4, below, consisted of 20 discs mounted on a spindle, each of the discs bearing a different alphabet engraved on its periphery; the discs were indentifiable

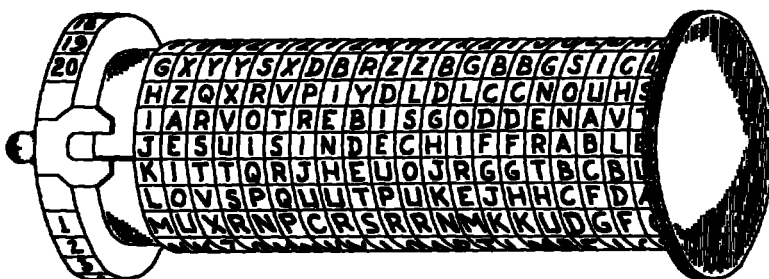


Figure 4.

⁶ Credit for the original invention of this cipher device and cryptosystem belongs to Thomas Jefferson after there was discovered, in 1922, a description of the device among Jefferson's papers in the Library of Congress (vol. 232, item 41575, Jefferson's Papers). For a photographic reproduction of this historically interesting item, see pp. 189-191 of Articles on Cryptography and Cryptanalysis Reprinted from The Signal Corps Bulletin, OCSigO, Washington, 1942.

⁷ Librairie Charpentier et Fasquelle, Paris, 1901.

⁸ Bazeries apparently was not troubled by the fact that a general solution had been arrived at by the Marquis de Viaris and published in the latter's book, L'art de chiffrer et déchiffrer les dépêches secrètes, in 1893. The theory of solution formulated by de Viaris is one of the most brilliant pieces of cryptanalysis in history, considering the state of the art at the time.

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by a unique number from 1 to 20 assigned to each disc. In using the device, the discs were first arranged on the spindle according to a predetermined order, and the first 20 letters of the plaintext message were set up in a row across the device. The discs of the device were then locked into position, and the cipher text was obtained by reading off, in groups of five letters, any one of the remaining rows or generatrices. The same treatment was applied to the second, third, ... sets of 20 plaintext letters, until the message was completely enciphered. In decipherment, the 20 discs were first arranged on the spindle according to the specific key, and then the first 20 ciphertext letters were set up in one row on the device; then, by inspection, the deciphering clerk would find the one and only one row of letters that read plain text all the way across, which process would be repeated until the entire message was deciphered.

c. Bazeries' device incorporated 20 systematic 25-letter alphabets, including 14 keyword-mixed sequences, some of which were calculated to appeal to a patriotic Frenchman;⁹ Jefferson's device was comprised of 36 discs, on the periphery of each there was to be put "all of the letters of the alphabet, not in their established order, but jumbled & without order so that no two shall be alike"; Hitt's device had 25 discs consisting of systematic arrangements of the vowels and consonants. Captain Hitt brought his device to the attention of Major J. O. Mauborgne, in the Office of the Chief Signal Officer; Major Mauborgne devised 25 very thoroughly disarranged alphabets which augmented considerably the security of the device, and he was the one responsible for the manufacture and production of the U. S. cipher device of 25 aluminum discs, known as the Cipher Device, Type M-94; this was widely employed in the U. S. military services and to a more limited extent in other U. S. services from 1923 until 1942, when it was superseded by better devices.

d. A modification of the Jeffersonian principle which has found merit in practical cryptography is the strip cipher system. This is nothing more than a series of printed, random-alphabet strips to take the place of the discs of a cylindrical cipher device; these strips, bearing identifying numbers, slide freely in a strip board which may be made of metal, wood, or plastic. The strips are simpler to produce and more economical to replace than metal discs; but, most important of all, with the use of strip systems it is possible to incorporate certain simple modifications of the Jeffersonian principle which result in a very considerable augmentation of the security of the system. First of all, in cylindrical cipher devices the number of discs must be limited, for the sake of practicability, and furthermore all n discs (20 in the Bazeries device, 25 in the M-94) are always used together, so that the latent period is always n. But with a strip system, it is possible to employ, say, 100 or more strips in the basic system, and then choose, for example, 30 of these strips for a daily key; furthermore, it is possible to employ a variable keying element for each message, so that several of the 30 strips are eliminated before encryption begins, avoiding the possibility of the encryption of two messages in exactly

⁹ Two of these sequences were based on "Allons enfants de la patrie, le jour de gloire est arrivé" and "Dieu protège la France"; a little harder to rationalize were the sequences based on "Évitez les courants d'air" and "J'aime l'oignon frit à l'huile."

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the same key, and in general resulting in a flexible latent periodicity of perhaps between 20 and 30. Finally, because of the ease of production of paper strips, it is possible to have different sets of strips for different groups of holders, or for various types of traffic, thus reducing the volume of traffic in any one cryptosystem.

7. The Kryha machine.--a. This machine, invented by Alexander von Kryha in Germany in 1924, is a spring-operated polyalphabetic cipher machine which has as its principle the irregular displacement of two concentric discs which comprise the plain and cipher components. (Actually, the cipher component is a 52-element disc while the plain component is in the shape of a semi-circular frame juxtaposed against the revolving cipher component.) The letters of the two components are printed on small metal tabs which are inserted in slots on the two discs so that the sequence of the letters in the components may be varied according to prearranged keys. The displacement of the alphabets occurring after each encipherment is accomplished through a selector wheel having on its periphery 17 toothed sectors consisting of from one to six teeth each, the sectors being designated by the numbers 1-17. These teeth serve to displace the components a distance equivalent to the number of teeth in the sector; however, owing to the manner of spacing between the toothed portions of the wheel, an additional displacement of four positions is added at each operation of the machine. The selector wheel has the following effective displacements between its 17 numbered positions:

Pos.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	1
		7	6	7	5	6	7	6	8	6	10	5	6	5	7	6	5	9

Since the sum of these displacements is 111 (= 7, mod 26), it follows that after a complete revolution of the selector wheel the two components will be displaced 7 positions to the right (measured on the cipher component) from their original juxtaposition; and since this number, 7, is prime to 26, there will be 26 series of 17 displacements each, making the period of the machine $17 \times 26 = 442$.

b. As an illustration of encipherment, let us assume that the components of the machine have been arranged as follows:

P:	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
C:	H	Y	D	R	A	U	L	I	C	B	E	F	G	J	K	M	N	O	P	Q	S	T	V	W	X	Z

If the initial juxtaposition of the components is that shown above (i.e., in the key of H), the first plaintext letter is enciphered in the H alphabet, and a stepping button is pressed to bring the next alphabet into position. If the setting of the selector wheel was at position 16 at the beginning of the encipherment, the next alphabet to be brought into play will be 5 to the right of the H alphabet (i.e., the U alphabet), and the one after that will be 9 places to the right of the U alphabet (i.e., the K alphabet), and so on.

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c. A subsequent model of the Kryha machine incorporated a selector wheel with 52 adjustable screws or "stops," each screw having the function of bringing into play a particular displacement of the alphabets. Any combination of these 52 screws may be used to generate a sequence of successive displacements. The complete cycle of this machine is dependent on the number of stops employed, and is usually equal to 26 times the number of stops selected; the cycle therefore lies between 13 or 26 (when only one stop is used) and 1352 (when all 52 stops are used).¹⁰

d. The usual claims of indecipherability were of course made by the inventor for this machine--we would be very much surprised if they weren't. The inventor demonstrates "mathematically" that the number of possible keys with his machine is 1.4×10^{64} ; this number compares very favorably with the number of atoms in the universe, namely, 3×10^{74} . With this happy note we will go on to the next subject.

8. Code systems--a. A code system¹¹ is a more or less highly specialized form of substitution. The basic principle underlying code systems is the replacement of entire words, long phrases, or complete sentences constituting the plain text of a message by arbitrarily selected equivalents having little or no relation to the elements they replace; these equivalents may be other words, groups of letters, groups of figures, or combinations thereof. It is only exceptionally that the replacement or substitution process is applied to elements smaller than whole words, and when this is done the elements are single letters, groups of letters, or syllables. If it were possible to memorize a long list of words, phrases, and sentences, together with the arbitrary equivalents called code groups assigned to represent them, there would be no need of having written or printed code books. In a code book, the words, phrases, and sentences are listed in a systematic manner and accompanied by their code equivalents; correspondents must possess identical copies of the document in order to be able to communicate with one another. An ordinary dictionary may, and often does, serve the purpose of code communication, so far as single words are concerned, but as a rule a specially prepared document containing the words, phrases, and sentences, suited to particular types of correspondence, is used. Such documents are called, in the United States and in Great Britain, code books or simply codes. In other countries they have been called repertories, word books, cipher dictionaries, etc., although the term "code" is becoming prevalent throughout the world.

b. There are various types of codes each suited to particular types of correspondence. Some are large books used for general business or social correspondence; others are intended for particular industries--for example, rubber, sugar, steel, and automobile--and contain highly specialized technical vocabularies. Most large commercial firms have their own private codes, constructed especially for their use. While the resemblances between the

¹⁰ If several stops are used and the sum of the displacements is $13 \pmod{26}$, the length of the cycle will be only twice the number of stops used; if the sum of the stops is 26 or a multiple thereof, the cycle will be equal to the number of stops used.

¹¹ Cf. subpar. 11d, Military Cryptanalytics, Part I.

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ordinary commercial codes and the usual military codes are marked, their primary purposes are different. Code is used in commercial communications principally to effect economy in cost of communicating, secrecy being of secondary importance. In modern military signal communications, code is used to effect secrecy, brevity, and speed, especially in front-line communications. However, in lengthy administrative messages, the economy afforded by a properly constructed code is important.

c. Messages encrypted by means of a code book are secure only when the code book is kept secret. There are, however, code systems in which secrecy is not a factor. Such systems are intended for brevity or, in transmission by commercial telegraph, for economy. Code books afford a means for abbreviating or condensing the writing necessary to convey information. A single, comparatively short group of code characters may represent a whole word of as many as 15 or more letters, a long phrase, or a complete sentence. Thus, as a rule, the text of a code message is much shorter than the plain text, and therefore costs less to send. Naturally, the condensing power of a code book varies with the extensiveness of its vocabulary, since in a small book there can be listed only the most common words and only a few phrases and sentences, whereas in a large book practically all the words likely to be used in telegraphic communication, together with many common phrases and sentences, may be included. When a code book is used to condense text only for purposes of economy, it is called a non-secret code. Examples of such codes are the ordinary commercial codes sold in book stores. A code book may combine the features of economy and secrecy, in which case the book itself must be safeguarded from the enemy as a secret code. In addition to money saving, code systems save time and labor in transmission and reception, as the number of characters handled in code systems is smaller than in cipher systems. The saving of time is an important factor in front-line communications where speed is essential and sometimes outweighs security considerations.

d. In military cryptography, the greatest degree of condensation is afforded by "prearranged-message codes," "brevity codes," and the like. A prearranged-message code is a tactical code adapted to the use of units requiring special or technical vocabularies; it is composed almost exclusively of groups representing complete or nearly complete messages and is intended for shortening messages and concealing their content. A brevity code has for its sole purpose the shortening of messages. A field code is primarily a small tactical code which contains a large number of code groups representing words and a few common short phrases, from which sentences can be composed; a syllabary, which is a list of code groups representing individual letters, combinations of letters, or syllables, is usually provided for spelling out words or proper names, not present in the vocabulary; numerical tables, or lists of code groups representing numbers, dates, and amounts, are also included. A jargon code is another name for a simple, very short code in which bona fide dictionary words, baptismal names of persons, the names of rivers, lakes, etc., are used as code groups. A voice code is used for transmission by the small radio-telephone sets used in combat areas and may be a prearranged-message code, a brevity code, or a jargon code. Other names used to designate small military codes are combat code, and operations code.

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e. In encoding a message, a code clerk merely replaces the various words, phrases, sentences, and numbers of plain text by their code equivalents. The code text is built up from code units each representing the longest possible plaintext unit the code book affords. For example, if the sentence ENEMY FORCE ESTIMATED AT ONE BATTALION ENCOUNTERED ONE MILE SOUTHEAST OF GREENVILLE is to be encoded, and the code book lists the phrase ENEMY FORCE ESTIMATED AT, the code group representing this phrase would be used rather than separate code groups representing the individual words ENEMY, FORCE, ESTIMATED, and AT, all of which might also be present in the code. The word GREENVILLE would be encoded by using the equivalent of the word GREEN, followed by the group for the syllable VILLE, or, if this latter is not in the code book, by spelling out VILLE as V-III-E or V-II-LE by means of the syllabary of the code.¹² The process of decoding is the reverse of that of encoding. Each code group is looked up in the code book, its meaning found and written down. Where the errors in transmission are few, the process is rapid; but even a small number of errors in a message may obscure the meaning or render a message unintelligible.

f. The elements of which code groups are composed may be of one or more of the following types:

(1) Bona fide words--real words taken from the dictionaries of one or more languages. The usual languages employed as sources for code words of this type are Dutch, English, French, German, Italian, Latin, Portuguese, and Spanish.

(2) Artificial words--groups of letters having no real meaning, constructed more or less systematically by arrangements of vowels and consonants so as to give these groupings the appearance and pronounceability of bona fide words.

(3) Groups of letters presenting no appearance of bona fide or artificial words and resembling cipher groups.

(4) Groups of arabic figures.

For special purposes, code groups composed of intermixtures of letters and figures within groups may be used. Call signs for radio stations, such as W2KA and W5AZZ, are examples of such intermixtures often used in radio call-sign codes. In certain highly specialized naval or military codes, the intermixture of letters and figures is sometimes necessary. Such intermixtures, however, are either not accepted or, if accepted, are charged for at a greatly increased rate when they appear in messages transmitted by commercial communications agencies.

g. A code may contain two or more parallel sets of code groups of different types. For example, in many commercial codes and in some military and naval codes, there is one series of code groups of the bona fide or

¹² Many codes contain a small block of code groups designated as "supplement groups", the meanings of which are defined in special lists which are effective for specific dates or for specific geographical areas. These supplement groups may contain equivalents for specific names, places, organizations, and the like.

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artificial word type and another series of the figure-group type, both applying to the same series of words, phrases, and sentences of the code. There are several reasons for this. In most parts of the world where italic or roman letters are used for writing, letters possess greater advantages in accuracy of reading and handling by telegraph personnel. This is necessary for correct transmission and reception of messages. However, in some parts of the world--for example, Russia and China--telegraph personnel, except in large cities, are unfamiliar with the English alphabet and hence many errors in transmission arise. But arabic digits are almost universally recognized and used, so that for communications between obscure ports and small cities in foreign countries, figure groups are preferred over letter groups. There are certain methods of condensing code groups composed of figures into still smaller groups composed of letters by means of condensers, so that many firms use figure groups for such purposes in expensive transmissions. Finally, in certain methods of enciphering code messages for the sake of greater secrecy, figure groups often form the basis for the encipherment more readily than do letter groups. Prior to 1 January 1934, in practically all modern codes constructed by experts, letter code groups were of the artificial-word type. On that date new rules in international communication became effective,¹³ permitting the use of letter code groups without restriction in their formation, as class (3) in subpar. f, above. The majority of the codes published subsequently to the foregoing date contain letter code groups of the unrestricted type.¹⁴

h. The greatest advantage possessed by letter groups over figure groups lies in the availability of a far greater number of permutations, or interchanges, of letter groups, because there are 26 letters which may be permuted to form letter code groups, whereas there are only 10 digits which may be permuted to form figure groups. If code groups of five elements are used, then there are available 26^5 , or 11,881,376 groups of five letters, and only 10^5 , or 100,000 groups of five figures. Now since the number of permutations of 26 letters taken in groups of five is so great, only permutations conforming to special types may be selected for use, and there will still remain a sufficient number of code groups for even the largest codes.¹⁵ Certain types of code groups are selected so that possible error in telegraphic transmission can be reduced to a minimum. If the code groups have been constructed scientifically it is possible to correct such errors quickly without having the message repeated.

i. The length of code groups used, whether the groups consist of two, three, four, or five elements, depends upon the size of the code. This applies almost exclusively to field military or naval codes, where transmission is through a governmental agency; in commercial messages or in governmental communications transmitted over privately-operated lines, five-letter or five-figure groups are used almost exclusively because of the

¹³ See Telegraph Regulations, International Telecommunication Convention, Madrid, 1932.

¹⁴ For a treatise on the development of codes see "The History of Codes and Code Language, the International Telegraph Regulations pertaining thereto, and the bearing of this history on the Cortina Report," by Major William F. Friedman, Sig. Rea., Government Printing Office, 1928.

¹⁵ A real whopper in codes is the Western Union Code, comprising nearly 380,000 groups.

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regulations adopted by the International Telegraph Conferences and by commercial telegraph and cable companies. As a general rule in the transmission of code and cipher messages, each group of five letters is counted as one word regardless of the number and arrangement of vowels; each group of five figures is counted as one word.

j. Code groups of modern codes are constructed by use of tables which permit more or less automatic and systematic construction in the form desired. These are called permutation tables. Because they may be used to correct most errors made in transmission or writing, such tables are usually included in the code book and are called mutilation tables, garble tables, error-detector charts, etc. Before the invention of permutation tables, code as a system of communication was not wholly reliable. Scientifically constructed tables, however, include a feature which has remedied this fault to a great extent; this will be discussed in the next paragraph.

k. To make an error in a group of five letters is not unusual on the part of the average telegraph or radio operator. If a difference of only one letter distinguished one code group from another in the same code, as ABABA and ABABE, then serious errors may be introduced in the meaning of a message, or the message may be made unintelligible by only a few transmission errors. If, however, every code group in the code book is distinguished from all other code groups in the same code by a difference of at least two letters, then there would have to be two errors in a single group and these two errors would have to produce a code group actually present in the code before a wrong meaning would be conveyed. This principle of making code groups within the same code differ from each other by a minimum of two letters is called the two-letter differential. It is most easily incorporated in code groups by constructing the permutation table to this end. The differential may be the absolute difference in the identities of two letters or the relative positions occupied by them. For example, BACOF, and BACUG differ from each other in the identities of the final pair of letters; considered as a combination of letters, the two groups present a two-letter difference. The two groups BACOF and BOCAF, however, differ in the relative positions occupied by two of their letters, but considered as a permutation of letters, these two groups as well as the two groups BACOF and BACUG, present a two-letter difference. In short, when at least two corresponding letters in a pair of code groups differ in their identities, the two code groups are said to present a 2-letter difference. Errors arising from the exchange of position of two letters, without a change in their identities, are referred to as errors of transposition. They are not unusual but fortunately, as a rule, they involve only letters which are either adjacent or alternate. For example, in the pair of groups BACOF and BOCAF there is a transposition of the alternate-letter type. In recent codes, attempts have been made to devise permutation tables which will eliminate one of the two members of every pair of groups which differ from each other by the mere transposition of two adjacent or alternate letters. Codes using groups based upon a permutation table will show the table and explain how to use it in correcting the usual mutilations of groups. The use of the two-letter differential reduces the possibilities for constructing letter-code groups from 26^5 to 26^4 (= 456,976), but considering the advantages, the

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sacrifice is worthwhile. Permutation tables for the construction of figure-code groups are similar in nature and purpose to tables for the construction of letter-code groups. However, because of the more limited number of characters available for permutations, the maximum number of 2-figure difference groups possible in a 5-figure code is 10^4 , or 10,000.

1. In their construction or arrangement, codes are generally of two types:

(1) One-part, or alphabetical codes. The plaintext groups are arranged in alphabetical order accompanied by their code groups in alphabetical or numerical order. Such a code serves for decoding as well as for encoding.

(2) Two-part, or randomized codes. The plaintext groups are arranged in alphabetical order accompanied by their code groups in a nonalphabetical order. The code groups are assigned to the plaintext groups at random by drawing the code groups out of a box in which they have been thoroughly mixed, or by some other manner in which the element of chance operates. Such a list can serve only for encoding. For decoding, another list must be provided in which the code groups are arranged in alphabetical or numerical order and are accompanied by their meanings as given in the encoding section. For this reason a two-part code has often been called a cross-reference code. The following brief extracts from typical one-part and two-part codes illustrate the difference between them:

One-part code		Two-part code			
		Encoding Section		Decoding Section	
ABARD	A	GAJVI	A	ABARD	Obstructed
ABACF	Abaft	TOFTY	Abaft	ABACF	Term
ABAHK	Abandon	FEHIL	Abandon	ABAHK	Zero
ABAJL	....it	BAYLT	....it	ABAJL	If it has not
ABALN	Abandoned	ZYZYZ	Abandoned	ABALN	To be sent by
ABAMP	....by	NYSYZ	....by	ABAMP	Acceding
ABAWZ	Abandoning	IFWUZ	Abandoning	ABAWZ	Building
ABBAD	Abandonment	RUMGO	Abandonment	ABBAD	Do not attempt
.....		
.....		
ZYZYZ	Zero	ABAHK	Zero	ZYZYZ	Abandoned

Between the two extremes are codes which have features of both; that is, complete sections may be arranged in random sequence, but within each section the contents are arranged in some systematic or logical order. This is true, however, only of some of the older codes. In modern types, the two-part construction is more common.

m. When a strict alphabetic arrangement is used in the sequence of the phrases, the code is said to be a strictly alphabetical code; when the phrases are listed under separate headings based upon the principal word or idea in the whole expression, the code is said to be a caption code. The following extracts will serve to illustrate the two types:

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Assistance
Give assistance
Require assistance
No assistance required
Assistance has been sent
Assistance for
Assistance from
Assistance to
Assistant
Assisted

etc.

Strictly alphabetical

Assistance
Assistance for
Assistance from
Assistance has been sent
Assistance to
Assistant
Assisted
* * * * *
Give
Give assistance
* * * * *
No
No assistance required
* * * * *
Require
Require assistance

More precise and economical encoding is possible with a caption code than with an alphabetical code. With the caption code it is easier to assemble an extended variety of expressions and shades of meaning under specific headings than with the alphabetical code. On the other hand, the use of a caption code involves more time and labor in encoding, especially by untrained or unskilled personnel, than the use of an alphabetical code. Where the phraseology of communication is standardized or stereotypic, the most common expressions may be listed in an alphabetical code as readily as in a caption code. In both types of codes there may be tabulated material, such as tables of numbers, dates, equipment, geographical or personal designations, either forming isolated sections in the code or inserted in the vocabulary under appropriate headings.

n. Two-part codes are used by many governments for their secret diplomatic, military, and naval communications because the advantages they offer over one-part codes are greater than their disadvantages. The disadvantages are: a two-part code is harder to handle than a one-part code because it is at least twice as large in content, since each code group and each plaintext element must appear twice; the cost of printing is approximately double; and the amount of labor in compiling a two-part code is nearly four times greater because of the necessity for preparing the accurate cross-reference arrangement which is its basic principle. On the other hand, the advantages of two-part codes are greater secrecy, and greater accuracy.

o. In a one-part code the plaintext groups progress from A to Z in a regular alphabetical sequence, accompanied by their code groups, also in a regular alphabetical or numerical sequence. If the word ABAFT is represented by a code group whose initial letter is A, or whose initial number is 1, then the word ABANDON will be represented by a group whose initial letter is also A, or whose initial number is also 1. In other words, the enemy cryptanalysts have definite clues to follow in breaking down the code because of the parallelism of the two sequences; the determination of the value of one code group affords definite clues to the value of many other code groups. In a two-part

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code, however, the word ABAFT might be represented by a group whose initial letter is T, or whose initial number is 8, and the word ABANDON might be represented by a code group whose initial letter is F, or whose initial number is 3. In other words, the two sequences are not alike in progression; hence the determination of the value of one code group will give no clues to the value of any other group.

p. In considering the greater accuracy of a two-part code over a one-part code, the following pair of phrases (in a hypothetical one-part code) are given as an example:

WOVAM Will be ready to attack
 WOVEN Will not be ready to attack

Such an arrangement is subject to two sources of error. A code clerk working under great difficulties, in a hurry, may accidentally write down WOVAM instead of WOVEN as a result of the contiguity of the two sets of letters which are similar in appearance and are so close together on the page that his eye may take the group from the wrong line. Again, on account of the similarity in sound, his ear may deceive him into writing WOVEN when he should have written WOVAM. Now the meaning of the one group is the exact opposite of the meaning of the other and, since either meaning may fit in correctly with the context of the message, the error may remain undiscovered for some time, thus causing serious inconvenience or, in the case of combat, actual loss of life. Furthermore, although the making of two errors in a single group is rather unusual in transmission or reception, nevertheless it does happen and, in such a case as the above, would not be detected. This is especially true in connection with tabular material such as lists of numbers, dates, and names, in which the context often fails to yield clues to the correction of garbles or errors, or to give conclusive evidence of the presence of an error. But in a two-part code such errors are improbable. In the first source of error mentioned above, the clerk would be very much less likely to confuse two entirely different groups of letters; in the second source, if two errors are made in the transmission or reception, and if these errors involve two letters producing a group which actually has a meaning in the code, this meaning is so unlikely to fit in correctly with the context that its probability of occurrence may be negligible. Thus, if this sort of error does happen, the meaning of the group fails to fit in with the context and at once indicates an error. Knowledge of such an error, even if it is impossible to correct it, is more preferable than ignorance of its existence, with a possible action based upon incorrect decoding.

q. The following are some closing observations on the subject of codes and code systems:

(1) In commercial code messages there is sometimes encountered the practice of mixing plain text and code text; in governmental code messages, military or diplomatic, such intermixtures are today so rare that their presence in telegrams indicates abysmal ignorance of some of the fundamental rules of cryptographic security. Because the plaintext words give

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definite clues to the meaning of the adjacent code groups, even though the former may apparently convey no intelligibility in themselves (such words as and, but, by, comma, for, in, period, stop, that, the, etc.) their presence constitutes a fatal danger, and no cryptographer who is aware of this danger will countenance such intermixtures.

(2) It often happens that correspondents employ a code which makes no provision for encoding proper names or unusual words not included in the vocabulary of the code book. Rather than leave the unencodable text in plain language in the message, since its appearance will surely lead to clues to unauthorized reading of the message, the correspondents encipher such words and proper names by means of any prearranged cipher system. Also, in some cases, when the code is limited in its vocabulary and the various inflections of words are not represented, the correspondents may suffix the proper inflections ("ed," "ing," "tion," etc.) in cipher. This procedure, however, is not to be recommended, because it considerably reduces the cryptographic security of the whole system.

(3) Sometimes correspondents make use of two or more codes within the same message. This is occasionally the case when they are making use of a general or commercial code which does not have all the special expressions necessary for their business, the latter expressions being contained in a small private code. Sometimes, however, the intermixture of code text from several codes is done for the purposes of secrecy, though it is, as a rule, a rather poor subterfuge.

9. Enciphered code systems.--a. Sometimes the code groups of a code message undergo a further process of encipherment; the resulting cryptogram constitutes an enciphered code message. Both of the two general classes of cipher methods, transposition and substitution, may be used in enciphering code. Enciphered code is used under the following circumstances:

(1) When the basic code has had wide distribution and the code might fall into unauthorized hands. Commercial codes sold in bookstores, and even special codes distributed widely throughout governmental offices, illustrate the types of codes to which this added safety factor should be applied.

(2) When increased security is necessary for highly classified communications. Although the basic code book may already be secret, further encipherment would greatly delay the solution of the code if it fell into the hands of enemy cryptanalysts.

b. Transposition methods wherein whole code groups or series of them are shifted about according to some key are not frequently encountered; transposition methods applied strictly within the code groups, by rearranging or shifting about the letters or figures composing them, have occasionally been used. One of the most commonly used transposition methods for the encipherment of code is keyed columnar transposition, either with special matrices, designs, or forms having nulls or blanks, or without these features. Transposition encipherments of code, however, are very subject to error and require high-grade personnel for their practical operation. They

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are, of course, wholly unsuited for practical military usage, though they can be employed for other purposes. Solution of such systems can be a very difficult matter indeed, especially if the basic code book is not known.

c. All of the methods of substitution applicable in the case of cipher systems may be used for the encipherment of code, ranging from simple mono-alphabetic methods to the most complex polyalphabetic methods, including machine encipherment. Digraphic methods may also be used; combinations of digraphic and monographic methods are frequently encountered. A favorite method in one-part codes having both letter-code and figure-code groups is that in which the letter-code group standing at a prearranged interval before or after the letter-code group representing the actual word or phrase intended to be conveyed is substituted. The interval may remain fixed within a single message, or it may vary according to some predetermined key; numerical code groups make the use of large intervals practicable. This method, with modifications, has also been used for the encipherment of two-part codes.

d. Substitution tables of various sorts are often employed. For example, using a table applicable to code groups of 5 figures, a table giving pronounceable combinations of letters for the combinations of digits may result in converting a group such as 75152 into the letter group KOBAL. Tables for substituting combinations of letters into other combinations of letters are equally feasible. The substitution may be strictly digraphic, combining two 5-letter or 5-figure groups into a series of 10 digraphs; or it may be a combination of trigraphic and digraphic substitution, each 5-character group being split up into a 3-character and a 2-character combination. Other combinations are, of course, also possible. In all of the foregoing methods the chief objection is that the advantage of the 2-letter differential feature is more or less dissipated by the encipherment, but this is true of almost every substitutive method that is superimposed on code; this disadvantage is absent in those cases in which the encipherment operates merely to substitute other code groups of the same book for the message code groups. The most common methods of this type make use of the figure-code groups, the latter being manipulated in various ways to change them and the resulting groups then being given their letter-code equivalents.

e. The most important of the various methods of enciphering code are arithmetical methods, which will now be discussed. If the code groups are numerical, the addition (usually mod 10) of an arbitrarily selected number to each code group in the code message constitutes a simple form of encipherment. It may be varied by prearrangement between correspondents, simply by changing the fixed number as frequently as may be deemed necessary, or by some easily arranged system of change. The group of digits composing the number which is added to the plain code values is commonly termed an additive group, or, more often, an additive, or sometimes simply an adder. In decipherment, the additive is merely removed from the received enciphered code groups by subtraction, leaving the plain code groups, which can then be decoded by reference to the code book. Often the date or some number derivable from the date is employed as the additive but usually the number

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is simply an arbitrarily composed group of digits. Because the same number is employed throughout the encipherment of the entire code message, such an additive is called a fixed additive.

f. Methods such as the foregoing are particularly weak cryptographically if the basic code book and the code groups embody limitations in construction. For example, should it be employed in connection with a code having only 3000 groups numbered consecutively from 0000 to 2999, then the initial digits of the groups are limited to the three digits 0, 1, and 2; the application of a fixed additive can therefore produce only three different digits as the initial digits of the enciphered code text. This phenomenon would, of course, quickly lead to the determination of the initial digits of the plain code groups. One rather simple scheme involving the use of fixed additives in the case of codes having alphabetical as well as numerical code groups is to apply the fixed additive to the numerical code groups representing the plaintext words or phrases and then take the alphabetical code groups corresponding to the sums as the final enciphered code groups. In codes of this type, the additives may be rather large numbers and the process of finding the alphabetical code groups corresponding to the sums is very easy. But in codes wherein only alphabetical code groups are listed, that is, no figure-code or numerical groups are also given, the additives employed must naturally be rather small numbers. It would be extremely laborious to count 573 groups forward, for example. In cases such as these, additives limited to numbers from 1 to 20 or 30 are common.

g. Instead of adding a fixed number in encipherment, the latter may be subtracted, in which case, in decipherment, the fixed number must be added to the enciphered code groups as received. Such a group may be termed a subtractive group, or subtractor, because subtraction is the process used in encipherment; in decipherment the group becomes, of course, an additive. A third method involves the subtraction of the plain code group from the key to yield the enciphered code group in encipherment, and the subtraction of the enciphered code group from the key to yield the plain code group in decipherment; this method, known as the minuend method, is quite prevalent in cryptographic practice. Addition and subtraction of a fixed numerical group may be alternated within the same message, according to some simple subsidiary key; for example, a series of additive groups corresponding to the keyword BAD might, by prearrangement, consist of the numbers 200, 100, 400. These might be used in repetitive manner, or the correspondents might agree to use these key numbers alternatively in additive and subtractive manner, such as +200, -100, +400, -200, +100, -400, +200, -100, +400, etc.

h. Instead of a fixed additive, it is possible to employ a sequence of digits used in the manner of a repeating key for addition or subtraction, the sequence being agreed upon in advance or derivable from a literal key, etc. If a 9-digit key were employed in conjunction with 4-digit code groups, the keying cycle would repeat after the encryption of 9 code groups. If, however, the key were composed of 10 digits, then the keying cycle would repeat after only five code groups, since the common factor 2 cuts the potential keying length in half; and if a 12-digit key were employed, the keying

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cycle would repeat after three code groups, because of the common factor 4 between the numbers 12 and 4.

1. When special tables are employed as the source of the additives or subtractors for enciphering code, a much more secure system is provided. The tables may be contained in a book or document called a key book, an additive book, or a subtractor book. On each page of such a book, groups of numbers are regularly disposed in rows and columns on the page. By applying identifying symbols called indicators to the pages, as well as to the rows and the columns on each page of the key book, it is possible to provide for the safe encipherment of a large volume of traffic. All correspondents must, of course, be provided with the same basic code book and the same key book. In employing the key book, the indicators tell the recipient of a message what key groups were used; that is, where to begin in the decipherment of the enciphered code. A page from a typical key book of this sort is shown in Fig. 5; this figure contains two sets of 100 4-digit key groups, disposed in numbered blocks each containing 10 rows and 10 columns of groups. To designate a group as the initial one to be employed in encipherment or decipherment, it is merely necessary to give the block number, the row number and the column number of the group. For example, 0116 is the indicator for the group 8790.¹⁶ It is usual to take the successive groups in the normal order of reading, that is, from left to right and from the top downwards, although any other order of reading may be agreed upon between correspondents. The book from which this example was taken consisted of 50 pages each containing 200 groups, making 10,000 in all. The groups themselves, of course, consist merely of digits selected at random when the key book is in preparation.

1. If a key book for an additive or a subtractor system is used once and only once, security of an absolute order is imparted to the messages even if the basic code book is known to and possessed by the enemy. It is not even necessary to use indicators except where a question may arise as to the serial order of one of two or more messages arriving at about the same time. In such a case the system is referred to as a one-time system and the key book is called a one-time pad because the pages are usually fastened securely in the form of a tablet or pad and are destroyed as soon as it is certain that the recipient of a message has properly deciphered and decoded it. The disadvantages of such a system are two in number, both very serious. In the first place the production and distribution of the pads present very difficult problems in composition, printing, assembly of sheets, etc. For voluminous correspondence many pads are necessary and the mere question of the production, timely distribution, and proper safekeeping of the pads is a serious one. In the second place, a system such as this is suitable for only two correspondents and even in this case there usually must be two pads, one for incoming, the other for outgoing messages, otherwise it will occasionally or frequently happen that both correspondents will use the same series of additives or subtractors.

¹⁶ In actual practice, indicators are often disguised or encrypted by a special key or set of keys; this procedure adds considerably to the security of the system.

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		BLOCK 00									
		1	2	3	4	5	6	7	8	9	0
1		0378	9197	3260	3607	2699	9053	9733	1844	6622	4213
2		7185	0135	6091	2387	4957	3113	7284	0750	3501	1945
3		5037	3365	1294	8261	2149	0718	3678	2510	7238	5268
4		8004	5199	3859	1293	5311	3550	9915	0512	1518	3776
5		9282	6893	4229	9736	0927	1418	1930	9864	0090	8974
6		7259	9399	0769	3144	9801	1378	4732	5134	1435	5282
7		2878	9963	7943	4519	3404	9810	0190	4467	7069	5348
8		1620	5879	0218	1064	9560	5732	6661	0883	1883	2619
9		3868	1905	2500	6654	0824	3710	3875	6332	1503	7259
0		4319	3298	7819	8721	1549	6630	6301	5701	3586	1907

		BLOCK 01									
		1	2	3	4	5	6	7	8	9	0
1		9328	1135	3871	1549	0839	8790	1771	8251	3274	1173
2		2297	9550	5033	0102	6817	5597	0847	4038	1200	2949
3		3640	3984	3299	1181	3811	8844	2500	4557	4133	0487
4		1456	9614	5520	8372	1941	2417	1098	4039	3943	8282
5		1751	4254	8479	8647	2684	5511	8680	4660	3858	4266
6		3643	0445	4673	6178	5250	4310	9580	0481	1005	4100
7		5875	0710	7652	5415	6851	6001	9668	2109	8471	3276
8		4555	9772	0128	2171	6835	3142	9514	1478	9746	7625
9		0183	2959	3757	7481	4398	4586	8143	8049	7478	8417
0		5072	4405	4128	9068	5023	4374	7741	6373	9454	7733

Figure 5.

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k. The foregoing difficulties make it desirable to modify the system so that while its security may not be absolute it can be employed by a larger number of correspondents, cutting down on the number of pads required and permitting of intercommunication among all correspondents. For such use, indicators are absolutely essential in order to facilitate the prompt decipherment of messages received from several different correspondents. The security of a scheme such as the foregoing is dependent upon the manner in which the indicators are treated in the enciphering processes. If the indicators are given in clear, that is, without disguise of one sort or another, it becomes possible to study a series of enciphered code messages and perhaps to solve them, even without possession of the code. On the other hand, if the indicators are themselves disguised by enciphering them according to a well-designed method, the system as a whole becomes very secure and may, indeed, be made impregnable against attack for a very long time.

l. It can be perceived by this time that the foregoing arithmetical methods are, in reality, substitution methods. Where a fixed group is added or subtracted from the plain code group this is easy to see. For example, if the fixed additive is 3089 and the plain code group is 8752, the enciphered code group is 1731. This is the same as saying that a 4-alphabet system is involved, and the alphabets are as follows:

Plain code.....	1	2	3	4	5	6	7	8	9	0		
Alphabet No.	1	2	3	4	5	6	7	8	9	0	}	"Cipher"
	4	5	6	7	8	9	0	1	2	3		
	2	1	2	3	4	5	6	7	8	9		
	3	9	0	1	2	3	4	5	6	7		
	4	0	1	2	3	4	5	6	7	8		

Note that merely a simple cyclic displacement of values is involved in the process, the amount of displacement being governed by the particular digit in each position of the additive group. What this amounts to, in cryptographic terms, is a four-alphabet encipherment using direct standard alphabets, where the "normal alphabet" is 1 2 3 4 5 6 7 8 9 0. The process could be made more difficult by employing "mixed alphabets" of course, but then the feature of speed, which is now possible (in view of early training in addition, whereby the mental arithmetic involved becomes second nature), would be lost, since constant reference would have to be made to enciphering and deciphering tables.

m. It becomes clear that when a series of different additives or subtractors is used, as when a key book is employed, then the number of alphabets involved corresponds to the number of digits employed. Thus, despite the fact that the encipherment process is here one that involves merely the numerical equivalents of direct standard alphabets, the system can have great cryptographic security, depending upon (1) how long the keying sequence is, that is, the number of groups comprising the additive or subtractor series; (2) the composition of this keying sequence, that is, whether it consists of random digits or is systematic in its construction; and (3) whether this sequence or parts of it are used only once or several times.

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The last-mentioned factor is the most important of the three, for if the keying sequence or parts of it are used but once or a very limited number of times, say 2 or 3, its recovery by cryptanalytic processes is difficult or impossible and therefore even if the sequence is systematic in its construction, this fact might not become known. However, as a rule the additives or subtractors are merely digits selected by a purely random means, such as drawing them out of a box, or equivalent means. The length of the sequence is guided only by the amount of traffic to be enciphered; for a voluminous traffic, key books containing thousands of groups are necessary, even with a good indicator system, and even then the key books must be changed at frequent intervals.

n. Arithmetical methods are favored above most other methods of encipherment of code because of their simplicity and relatively better speed of operation than in the case of alphabetical methods. The speed factor is, of course, attributable to the fact that practically everybody can add (or subtract) rapidly and accurately when single digits are involved, and although very similar processes could be applied in cryptographic processes involving letters of the alphabet, the operations of addition or subtraction would proceed very much more slowly because early training does not devote any time to arithmetical processes involving letters. For example, every child learns that "8 plus 5 equals 13" but none learns that "H plus E equals M." However, these arithmetical methods have two serious disadvantages. First, there is the disadvantage that the final enciphered code text is composed of numbers. The latter are not only more subject to errors in telegraphic handling than are letters, but also it is more difficult to correct garbled groups when figures are involved than when letters are involved. These disadvantages are, it must be admitted, more serious in American practice, when emphasis in training is laid upon the telegraphic transmission of letters and not figures, than they are in other practices; they may not hold in regard to countries where the emphasis in training is in the other direction, figures being preferred to letters. Second, the physical procedures involved in the preparation, reproduction, distribution, and accounting of the necessary key books of additives and subtractors are tedious, costly, and time consuming. Where provision must be made for voluminous intercommunication among many units and for relatively long periods of time, these matters constitute a difficult if not impossible problem for the compiling agency.

10. Machine cipher systems.--a. Cryptographic principles or methods which are too complicated for hand operation may nonetheless be readily mechanized and become highly practical. Electrical and electromechanical cipher machines have been developed which are capable of producing cryptograms of great complexity; these cipher machines are to be differentiated from cipher devices, which latter are relatively simple mechanical contrivances for encipherment and decipherment, usually hand-operated or manipulated by the fingers, such as sliding strips or rotating discs.

b. Machine cipher systems may be classed into two broad categories of systems: (1) literal systems, in which the plaintext and ciphertext symbols produced or accepted are the normal alphabetical characters and digits;

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and (2) nonliteral systems, designed for the transmission of data in which the symbols or signals produced or accepted are other than the normal alphabet and digits (e.g., teleprinter, ciphony, cifax, civision, etc.). Furthermore, literal cipher machines may be divided into the general classes of key generators and alphabet generators, or a combination of the two; non-literal machines are almost always of the key generator class.

c. Transposition cipher machines are rarely encountered; the files of United States patents disclose but two examples and so far as is known no actual machines have been constructed conforming to the specifications covered therein. Since substitution methods lend themselves so much more readily to automatic encipherment than do transposition methods, the possibilities for the construction of cipher machines for effecting transpositions are almost completely overlooked. Basically it would seem that a machine for effecting transposition would have to include some means for storing up the letters until all the plain text has been fed into the machine, whereupon the transposing process is begun and the letters are finally brought out in what externally appears to be a randomized order. It is conceivable that a machine might be devised in which the disarrangement of the letters is a function merely of the number of letters comprising the message;¹⁷ daily changes in the randomizing machinery could be provided for by resetting the elements controlling the process.

d. The substitution principle lends itself ideally to mechanization by cipher machines; these cipher machines range from the most primitive types which afford only a monoalphabetic substitution to very complex types in which the number of alphabets and the length of the keying cycle run into the millions. Little need be said of those machines in which the ordinary keys of the keyboard are merely covered with removable caps bearing other letters or characters (such "machines" have actually been patented!). Even when the mechanism is such that a whole series of alphabets can be brought into play, if the encipherment is monoalphabetic for a succession of 20 or more letters before the alphabet changes, the degree of cryptosecurity is relatively low, especially if the various alphabets are interrelated as a result of their derivation from a limited number of primary components. In some cipher machines on the commercial market the number of secondary alphabets is quite limited, but the method of their employment, or rather the manner in which the mechanism operates to bring the cipher alphabets into play is so ingenious that the solution of cryptograms produced by means of the machine is exceedingly difficult. This point should be clearly recognized and understood: other things being equal, the manner of shifting about or varying the cipher alphabets contributes more to cryptosecurity than does the number of alphabets involved, or their type. For example, it is quite possible to employ 26 direct standard alphabets in such an irregular sequence as to yield greater security than is afforded by the use of 1,000 or more different random-mixed alphabets in a regular or an easily ascertained method. The importance of this point is not always recognized by inventors.

¹⁷ A further variable would have to be introduced in cases such as these, to avoid or eliminate the possibility of producing two or more messages of exactly the same length in exactly the same key.

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e. In the following paragraphs we will discuss the Hagelin C-38 cipher machine as a typical key generator, wired-rotor machines as typical alphabet generators, the B-211 cipher machine as a typical fractionating machine, three machines which are representative of typical cipher teleprinters, and we will discuss the principal notions involved in the encryption of speech, facsimile, and television signals.

11. The Hagelin machine, type C-38.--a. This machine, one of an array of ingenious machines invented and manufactured by a Swedish engineer with the resounding name of Boris Caesar Wilhelm Hagelin, is a small, compact, hand-operated, tape-printing, mechanical cipher machine, weighing 6 pounds, with dimensions $7\frac{1}{2}$ " x $5\frac{1}{2}$ " x $3\frac{1}{2}$ ". The cryptographic principle embodies poly-alphabetic substitution, employing a complex mechanical arrangement to generate a long running key which is used in conjunction with reversed standard alphabets for the primary components. In encipherment, the machine effectively subtracts (mod 26) each θ_p from the key to yield the θ_c , and subtracts each θ_c from the key to yield the θ_p ; ¹⁸ because of this, the C-38 and machines of similar genre have sometimes been called "letter subtractor machines."

b. The C-38 has six wheels or rotors of identical diameters; these wheels are so constructed as to have individual periods of 26, 25, 23, 21, 19, and 17. Equidistant around the peripheries of the wheels are engraved the following sequences of letters:

Rotor I or "26 wheel":	ABCDEFGHIJKLMNPOQRSTUVWXYZ
Rotor II or "25 wheel":	ABCDEFGHIJKLMNPOQRSTUVXYZ
Rotor III or "23 wheel":	ABCDEFGHIJKLMNPOQRSTUVX
Rotor IV or "21 wheel":	ABCDEFGHIJKLMNPOQRSTU
Rotor V or "19 wheel":	ABCDEFGHIJKLMNPOQRS
Rotor VI or "17 wheel":	ABCDEFGHIJKLMNPOQ

At each lettered position there is associated a small pin near the edge of the wheel, which pin may be pushed to the left (or "inactive" position) or to the right (or "active" position). The six wheels¹⁹ of the C-38 move one step with each encipherment or decipherment; if they are initially aligned at AAAAAA, the second alignment will be BBBBBB, the 18th will be RRRRRA, and the 27th will be ABDFHJ. Since the wheels are relatively prime to each other, the cycle of the machine will be the product ($26 \times 25 \times 23 \times 21 \times 19 \times 17$) or 101,405,850; in other words, the wheels will not return to their initial position until after this number of letters has been enciphered.

c. Just behind the six wheels is a revolving drum something like a squirrel-cage, composed of two circular retaining plates holding 27 horizontal bars,²⁰ on each of which are two lugs,²¹ one or both of which may be

¹⁸ The machine actually adds the key to the complements of the plain or of the cipher.

¹⁹ The formal name of these wheels is "variable pin rotors," to distinguish them from "fixed pin rotors" used in some types of cipher machines, and from "wired rotors" used in electrical cipher machines.

²⁰ The retaining plates actually have 29 slots, and some models of the C-38 have been equipped with 29 bars.

²¹ Some models of these machines were equipped with only one movable lug on each bar, other models have been made which had one lug, permanently fixed, on each bar.

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set at six effective positions (corresponding to the six wheels) on the bar, or to neutral positions. The pins, when in the "active" position on a specific wheel, serve to engage those lugs which have been set opposite that wheel,²² causing the particular bars to be displaced slightly to the left; these displaced bars act as teeth of a gear wheel, displacing the reversed standard alphabets²³ a corresponding number of positions. The number of lugs in the path of a particular wheel is known as the "kick" of that wheel; the total kick or key is the sum of all the kicks contributed at a given position of the six key wheels, as governed by those key-wheel levers which are in a position to contact the lugs on the drum. When both lugs on a bar have been set to effective positions, the activity of either one or both of the wheels involved will still contribute only one kick for that bar, since the bar acts as one tooth of a gear. This situation is known as the "double lug effect," and the amount of the "overlap" (i.e., the number of displaced bars having two effective lugs) must be subtracted from the total number of lugs actuated at a given setting to ascertain the actual total key; for example, if wheels with kicks of 1, 4, and 7 are the only ones at a given position with effective kicks, and if among the bars displaced there is an overlap of 2, the total key is $(1 + 4 + 7) - 2 = 10$.

d. The encipherment (or decipherment) of a letter is accomplished by obtaining the sum (mod 26) of the key and the complement of the letter. For example, assuming the juxtaposition of the reversed standard alphabets to be fixed as

(P): ZYXWVUTSRQPONMLKJIHGFEDCBA
(C): ABCDEFGHILJKL MNOPQRSTUWVKYZ

if R_p is enciphered at a setting of the machine where the total key is 5, the cipher equivalent is N_c , measured 5 intervals to the right of the complement, I; if the key were 6, E_p would be enciphered as B_c ; etc.²⁴ The relative juxtaposition of the reversed standard alphabets may be varied by what is known as the slide, which has the effect of adding a constant to all the elements of key being generated by the machine.²⁵ In the example above, the slide was really $A = Z$ ($= \phi$, mod 26). If instead of $K - P = C$ we express the Hagelin formula as $\bar{P} + (K + S) = C$, where \bar{P} is the complement²⁶ of the plain and S is the slide, and if we use the mod 26 scale

²² In actuality, the activity of the pins (at a sensing or "reading" position) is transmitted to key-wheel levers behind each wheel. A lever which is pushed back engages the lugs in that wheel position and causes the bars to move to the left; a lever in the forward position does not come into contact with the lugs. (If Rotors I-VI are aligned at the apparent or "window" setting of AAAAAA on the bench mark, the effective positions of the six wheels will be at PONMLK.)

²³ The alphabets comprise the indicating disk (for setting the plain or the cipher) and the type wheel, which prints the enciphered or deciphered letters.

²⁴ It will be noted that in the operation of the C-38, the kick imparted to the type wheel is in the order of the ascending alphabet, whereas the sequence on the indicating disk moves in the reverse direction.

²⁵ The slide is brought about mechanically by adjusting the relative displacement of the type wheel and the indicating disk.

²⁶ The complement of a number a , mod m , is $m-a$.

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A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26

it can be seen that if R_p is enciphered with a kick of 7 and a slide of 22, then

$$\bar{R}_p + (7 + 22) = (26 - 18) + (7 + 22) = 37 (\equiv 11, \text{ mod } 26) = K_c;$$

likewise, if E_p is enciphered with a kick of 9 and a slide of 22, then

$$\bar{E}_p + (9 + 22) = (26 - 5) + (9 + 22) = 52 (\equiv \emptyset, \text{ mod } 26) = Z_c.$$

Since the C-38 employs reciprocal alphabets, the operations of encipherment and decipherment are complementary; therefore the decipherment formula is $\bar{C} + (K + S) = P$, as is shown by the example

$$\bar{K}_c + (7 + 22) = (26 - 11) + (7 + 22) = 44 (\equiv 18, \text{ mod } 26) = R_p.$$

e. As an illustration of the generation of key in the C-38, let us assume that the six wheels have the following pattern of active (x) pins and inactive (.) pins:

Rotor I: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
 . . x x x . x . x . x . . . x x . x x x x . . x . x

Rotor II: A B C D E F G H I J K L M N O P Q R S T U V X Y Z
 . x . x . x . . x . x x x x x . x x x x .

Rotor III: A B C D E F G H I J K L M N O P Q R S T U V X
 . x . x x . x . . x . . x x x x . x . x . x x

Rotor IV: A B C D E F G H I J K L M N O P Q R S T U
 x x . x . x . x . x x x x . . . x

Rotor V: A B C D E F G H I J K L M N O P Q R S
 . . x x x x . x . x . . x . . . x x x

Rotor VI: A B C D E F G H I J K L M N O P Q
 x . . x x x x x . . . x . x

Let us also assume that the lugs have been set up against their respective wheels as shown below (with the overlap distributed as is indicated by the brackets):

I	II	III	IV	V	VI
8	9	4	1	6	2

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The sum of the kicks of the individual wheels is 30; this number minus the three overlaps shows that 27 bars have been used. (With this particular overlap pattern, when wheels I and II are effective, their combined kick is 15; when II and V are effective, their combined kick is 14; and when wheels I, II, and V are effective, their combined kick is 20.) If the rotors are aligned so that the effective setting is at HHGKPF,²⁷ and if the slide is ϕ (i.e., the indicating and print wheels are set at A = 2),²⁸ the generation of the first 30 key elements is shown in the following diagram:²⁹

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
2 { I	. 8	. 8	. .	. .	. 8	. 8	. 8	. 8	. 8	. 8	. .	. 8	. 8	. .	. 8	. 8	. .	. 8	. 8	. .	. 8	. 8	. 8	. 8	. 8	. 8	. 8	. 8	. 8	. 8
2 { II	. 9	. 9	. .	. .	. .	. .	. 9	. 9	. 9	. 9	. .	. 9	. 9	. 9	. .	. 9	. 9	. .	. 9	. 9	. .	. 9	. 9	. 9	. 9	. 9	. 9	. 9	. 9	. 9
1 { III	4	. .	4	. .	4	4	4	4	. 4	. 4	. 4	. 4	4	. 4	. 4	. 4	. 4	. 4	. 4	. 4	. 4	. 4	. 4	. 4	. 4	. 4	. 4	. 4	. 4	. 4
1 { IV	. .	. 1	. .	. .	. 1	. 1	. 1	. 1	. 1	. 1	. 1	. 1	. 1	. 1	. 1	. 1	. 1	. 1	. 1	. 1	. 1	. 1	. 1	. 1	. 1	. 1	. 1	. 1	. 1	. 1
V	. .	. 6	. .	. .	. 6	. 6	. 6	. .	. 6	. 6	. 6	. 6	. 6	. 6	. 6	. 6	. 6	. 6	. 6	. 6	. 6	. 6	. 6	. 6	. 6	. 6	. 6	. 6	. 6	. 6
VI	2	2	. .	. .	2	. .	. .	2	. 2	. 2	. 2	. 2	. 2	. 2	. 2	. 2	. 2	. 2	. 2	. 2	. 2	. 2	. 2	. 2	. 2	. 2	. 2	. 2	. 2	. 2
Total key:	6	17	6	20	0	2	10	19	25	16	15	27	16	25	14	16	26	3	21	10	4	24	10	19	1	14	20	14	12	15

If the first word of a message was ADVANCE, it would be enciphered as EMJSLYE with the keys 6 17 6 20 0 2 10. Note, in the diagram above, that the key of 26 in col. 17 is equivalent to ϕ , and that the key of 27 in col. 12 is equivalent to 1. Also note that there are several ways to obtain certain keys, such as a key of 10 in cols. 7, 20, and 23.³⁰ As an exercise in decipherment, let the student recover the plain text from the following cipher which was encrypted with the keys above, and continuing for a total of 50 key elements:

EMJSL YESEA OKHXU KZQLV YXCAV IFNKA
GJLYU GZ NKH VSPKU OKSAB

f. The following are the detailed steps performed in the encipherment of a message with the C-38.

(1) First of all, of course, the pins and lugs are set up according to the key for the particular date. A slide is selected (either at random or according to a prearranged key) and is set on the machine. An initial

²⁷ The apparent setting in this case would be SSQBSM (cf. footnote 22).

²⁸ If the slide were any value but ϕ , the total key would be increased by a constant equal to the amount of the slide.

²⁹ The brackets in the individual key streams mark the cycles of the respective key wheels in terms of the initial alignment.

³⁰ There are 64 possible combinations of six things taken from 0 to 6 at a time, and since there are only 26 different displacements possible of the primary components, there is of necessity a considerable duplication of key elements. With this particular lug arrangement, there are 7 key values (2, 3, 4, 5, 23, 24, 25) that can occur in only one way (considering that 26 = 0 and 27 = 1), 6 key values that can occur in two ways, 8 key values that can occur in three ways, 4 key values that can occur in four ways, and 1 key value (15) that can occur in five ways. With some lug arrangements, certain key values might be impossible to produce.

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message rotor alignment is selected, usually at random, and recorded for future reference; this initial alignment, together with the slide used for the message, will be incorporated in the indicator groups which are usually placed at the beginning of the final cryptogram.³¹ The letter counter is reset to zero, and a small encipher-decipher knob is set to the "C" position. The machine is now ready for encipherment of the message.

(2) The first letter of the message plain text is now set on the indicating disk against a bench mark, and the drive knob is given a clockwise turn. This causes the drum to make a complete revolution, imparting a kick to the print-wheel assembly equal to the number of bars which have been displaced by the action of the pins against the key-wheel levers, and the enciphered letter is printed on the tape at the end of the operating cycle.³² The six key wheels have moved one step each during the process, and new pins have come into contact with the key-wheel levers to set up the key for the encipherment of the next letter.

(3) The succeeding plaintext letters are treated in the same fashion, with the proviso that at the end of every word a fixed letter (usually Z or K, depending upon the construction of the machine) is enciphered as a word separator. After the encipherment of every fifth letter (if the counter had originally been set back to zero, or for that matter to any multiple of 5), the machine will cause the tape to advance an extra space, so that the final cipher text will be printed in 5-letter groups, ready for transmission.

(4) In decipherment, the pins and lugs of the machine are first set up according to the key, and the slide and the message rotor alignment for the particular message are established from the indicators. The encipher-decipher knob is set to the "D" position, and the first letter of the cipher message is set on the indicating disk against the bench mark; when the drive knob is operated, the decipherment will be printed on the tape. When the encipher-decipher knob is set to "D", it engages a contrivance which suppresses in decipherment the printing of Z_p (or, in other models of the machine, K_p); since the letter Z_p was enciphered at the end of every word in the original plaintext message, the suppression of printing of this Z_p results in the deciphered plain text being printed on the tape in word lengths.³³

G. Now that the student has gained a knowledge of the cryptographic principles and of the mechanical aspects of the C-38, he is in a position to peruse the illustration of the machine in Fig. 6 with more understanding.

³¹ These indicator groups are usually not sent in the clear, but instead are encrypted either by means of special indicator enciphering tables, or by means of the machine itself.

³² In case the tape is exhausted, the enciphered result may be read on the reproducing disk which moves together with the type wheel.

³³ Words which contain a Z, such as ZERO and ORGANIZATION, are sometimes spelled with an X in place of the Z (such as in XERO and ORGANIXATION) before encipherment, for the sake of ease in reading the text when it is deciphered.

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The machine is shown here in the open position, with the inner cover raised to expose the mechanism. The principal components of interest to us are

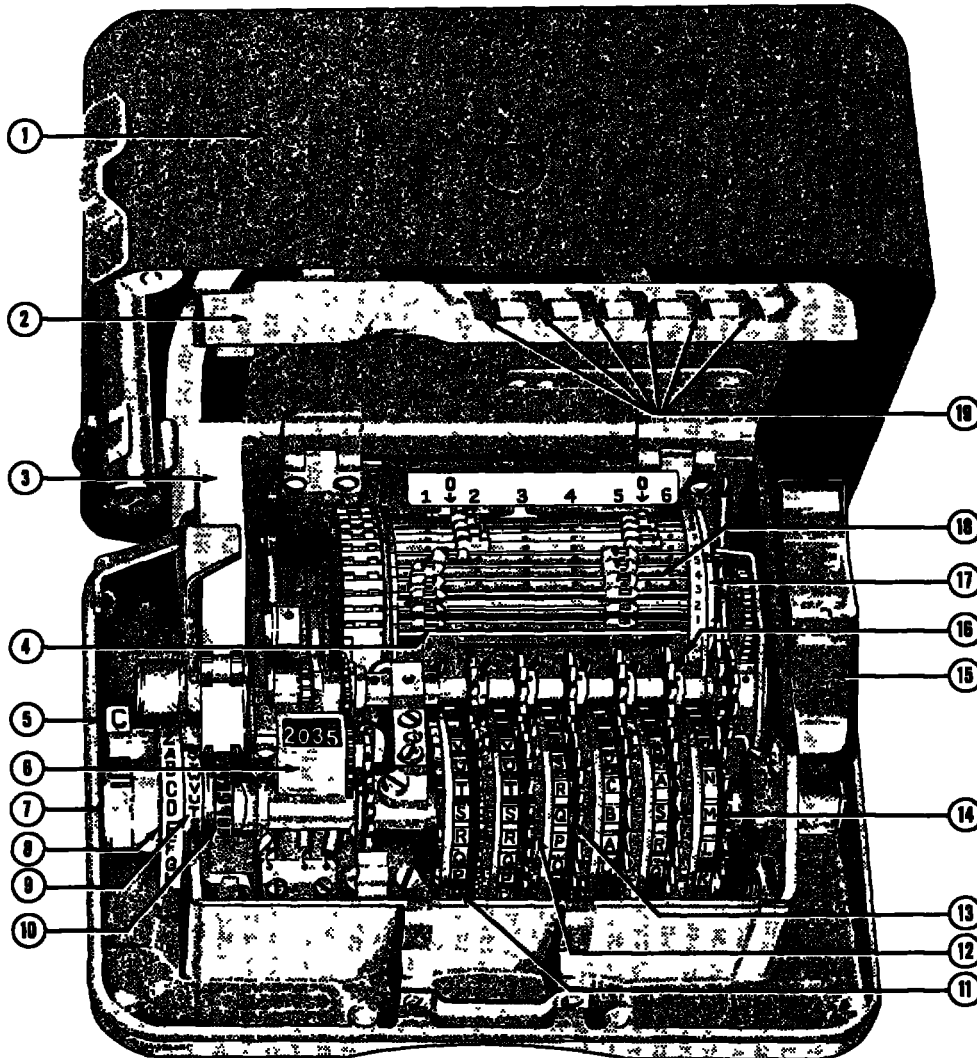


Figure 6.

marked in the illustration and are enumerated as follows: (1) the outer cover; (2) the inner cover; (3) the paper tape; (4) a lug; (5) the encipher-decipher knob; (6) the letter counter; (7) the setting knob, which moves the indicating disk (8), the reproducing disk (9), and the type wheel (10) simultaneously; (11) one of the key wheels; (12) a pin set to the "inactive" position; (13) a pin set to the "active" position; (14) the row of letters which will be at the bench mark when the inner cover is closed; (15) the drive knob; (16) a key-wheel lever, in the rear position where it will contact the lugs set opposite its corresponding wheel; (17) the drum; (18) one of the drum bars; and (19) the key-wheel windows, through which the alignment of the key wheels at the bench mark may be seen when the inner cover is closed.

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h. The C-38 was used during World War II by United States military forces as a low-echelon cipher machine, under the nomenclature of M-209 in the Army and CSP 1500 in the Navy; the U.S. machines, however, were not equipped with a slide, and the reversed standard alphabets were set at A = Z. The Hagelin machine, type C-36, was similar to the C-38 except for the fact that it was a five-wheel machine having single fixed lugs. The original model of the C-36 had 25 bars with a lug arrangement of 1, 2, 4, 8, 10; the feature of the slide, as well as the introduction of 27 bars (and sometimes 29), was incorporated in later models. The Hagelin firm makes many different types of cipher machines which are available on the commercial market; when the designation "Hagelin machine" is used without further elaboration, it usually means the C-36/C-38 type.

12. Wired-rotor machines.--a. Electrical cipher machines of the alphabet generator class usually employ cryptographic components called wired rotors as a means of generating a multiplicity of alphabets. A typical rotor might be visualized as a disk approximately 3" in diameter and perhaps $\frac{1}{2}$ " thick, made of molded plastic or other insulating material. On each of the two faces of the rotor there are 26 small metal studs or contacts, arranged in a circle near the edge of the rotor. The studs on one face are connected in a random manner by wires to the studs of the opposite face; thus we have a representation of a mixed alphabet by means of electrical wiring. The rotors have engraved on their peripheries the normal A-Z sequence, as a means of aligning the rotors at specific positions against a bench mark. Several of these rotors are used side by side in a cipher machine, so that the studs of each rotor come into contact with the studs of adjacent rotors; the entire set of rotors in the machine is contained between two endplates likewise constructed with a circle of 26 contacts which touch the studs of the rotors placed next to them. In encipherment, when a letter of a typewriter keyboard is pressed, it sends a current to one of the points on the input endplate, going through the maze of rotors (each of which contributes the effect of one monalphabetic substitution) to a point on the output endplate which is connected either to one of 26 lamps or to a printing mechanism, giving in this way the cipher equivalent of the plaintext letter. This is illustrated in schematic form for a three-rotor machine in Fig. 7, below:

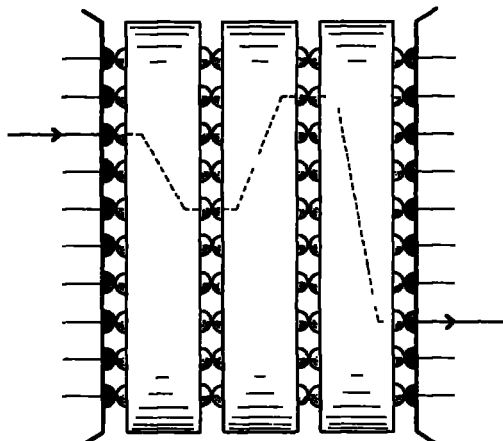


Figure 7.

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In decipherment, the current is merely sent through the rotor maze in the opposite direction, and the plaintext equivalent is either indicated by the lighting of one of 26 lamps or by printing on a tape.

b. If the rotors were fixed and did not move, the encipherment would be nothing more than simple monoalphabetic substitution with a random-mixed alphabet; however, after the encipherment of each letter, one or more of the rotors will move one step, turning on the principal axis. This will result in the generation of a succession of different alphabets, the number being equal to 26 raised to the n th power, where n is the number of rotors in the maze. Thus for a three-rotor machine we will have 26^3 or 17,576 different alphabets, and for a five-rotor machine we will have 26^5 or 11,881,376 different alphabets. If the motion of the rotors is metric (i.e., meter-like as in an ordinary counter or an odometer),³⁴ these numbers will also represent the periods of the machines.³⁵ In Fig. 8a, below, we have a diagram of a three-rotor machine, in which the wiring of each

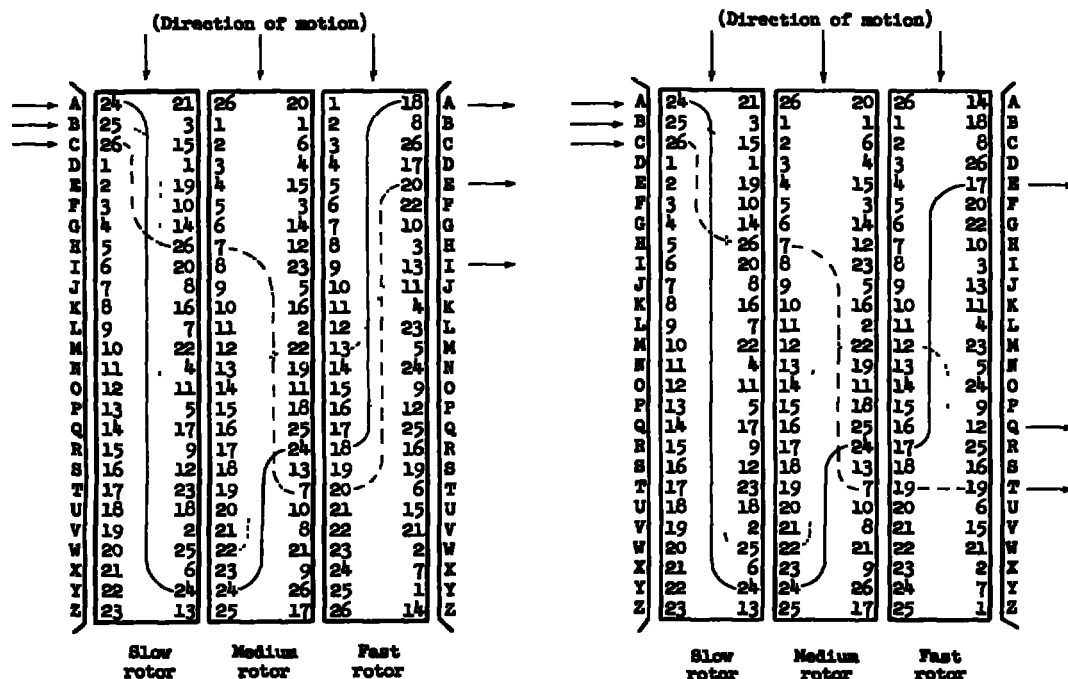


Figure 8a.

Figure 8b.

³⁴ It is usual to refer to the rotor which always moves one step after each operation of encipherment or decipherment as the "fast rotor"; the rotor which steps at a certain position (or positions) of the fast rotor is called the "medium rotor"; the rotor which steps at a certain position of the medium rotor is called the "slow rotor."

³⁵ Rotors have one or more turnover points which cause other rotors to step when the position of a turnover point is reached. In a set of rotors with single turnover points, if the rotors are set initially at these positions, the medium rotor will step once when the fast rotor has made a complete revolution, and the slow rotor will step once when the medium rotor has made a complete revolution.

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rotor is represented by numbered contacts on the left- and right-hand faces of the rotor; wires are understood to connect like-numbered contacts from one side of the rotor to the other. It can be seen that A_p entering the input endplate comes out as A_c on the output endplate; at this same position of the rotors B_p becomes I_c , and C_p becomes E_c . (In decipherment the current is sent in the opposite direction, so that $A_c = A_p$, $E_c = C_p$, and $I_c = B_p$.) After the encipherment of one letter the fast rotor has moved one position, as is shown in Fig. 8b; at this setting of the rotors, it can be seen that $A_p = E_c$, $B_p = Q_c$, and $C_p = T_c$.

c. The foregoing illustrations were of straight-through rotor machines. It is also possible to have rotor machines which incorporate what is called a reflector or a reversing rotor as the last element of the maze. This reflector has studs on one face only, and these studs are connected two-by-two by thirteen pairs of wires; a current which enters the single endplate (known as a stator) goes through the maze to the reflector, which sends the current back through the maze in the opposite direction along a different path, exiting at a point on the stator different from the original entry point. Such a machine, known as the Enigma³⁶ type, is shown in schematic form in Fig. 9, below:

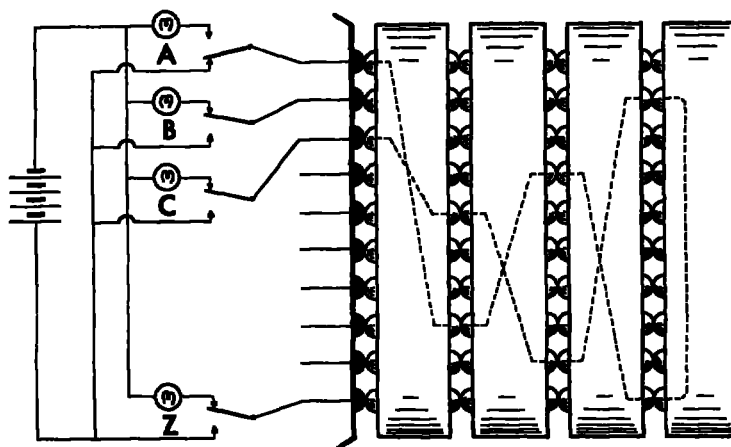


Figure 9.

Note that when the key associated with the letter A on the keyboard is depressed, the current is sent through the three rotors to the reflector, and back through the maze to the lamp associated with the letter C. It can be seen that Enigma encipherment is reciprocal in nature;³⁷ in the

³⁶ The first patent application for a wired-rotor machine was filed in Germany in 1918, a modification of this machine was patented in 1923 and manufactured commercially under the trade name of "Enigma." The machine of the original patent was a straight-through rotor machine, and was the invention of either Hugo A. Koch or Arthur Scherbius, it is not known which; the Enigma machine with the reversing rotor was invented by Koch.

³⁷ Note, however, that Enigma encipherment is noncrashing, that is, it is impossible for a letter to be enciphered by itself. In Hagelin encipherment, which is also reciprocal, the noncrashing feature is not present.

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foregoing illustration, A (either plain or cipher) goes to C (cipher or plain). If the "C" key were depressed, the current would go through the rotor maze and come out at the "A" lamp, since the "A" key would now be in the "up" position. The circuitry of an Enigma machine is shown more clearly in Fig. 10, below:

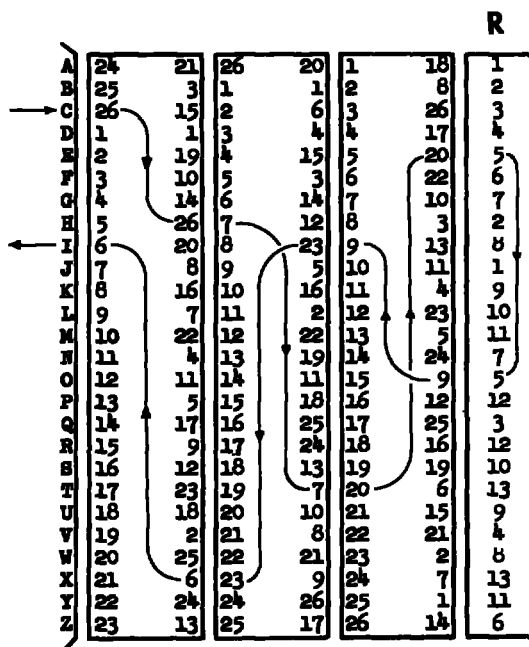


Figure 10.

In this illustration the encipherment (or decipherment) C = I is indicated by lines representing the wires which constitute the path of the current through the maze. (The reflector "R" is here shown as 13 pairs of numbers which represent the pairing by two's of the 26 points of the reflector.)

d. In Fig. 11, below, we have an illustration of one of the models of the Enigma machine. This particular machine has three rotors and a reversing rotor; the rotors are interchangeable but the reversing rotor (in this machine the first one at the left) always occupies the same position. All four rotors may be set to a particular initial alignment, but only three of the rotors step during the operation of the machine--the reversing rotor is usually a "dead" rotor with no motion. In the illustration below of an Enigma machine with the outer cover removed, the salient features have been indicated as follows: (1) inner cover; (2) aperture for reading the message rotor alignment; (3) slot through which rotor may be set at initial alignment; (4) rotor; (5) reflector; (6) illuminated lamp board; (7) keyboard; (8) plugboard, by means of which the connections from the keyboard to the stator (to the right of the fourth rotor) may be varied in order further to enhance the cryptosecurity of the machine; (9) battery box; (10) battery connection jack for outside power

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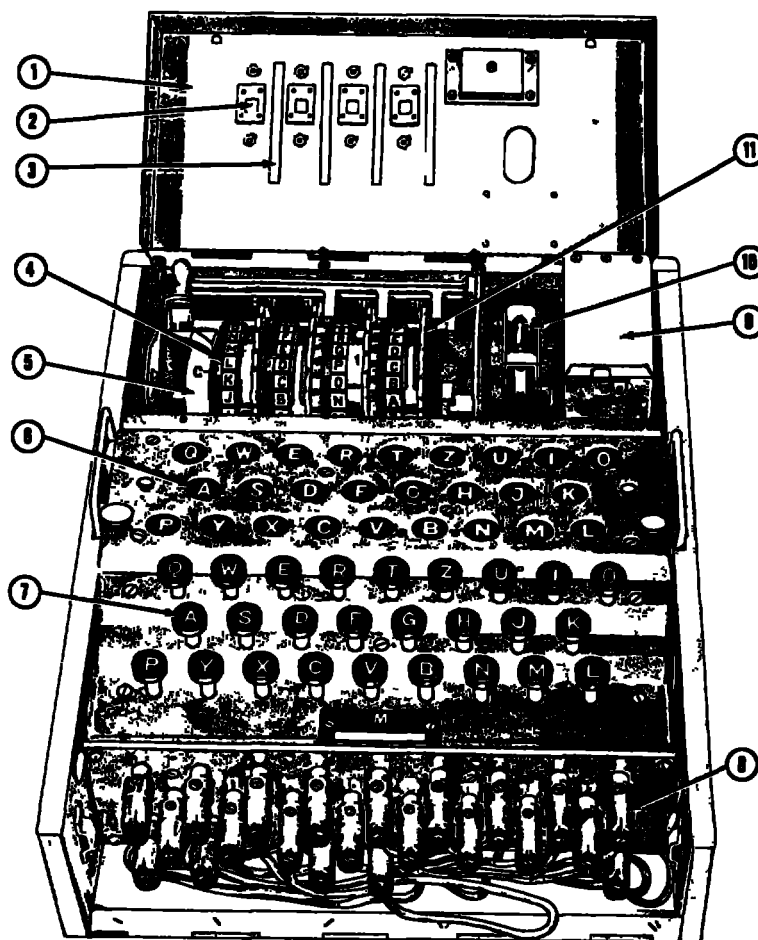
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Figure 11.

source; and (11) rotor rim which projects through slot in inner cover. In the operation of the machine, the rotors are first arranged in the order specified for the particular date, and the plugging is also set up according to a key list. An initial message rotor alignment is selected, and the key associated with the first letter of the plain text is depressed; the lamp which lights up is the cipher equivalent of this letter. The depression of any key also causes a rotor or rotors to step, so that a new alphabet comes into play with each letter enciphered or deciphered. The message rotor alignment, in clear or disguised form, is included as an indicator, usually at the beginning of the message. Since the Enigma is a reciprocal machine, decipherment follows along the same steps as outlined for encipherment.

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13. The B-211 cipher machine.--a. This electromechanical cipher machine was invented by Boris Hagelin and put on the public market in the late 1920's. The cryptographic principle of the B-211 may be expressed as a fractionation of the plain text by means of a 5x5 square, followed by separate encipherment of the row- and column indicators of the square, and finally a recombination to uniliteral terms through the same square. The fractionation is accomplished by a clever mechanical arrangement, whereby the depression of a key on a keyboard sets up a unique pair of rods equivalent to a specific pair of row- and column indicators of the fractionation square. The enciphering elements consist of four variable-pin rotors of sizes 17, 19, 21, and 23 (similar to those in the C-38) and two electrical switching devices. The switching devices consist of two 10-point "half-rotors," in which only the exit contacts of the rotors oppose an endplate, the entry points of the rotors being made through slip rings, in contradistinction to the usual wired rotor which in effect moves between two endplates; these switching devices, the movement of each of which is controlled by its associated pair of variable-pin rotors, serve to select what amounts to one of ten rows of a table for the encipherment of the row coordinates of the fractionation square, and one of the ten rows of another table for the column coordinates.

b. The fractionation square of one of the models of this machine is the following:³⁸

		e^2		
			L N R S T	
	e^1	A	L	M
		E	O	J
		I	P	U
		O	K	N
		U	I	H
			V	E
			A	

If there were no further encipherment, the word YOUR would be encrypted biliterally as AR EL IN ES. Now let us assume that both of the following two sets of alphabets are used successively to superencipher the e_p^1 and e_p^2 components of the fractionated plain text:

	e_p^1		e_p^2
	A E I O U		L N R S T
	O I U E A		R S N L T
e_c^1 :	E I O A U	e_c^2 :	S T R L N
	U O A I E		N R L T S
	I O U E A		R S N T L

It can be seen that the biliteral pairs AR EL IN ES are enciphered as ON IS AR OT; these new cipher digraphs are then transformed into single-letter cipher equivalents by means of the original fractionation square, resulting in NCYQ_c as the encryption of YOUR_p. The two sets of 10 enciphering alphabets (labeled A through K, omitting J) produced by the

³⁸ In this square the letter Z is missing; words which contain a Z are spelled with an X in place of the Z before encipherment.

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rotation of the switching devices in the B-211 are actually the following:³⁹

		θ_p^1				θ_p^2	
		A E I O U				L N R S T	
	A	A E I U O			A	R S N L T	
	B	O I U E A			B	S T R L N	
	C	E I O A U			C	N R L T S	
	D	U O A I E			D	R S N T L	
	E	I O U E A			E	L N T S R	
θ_k^1	F	A U E O I	θ_c^1		F	N R L S T	θ_c^2
	G	O U A I E			G	T L S R N	
	H	E A I U O			H	L N T R S	
	I	U A E O I			I	S T R N L	
	K	I E O A U			K	T L S N R	

Figure 12.

The switching devices step each time an active pin is sensed (at the effective position⁴⁰ of the rotors) on either or both of the variable-pin rotors associated with the switch; this stepping takes place just prior to the encipherment or decipherment of each letter. Each of the four variable-pin rotors moves one step at every encipherment or decipherment, as in the C-38.

c. An example of the mechanics of encipherment on the B-211 will serve to clarify the foregoing discussion. Let us assume that the four variable-pin rotors have been set up at the apparent setting of AAAA at the bench mark, and that at the effective setting the patterns of the active (x) and inactive (.) pins for the first 30 positions are as shown in the top four lines of Fig. 13, below, just under the position reference numbers. (The two switching devices are also assumed to have been set at AA.) The plugs are in the normal position, A = A, E = E, etc.

³⁹ The B-211 has two sets of plugs which serve to change the composition of the θ^1 and θ^2 enciphering tables; one set of five plugs consists of plugs marked with the letters A, E, I, O, and U, while the other set is marked with L, N, R, S, and T. Any one of the 5! (= 120) permutations may be used for the vowel plugs, and similarly for the consonant plugs, so that the total number of combinations of pluggings is $(5!)^2$ or 14,400; cross-plugging between vowel and consonant plugs is inadmissible. The tables in Fig. 12 result when straight-through plugging is made (i. e., where A = A, E = E, etc.). If the plugging were such that, for instance, A = O, the effect of the plugging would be that all the A's within the matrix would be changed into O's.

⁴⁰ The "23" rotor has the letters A-Y (omitting J and W) in normal sequence on its periphery, as a means of designating the setting of the rotor against a bench mark, the last letters of the "21", "19", and "17" rotors are V, T, and R, respectively. When the 23, 21, 19, and 17 rotors are all set at "A" against the bench mark (i. e., when the apparent setting is AAAA), the effective setting will be GFHG.

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	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
23:	.	x	.	x	.	x	.	x	.	x	.	.	.	x	x	.	.	x	.	x	.]	.	x	.	x	.	x	.	.	
21:	x	.	x	.	x	.	.	x	x	.	x	.	.	.	x	x	.	.	x	.	]	x	.	x	.	x	.	.	x	x
19:	.	x	.	x	.	.	.	x	.	x	.	x	x	.	.	x	.	.	x]	.	x	.	x	.	.	.	x	.	x	.
17:	.	x	x	.	.	x	.	.	x	.	x	.	x	.	x	.]	.	x	x	.	.	x	.	.	.	x	.	x	.	x
θ_K^1 :	B	C	D	E	F	G	G	H	I	K	K	A	A	B	C	D	E	E	F	G	H	I	I	K	A	B	C	C	D	E	
θ_K^2 :	A	B	C	D	D	E	E	F	G	H	I	K	A	A	B	C	C	C	D	E	F	F	G	G	G	H	I	K	A	B	
P:	Y	O	U	R	B	A	T	T	A	L	I	O	N	W	I	L	L	S	U	P	P	O	R	T	F	O	U	R	T	H	
$\theta_P^1 \theta_P^2$:	A	E	I	E	U	O	O	U	A	U	E	O	I	U	A	A	E	I	I	E	E	O	A	E	I	E	O	U			
	R	L	N	S	R	T	R	R	T	L	L	L	N	T	L	L	L	T	N	L	L	L	S	R	S	L	N	S	R	N	
$\theta_C^1 \theta_C^2$:	O	I	A	O	U	E	I	U	I	I	U	E	U	U	U	U	I	O	E	A	I	A	A	A	A	I	O	I	A		
	N	S	R	T	N	R	T	L	N	L	S	T	S	T	S	N	N	S	S	L	N	N	R	S	R	L	T	N	N	T	
C:	N	C	Y	Q	H	B	W	I	U	P	E	S	E	A	E	H	U	D	R	L	U	M	Y	F	Y	P	Q	U	U	X	

Figure 13.

The 23 and 21 rotors actuate the switch for the θ^1 components, while the 19 and 17 rotors actuate the switch for the θ^2 components. Since, as we have already said, the stepping of the switches takes place just prior to encipherment, the presence at position 1 of an active pin on the 23 rotor will cause the switch for θ^1 to advance one step; the θ^2 switch does not step, because the pins on the 19 and 17 rotors in position 1 of the diagram are both inactive. Therefore the keys for enciphering the θ_P^1 and θ_P^2 components of the first plaintext letter are BA. The key stream for enciphering the first 30 plaintext letters is shown in the two lines labeled θ_K^1 and θ_K^2 . In the line labeled "P" we have the plain text, which is shown in fractionated form in the lines labeled $\theta_P^1 \theta_P^2$; the encipherment of the fractionated plain text is shown in the lines labeled $\theta_C^1 \theta_C^2$, and the recombination into the final cipher text is shown in the last line, labeled "C." In decipherment, the cipher text is fractionated into its $\theta_C^1 \theta_C^2$ components, deciphered into its $\theta_P^1 \theta_P^2$ equivalents, and converted into the original plain text. As an exercise in decipherment, the student may try his hand on the following cryptogram which was enciphered with the keys above, containing an additional 20 letters beyond the last elements of key given.

N C Y Q H B W I U P E S E A E H U D R L U M Y F Y P Q U U X
 A W M B N R I Q C T T J L I W O Y L M B

d. In the operation of the B-211, the pins of the four rotors are first set up according to a prearranged key, as are the plugs. Next, the four rotors and the two switching devices are set up at some arbitrary alignment against the bench mark; the six letters designating this alignment constitute the message indicator, which is sent in either plain or encrypted form. The letter counter is set to zero, the encipher-decipher switch is set to the "C" position, and the machine is ready for enciphering. In decipherment, after the pins and the plugs have been arranged according

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to the key for the cryptoperiod, the rotors and switches are aligned according to the indicator, and the encipher-decipher switch is turned to the "D" position.⁴¹

e. The maximum period of the B-211 is $10^2(23 \cdot 21 \cdot 19 \cdot 17)$ or 15,600,900, while the shortest period is $(23 \cdot 21 \cdot 19 \cdot 17)$ or 156,009; the other periods possible are 156,009 multiplied by one of the factors 2, 5, 10, 20, 25, or 50. The B-211 has a self-contained tape-printing unit; in two earlier models, the one designated as the B-21 had lamp indications similar to the Enigma, while the B-22 was to be used with a specially equipped electric typewriter.

14. Cipher teleprinter systems.--a. Machines for the automatic and simultaneous encryption and decryption of the Baudot code used in teleprinter communications are usually constructed along the lines of key generators, and the key which is produced is applied to the plaintext Baudot characters according to the rules of Baudot addition.⁴² Generally, these machines employ either notched wheels (which in effect are fixed-pin rotors) or variable-pin rotors as a means of actuating relays which determine the substitution key for the plaintext Baudot character at each position of the message. Examples of some typical machines are described in the subparagraphs below.

b. A cipher teleprinter invented by Col. Parker Hitt, U.S.A., retired, and built in 1931 by a subsidiary of the International Telephone and Telegraph Corporation, had in its cryptographic unit an assembly of ten notched wheels mounted on a common shaft in such a manner that each wheel stepped one position with every operation of the keyboard of the machine. The first wheel had 96 positions, and each wheel thereafter had one more position than the preceding one, so that the tenth wheel had 105 positions. The depression of any key on the teleprinter keyboard actuated the mechanism which moved the wheels one step each.⁴³ Behind each wheel was a cam switch which was acted upon by an irregular arrangement of notchings (i.e., elevations and depressions) on the periphery of the particular wheel. At 26 of the positions of each wheel, spaced more or less regularly on the circumference, were the letters of the alphabet in normal order, permitting the wheels to be set up at designated initial alignments against a bench mark.

c. Each pair of wheels, 1-2, 3-4, 5-6, 7-8, and 9-10, was used in combination to produce a key stream for baud levels 1 to 5, respectively, for the encipherment of a Baudot character. For example, if the notches at the reading position of wheels 1 and 2 were alike (either two elevations or two depressions), the key produced would be a mark (+); if the notches were unlike (i.e., one elevation and one depression), the key produced would be a space (-). The key produced by the five pairs of wheels was applied by Baudot addition to the plaintext character to yield the enciphered resultant.

⁴¹ The effect of the encipher-decipher switch in the "D" position is to send the current through the machine in the opposite direction from that which it follows when the switch is in the "C" position.

⁴² Cf. subpar. 97b of the text, on p. 345.

⁴³ The period of this machine is therefore the least common multiple of the wheel sizes; in this case it is $2^5 3^2 5^2 7^2 11 \cdot 13 17 \cdot 97 101 \cdot 103$, or approximately 8.65×10^{14} .

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At each operation of the keyboard, ten new notchings would arrive at the reading position to be combined into a new Baudot key character. As an illustration of the key generation and application, let us assume that the ten wheels have been aligned at the bench mark so as to produce the individual wheel streams shown in Fig. 14a, below. The combined key streams:

	1	2	3	4	5	6	7	8
Wheel 1:	+	-	+	-	+	-	+	-
Wheel 2:	+	+	-	-	+	+	+	+
K ₁ :	+	-	-	+	+	-	+	-
Wheel 3:	-	+	-	+	-	+	-	+
Wheel 4:	-	-	-	+	-	-	-	+
K ₂ :	+	-	+	+	+	-	+	+
Wheel 5:	+	-	+	-	+	-	+	-
Wheel 6:	-	-	-	+	+	+	-	-
K ₃ :	-	+	-	-	+	-	-	+
Wheel 7:	+	-	-	+	-	+	-	+
Wheel 8:	+	-	-	-	+	+	+	-
K ₄ :	+	+	+	-	-	+	-	-
Wheel 9:	-	+	-	+	-	+	-	+
Wheel 10:	+	+	+	-	-	+	-	-
K ₅ :	-	+	-	-	+	+	+	-

Figure 14a.

	1	2	3	4	5	6	7	8
	A	D	V	A	N	C	E	9
P ₁ :	+	+	-	+	-	-	+	-
K ₁ :	+	-	-	+	+	-	+	-
C ₁ :	+	-	+	+	-	+	+	+
P ₂ :	+	-	+	+	-	+	-	-
K ₂ :	+	-	+	+	+	-	+	+
C ₂ :	+	+	+	+	-	-	-	-
P ₃ :	-	-	+	-	+	+	-	+
K ₃ :	-	+	-	-	+	-	-	+
C ₃ :	+	-	-	+	+	-	+	+
P ₄ :	-	+	+	-	+	+	-	-
K ₄ :	+	+	+	-	-	+	-	-
C ₄ :	-	+	+	+	-	+	+	+
P ₅ :	-	-	+	-	-	-	-	-
K ₅ :	-	+	-	-	+	+	+	-
C ₅ :	+	-	-	+	-	-	-	+
	Q	R	J	8	9	D	F	X

Figure 14b.

are shown in the lines labeled K₁, K₂,...K₅. Now if the first word of the message were ADVANCE, followed by a space (Baudot "9"), the five key streams shown in Fig. 14a would be applied to the plaintext bauds as shown in Fig. 14b, to yield the final cipher resultant of QRJ89DFX. That is, the first plaintext character (A), ++---, when enciphered by the first key character, ++++-, yields ++++- (= Q) as the cipher, and so on for the rest of the encipherment.

d. The next cipher teleprinter we shall take up is the machine patented in 1941 by the Olivetti firm in Italy. This machine has for its cryptographic elements a set of seven wheels having near their circumferences 26 holes into which may be screwed small metal studs at random so as to produce what amounts to fixed-pin rotors, of a variable sort at that; these wheels have the letters of the alphabet marked near the positions of the holes, so that the wheels may be set at specific initial alignments. Five of the wheels are cipher wheels, each one of which is used to produce the key stream for enciphering one of the five baud levels of the plaintext Baudot characters;⁴⁴ the remaining two wheels are used as motor wheels for stepping the cipher wheels in an irregular fashion. The first motor wheel (at the extreme right in the assembly of seven wheels) moves one step with every operation of the keyboard; the second motor wheel (immediately to the left of the first motor wheel) moves one step every time there is no pin effective at a sensing position on the first motor wheel.

⁴⁴ The leftmost wheel is used for the first baud level, the one immediately to its right for the second baud level, etc.

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The first cipher wheel is moved in similar fashion, stepping every time there is no pin effective on the second motor wheel; each succeeding wheel steps in the same way when there is an absence of a pin at a sensing position on the wheel immediately preceding, so that, for example, the fifth cipher wheel (at the extreme left of the assembly of seven wheels) is stepped by the absence of a pin at a sensing position on the fourth cipher wheel. In this machine a dependent ("junior") wheel keeps on moving as long as no effective pin is being sensed on its controlling ("senior") wheel.

e. The Olivetti machine is equipped with a set of ten wheels, any seven of which may be inserted interchangeably in the machine; this permits greater latitude in the number of keys available, without the necessity for frequent changing of the screwable pins. The internal key, governed by the cryptodate, consists of the particular selection and arrangement in the machine of seven of the ten available wheels; the external key or message indicator is the 7-letter sequence which specifies the alignment of the seven wheels against the bench mark.

f. The third cipher teleprinter we shall discuss is the Siemens cipher teleprinter patented in 1931 and manufactured in Germany by the firm of Siemens-Halske. This machine possesses the interesting feature, among others, of accomplishing in the encipherment not only baud substitution, but also baud transposition. The machine contains ten notched wheels with the number of positions on each wheel relatively prime to each other; these wheel sizes are 73, 71, 69, 67, 65, 64, 61, 59, 53, and 47. Five of the wheels are used for the substitution key applied to the plaintext Baudot characters, and the five remaining wheels are used to obtain the transposition keys which transpose the bauds of the first substitution to yield the final cipher;⁴⁵ the selection of which wheels will be used for the baud substitution and which for the baud transposition is controlled by the plugging of a small ten-position plugboard. In later models of the machine, the key for the five elements of the substitution and for the five elements of the transposition is obtained from ten different combinations of four wheels each, the particular combination for each element being determined by a plugboard.

g. In the original Siemens machine, all ten of the wheels moved one step with each encipherment or decipherment; in later models, two types of complex motion were introduced. In one type, the motion of a particular wheel is controlled by a motor sensing position on two other wheels, and in the other type of motion, different from the first, there is introduced an additional factor of irregularity by a kind of autokey feature, wherein the presence of a mark in the third level of the preceding plaintext character causes a movement of two of the wheels, while the presence of a space in the third level of the preceding plaintext character causes a movement of two other wheels. These two types of motion, called "ohne" and "mit" respectively, take their names from the legend on a two-position switch whose two states are marked "Ohne Klartextfunktion" and "Mit Klartextfunktion." If the ten wheels in descending order of size are designated by the letters A through K (omitting I), the two types of motion are as follows:

⁴⁵ The 5! (=120) permutations theoretically possible yield only 32 distinct Baudot characters after the transposition, however, owing to the particular switching arrangement in the Siemens machine, only 30 transpositions are actually possible.

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~~CONFIDENTIAL~~"Ohne" Motion

A,B,C,D step	if E is -	or F is -	
E steps	" F "	+ " G "	-
F "	" G "	+ " H "	+
G "	" H "	- " J "	-
H "	" J "	+ " K "	-
J "	" K "	+ " A "	-
K "	" D "	- " E "	+

"Mit" Motion

A steps	if B is +,	C is +,	or Θ_p^3 is +
B "	" C "	-,	D " +, " " " +
C "	" D "	- or E "	+
D "	" E "	- " F "	-
E "	" F "	+,	G " -, or Θ_p^3 is -
F "	" G "	+,	H " +, " " " -
G "	" H "	- or J "	-
H "	" J "	+ " K "	-
J "	" K "	+ " A "	-
K "	" A "	+ " B "	-

Note that in the "ohne" motion the first four wheels step together as a block; this has the effect of guaranteeing a cycle of at least 73-71-69-67, or 23,961,009. The "mit" motion, being aperiodic, has no determinate cycle.

15. Ciphony, cifax, and cdivision systems.--a. Methods for the encryption of speech, facsimile, and television signals employ the same general ideas of substitution and transposition as are found in literal cryptosystems. However, whereas in literal cryptosystems the unit of encryption is usually a single character, the corresponding unit in a ciphony, cifax, or cdivision system is a timed portion of the continuously varying audio or image scanning signal. Ciphony, cifax, and cdivision systems fall into two broad categories of systems, viz., privacy systems and security systems. The cryptosecurity afforded by a privacy system is minimal, offering protection only against direct listening or viewing; on the other hand, security systems offer maximum, which in some cases might be absolute, protection against cryptanalysis.

b. Speech privacy systems embrace those systems which operate directly on the speech itself, in either the frequency dimension or the time dimension, or both. The earliest basic idea of a speech privacy system is the principle of frequency inversion such as is embodied in commercial transatlantic telephone systems. This principle involves the modulation of the audio signal with a fixed frequency, so that the resultant signal is the difference⁴⁶ in frequency between the two component signals; this has the effect of changing high frequency sounds into lower frequency sounds, and vice versa. From this simple idea we can progress into systems in which several frequencies are used in a changing pattern for the modulation, or in which the modulating signal is continuously changing within a frequency band. Another idea widely used in commercial ciphony equipments is that known as band splitting, involving splitting the entire speech band into several smaller bands and then shifting these smaller bands in the frequency spectrum.

c. The foregoing systems are substitutive in character; the next system to be mentioned, transpositive in nature, is that known as time division scrambling. Speech in this system is recorded on a magnetic tape, and the

⁴⁶ The sum of the two signals is also produced at the same time, but this sum is eliminated by a filter circuit.

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transcription from the tape is "read" in an irregular manner. In one typical system, units of speech of 3/4 second's duration were divided into 20 segments, and these segments were transposed to constitute the enciphered speech transmission.

d. Speech security systems embrace those systems in which the continuous speech wave is first converted into a series of binary impulses (similar to the impulses of the Baudot code), and then this intermediate plain text of "binary digits" is enciphered by adding a binary key stream (derived from a suitable key generator) to the binary plain text. The three principal methods by which speech is converted into binary form involve (1) pulse code modulation, (2) delta modulation, or (3) a vocoder. Each of these methods converts the continuous speech wave into a digital approximation of the original wave, as described below:

(1) In pulse code modulation, the amplitude of the speech wave is sampled at a rate at least twice the highest frequency component in the wave; each sampled amplitude is then approximated by categorizing it as one of n discrete levels (represented by binary coding) spaced along the amplitude dimension. In a typical system, the speech is sampled 6000 times per second, and each sample is identified with one of 16 possible amplitude levels represented by a four-element binary pattern; the output of this pulse code modulation system is a stream of binary signals at the rate of 24,000 "bits" (i.e., binary digits) per second.

(2) In delta modulation, an approximating wave is generated by comparing the amplitudes of the speech wave and the wave being generated. If the amplitude of the generated wave at the instant of sampling is less than that of the speech wave, the next fragment of a synthetic wave is generated for a fixed interval (until the next sampling instant) and with a fixed constant positive slope; if the amplitude of the generated wave is more than that of the speech wave, the next fragment of the synthetic wave is generated with a fixed constant negative slope--thus the generated wave being synthesized is constantly correcting itself, in zigzag fashion, so as to produce an approximation to the original speech wave. The positive and negative slope information is represented by binary digits; good quality speech can be obtained by the delta modulation process using approximately 25,000 comparisons per second.

(3) The vocoder is a speech analyzer and synthesizer developed by the Bell Telephone Laboratories; in a vocoder system the spectrum of the speech wave is separated into a number of nonoverlapping frequency bands, and the amplitude in each band is sampled and coded by the pulse code modulation process. At the receiving end, a synthesizer creates artificial voice sounds from the incoming digital information.

e. The earliest idea for a facsimile privacy system was patented in 1928 by Edouard Belin, and involved variations in the velocity of the synchronized sending and receiving drums of the facsimile equipment. Other facsimile privacy systems include pretransmission scrambling, in which the

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plaintext copy is optically disarranged before transmission, and time division scrambling similar to that employed for ciphony purposes. In facsimile security systems, the plaintext copy is optically scanned and converted into a stream of binary digital signals; each square inch of the image is converted into approximately 10,000 binary digits of black-white information. A binary key, generated by a suitable key generator, is added to the binary intermediate plain text; at the receiving end, the same key is added to the incoming cipher signals to produce the original plaintext copy.

f. Television privacy systems may use adaptations of any of the methods of speech privacy systems. Television security systems would likewise employ the same general techniques as are found in secure speech and facsimile systems; however, owing to the broadness of the frequency spectrum necessary to transmit the secure digitalized television signals and the very high speeds necessary in the key generation for encrypting them, major difficulties are encountered in the development of these systems.

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APPENDIX 7

INTRODUCTION TO TRAFFIC ANALYSIS

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INTRODUCTION TO TRAFFIC ANALYSIS

	Paragraph
General.....	1
Radio communications.....	2
Operating data.....	3
Radio procedures.....	4
Radio messages.....	5
Preliminary net reconstruction.....	6
Analysis of radio operations.....	7
Traffic intelligence.....	8
Concluding remarks.....	9

1. General.--a. In Appendix 7 ("Communication intelligence operations") of Military Cryptanalytics, Part I, the general nature of traffic analysis was broached briefly, together with the related fields of interception, radio direction finding and radio position finding, and Morse operator analysis and radio fingerprinting. Traffic analysis is defined as that branch of cryptology which deals with the study of the external characteristics of signal communications and related materials for the purpose of obtaining information concerning the organization and operation of a communication system. By means of traffic analysis valuable information can be derived concerning the enemy and his intentions, even without actually reading the texts of the intercepted messages; the solution and translation of messages are the functions of cryptanalysis and not traffic analysis.

b. Traffic analysis can yield a detailed knowledge and thorough understanding of a communications network; traffic analysis techniques involve, among others, the reconstruction of the nets and the determination of the methods of their operation, the solution of call sign and routing or address systems, the solution of frequency rotation systems, the identification and analysis of components of the message externals, the interpretation of radio procedure, the study of the distribution of cryptosystems, and the analysis of authentication systems. The results obtained from traffic analysis materially contribute to the following:

(1) Intercept operations. Traffic analysis provides information such as call signs, frequencies, locations, and schedules pertaining to target enemy stations, thus assisting intercept stations in the accomplishment of their missions; and, in coordination with cryptanalytic and intelligence interests, traffic analysis assists in establishing the priorities for the interception of individual circuits.

(2) Cryptanalysis. Traffic analysis furnishes assistance to cryptanalysis in many ways, depending upon the particular communications situation; this assistance includes information as to the identity and location of radio stations, information of cryptanalytic interest gleaned from enemy operators' "chatter," identification of possible stereotype or proforma messages from external characteristics of the traffic, and identification of isologs.

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(3) Intelligence. The organization of a radio network and the manner in which messages are passed over this network reflect troop disposition, command relationships, and impending movements and preparations for military activity; therefore an analysis of net structure, traffic contacts and patterns, traffic volumes, and similar communications features, is of considerable assistance in building up a complete intelligence picture.

(4) Security. The techniques developed by traffic analysis in the attack on intercepted enemy communications may also be applied to our own monitored signal communications in order to uncover possible weaknesses and to maintain high standards of communication security by preventing these weaknesses from developing in our communications.

c. There are three kinds of basic data used in traffic analysis, as follows:

(1) Intercept data, comprising all information supplied by the intercept operator, and consisting of the frequencies on which transmissions are heard, the time the transmissions are heard, intercept operator comments such as signal strength and audibility, "fist" characteristics of the target radio operator, and any peculiarities in the transmission or handling of the traffic that strike the intercept operator as being significant or out of the ordinary.

(2) The transmission, comprising everything transmitted by the target radio operator, and including the initial call-up, the exchange of call signs, the traffic passed, the servicing incidental to the traffic being passed, the radio operators' chatter, and the signing off. Traffic consists of the message externals (i.e., the preamble and postamble, if any) and the message text proper. The externals comprise various items that facilitate the handling of the message, among which are the radio station number and perhaps a message center number or other reference numbers, the group count, routing and address information, precedence indicators, the file date and time, etc.; all this information is of considerable potential value in traffic analysis. The message text, if it displays patent cryptographic characteristics, can also be of use.

(3) Collateral information, comprising any information, other than that derived from a study of intercepted communications, which may be of value in traffic analysis; e.g., captured documents, intelligence reports, etc. In addition, traffic analysis is aided by communication intelligence collateral such as direction-finding bearings, Morse operator analysis, plain language messages, and decrypted traffic.

d. In traffic analysis the details of each feature of the communications operations or structure are studied, followed by analysis of the interrelationships among these features, culminating in the reconstruction of an entire net together with all the details of its operation. At the start of a traffic analysis problem, little may be known concerning the target communications; it would first be necessary to segregate initially intercepted traffic into several major types or nets by means of cryptographic features,

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common operating characteristics, or other means. At this point the intercept stations are given general search missions over the entire range of radio frequencies to intercept desired types of transmissions. As traffic accumulates, fragmentary nets are diagrammed and analysis is begun on the transmission characteristics and on the message externals, with particular emphasis on the preamble components and on routing methods; research is performed on call signs, frequencies, schedules, procedure signals, external message numbers, routing indicators, and cryptographic features, resulting in the ultimate reconstruction of the complete net with all its pertinent details.

2. Radio communications.--a. Efficient radio communications are dependent upon (1) the physical laws for the transmission, and (2) the requirements imposed by the necessities for the establishment and maintenance of communications. The first consideration involves the frequencies and power used, and the second consideration embraces the details necessary for the communications themselves, such as the call signs, routing, message numbering conventions, and receipting and servicing of the traffic. These latter items may be varied or changed by direction of the communications authority either for convenience in handling traffic, or for purposes of secrecy, or both.

b. From the standpoint of traffic analysis study there are three main aspects of radio operations, as follows:

(1) The operating data. These consist of the basic operating and functioning data of the net; e.g., the structure or form of the net, the frequencies, the call signs, and the schedules.

(2) The radio transmission. This includes the particular Morse code used, the procedure signals employed, the order of elements of the transmission, and radio operators' chatter.

(3) The messages. These include the message texts proper, together with the message preambles and postambles. The cryptographic features of the message texts, such as discriminants and message indicators, the type of cryptographic text (whether in letters or digits), and the length of the code groups, are all of considerable assistance in traffic analysis; plain-language messages are also exploited.

3. Operating data.--a. Radio stations are linked together and organized into nets for the purpose of intercommunication; this organization follows definite patterns, reflecting the command structures since the lines of communication must coincide with echelons of command in order to meet military communication requirements. In a particular grouping of stations the one serving the senior echelon is the station usually in charge of the subordinate stations; this station is called the net control station (abbr. NCS), and the others are called outstations. The control station is responsible for the supervision of transmissions, procedures, and circuit discipline. A typical net structure is shown in Fig. 1, below.

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Station 1 is the superior headquarters, with Stations 2, 3, and 4 as the immediately subordinate outstations; Station 2 in turn has two outstations,

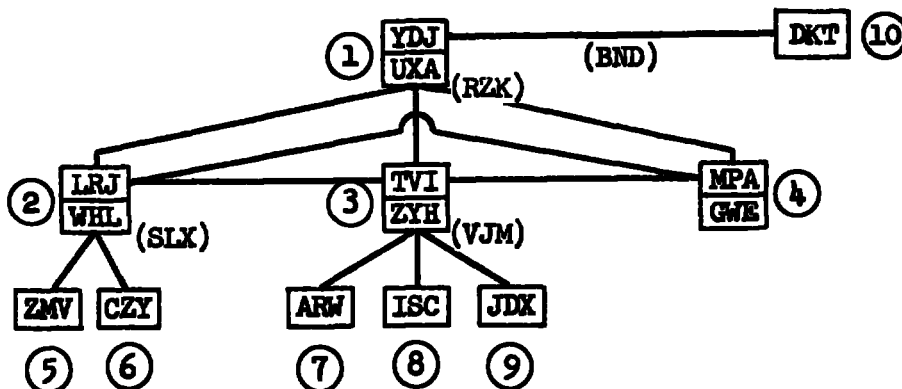


Figure 1.

and Station 3 has three outstations. Station 1 is also in communication with Station 10, the NCS of another net.

b. Stations are identified by one or more call signs which consist of a group of letters, digits, or both. In the diagram above, Stations 1-4 have two call signs each, while the remaining stations have but one call sign. Multiple call signs are used for convenience of operations, or for security; they are either in the form of variant call signs (the selection from which being left up to the radio operator) or of split call signs (the selection of the proper call sign being governed by the time of day, the radio frequency used, etc.).

(1) The usual type of call-up is the double-station call procedure, wherein the call signs of the called station and of the transmitting station are sent, separated by the procedure signal DE (meaning "from"); for example, if TVI is calling UKA, he would transmit the following:

UKA UKA UKA DE TVI TVI TVI

The reply from UKA would then be:

TVI TVI TVI DE UKA UKA UKA

(2) In the single-station call procedure, only one call sign, usually that of the called station, is used. For example, if ZYH is calling ARW, he would send ARW ARW ARW; when ARW answers, he would reply in the same manner, ARW ARW ARW.

(3) Sometimes one particular call sign is assigned to a link, i.e., for intercommunication between two specific stations. For example, referring to Fig. 1, when Station 1 wishes to make contact with Station 10, he would send the link call sign BND repeated several times, and Station 10 would reply with the call sign BND.

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(4) In addition to the foregoing types of calls, there may also be used a collective call sign for calling several specific stations in a net; when such a call sign is used for alerting all of the stations in the net, it is called a net call sign. For example, Station 1 uses the net call sign RZK for reaching his three outstations, and Station 3 uses VJM as his net call sign.

(5) In all of the foregoing procedures, split-call working might be employed. As an example, we note in Fig. 1 that Station 3 uses the call sign TVI when communicating with its superior, Station 1, or with Stations 2 and 4; however, when Station 3 is communicating with its own outstations, it uses the call sign ZYH.

c. Stations in a net are assigned one or more frequencies for radio communication; the allocation of frequencies is predicated upon transmitter characteristics, distance requirements, the time of transmission, and other factors. In simplex working, stations operate on a common frequency; in complex working, more than one frequency is used. In complex sending, stations are assigned transmitting frequencies, and each station uses its assigned frequencies to make contact with other stations; in complex receiving, stations are assigned receiving frequencies, and stations sending to a particular station use the frequency assigned to it.

d. The time of communication is an important factor in radio operations. Schedules for communication are established for those stations which pass comparatively little traffic, or which have an insufficient number of operators for free communication with all necessary stations; in such cases, schedules are arranged so that each operator may take care of several circuits at different times. Such schedules also permit maximum use of one frequency, without interference or confusion. When no schedules are in force, stations are free to contact each other at any time, either by setting the time for the next contact at the last transmission, or by maintaining a watch on assigned frequencies.

4. Radio procedures.--a. In radiotelegraphy the transmission of information is accomplished by means of Morse codes. In the case of countries whose alphabets differ from the English alphabet, modifications of the international Morse symbols are introduced to take care of accented and other unique letters of the language.

b. Radio operators use certain signals and signs to facilitate operating and passing of traffic. The most common sets of operating signals, used in international practice, are "Q" and "Z" signals which are three-letter combinations beginning with these letters. For example, QRU means "I have nothing for you," and QRU followed by a question mark (Morse IMI) means "Do you have anything for me?" Besides these operating signals, various procedure signs are used by the operators, such as the following:

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AR	End of transmission	GR	Group count
AS	Wait	IMI	Repeat or question
BT	Break	K	Invitation to transmit
C	Correct	WA	Word after
DE	From	VA	End of schedule

In addition to the foregoing, radio operators may be provided with a specialized cryptosystem, usually in the form of a small chart (with row- and column coordinates) containing letters, digits, words, and useful short operators' messages.

c. In order to prevent enemy stations from entering a net and confusing its operations, authentication systems are used. In station authentication, challenges and replies are exchanged mutually by stations upon establishing initial contact; in message authentication, certain elements from the heading and from the message text are designated by prearrangement as test elements, and these test elements are validated by an authenticator symbol or symbols in the preamble.

d. In military communications, a single time designation is used to avoid the confusion that would result if each station used local time as reference. Normally, Greenwich Mean Time is used for all communications, although in some instances the time zone of the capital of a country is employed; in any case, it is usual practice to include the suffix letter of the time zone, as for example 231600Z meaning 1600 Greenwich Mean Time on the 23d of the month.

e. There are certain elements of the transmission which are standard for most radio operations. These are: (1) the call-up, or the procedural rules by which stations make contact with one another to prepare for the transmission of traffic; (2) the order of traffic, governed by rules which determine which station is to transmit its traffic first, and in what order; (3) the transmission of traffic, in a prescribed manner; (4) the receipting for traffic, in which the receiving station acknowledges receipt of messages; (5) corrections and services, to insure that the traffic transmitted and received is as garble-free as possible; and (6) the signing off, or the procedures prescribing the manner of terminating transmissions. Variations in the number and detail of the foregoing elements exist not only among various nations, but also among the military services of a particular country and among the different echelons of these services.

5. Radio messages.--a. Radio messages must carry pertinent information to insure proper handling in both the message center and the radio station. This information, almost invariably incorporated in the message externals, usually includes serial numbers of various kinds, date-time groups, precedence symbols, routing instructions, addresses and signatures, the group count, and other special instructions.

b. The number which is put on the message by the transmitting radio operator for reference purposes is known as the station serial number

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(abbr. NR); a number series may be assigned to all messages transmitted by a particular station, or separate number series assigned to messages passed on each communication link. Message center numbers (abbr. MNR) are numbers assigned serially by a message center to all outgoing traffic, regardless of destination; these numbers are used for reference purposes between originating and receiving message centers. When messages are relayed, the station serial numbers change on each link of the communications path, whereas the message center number usually remains constant. Other kinds of numbers are sometimes found in message externals, especially at the higher echelons, such as cipher office numbers, radio station in-desk numbers, etc.

c. Precedence indicators or symbols for expediting traffic are either in the form of abbreviated plain text (such as "U" for Urgent) or in encrypted form as a group of letters or digits. Sometimes variants are provided for these indicators as a security measure, or these indicators may be subjected to encipherment.

d. When direct communication between two stations is not possible, routing instructions are usually incorporated in the externals of messages. Designations of locations or units in plain text may be utilized for this purpose, or call signs may be used for the routing, but, more usually, routing codes are employed which contain code groups for principal locations or units, as well as syllabary groups for encoding designations not in the body of the code. Similarly, when addresses and signatures are distinct from routing instructions, a separate scheme may be devised for the transmittal of this information, usually by means of codes.

6. Preliminary net reconstruction.--a. In the initial approach to a traffic analysis problem, traffic identified by the language of plaintext chatter or by national characteristics of the transmission as belonging to the target country is segregated into major homogeneous types on the basis of common operating characteristics, message formats, discriminants, chatter, or any collateral information. Thus traffic from army, navy, air force, and other nets may be isolated into distinct groups.

b. A preliminary grouping of stations is diagrammed from observed contacts between stations. Simultaneously, analysis is begun on the characteristics of the radio operations. As an example, let us assume that the groupings of stations in Figs. 2a and b, below, have been reconstructed from observed contacts on the transmitting frequencies in kilocycles as indicated, and that we have made a mental note that, on the basis of procedural characteristics, UXA and ZYH are probably net control stations. We note that TVI and ZYH have the same frequency; if frequencies are assigned uniquely to target stations, then TVI and ZYH represent the same station. Tentative confirmation may be obtained if it is found that the serial numbers used by TVI interlock with those of ZYH, or if routing information on messages from TVI and ZYH shows identical originators; further confirmation may be obtained from chatter (wherein, for example, the operators at TVI and ZYH refer to the same person as their commanding officer), from direction

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finding bearings, Morse operator analysis, discriminant and indicator studies, etc. By continuing this method of analysis, we shall arrive at

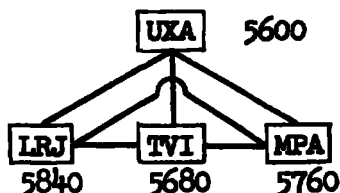


Figure 2a.

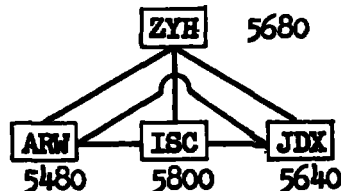


Figure 2b.

a portion of the diagram in Fig. 1, wherein TVI and ZYH are shown as split call signs belonging to one station. This example of approach is perhaps an oversimplification, but it is illustrative of the general methods followed.

7. Analysis of radio operations.--a. This phase of traffic analysis involving the study of the operating data and the elements of the transmission is, as previously stated, carried on concurrently with initial net reconstruction. When fragmentary nets have been put together, continuity over date breaks is made possible by the analysis of radio operations.

b. Callsign analysis embraces the determination of the methods of generation, allocation, and rotation of call signs, together with the system of use. Call signs may merely consist of different random N-character groups, in which case no system of generation is recoverable, or they may be generated by a permutation table or similar scheme. The available call signs may be arranged in the form of a chart or in a book of tables, and stations may be allotted specified positions in the chart or book on, let us say, the first of the month; subsequent changes of call signs may be governed by following a prearranged route in the chart or book, or by the application of some mathematical formula. Callsign systems may also involve several sliding strips as a means of generation, with a convention prescribed for the manner of selection and rotation of the call signs derived from the strips. Regardless of the system of generation and rotation, when sufficient callsign continuity has been established, interpretation of the patterns and phenomena disclosed will permit recovery of the system.

c. Frequency analysis has the same general objectives as callsign analysis, viz., the determination of the methods of selection, allocation, and rotation of frequencies, together with the system of use. When more than one frequency is assigned to each station, lower frequencies are generally used at night and higher frequencies during daylight, for technical reasons; certain of the frequencies may also be designated as standby frequencies. Frequency assignments may be published in chart form, with an initial allocation and rotation system similar to that used in callsign systems. Here again, continuity of frequencies will permit recovery of the system. Both in callsign and in frequency analysis, continuity may easily be obtained if some of the operating data or elements of the transmission change and some

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do not. Even if call signs and frequencies change daily, continuity may be established by taking into consideration any of the following: patterns of station serial numbers or message center numbers; routing information; discriminants (especially one-time-pad discriminants which are usually unique for each link); procedural peculiarities (e.g., the use by a particular station of distinctive separator signs, tuning signals, etc.); chatter; schedules; service messages over a date-break; and direction finding and Morse operator analysis reports.

d. Procedure messages and chatter between operators are of particular interest in traffic analysis. When unknown procedure signals are used, or when procedure signals are encrypted, their meanings may be determined through observation and interpretation. As an elementary example, let us suppose that at 0915 an intercept operator hears TVI send to UKA on 3800 kilocycles the procedural transmission "XLC 1200", after which contact with TVI is lost, and that TVI is heard calling UKI again at 1158. The inference may be made that XLC means "I shall contact you again at ___ hours", followed by the time. Or again, let us suppose that after that same transmission, contact with TVI was lost, and that the intercept operator in searching for target stations on his receiver picks up TVI a few moments later on 4800 kilocycles. In this case, it may be inferred that XLC means "I am changing my frequency to ___ kcs", followed by a frequency designator which is to be multiplied by 4 to indicate the actual frequency.

e. The identification of preamble components is a relatively simple matter. If messages from Station A to Station B are sorted by intercept time, the station serial numbers should be in an ascending series (barring, of course, missed traffic), so that we look for such manifestations in elements of the preamble. If all the traffic sent from one call sign, regardless of direction, is sorted by file time (where this information is included in the preamble), the message center numbers should be in an ascending sequence, with gaps caused either by missed traffic, or because the station concerned used more than one call sign, or because some messages may have been transmitted by means other than radio. The position of originator groups in the message preamble may be discovered by sorting traffic by transmitting station and noting the consistency of certain groups in a particular position; likewise, addressee groups may be identified by sorting traffic by receiving station and looking for a high rate of occurrence of some group or groups in a particular position in the preamble. The identification and interpretation of precedence indicators may be accomplished by studying a small volume of traffic emanating from one station and comparing the file times with the intercept times; when a series of messages are transmitted by a station one after the other, the messages with higher precedence are invariably transmitted first, and study of the traffic will give clues as to the meanings of these indicators. Sometimes preambles also contain groups indicating the security classification of the message; these groups are often difficult to identify and interpret, but nevertheless a study of chatter and of the discriminants used on the various cryptonets will permit a solution.

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f. As may be observed from the foregoing discussion, identification and partial solution of the elements of the preamble proceed simultaneously; further study and analysis will make possible a complete solution of these elements. Additional information on radio operations can be derived through study of schedules, textual features of encrypted traffic, cryptonets, and discriminants and indicator usage. Collateral information will be of assistance in these studies, as will information derived from cryptanalysis and other communication intelligence sources.

8. Traffic intelligence.--a. The last phase of traffic analysis is the reconstruction of the complete enemy network in the form of an integrated diagram showing call signs, frequencies, and other technical data such as serial-number allocations, discriminants, etc. Identifications of unit organizations and their geographical locations are shown, which, when coupled with intelligence from all sources, will portray the enemy Order of Battle.

b. When changes in net structure take place, these may be brought about by the appearance of new units in a command or the deactivation or redeployment of old units. Changes in contact relationship may be indicative of impending moves; significant changes in traffic volumes or in cryptographic systems may be indicative of preparations for military activity.

9. Concluding remarks.--a. Traffic analysis furnishes much information on communications features of assistance in cryptanalysis, such as information concerning the originators and addressees of the messages, isologs and resends which result from cryptographic error, messages with potential crib value, and chatter pertaining to cryptographic matters.

b. Some traffic analysis items of particular interest to the cryptanalyst are the following:

(1) When the group count is constantly checked by the enemy operators, this is usually indicative that the cryptosystem includes transposition as one of its steps.

(2) When the date or file time is invariably checked, it is indicative that these elements are factors in key selection.

(3) When a group in a particular position of the text or of the preamble is checked frequently, this may indicate that it is involved in key selection.

(4) Rapid sending, with no requests for services by the receiving operator, is an earmark of practice or dummy traffic.

c. The general principles of traffic analysis have been presented briefly in the preceding paragraphs; however, actual application of these principles and techniques in some typical problems is necessary in order to insure that an adequate comprehension of the subject has been obtained. In the next appendix, "The Zendian Problem: an exercise in communication intelligence operations," opportunity is offered for the student to apply the general methods of traffic analysis he has learned and modify them to suit the contingencies of the particular situation, learning thereby additional facets of the art.

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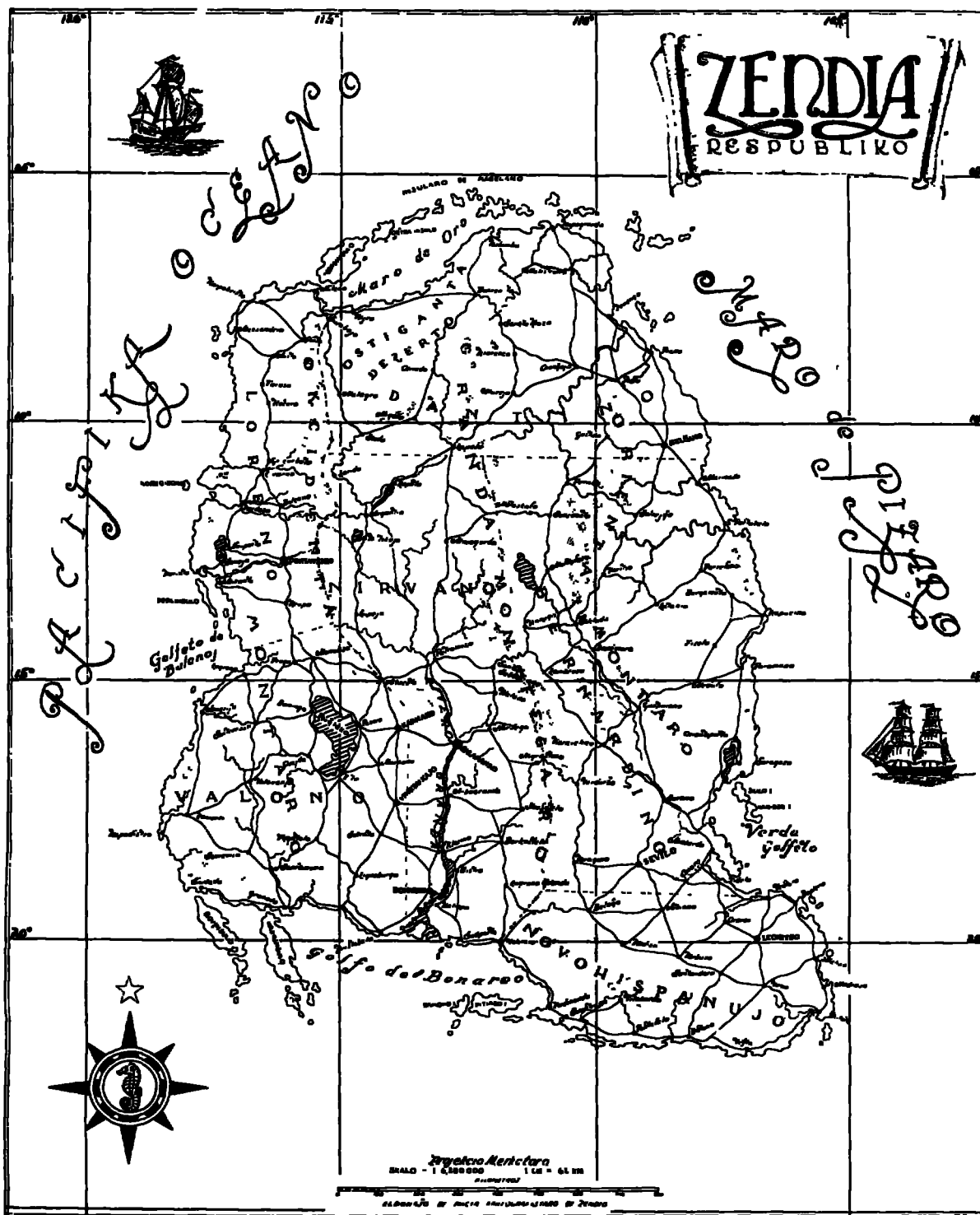
APPENDIX 8

THE ZENDIAN PROBLEM: AN EXERCISE IN
COMMUNICATION INTELLIGENCE OPERATIONS

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**THE ZENDIAN PROBLEM: AN EXERCISE IN
COMMUNICATION INTELLIGENCE OPERATIONS**

A. Introduction

1. The Zendian Problem, presenting an operational communication intelligence situation in miniature, affords opportunity to apply the techniques of traffic analysis and cryptanalysis, to derive intelligence, and to prepare reports. This problem deals with the enemy communications during an amphibious operation against Zendia, an island in the Pacific located approximately 2000 miles west of Peru, with an area of 990,000 square miles and a population of 17,320,000. Zendia is a totalitarian state under the absolute dictatorship of Marshal Salvo Salasio, the Prime Minister, who embarked upon a series of high-handed actions which led to an ultimatum by the United Nations Security Council; this ultimatum was rejected by Salasio. The United States, acting under the authority of the United Nations, assembled Task Force Pearl and embarked upon Operation Seahorse which had as its objectives the establishment of an occupation force to liberate the Zendian people from the Salasio regime, with a restoration of the true Zendian Republic.
2. In Phase I of Operation Seahorse, initial assault elements of the U.S. Eighteenth Army (consisting of XXIV and XXX Corps) landed at 0500 on 16 December, under support of naval gunfire and air attack, on beaches near Aleksandrio on the northwest coast of Zendia. The outnumbered Zendian shock troops near the invasion area fought a delaying action, retreating southward and crossing the Pontine River at Grizurbeto. The remainder of the U.S. expeditionary force was landed successfully, and by the night of 22 December had advanced to the north bank of the Pontine River; in the meanwhile, strong Zendian reinforcements were brought up on the opposite bank, preventing further advance on the part of the United States forces.
3. Intelligence efforts during the period of the U.S. advance yielded but little information; the few Zendian prisoners taken would give only name, rank, and serial number; and the interception of enemy communications revealed little of value, the enemy elements in the vicinity confining their radio activity almost entirely to sporadic low-power voice transmissions between rapidly moving units. By the morning of 23 December, however, radio intelligence units assigned to the U.S. Army headquarters and to the two U.S. Corps were fully operative and began an all-out effort to intercept and solve the greatly increased and now entirely encrypted Zendian communications, in order to secure vitally needed intelligence.
4. The traffic intercepted on 23 December totalled 375 messages; these are shown in Section B, with a digest of the day's chatter in Section C. The top line of the message heading is the intercept line, consisting of the receiving and transmitting call signs, the frequency, the intercept date/time, and the intercept station designation; also included is a teleprinter serial number (which can serve as a worksheet number in subsequent machine processing) used in forwarding the traffic

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to the United States by radioprinter. The second line of the heading is a message preamble which consists of eight 4-digit groups; this is followed by the message text, invariably transmitted in groups of five characters. (In all messages, the first two groups are repeated at the end--these from their appearance are the discriminant and message indicator.) Initial analysis of the preamble components revealed that the first three digits of the preamble constitute the station serial number, the next three a message center number, the next six the file date/time, followed by four groups whose meaning has not yet been determined; in the last group of the preamble, the first two digits constitute the group count, and the last two digits are still unidentified.

5. Data from the traffic for 23 December were recorded by hand on traffic analysis logs for initial study; as machine time became available, these data were punched on IBM cards from the original traffic and listings were made for traffic analysis purposes. In the listing shown in Section D, the major sort is on the transmitting call sign and the minor sort on the receiving call sign; in Section E, the major sort is on the frequency and the minor sort on the transmitting call sign; the listing in Section F (useful for cryptanalytic purposes as well) has the major sort on the discriminant, with intermediate and minor sorts on the A2 and A3 groups. Data from the traffic of 24-26 December are included in Section G, which is a listing with major sort on date, intermediate sort on transmitting call sign, and minor sort on receiving call sign. In all the listings except that in Section F, the data are in the following order: (1) worksheet number; (2) transmitting call sign; (3) receiving call sign; (4) frequency; (5) intercept date/time; (6) station serial number; (7) message center number; (8) file date/time; (9) to (12) the four unidentified tetranomes in the message preamble; (13) group count; (14) unidentified dinome in the message preamble; and (15) discriminant. In Section F, certain elements of the heading have been omitted in order to make room in a concise listing to include the first five groups of the message.

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NCM DE IZW 5385KCS 230136T UEM-99/0001

0018 0923 0100 1101 3644 5815 3917 8012

JGGJG DZBDD XJKUF TWLIM XOPAF QKQPM WGLWF KQLAF ROOVB TBCWK
XDMIU NWSNA UWKAD YXDEM WQAFW LCDNF STUBQ WVKAI HBYXC LMCJJ
PLJMG ZOJCR LFLLE BRGKA SKEMZ XEDGC MBZQK HIRKO GOMEN RYHDA
PJXCB TZLFR NMAHE YFVEP PASZK DRTCY KKTDM CVCTO KUFZR IQBEPJ
XSCLL BEDAX ONZBY DVMQY DRPTJ DREXL TOKJM ZSLNS ANARQ OBTMK
YLJQP MMBVU LUNTR POHLZ CBART TLZVH UDEHH JOPWT QIAAV CZEDI
MBQNC FQONE BSTVB VLPFA HJGIM XKOZA VRYRG FKGGA XIKGN QOAGL
XOJEH EVZCR MJTEZ RCKPD OPPIM RLZNC AXYSW DDEKN JGGJG DZBDD

NCM DE IZW 5385KCS 230157T UEM-99/00002

0028 0923 0100 1101 3644 5815 3917 8024

JGGJG BRDAJ TWSFR ZFYUZ JWADS GBOAG BCYXT MPDEF PVAEL HQGXF
VJVED LKUVI BSKFPQ KIVWA KERDN WNGAL BCJCK HLLIS RMQOU FANTQ
VDRKD XSEFD PZOZB AINJJ JFPLF EROYT ZVKEI KTDGQ HJING YOBVC
SQUKX VEMLM HAAAI XYMER NBYTC VZDFP KQWWD CACQK BBSYX BILTW
RQVKE VIBFV BTEZE GZFTS LIBYU WTBWP MFWWE QKYJF JEPBI UELLS
SQCYX MYCYG HXKLF GLOFL YBDYN AUDVB FCBHR CRPKG MRGCH QIMNO
MRQDQ XUMJD RAOBL OQLAQ ZNDEF KNVME PFTYN VFFXK TUMDU YDFTT
XFBYP LQDDO VBOME OZPZF AJPZA EBLLF ZAEHN DNLAW JGGJG BRDAJ

FZX DE GFB 2620KCS 230103T UEM-99/00003

5511 6723 0025 1101 4606 4997 0172 4411

CIBCI WUHLJ HAVAM TYBAG FRKLE BUVKM GZLAF BYRQI NJUDT HBPEI
EDKFD BIGGJ HDCIE AKLKC ZIZDO UMGZD BSVMQ YBYXC FRACD AMBBB
UKGLD FRKCN RDPKI QKCTJ EDUYU LLEME INTGP CLBVE HUVBG MIFPA
UTMGU FIDET SKMKE LEROT FCKLE XPOGB QGHIL YWRH CMBZB DIIHG
TRSRB SUIUS CIBCI WUHLJ

ZIC DE HCO 2350KCS 230104T UEM-99/00004

0537 1823 0020 1561 2239 8740 5726 4507

FBRFB KZVEJ KHIGO QDBKN ZUQIA TWUQL TIZVV LFRKR QICGE VIKON
XWBSN ZYORT FGNWH CTFJS CIGTD KZGHW FYOKG MZLWF PZJZE OZRJM
CJFO RILQK XCEPO FCTKU WFFTB BHOQV UIELJ UCFGO EYIOC WYICK
FFBGD IPEXY FNFJX RFOZP YBNGJ YOQBP TUVLM IMAPA AUCUD MZDBB
MSQKL YVTUA HIGKB FBRFB KZVEJ

SPV DE XYR 2310KCS 230054T UEM-99/00005

3516 3123 0005 8140 7487 8641 5320 6630

KBEG FLIGH FROYZ YQKCM KOKBB KKHED LYVNE FRDAN LBNWC RYDVP
JYTHV OLECC DMKA LNRLE MFAXM KZUQA BHMNQ GHEUB BIZRH BSYM
VPAAP MBQDI GQZV HWYCK ALJOM AFILL CBVAT CLEUT RCATS ISBID
ZKDER ZDKHT GOUDO FGALS YIANC ISWZC RCDUG IKINV TROOK PJOAM
BFRCP UTSWE WYHEX XBLJY QLANA YIYYP TEPYR BBJVT JAJJV JCPKG
DKBOM JMWGG ZJHEV ABWFB MABOS PFVNY WBYTZ YDMYI OTUYC BOLAQ
XPZRO WYERE LJLNU RINVT BQBEG FLIGH

IZW DE WHH 3490KCS 230154T UEM-99/00006

8515 1823 0110 2172 4803 5743 0334 5226

EIDEI RLKXB GUBHI YXUOL WOVJE LSYAN SFRNK GRVMO IADZZ FJNGR
YVGGF LZKEL HXELJ ATYUW BDEMR LEUDE GBNMF YKQDQ BQFCC BVOAV
FFWVU WGIYY XIDJI JMRB CTQXP ABODI PCZFY WRKRE BDMBO MPZOU
QJDFP LYTYA NPITP DSDRD TIOQC JEMFG STPMR BGLPG BVDAG VTEHU
ERVAA QUNMQ TBGBJ ZJRRG HNNIM ISSOH ODKUJ KXHPF WBSBQ AUANL
EIDEI RLKXB

LLZ DE ZZZ 2030KCS 230116T UEM-99/00007

1011 2123 0040 3973 4094 4258 5942 6323

IIFPF CJRBC MJUKM LRVWV JQIFG ELIJC FEJMF CACFZ ZKEDJ DWASZ
EHDLE STSPT PODDZ XARPT JZLUN ZCQBC OUIRY WKASK PDMW XIMGF
VIRHW RALKP UDOEU UZMPH OPPJX KCZBC QOOTB PFTBQ HREHY LAUIX
MURER GZNTY RENDP WQZOH KYRQP IATUU SFZLS LOKDE BMLT AHSBM
WFTLJ WIYCT UGAXV TSTFY BKAXR WBSIS AVBQQ LYURK AJUZV ABBIQ
OKKDK JUOAK ZRRHY WZCBE TBYZM XZMR VSTXE LFTZY XTBBQ KLFII
JXCK IIFPF CJRBC

BWO DE TTY 3360KCS 230157T UEM-99/00008

7018 1123 0120 8943 0611 2025 8156 3227

CFIFC GIBEX ANMFO MEDAL TRAZQ JAGAP IGWFO WCFUW BUKY VUFYF
EYDCY KQMS GOKK MOBUQ YPCTY YPCAU BBIVZ PAVEM ABUPI GWKYH
QUGDS QIQOQ BMBHU KVXYD XGUFM BQGPS YCSFY GATOA TJAOA HBSCK
CFIFC GIBEX

573

B. Zentian messages, 23 December

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IZW DE XTG 3990KCS 230058T USM-99/00009

6516 2823 0005 9518 8423 7543 9083 7135

DDHAA	GEZME	IMBRZ	FBMTQ	ZFQZA	LWCY	PMIYI	VPVQK	LBSXN	QOPLZ
MRKLL	QLZDE	XWBYN	RYLLD	XUUMM	JMJEF	RYZLP	SVLYL	ZPLQN	VLKXS
WLNWT	GLQUB	XKRMJ	CJHME	BNCHY	IBGKR	LBPFR	IBNOY	DDMVK	XTXDE
YBPH	ULRRQ	WIKRV	JSIKZ	YFKIF	LYYK	MWMC	ACZFK	UHFKH	BPYPR
XGQPD	JDDXF	LRIIL	TGYOB	ICPVV	HRUVV	XVWDO	DREOK	RUZZN	CGUSA
CQJLP	YFOSS	RZKCP	VDBLO	QKUDF	HCUAD	KYTCF	ZSTYB	AWUTE	GKFTM
IBEND	QIDJC	VRIDL	GFDFH	ELAAE	SMXIV	RLTIU	ILFOU	WXXXX	DDHAA
GEZME									

MKP DE PSD 2960KCS 230053T USM-99/00010

5518 4823 0010 5504 1476 6607 5762 6107

ECBCE	TWUOS	RODRT	APDIU	XRDOA	EMPAN	ENERO	CSRUC	SSOQP	LOCNW
RPOTL	FIBEA	STYEN	MBENP	GSBPO	ETOTE	NAFYR	AAMSI	RUJLS	EMRII
EAOPA	HRFTA	ROBCO	AMBIN	RRBOP	ELINT	LMMME	UREAB	EDATO	FARLT
PCOOZ	QEAJR	RCBEO	RPPAU	ENBAE	SIMPA	BLPEB	ONFSR	TDEZT	CUNNS
MEYER	RIRES	MAREKI	MWITB	LMLDO	OASBS	MLPOE	LOGMC	HRORP	POROA
EYKTB	ACTNP	REKCP	ESNEP	ELALA	COXOO	UYCRM	MARLL	ANVRO	ECBCE
TWUOS									

MKP DE PSD 2960KCS 230114T USM-99/00011

5528 4823 0010 5504 1476 6607 5762 7516

ECBCE	TWUO	ROZET	APVLL	NEROA	OSMCP	ERBCE	NSIDO	ZSYNO	WECUE
RFORU	HEZEA	RYEKI	AROKP	GSYFM	AROTO	FYPMI	NOWSA	RAIDN	EMREK
ELORO	EPCEP	ONOSO	EASTM	MUKOI	UNNDM	MEDRE	XAAYE	AUMNE	SEBEC
FFPAO	POPOX	SEMRU	OAMBO	TLMIV	MARAE	RELBE	QERNO	QEDTA	FRRTO
HPILP	REKTC	MVCGM	IUBCR	QBCHT	ERBTO	GRSSR	EMPRN	ALSON	OLRNE
MVWPC	PAZAO	QADNE	LKPCP	WTLLA	MHOLT	ERTBE	BOEKO	HUKII	BAAAZ
ESARK	GVITC	XEWOP	PSREK	ASACI	RRPID	EANAT	RUELW	KEBAP	EZCGP
UMPER	ACRKO	MOYEA	ECBCE	TWUO					

TWP DE ROU 2220KCS 230313T USM-99/00012

5522 2123 0240 3749 0420 7101 4718 3728

CBCEB	LJESA	CZMSK	BRERC	UAYJK	AZYLE	WUZBK	PIXES	NKKVZ	RHDCY
QDEPV	MEPYL	GVCJV	ZRTMZ	MBCEK	ORWQQ	POWZL	YRCLF	AQDCT	SVMKO
TWAGD	BLLLV	EMREK	KWZLL	ZLREP	BRKPY	YAJGY	RINOY	OLZCN	LKRCJ
SILLH	TSYXK	IOLNQ	BGJKP	HKRYN	CBCEB	LJESA			

ZIC DE PSD 2400KCS 230354T USM-99/00013

2516 4723 0310 8140 7487 1161 5726 4625

HDBHD	PSBDI	AMCQV	VBHEK	JCCBU	HQLLI	AYBAJ	KRBIP	SZBPH	JYKHA
ZJYDC	QAMJR	ZBYFQ	SMNPI	BKMAZ	INGYP	BOBEK	YGIWF	HEOVJ	UJRVV
SBHLP	ZCOKJ	BMYTK	HRPIL	RUMNP	EDCC	MSFCM	VGTVI	MBOGN	KPQUS
XVQEN	LFDLJ	LFTBK	SLIYR	RUMFB	MLDLK	JEBEN	VMTQM	XCPWD	DYJTH
ORDBD	EDGHR	RPIIR	PQJFQ	HDBHD	PSBDI				

SPV DE XYR 2310KCS 230243T USM-99/00014

3546 3623 0200 9518 2239 8641 5320 4944

EGBBG	DZKFD	EMWY	BJJNE	BYQVK	QZCSJ	PQDUU	HQYQG	VDBST	FPZUF
EPBYX	ODRER	WJPL	GSIVC	EWLAV	ETCYM	KQOFM	JWFPQ	OGVLI	FFPKW
XMBZF	TZBFY	GMGX	SOJCH	LAQSG	WSXQK	MKTYI	QVUSH	QKYVO	FIAFW
LAMMF	VBGTI	JLHOK	FUSNE	WJFSH	WQJJC	GRFNU	LAORR	BQZLF	HRYSK
OIQYQ	UAKPC	WPKV	DMPVP	RFRPH	IGDJO	TBFGU	EGBBG	DZKFD	

ZIC DE EDR 2210KCS 230212T USM-99/00015

1534 8023 0125 4775 1663 6977 5726 4437

BGIBG	HTQHI	HEPEJ	XYIDJ	NYURE	XPVFL	SJTYU	DGWWQ	NJAAV	TGJJC
CTJEG	OKCQ	YNOZH	SLWZI	RTUYB	WGWUV	ZJWBI	SOWEK	MOFBH	QYDHA
FYITG	KWRYI	QZVJU	GYSBI	YKHEP	DBECL	CEFPZ	URENS	BLOXC	MADOK
XVBRZ	DERYA	LAKCB	BOBYI	OAXEC	BARAS	SVGBG	XWJEN	BARXL	DMYCS
GTLBT	WIKJK	BGIBG	HTQHI						

PVK DE AAA 2685KCS 230317T USM-99/00016

6022 1523 0235 9969 7046 9262 3061 4808

IIRFF	BJOBC	JCMJK	LXWV	HLOQP	WQOAF	BYIIC	RJTMJ	YXZCC	PEZUN
KTMFG	FIUCM	GUGNB	HFCDS	UVFLE	CHPMU	KLQIB	MEBDC	PDWE	VYFTT
MREIV	LQZDS	UJNJP	TYNBL	NJFWB	MDXIO	ALTEG	FZTLR	BZMVN	ISNGO
BEKYB	JRASE	KIDUN	SHGMH	JRMBL	BUTEM	BKLEB	VOVYI	DNVFK	WJSCA
SBJJK	WROD	MVIIV	SPODC	ACFDO	TBPRS	IIRFF	BJOBC		

ZZZ DE LLZ 3520KCS 230236T USM-99/00017

6016 1223 0140 9329 5074 8146 7094 8017

HAIHA	FLVBI	UYGKK	RRHAA	BOCKY	ELMNN	IUAFN	QYDKV	PDMEK	JUJAF
IUIMR	YTDVW	TGKPK	HRPYD	MLBKE	XFCFB	STMLB	VEKPY	IBEND	FIFML
OMIKP	IVDUX	QAGAA	GIEKJ	XUOPZ	OMARI	LQBLJ	CULRM	CJYYC	OBKTY
XURYZ	FRBAQ	EYUJQ	TEYTK	NCZFP	ERJOG	PSYIH	ZQLJT	YIQZK	LCQZD
FBQGP	BRYRN	LZWEC	FENDL	JXJLU	VUYNW	JGUDY	EPUCS	KAHYN	DCJJC
KEYKH	UUAKP	AFDDV	FANJD	CYRFG	XKDCS	WRAPB	UOANG	CBSQL	JVVJK
SZOC	LFRYI	AUCPK	BWGRV	GDLUN	SIXKD	NKFOQ	WOWO	LAPAV	OMQIE
ULVOR	CTIME	UNZRM	ZJMEY	OYUKC	WUMOU	PKBKV	LKIK	HAIHA	FLVBI

ZZZ DE LLZ 3520KCS 230259T USM-99/00018

6026 1223 0140 9329 5074 8146 7094 6028

HAIHA	FLVJE	CLFSP	KKELU	UNFAK	IMNIV	NUDBN	PFOYR	JYRLR	LECKN
NIKYR	VSDLL	VUNLL	YZRBU	SOPKI	RODMT	VSTDM	RADMO	RCJAX	IBYGR
HDKVB	TKLIF	FEJQJ	XWLCV	AJSSN	SDFWR	EZQPP	UREKP	LDMVK	DMYVK
WNEZQ	FRUJZ	WLISA	WJGKJ	ZYXNS	SIMYT	AKCRA	IQLK	IMWJF	ZVCOM
ZKREH	OQJXP	EPWIZ	NCQUY	ZLQKJ	YKFM	RJWYF	CUZNU	QIRPH	FTATP
PONCU	BURKZ	TWYTE	RAKNI	BDANA	OWLTX	OCWAI	OPYYM	HAIHA	FLVJE

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RHW DE NVT 2020KCS 230242T USM-99/00019

1025 8723 0205 4775 2645 7525 1081 3638

AJAAJ LMPDO GKXFI FNDVH XYPFB JFMRL IBHFB UEBDA SJLJW KPFCY
DLJFU KINQM LGOKO PEBMM HXLVP MBGUL TIRCT JBQBC RSHBV FQSRK
DNXAJ QROBR AOCZM UQJFY VDGZY ZAZKY SKMVK PSLJW BQJAM NLJXQ
YXXPT PQQFU XQAM UERPT AJAAJ LMPDO

ZZZ DE MLR 2020KCS 230347T USM-99/00020

7025 9023 0315 3973 7487 7525 7094 9028

FRAPE TBSIG QPXTZ PCYLK TLIXR BOKKA UBONW OXBRO JMWPU JVRBT
TSCAV TDFPA KQULJ HJMKO XQQVP FVQTK KRQJB YBCAV DUGRO TVKRW
EBILY KIDBS XATFG PQSJD MNCBM XSTIC HDLHR BJOMU SGLDO BQJFR
ACJLM ZCFLP IQPJJ FBYED IGAGP ZRSHW UJODQ HFBFB BFMEL UXCIE
IDREL QPFWO UEBTA YRDMY XAIOH DEXIY JDMHW TULLA LBSRP QJHRB
TULOS OVQZB VBUVA WFXKX WYBVG OSWQO LSINR IYRLJ UNFJT LBSYL
IBLIX AXQCE MCPQJ JFBPK OMBWY YRDXG BMBLZ GKHLL LIVEZ VQGBM
CJQIU IXQCF IPQPQ KRZKE SLJBO HBJMF UACQT YXRLJ UKILF SVBHG
ZALIG LVOTF YKUTE ILIHT BIRKU CVARH UCGMU DUFYF FRAPE TBSIG

KCM DE IZW 5385KCS 230212T USM-99/00021

0038 0923 0100 1101 3644 5815 3917 3422

JGGJG BRDIF VJHFQ ZPKNE BHKKI LSKHP PFLJW FIMGN FIRIN SXIKD
MHWAO RZJCF TJCFJ DFALS VMOP MBTVN KJXKX IBCRU SXCKI ATUCP
JRMWY DMQFU BMBCL UGROA PJJJW MBPCR GAKBS HDBUB NPUIX ABKCP
TMBGP WTBGO JGGJG BRDIF

ZZZ DE ZZZ 5955KCS 230326T USM-99/00022

0011 2623 0200 2750 2664 4258 7094 8718

IIRFF AKLBC TULCL NYMFI YKDBI BWKOW BAWDA LMLVC ZBHG BAIYF
XIGQT ZFCAM ZJTYD RVRTV FDMOZ FVSHU DUDYF BUKQM YBKLH BOTPL
OGDMA MUXEL LEBEJ FQVZZ BMRBP GAREJ HUDGM AYKDI XLERO BGFKO
BHQOT ZPOIL BSOQL VUZIO BHKQK BBJQY BHCXC IQJYF DGFOP ICATM
WUGUH LACAK IOBBS KUPKB RFGAC OMDLL VBNVI GJHLL BSOQG RBUA
BPKYI ZPVBO KOPDM KXBRQ YPDM WPMFX FDMFW LFBVE VBANK DZBMS
BARKK RYEDD NPIBA IQGHD LQJNJ LGAAL BFPBP BAHPP FMAPM VPLJY
KMGWV JGZKH MFKHL FCOIY XOKKK ZEQDY PFUFK MIOCT IGUZE IOWTE
LAPKL PTTOU FNVHA BMDKL XGUYX IIRFF AKLBC

ZZZ DE ZZZ 5955KCS 230358T USM-99/00023

0021 2623 0200 2750 2664 4258 7094 8510

IIRFF AGOBC VRROR MCSAK PCXGQ VQHYV QTFPL ASABD TYLEM AMXIC
MFWBC BGDW BHPWB ZBZRE UPZBJ UVTAC BXMED BVJPM OUPWP AHLAR
IYJLE OJCEZ GYZOK UKJXY LZMBX MUGBN LQCR LQTFJ KLUOK BTZIF
YBQIF AFHBN OMKGY ACCRZ JWZKT SIRBT QAKET QMQP RVFPL YRPTD
ASRVR OPMZ SYZAA KCFYP FQCYG OUYAW CYUBN UZABN QMTER FDRDH
FWGBM DDDKI UODOZ BFOZB GSDPT QROYE RCFER AXQZV VBRAI HXGAC
QRREM TLHEL HVQOU PVMKP AYVTR BYLML RMXDL OGWTV RQFTT LNKWH
CQAWA BRLLR MTQOC BFMUE TXLVG VMSOP DGEZM RCMWL OCEPP AJQRA
GZEDL BQKFR OZXXX IIRFF AGOBC

TPY DE BWO 3990KCS 230337T USM-99/00024

2036 3223 0210 5504 1476 3565 9713 5930

CFIFC SYDER EYORU IVMOH UQYPC TTYFW UBVCY XIGIK SQIKO TOKCG
OIQTA QAWW TBRED LDMVJ BVGCV TVVOT BVALE ZUYUB YQBCA UBBAN
BLERD BBTZ UUYBY QRSIN USUND NYLVZ AZZDA LTHAZ QUBER WMTB
BKMNU BVVOR LDUTC BOTBT IQKKA UBCID IREQI NQWZ ISUBU NDMOP
KCYBQ QAITD BVCZU YUBYQ BMRDM FUMBK UBODA OAVOB BLERD ZIWUJ
UTBSU NDBOO RPUYM NAZQV IPKGO GOPOA PXXXX CFIFC SYDER

UNK DE FHI 3670KCS 230208T USM-99/00025

4516 0823 0115 9942 3456 6869 7904 6029

80808 42831 71157 33931 99675 09460 50648 52699 93419 55699
05090 44424 93475 23012 99169 13772 92900 31931 37729 29602
93489 89761 81423 59595 52934 53197 12893 07227 59833 93493
43728 69293 23050 30305 62359 74444 24934 75230 12991 69137
72929 50102 93489 89761 81423 59595 52934 53197 12893 07227
59833 93493 43728 69297 30669 74029 38829 56740 80808 42831

YWP DE UBT 2850KCS 230347T USM-99/00026

6524 9323 0310 1561 6010 6832 4718 3923

AKFEA KYMBB BCBDA IRKXU OKBER FYQJUV YBTCY RIFBO WREPY SULBB
AKQPT BOTIQ KAAMB XDFYK UFFKY LTRYU IQAKC LICFP IDLXA VUMBU
RVBQM DAGPE IRONI FBBIH MWIRW HAVGN OILVI MGRFP YLEWK KILT
IYDNU BUXAW VBARQ KOWP OFUJY ARKYL TBYFM AKFEA KYMBB

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YWP DE INJ 3330KCS 230249T USM-99/00027

7518 1123 0215 9329 2645 1864 4718 6409

AEFEA WIRNP OZQZO EBXYV FVIDV XOCYK OZKCY TVFOM SHIZI TURND
EKRBE FUDAI RLICP QAKCV URAMO F8PTV BFAPP NOKLE IZILLO DFBUL
EMIQD WRQWV LVLJU BXQAC VXYFZ VIDVC YKMGF FGCYT VFORM XIORM
ANGMO ZMKYL TILING DAIRL ICFBE FLBUN YCOZD KACQP EYFVE HDQAK
CHBQF VIAVY UOYKY LZUZY UHIDW MAUKG OHPWI HDLBO UTUUM TOIBS
AFMPO UAFON TQAAZ ZUYUB AYEDA IRFAB DMEMA QAKCN APPKY LTKUE
OKARE FEBSX AEFEA WIRNP

YWP DE INJ 3330KCS 230331T USM-99/00028

7528 1223 0240 1120 7263 1864 4718 4004

AEFEA CAIQF YTXQA OQOAK CFIEM HUKRP YERKY LBSYU VJIOR HIDEZ
AMMOU OUZUF BNUZF DRGOP IAQZA MMNYE XNITG SULBZ UFBOO RPROR
YBUNP BEKFP OGBKY LERYU ITUUM DOLAQ EVGBU BPVYO FWIRN VUFYM
YKXRY CRMAQ FQOWL KIGBT OMBDI UHMLR HQAKC JOBBX AEFEA CAIQF

MKP DE BVV 3910KCS 230356T USM-99/00029

4033 8823 0300 0120 1871 5086 5762 4816

DJDDJ VUKCH IBLKO ZKCYT VHYQH HIZIW YHPSA HCGAL VQYDR ZUBIS
AVQCA QDPAC YVUKC HIBLK OZKCY TVHYQ WHYQW JISBJ OFFRY FUJIB
MVUKC HIBLK OZKCY TVHYQ WHIZI TEGBR AYSSI QICAS ZDUMQ LARFB
OKHCY DRWYI TBAEC MAEYW YNFGS BLDUM QTODW LOOZH OAIHI BLWEM
IVUKC HIBLK OZKCY TVBET YBRTY JISCK DJDDJ VUKCH

NIO DE POH 3520KCS 230321T USM-99/00030

7516 0823 0105 2750 7263 8146 8912 7701

FFBGG SRRIL MSYCG YMDUK QWGSN VIQCC TFAMG YRTZE GEMOQ RPKSQ
ZKJJE CPLFK CAXAM WMCA OMRIW VRLPM TMGEG RUIYQ IROQE ACPZT
AJREP SKQFZ ZQMUP KXJAI PLTYD GQWPK ROYAC RAJTP WBIQH FIKKY
QMLHN ILOOS JHQMR KSBZE WFRSD LEGOP LQTVS BSMOO RGFJV GCAMB
WYHNU CFZLI KBBJR GZYUW AKSUF KIIAG CCIRO SVVHP AGSTM ABTGW
FDRIQ QTNBF WOVEM SBCEB RGHEN PKZST CQREO OMJTH QXWKN MRUIT
LPIBE ZFYBT BAAZE AKCEO AQFLI RPKKJ QDDEK CZFKN BWPXK LFJLS
CFDMU MRKVS KQKSA XJZZK VQJGA FFBGG SRRIL

FBG DE POH 3520KCS 230305T USM-99/00031

8516 1423 0215 1101 7820 8146 3313 6326

FFBGG FKINA CUONE VRFCR BMOZO EYHWX YIZAC OBQZB LHITY SHOGJ
RPHED VMPFW JJYMD KINCS MZKEP VRUGM ISNVT YONIP JMAJK EDKAS
HELJF VEZLO ZTOUW AUEFW NLMML PTDQW TONSF QOUNM SBKRM ORTGB
UCIZM BMSRA CBOAD DIRKN KPZKS ADMWJ DJYTS RMQIN ADFDK KZLVU
ERLNI ZYHYV GNAKE PRJBU KHPMN VWJKA XDFQD DTYWV BZGMW MEBIV
XKSAI YGVFL SAOAD ZSXZL FBTSG FRUAE ZGSSP YJEMG LSVRB YDUYT
DIOXX FFBGG FKINA

WRN DE IZM 2100KCS 230252T USM-99/00032

3028 1023 0130 0121 8820 5815 4718 9422

DDHAA LJTTE PSJMU GLZBH CFRUM IYBBO QWIGO TLEEM CJTDT DVKOW
CCSDO CHOLX VSDIS DOIEM FJRYL CFWER BOLCW WQCMV FEJUK SZCAJ
PILZL CAQIE GZYOS JHLVN OZDMR KAFFX TFKKY BSYTT DMKKU UKFUD
ILQJT CFKMN SFBEL BKINY BTOQV LZDJF NIBCT CCFBE WMBBB DEFSU
AVNMP FZBZE EKCPB VBRKP RZZZW SBHJE NJCPV JUDGE AWXEQ RUFBU
BHYFP ORVZD ZG8QV PFLPG TYRKC MRMLV BCKQI VDIJF GROOP URISQ
BQPQP DMJRF SVEVC TKPRZ JAVJN QUGSW UEDIF AUBA MGBRU RUGS
RCEZG BLQDL BFUAJ PTTVJ WNVAX FZELB DYNZD VCTVB WMOOG MBGXE
JNHIG DFFED GIKAY TDAJD RDKHO WBUOM BPIFQ OZYCB FUFVJ WJWFL
URWRM GMZXX DDHAA LJTTE

MKP DE HZY 2750KCS 230248T USM-99/00033

7017 6523 0135 9942 8820 8623 5762 6112

95459 68942 32654 13390 43054 48740 48192 14428 56569 61846
67451 85456 96184 66743 30944 62295 41068 94232 65680 60643
16538 46617 47365 83213 73638 46617 47385 45881 79886 06443
36229 54106 89423 26568 06064 31653 84661 74730 58817 98860
64433 38998 01273 85692 24273 85841 67944 32472 28258 73659
51263 22822 32986 73554 76229 91173 12292 42982 25800 95459
68942

XYR DE VIL 2990KCS 230338T USM-99/00034

2017 2223 0315 9742 5237 1260 8444 5524

50505 77620 98696 91537 27597 03349 39747 97968 91774 37997
45857 97462 09896 96527 48597 57373 98060 57398 79795 91986
05794 70504 91573 98958 60591 69605 28605 96497 60336 99965
38849 76737 56960 98573 57277 52985 89759 13879 42597 47979
75898 97603 37898 96969 95395 73059 99698 73905 91997 41914
19199 04752 73380 50505 77620

FMT DE FZX 3760KCS 230513T USM-99/00035

5011 9123 0420 9518 7487 7741 2620 4418

GHRGH CWIHE VMVIB UROFR RDREU UWRWU XFZEN ZOQXZ IUGRM HIYYZ
BORBJ LLPET URDUU QBXAB PRJAK UMLXO ZUREK EBQLS JVOGB EIBFJ
CUUBL BOQVO IYIQB MKSJJ BPCBM KNYGC MKNJL PGVPU MUQHO ZZABZ
TWNKV UJGDO XIVCT ELDER BZPFR KGVFH XCHFM MKQDC SITLL PRIBS
ZSTUC TWYBM GHRGH CWIHE

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12W DE CUM 4205KCS 230557T USM-99/0036

4521 3523 0515 1101 5074 2241 083 5938

AGHAG TPOCG EZNQO WUUBS MKQHC HGVIM IPEFC CSITY XQJIF VSOET
POPRQ OSPTM KMZTZ NYBBO GDTHK FEQYB UDLAG MHIDY SZHEZ BGOAC
PZKBL DOWNR QLUEN PWROJ WHURT CMSGS OPGHO GTYMO FYAVP DALEW
TJFUR PTMWA KYBSW JQYKX KNOER OXFLA GRQDK KMMMN YJIEF SIGAP
HUUOG MRIGP FFBFW RPNHY QOCKO IQRKC YCCOU RLUXK JZIMD GCKKW
QHWAK RBZRL RPFPU NYGHR PZRED SQQMF AGHAG TPOCG

ZCA DE WIM 3480KCS 230508T USM-99/0037

9512 7323 0420 3329 2239 4717 1081 3909

BFBFB NFIED NSDJD SPYTY JKATT HAFMU ZZCTE IQJWZ AWIKL QUAQZ
FEVOK HQZKG REDND ECSSZ ZAWWY HYRPM OUGUI PKUUI QYJOK KLGFP
HUUVN JJFAB YHCOO JEXXG XURKS RPKCL DUTFJ ZFKXJ VCIFR NSWGO
BRUFT GZWUC FJQQP CLWSX YLIAB KVIUW LFCOU BFBFB NFIED

NIO DE BWO 4095KCS 230536T USM-99/00038

3016 4023 0455 1561 6442 3565 2125 6712

CEBCE JLKDF UMFKE GHRXR PQEJJ SBNAB QJUNC ZAWQL QHUCP UYVVI
HASIM GHOCL LILPC QVQFO KREKA DDCVH DRKHP ZCUAO DRNUK RITTE
NABRY EAKQA XVOXT ELABJ TTYCY ROEXK LJTTT YEDZV CYDKB QDFLL
TBNES OWHLE VDAYO WAPER RLNVG WSPUL XOBRR YWZVK YQUYC BKDCZ
WEEZK IHYTK ECRGP UATUW OXNGK JEZKO CJMNT PVFTQ LSNDB JMBGR
RNIVY PHSAA JINXG YBVGN JTABW NBYXK PCFTC RWENX QDDIR RBJAJ
BIMMT ELLFG IGGTZ ESNBZ FWCEU CEBCE JLKDF

NVT DE OAL 3910KCS 230456T USM-99/00039

0523 9023 0410 5161 7487 4555 3485 3723

CJCCJ GLNJJ MMYIM PDSUJ DKXMH SZWSK ODKFS MUKCG DKWCC MYBLZ
NGUYF ZACHL APTFJ WFNZH ATRYG XROJK NRJKG HRUZG TJDDH KIKDG
QGOBH CANKPN GERBA MEZBN BGVXK TYKFE YSQKK PCZVA CZURM BLFKX
EULDV SRWZL WBSW BTOOD ZTDEQ CJCCJ GLNJJ

MLB DE ZZZ 5955KCS 230557T USM-99/00040

3011 3823 0500 1101 7487 3637 1117 7620

FEAPE SOJFH SCYZR LLZTU XRVFL ZGVDS YXONG MKUTO QZEKS DVVVF
USJUE MKEIZ IFOKN GRCON AMWV FLXGM OYQFS FNVZS TRFDY JSMFC
CDQYK OIZWN DSRUJ GLDUP TUKFS NRVOB XPKXL SPZAK ZDRCP OBLJM
FRVJP QLZAK JEQDF DTEHM TYKRE VBJVG SOJJM NLWFF IEKUA YBOQV
BVLTB PPAQU BWPPW LFNVB YZPVO CIQFZ SUTOK NYMED EBFYJ RAGBR
WAMAK ICYTC OPUPU BGAXF SBTPT MYSOZ NMAUR OYNGY FPAIK MDPFM
JIJIKO MVORE KVBFY XYSAS UNCRE REARA AALFB BWCEF NIVBA SDPUN
XIQLF UYXKI XTGKX DSLGP FEAPE SOJFH

22Z DE ZZZ 5955KCS 230431T USM-99/00041

0031 2623 0200 2750 2664 4258 704 8321

IIHFF BIRBC TCMPE LADLJ VQUZY JIJTY NVKFO JMBPL BNVQP MSBRK
CCVVC UGDM EYKVO XKEVQ RAZES MGGLF UQCAO WAOZP QVYXA SZBVL
JAKLI YBPIZ BCBHE LKORL VFNUI CFESJ BMVXK QKSGB DMJIC EIKWV
KCZBR DLIVP HCPMT YKHZS IKPKQ FFOYO BPUQX BSPLX FLMBV DYONV
CMYKO YTTWD GVGBZ WVMND DAFWE RBUTL UAPPO QNZKS BRSDA MFBSP
WMLJW UNPKK UPOWM GMSBE BVADV BJSZB QNVKO FUVOA GQSES EDEBJ
FHLMG YPHKL JPYKE BVVPP JAAMU LKJVS LZPNI DYOYO UREYV TDFKJ
VZQYA YETWC ZFVSI VTMAP BBTUA EOBXO APVJV DUZRZ RPJFX QJZEZ
GKOL IIHFF BIRBC

DYO DE ZZZ 2030KCS 230407T USM-99/00042

4011 3023 0315 4775 8423 4258 3117 0016

IIHFF AGQBC EYBMM BOEJL RBZJR YPIKP TKPTP XNCJB DZQBR ZRCYO
XEQIR YUBXM MPAIZ JUZRI RNHLL GFOLB FMESW BGLER GFVHI YUCRE
MFLV CYPVW QOMRM PSRLN VVQPJ BBTBQ JJPNG UGJTB BKNSF WRKCV
YIAUQ EHMFA KETAB EAZCA ARENG BJJAI ZIYKA QTMFP MQOAC USSQQ
RMDTB CJMIS NOVOR PFEVR APULY ABTUT DGKHP FBSMT ACNOZ
FGKDD FJZEN LDLEW VGFEN ALXWV KMARY HVLBR YAOLK PHAQP LPNAG
FREJY ZDFES XDDLS RKHAO PZLFL KEJVN LFIOS GYUIV SYLLS CITLN
REBXU KARSJ SYJTV KBAIV AWGKR HFBPL BZRNK QPLDE RJONK QJSRS
YAZDG FTKQR QVPOE HVYDV CFROG QGGOQ YUZYK UITID JVRTZ ZKSBQ
PFSHP BJBHB WELUB PJIGN JTOYR WDNQY KIHZZ MJXXK IIHFF AGQBC

HDG DE TTY 4505KCS 230553T USM-99/00043

4028 1323 0450 3731 1476 2025 6707 7040

CCFII UVVDF DENJM EDOPR UYHTW UTEFP TMBRD NYZQS MKGFU DKSXW
LMGPD VBZTA DGCVS UPIKC KDUCH LKCFH JVKGF KUDOL HZEBW ORFQP
GCZLI LPODR EYAYU IQXDI WXLZL QSVXT OFATP QKSVN USEKP SHFCW
DQOZF EHCJT DKTWM FSUWS ULDCR MUEGO FLJRD NEJZV EFVEM PLBMO
BPLAN VCZVG RJRSP ZLPEB DFKFB CAKDT BDALK HDWEP ESBCT YUCAZ
LFOQN BVILD FYEUG JWFDZ WVKTC IQGKV DNKSH GDMYN LOFFY OZGBC
PCPUP DKNPO FPTBM SRVWO UVDFJ CSEQM FDTVL WXXXX CCFII UVVDF

IXI DE YXR 5615KCS 230508T USM-99/00044

2516 3823 0425 9329 2645 8641 2611 4724

68486 40752 20265 14472 54875 47314 19247 90959 58561 22521
48162 56848 53767 12386 51524 01999 71575 87075 29284 23032
32338 15476 11444 24754 89715 75873 14100 89266 04255 71641
14256 82187 58838 48895 20240 12063 84075 47353 89715 80785
04172 02986 58300 92200 88648 68486 40752

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ZIC DE HCO 5895KCS 230553T UEM-99/00045

0547 2023 0435 0121 3456 8740 5726 6103

DARAD HUDQH ATKJE WELAU IROLY FRAIS IUNPA WOMOI VLIJZK MUCOK
IDFBY UKJYH FJIZK TOMBJ EZLLO FRNIZ OROND HAVGK BOAFU MRLYD
NNOVI FBAIP EGXSO ZRBTU WTIYP VAQNM IVIVE IETUT LQITK QOMBH
IKGZY HEMAA YBETV CYKMN AFSRE ABJUM UDDMS ZIQOT IBVVO DKVEP
LQITK KAAOZ QFCBI INVUF DMARX DUGLF UMRBE TTRAV GFAYH FITAK
AONSO HEPQZ FTOLB VOVFH OKBJI ITCYA CZUBK DOYDH UBIDK DARAD
HUDQH

HCO DE FSD 5805KCS 230549T UEM-99/00046

3516 5023 0500 2110 7803 1161 8219 3405

DARAD DOEKZ YZUJI EPNAD UQITK LKCKE ADPFY FKVEI FTOLB GAEPQ
ADWQI TKKQZ KCYKM BBTYJ AFSMY XBJUM UDIMS LIIFT OADYQ KFKOZ
YDIMS ZIQOQ ITRKO ZKCYK MIOCY ROBDM XKBJU MUDDM SLITF TOATB
BTYGY KFKCK DARAD DOEKZ

IZW DE XTG 3990KCS 230503T UEM-99/00047

6536 3823 0415 9329 5445 5653 7300 6448

DDHAA LPVCD LZUUL EPMW XKEKE QQRJM QBNVY SVLYL CFFRN FFFIX
REYBF MORBQ KRBOF DEWJW DNFIL QSKPB HKPUQ RMYKE ZDKXP SIOQC
YGBMF VFOJD ROAGC MDGLG YYZGO WYLLI DLPTX FBSGM LQPID OKDOG
WSALV CZNLF TWMP ZTELK DWDIX DEEQT XNTEV QMPDP BPGDZ FOGZP
KUMQZ OVQGM VVVZH TTEDC PLLMD OYVWK OFNGJ QMLB XWCZV UCTYO
RDEEK HHLXR NDUND DDCBJ OAMFG EBRWF WYBEY IFTSQ LRUDB GQMLL
DJKLA TKKCK DDHAA LPVCD

HOU DE YWP 3490KCS 230507T UEM-99/00048

8025 2223 0425 8140 0665 5833 1793 5122

AEFEA BIEIC AMIFI DLXUO MBOIM KYCLR UVLBO NQCUY BFIAM MURQL
ICFBY BCYAB YKXEY FYANP EARTU CUPOF UKYLT GUVBV YKBHI DEBUE
RFIDL VIGED EGCCA MEMOT FBYBC DAGFY IGRLO IUSUL RYXK TAZVS
ULBSA QLEEK UDEGO FYAND AGPVI TOCOP TMOYF CUORP EMCRU BUZIP
NFUCH ZETSF UCHBA FRMEZ OKYCW CAZGD EGOPE WNFID LTOYR AEFEA
BIEIC

FZK DE VXI 2860KCS 230408T UEM-99/00049

9927 3523 0325 2110 7263 6940 0172 5128

EBGGE CYTWW UBYWY IUMUE YBETV MUIUQ OTITE WRKAV UMUIU XOCYJ
YTFDU RVZEN MMOGB WOLDB EBORI RADIP MBETV DITZJ YTFDU RVZEN
MVOGB KIIFS AOIBE TKJUD MJTYF DURVZ ENMWO GBFTY CKILF DLFNM
ESGHI ZLNOC YGYKP DURVN OGUMG GAKKE RDIFM BFTYK CZKJY YFDUR
VYIBV WOGEM IVIDI FMRAK DJYTF DURVZ ENMWO GBMIV IDIFM EBGGE
CYTWW

FZK DE VXI 2860KCS 230431T UEM-99/00050

9537 3523 0325 2110 7263 6940 0172 3628

EBGGE CYTWW UBYWY IUMUE YCYTV VUIUC YTWWE GDDUR VTYGX CRKQJ
ICNDI FMBET YWEGD DURVN EHXCE KQZYH CJICN DLFMK UVQDU RVYXQ
KRANG CEKQJ USADI FNEZA YVAFM DIRKD OCYKY LBJOC MPANE BYNOC
YXLJE XINEN CKILF DIRCK EBGGE CYTWW

INJ DE UBT 4535KCS 230553T UEM-99/00051

1524 9423 0500 5504 1476 6832 1397 4623

AEFEA PASKK AYDWA RPYVD VKOCY DITZF AFPTI QKQOZ KKOZK XYEIK
YLTDU DEKAY MQLLY WARPL UYTHA DPKAF EJOCM PANEB YNOFA FPKOY
ICYTV NOXLB EAFKO ZKDIT ZHEM WKOZCK OCTKY LBJOC MPANE BYNOC
YIMKO YIFAF POKL BEAFC YTVCY TVHEM WCYTV CYKMK YLTRY UIPEB
BQICT BECPJ OCMYD NQCKX AEFEA PASKK

POH DE FBG 2910KCS 230408T UEM-99/00052

2044 6823 0320 3749 4257 7165 4493 5620

FFBGG XPRJD IFRAN WDGIF JOFYB LFUJZ ZDUJM AIBYD ZHYVN SJGRF
PUBPF ZYVWK EYMD MZANV VPVBR FQVJH HJJB KLEBK URGJH ANUQJ
IFMUO XLCOW ISGCP YUBWV FWNIZ CGPFL UMBSZ REIFY DOCIM QYONG
CHISP RODWU DOVIV OGGIL CEYDH KVEM ZQBZU GZJRM NAHYI YSKNA
WREZGM UNOEL AIBBT BWLEW SPCDM WUDQT ZMUTV ARYUS OADQK OMEPC
RCQTD RMKSR IMBBI BRZDR FFBGG XPRJD

OAL DE REM 3160KCS 230407T UEM-99/00053

2020 2423 0335 4152 5218 2610 5320 6121

DDHAA RHETB XSHLO PNYEJ XEENE XNLAH VZZIV LLAIC EZJRK DJWFA
OKPMO OOBII YKKA KOKUX GRITJ UZMSS XDEEL IFCRB DUUWV EZDMA
FUVQL GELJA QFCY FPIWG NEMWZ IVVVI EVREA YKOFJ MVMC KRKFD
WKTUT MVMQZ EMOKK DAWJQ UBMOT UMRBU TZAZI DOJFU UCZHN HKQVE
IUFUQ KJOVY QCFII VDMR ROKW FENUQ ETUFL KKFJK CFICW WRBOK
LCKHI ARBIV BUMWE FKTBA GBETV BFWUZ RDNOP HNUOL XOMDV DDRAA
RHETB

NVT DE REU 2460KCS 230437T UEM-99/00054

6547 6723 0320 0121 7263 1080 2198 7138

DDHAA WRDZJ BJIRF IHPES OFIDD CGPKK HNGUX QCPEZ QLEUJ FRREDI
QOULR RKGWZ IYALT IDMR BLTQR CMXKS XWROL WABUW DNIQZ MZUQ
GVXNW CHCOB JSLPE DNJJB CFARD RIKEN XZPBP GEIDA YMBPB WITUK
BAULQ IHTW OMDQP SUZOP QFLTQ RPKAP APDQK BSKDG KNLAY MMYGD
HYHAA HBBGQ GBCHI CPTIW SDIJP MSBUY HGEDI PODFW SEYBU TFGSD
ZRWIM CCMOR CCZSA HQAYC NNNRK ZEVZU HVREB BBSGF MQDNK YFCVO
APMBJ AQPZI RQZPI YKQK YGDCA VKQIM UYEVI EPIML NKCLK DDHAA
WRDZJ

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ZZZ DE MLR 6340KCS 230659T USM-99/00064

7046 1123 0525 8140 3644 4447 0127 9631

IIHPF BJMBC MPQEK VTAUJ SPLKP QORYN JNZQY KJLMS YRRPR ABMNT
QUMKI BLYTR HEDCK IIRBK QYCKA VBARP FJROM PZZSZ VJCZF VERZM
PIAJLJ JZTOD DZBKD KYCEK ECZTE ZALTER MPDLU ILJKQ INVPT RCBSO
CZPVE QHRPJ HMYDM KELOP IXHPU OYBSF YUHOC YAAIV CAQJL QDMIE
PMOTY AQWPK WLLBE BEFOR QMFLM ZQKYO BOHNS ZZGZU NUUVH TPEMQ
RNVBC VPUQC UBSUS NQCKI XIHAU SWSST ZMCCR LUFYJ OUYCB ETPFO
WICYG MNAJU BAZDO RFDZU UZORD PYJHR GUIYX LEXOC ERVBE SRTAG
KMKZA YOCEN QKENS VQMF8 IZKED TKRPN CHELT ZVPEK SOTLG FLNUS
PKFBO GORZE ZVIMR JMLLD WLOBL NCTBJ MBJTR HXAQP ZREZA ITSMJ
UPHUN PRUOP YQAAQ CJCKX IIHPF BJMBC

FHI DE BFV 7830KCS 230725T USM-99/00065

6523 9723 0640 4775 4606 5086 8327 5618

ALJAI FZTGH ROUVV JSOCP YFDDO FVBCX TUZOR PCYSZ WBOGG LXBWK
JMWOT FOCZD CRTYI KNYJM SMYXP EBULA ASUDP YKBA UJOD WCZB
LPMRA XLRMJ JXPKR DEBID KERYX ZCNSV AKRPM KQZXY NLPBU ZPFLS
WVYR QOZGX HFLDA TJKRK IURDN FLRHA DTMJN ZIMBJ ZDFGO HFFPE
OYGNW CADRU FFLFL QJZRC TRBSQ YTRQY DEBLV PQZLI JJPJZ DGLPY
YLJLL LBIBO BOMME ZENGH ALJAI FZTGH

FHI DE TOJ 6430KCS 230730T USM-99/00066

7519 1023 0705 5161 3456 0162 8327 5321

80808 42831 71157 74793 46985 29674 37380 00505 62893 10105
25719 55694 48932 61592 93413 13731 51596 89111 24609 92117
31974 76882 99146 93752 79957 41910 83923 59798 52869 29319
34289 48092 98234 99342 93435 33130 55471 74449 59169 72013
60711 73197 49375 89796 20129 55929 16014 37529 34779 54177
77444 80808 42831

KXR DE BFV 4795KCS 230613T USM-99/00067

8013 9423 0525 3749 2645 5086 8444 4931

DCGCD TQIQD JKVVA IPVRE KUJCE CHERR HBOMT DCBDB DCUIQ PJRPF
ZQJWV GBKZY MQKBO SHLPE WKRRH KFLYQ BZQHD JQXFO XOARE DELCG
ZOFSE BLCGS HEBPQ VNTGB FBHJH XTJXO BQRMB DYQKE VVKPY QKCFZ
JTQCB BRJJZ MRYRB HPOFP SWAJU RUAXC AIRRB YDMGX MQDRE KQZJB
DYCFB HSPAS GZMSB VFUYD FCTMP CCRQO ZSPAX DCGCD TQIQD

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RHW DE OAL 7830KCS 230751T USM-99/00068

3023 9923 0700 1561 6010 5086 1081 6921

DDHAA BQBOF OLWAT WIXBY YKOOI WVPBV LZQBY HBTXG YCZEG AMYTK
PTVUO KUUTM SLSPW TKVGY YQROM DMJJC GROPL BKIYI ALKLO KWBYL
HJZGO QBUVP KJQFW CRFFM CIPBU BLIQN QBCZU GFWAT CZFNF ADNCI
XBSXX EYKTY BKXKG ZKXRI HBNWI DNDYX TEBMT TOHDL ZGRNF CBWZ
ODRVP MPTDE ZCBXT JPTXK HBURY UDDMJ AZZDB VYFJT JYGLL HBWZD
LBCMY REBBG XLDAG AMCPP TOGWT NBLAQ PTGIN VJALA BYIUP LXRDU
IONUA KOBAC BQZZM PSHIG ZELVD QYBJE JLCKX DDHAA BQBOF

TOJ DE FHI 5335KCS 230712T USM-99/00069

6516 1223 0600 2110 0611 6869 5609 8323

80808 10893 70985 29674 37389 37095 04442 49341 62275 98339
34934 37286 92955 83346 98666 15335 81989 78287 62141 35598
91725 95887 78962 43889 30774 79346 95819 72876 41471 97534
23339 93791 44579 96135 93493 12989 15959 79149 27173 19249
64852 69585 94771 73195 06499 33856 47173 19106 44699 39647
17319 90646 86535 99341 95317 64717 31970 64933 40974 19237
62769 74791 31334 89330 12989 73132 33509 74647 17319 80643
31309 34351 92376 27697 47913 13348 93301 29897 31323 35097
46400 80808 10893

TOJ DE FHI 7510KCS 230723T USM-99/00070

6526 1223 0600 2110 0611 6869 5609 5946

GIFIG WGOID BRCOM TBMWV MIMPP PRCSI MTSOS RINBM RTATX ACMTI
TERAM AODMR RTDIE MCAOA ALOOM NMCBS ITTIA EBORC MEMOO HWAG
AETEA ANCBH MDEPR MHTRS RAICH ONTRF ORORT DEBOY HMIAE WCBON
KEBSE RFRTP RUIOI MROAS ELEMK ONMDK BORDM IARTR ERAOI OLATZ
TRONO TLDHU OROAP RERRE RTTFR BCARE DORRS IOOQE DTCSS URSBS
KIDRE OMLIH TMBEB IPTXK KOLRI ARTEP BASOI GIFIG WGOID

GKW DE MCP 4925KCS 230634T USM-99/00071

2015 8823 0515 8943 7263 6625 9399 7528

95459 39028 18861 13145 04423 84628 19565 95679 76565 69618
46281 33486 46414 83491 81284 94684 46164 64860 27884 13145
03934 23169 25844 23846 28175 75456 77715 65622 22481 60643
11812 84948 58241 74171 27315 22621 07355 42143 27365 65226
21073 65752 26210 73659 56222 24817 38565 22621 07328 42857
58241 74171 23339 02815 10684 30284 22384 99164 02242 34232
19074 94679 76585 70049 08462 81942 36252 12225 49204 04786
39203 22583 30000 95459 39028

580

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3FV DE MKP 7320KCS 230725T UEM-99/00072

0525 9323 0645 0120 3698 6625 5320 6926

BCBEC MYTBE GMPKQ WMKUV YVLON YBCIF OTMBS KATYN QCCQL TTYWV
JFUUM BACVO YAVAD QJVOP QJRMK LMDOM THDZD LFMQK PLJJK VXBDW
KDNZJ JCSNZ HQJFP ZONGP OFBOR DJFHO WSCUB FWVFT HPKPA GQKKB
GASAP UPSUX ASQDA NKVUL MAIYT XHYSI EKGDG DKUJG CLCKL SRDIT
WOLJO YEKBS LKLRK ZKPMI WNIER FITYJ ILLAVU ESOJE JOSSE PSLYZ
OMGEM XRTVE VUHOV OKRAV PUPPB UOQDU UHBY LDIJY KGGFG KUDMO
SUCIN WYUCH LKXIF BKDSW CBWXY WCKBI YUGMD BCEBC MYTBE

BWO DE HDG 5045KCS 230618T UEM-99/00073

8533 2123 0520 5504 1476 9145 8156 4021

CFIFC LYDNK AVUJY GOCAU BLJKU HQBIS YQFKK KXZOS PBEPU CEBEC
OPTWU DDMAC SNOBP XAVUQ OBRFO LFFWU BMAEU SANEM AIYKY HQIYY
PTILE HAYKM YLWQU ZOCAU BFEVD JAOAK IDPQO BRHAY KGYKP GYKPB
BTWYV EKGXK PGYKP CTIWW UBVRU TAMOR UTILE TTYPK CFIFC LYDNK

BWO DE TPI 7400KCS 230722T UEM-99/00074

7058 1523 0635 1120 3456 2025 8156 5447

CFIFC ZISQT AYOVA KGFVE IKOCY GYKPH IZIMO HUTIY STTYB CAUER
OZQLI ANVOA UROHY BAKKD UOGLI PMAE UKOYI ROULF UNWQV LYDJE
WBAYE CEBHX UZUBE YDWEV SLEZN BOGKV UPYUW BVFEI RLIAN SURDQ
ORRCE PMAE UVTPK VOAUR OBYHA YKDUO SLLAN LYUDE KEFVO AUROH
YDOEK QYXLC OPTZI XYSUT VDCKP SABCY UWBPI MEWYX QQUJI ZOSPH
IGQSY RGXXX CFIFC ZISQT

BWO DE NIO 4885KCS 230630T UEM-99/00075

9534 6523 0525 9942 2664 4140 8156 4648

CFIFC GIKSB UDPJA OAKBK WZOSP FICKT ATPQA OGCAU EKYDK QAQW
UBVDO NSFAP PKOZK XOCYG YCPBE TYWUB VBIIG BUVMX YEKRE MEZOH
EROSI DUBWJ AOAKE KWFIC KROYF TOLDC AUBRI YQWIO CQAQG JONWK
UBOPI AENUB BNUBV DMRV YEKZI SGBAK ELYTT XUOK EKKCO PJJUT
BQOQP HATED EKEDU OSXXX CFIFC GIKSB

OAL DE XTG 7990KCS 230714T UEM-99/00076

5046 4323 0600 2110 9054 3565 5320 6127

DDHAA IFJDI GVJAA BMOID UGXWB VMQSA LVFNX MRJTD ZLWVC ZPERR
QUAKI DJTRF BHYXK ZETAK VIIGS DDFTD HFOJD RORHB TRNMS UMMZT
RYUWQ MZKFC POULZ TQRMN ZRUTL LROGW MNGGW YSFIY KKOJA JENEP
RMLUN LKIEB LVKFB WRNIT TQCSN RQALE AVREB CIGGX GNVVC ZMFAV
FJJDO AZBSD WDDCH HPMRF GXKMO ZBKHO AQBEZ IMHSG CMMUD XELMN
XCBDP LJZJQ IPQTH OATSV VNEBC TBZLL TVHRM SXXKZ SMYPT DDHAA
IFJDI

IZW DE WNH 7290KCS 230721T UEM-99/00077

8945 2623 0540 8943 7263 5833 3917 9920

DDHAA GZFEQ MCLAJ CYQDE TGBOC DDMFK SBYEZ FWLIO VZFO CUVYK
MPZRM JHTYN UZJWJ IPMLX HCCTP WPPNF CGEKS LJDEY LRTOV URLFO
SEZFO LKKOR TERWA YBJJD YIPNP SKZML GILTC PWICI GSPOP PGRKI
OKBZS VBWDE FMOIU YOFVD MCSBK RGGHE EGQDE OBUGZ XDMZV WVUBC
CTNRY EDHNO KBRLY NVMID KOUVA MMXQ YZRAV PTFPK GSNJO HMKLJ
JEMAT MUCJA XQDTM RVKRO XLSOP DLAPV SVQDP VKPHI WCFLP QGWYZ
KZTBG PFJIV MERNW YUVFI VLDDG ZPOTQ XMYZ XLNOF LBGBB SDITY
KCICK GAKPY XTCTP TMVQK KCTUG UNTOC SBWKA WPLX QZAGC JWUWK
XROBJ HZBJA EUQUB MPZMJ BHUFZ SZJEP RBMGL LQNTQ NEMJT ZABAV
XJFLM ZLRXK VGMJE MCOBS FLBHU PQTKH CIQIX DDHAA GZFEQ

ZCA DE MRS 4845KCS 230623T UEM-99/00078

7538 2523 0540 4775 3644 8669 1081 4338

HBJBB SALFZ YZUXO CYKOC YGYCP FUKCN AEVJY YFYTY FRUEU PUGUJ
OCKVE SOQAY RLAMA BAGNP IMXKY XRLIU SPIWM DUTELJ OBLZY CKGUF
MCOOS CYBUV ESOQA YREBQ ASBWQ QJEZE EAZZY ZUZIU SZUDZ KARDR
IUAGY FLHYR XZAMM JYTAG ATDJO NWFUZ NZUDZ DUTXN YUGBE RAGOG
OXXXX HBJBB SALFZ

VPO DE POB 4965KCS 230613T UEM-99/00079

0026 2123 0530 5504 4257 8146 5942 8633

DDHAA FGRTG TGGWA ZBWUV FAOTZ CEWEN SFUAI IYREH NVJXA QGJME
BFPQR KHWJE XQBMN FGIYY JORIS LXVGE AKQYD BQCKB XRSXK PPUJX
OMPSO SREHE BUKRU NUNVQ MEQWP IYUJW BOFEM MFWUF UNLQK XKCBK
OTCTD SBEUT VBARI LAJUV RTVMH QPZHF MCWVF DQJRF VDLID YONSE
WEVUS BFWCL TDCKP DVUUF ACDCZ DIBVF QDBOG FQZVL BRMQL GKFDU
KLSLZ HVZEP DKHOL MRYJJ FIZBV YKINF YOCIA TRMVL BMAUZ PMFOP
OYHLY QMUFJ VLRGY FROAF ZITTB XPOGG KTCQM RCKXB GZFRE VHEZQ
HOJHO BOEBE VOWWK JQBMN LXNPN SOYER ZBMAA XUNRY TMYTV MGOSE
SPGAT GSILJ WVKLR YHEBX DDHAA FGRTG

VPO DE POB 4965KCS 230644T UEM-99/00080

0036 2123 0530 5504 4257 8146 5942 8433

DDHAA FGRTG TGGWA ZBWUV FAOTZ CEWEN BQAI IYHJY YEQLO SJUGU
BFPQD JREZG PRTXP PKCYT DRDJE VQLKL ZADGE MYJXC VFBPT ESDIF
BURDE DCBBY FADTB GIMWI QGFFA DJZYI IMTII CFYFP RAJFP LUKIT
SEANJ GOBUT CIGOI VXFPU FLAKT JYZEB SSWDO UQSNV YEMVL BZCZD
LADXS JRICV RUSQY CVSKK NCLFP KQNRD CDLIN TGLAV AGVCU LKPMF
UHPJJ HJDAJ MHEIL HUBRI RRPDP BRRID AAYXA ADKLF EHQKP CSBXP
LARTC FITCM XLRBK FBYSP WISDY KUBRG SFAOK YLMBE AVRYI NLYDD
LUCBO DONRB IMARU SMDJU ZKOTI EYXRE ZRRGB JCTPK ZREBK QPSOG
FKVVO CJXXK DDHAA FGRTG

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UNK DE PHI 7510KCS 230816T USM-99/00108

4536 1223 0600 5504 8820 6869 7904 6342

80608 09147 28937 09852 96743 73893 70909 14794 47173 13406
40585 96434 65264 71731 96064 05859 65813 53326 47173 19206
44272 69392 94496 22177 37269 39295 85934 19992 21773 75075
58226 14982 21722 73728 62942 58198 58715 91698 96119 79014
83174 96916 7201 36076 37551 89335 32376 05184 42275 42894
80993 34126 55914 33934 93437 28692 58269 37598 21040 52571
95569 80808 09147

PZX DE FMT 7340KCS 230823T USM-99/00109

1533 9423 0745 0121 2664 8678 1360 6529

EGGGE NECSM EAPSI XQLJU EFAIS FUFIL ANAZA YXJIT DWLAW GIXPT
OQIDE ZAKUM FUGM FUFIL ETQDI BEMOC PKUMF PEEVQ ACVXY TNDLE
LLYMW NJUUM ITGRU QFFUF LDIEL LYDVT YARNI SQAC VKUMF WUEYX
YTNBE MRJUX FJAIT KUMFJ EUPHI DNDAX FKYN KANAZ AYYJI TDQOM
BBIGL BEPUB YUVGY BGMUI UVORL CIMRD OPUFU FLKUM FMBEQ QOVLN
OBSKI LHZBA ZQUVK CIDIF UFLQU APZOT QKLIU FAWFR ETKLI IUDAR
ZDOVA WUORM OPSXX EGGGE NECSM

YWP DE INJ 7450KCS 230812T USM-99/00110

7548 1623 0705 8943 2664 1864 4716 5221

CCFII GOOZS EPLJR TUQKX AMDUN ARDIT BJDNS XQJDP WAKJD LXPTA
POZSM LZJUM ZRYGV CZVYP GOXRT QSNUS ARHEJ NCDSEY NRPIM KUFQE
BTJZQ AVAMK EUSMN VUSRZ BNRAU ICWBU VTRDF HXSBU QPOHM ZAYCR
VGLFS KEIOX VQHYW GJAIX XQUSA BRLLD AOPAD GNAEB QMWIU YWFIA
ZHXIQ WREUT ARNEY GOZSE FLJBA QKNCZ KGLTI FZVOK BFKWV OLJXX
CCFII GOOZS

ZCA DE MRS 6900KCS 230927T USM-99/00111

7558 2923 0810 1120 2664 8669 1081 4318

HBJBH MIQDS YGWFA FPQIN DKOCY NAEVJ YFPJY YPRUE UNYKI FETBP
UGRBA LRKOE PZUDZ VIIDN YIFPU KXJEZ LNAKX RICUQ INDKU MVEYQ
WREBE GYKPK OCYQA LDQAL DZUDZ RUXSV ACZQI NDKUM VRYWY GXPKP
ALDQA LZJUD ZBLKE VACZE YQNGU FMPUG MSYTI PADVS AWLWA DBPUY
MOXXX HBJBH MIQDS

ZCA DE WNN 7280KCS 230856T USM-99/00112

9542 723 0800 1101 8423 4717 1081 4009

HBJBH DUEIL ICPP0 APBYM NZOCZ LOTEK UDFWE EBKOR BNYHT XMPFB
EIQME PDPID TGUFM DUNIN EGAIE WQPHN DKCYR GHEIZ EAZPU TEXUE
ZDUYK ZYXSN YHTDU TXZAR RBYDN FUKKK UMWZE AZBAH TQEDV NOZNV
ICYSI ATGUF MBEQA BEIOC OOSQI LBCAB INYHT DUNX HBJBH DUEIL

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FSD DE EDH 6170KCS 230939T USM-99/00113

4524 8723 0900 0121 3456 6977 7238 2841

DABAD MOWIH UDLCI WBFEM EPAOF FWERE DMDSU GXSFR GJOQZ CYKMK
OZKVY EMJYY FKELK TOTBS ONEKA AOZOF CMOZM FUMRD YQZYX ZUMOT
FMINI SUGKS YRGJO QZNIZ OLOPA RICUX DABAD MOWIH

XFR DE SFV 7830KCS 230929T USM-99/00114

8044 0523 0845 9518 5074 4726 1801 2815

EBBEG HQDCF LPYMY UUZYN EJZXL DOVOA ATOKA DBUCW XCWEX SLQEW
JTYRO XMPKS BQZKU KINFW HBRES OWIDM MNMLQ CHAZB UNGMR HLYXX
RCLFO XAAUR FCEZZ DODN HFGYI MLFMT EBBEG HQDCF

SPV DE XFR 6070KCS 230812T USM-99/00115

3596 4423 0725 2110 4257 8641 5320 4328

DJDJD LUDOS IQIHE TDXYI CFXKX TEKSK EDQJI BMKUI SFEZH QUBHD
IELDE NUFYX LWAIG JIBMP IBBRE OYGLI RRYBN RYVKJ YGOTA CYJIS
CLAMA NYTKW ULBJU UCCAV CDAKS HYZFG ELUGA LVFEI RCASZ SYBRQ
ODTBI QIGII RTIGA WUBVR IYQKI ZLSIQ IWOEC RIEZZ YBGA ZKPIB
RXCKX DJDJD LUDOS

HEZ DE MKP 7320KCS 230815T USM-99/00116

5015 9623 0750 9329 1871 6625 6473 2620

50505 98870 57309 89560 56891 39774 20489 39829 86954 93169
39662 57398 87447 52735 97042 99507 85581 91319 19689 11915
19199 66730 87895 90038 50505 98870

PSD DE MKP 7320KCS 230849T USM-99/00117

3015 9123 0620 3731 3456 6625 1243 7024

28082 22132 65415 26226 12240 94462 06579 51742 15760 34468
04647 65414 92116 34647 63295 26244 49204 40333 01251 16533
72431 51269 56253 10444 21123 31244 82655 25351 04403 92942
85416 41362 14091 40151 15542 15624 40218 53820 61732 59126
43755 00463 26344 21712 05765 42423 32862 35444 21575 11957
83083 62566 10530 15604 01341 48736 95765 25079 30812 62624
07226 36711 22664 87492 42313 70012 21326 53200 28082 22132

NIO DE HDG 7080KCS 230917T USM-99/00118

7013 2823 0825 8943 7263 9145 2125 4532

CCFII DDQEM OKLXF VEKLZ QKXSB OZJIV NUBOP SYRIU YCGPA TKLWC
KYRSH QXVWC BLJST GCKTV PJGQS YPFEC TDXYT JAZQE GVKLA SZMNX
DABOU FPKOK NEPMX CJDXE FCGEI AQLWB AQVXO LPUYE JUKYP LTQZN
DFPGA WXSNG RBUCB BYUDG VOLZT XPVEX LZQUE YCGME ADHPV UJDPZ
IHLQS ZMKGP UDMKS CCFII DDQEM

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EDH DE HCO 6030KCS 238022T USM-99/00119

4027 2323 0730 9518 8423 8740 5267 5105

DARAD LYKXEL ORCFA FPQIN DBERTY JAFBR BAZJU MUFUM RJEZL LOFRG
YTVJY YPTJU MJOEM VODIV YGRTY IBRUV LCYTV KOKKC YTVWY OGBRT
YKOCY NUPBC YFVKO ZKWTY GBERTY XOCYZ IQOJE ZLLOF REYQW BETYJ
QDBVO DKVYQ ETOIB RUVLC YKMYJ YPBYQ WYIOG CYTVH YQYNU PBCYK
MJYTF WYOGC YTVHY QYFUM RMOTF ZYZUZ AIIFU UZVIO IHORE DARAD
LYKXEL

NIO DE BWO 7990KCS 230913T USM-99/00120

3026 4723 0825 9518 6010 3565 2125 4928

CFIFC VREBA UZOXO WSLEZ NHAWE WAFEM UCOJA OALEZ NCTTV JAOAJ
YSZGA YDFEV DBAZF MOHUX OCYTY YPCAU BVAKG RUTDM AERMO QCFUN
BCOUY DORCD UOSKU BMYCN XMYEK RBQIQ ELABE YDHLA KKEKW LYMVB
AKDRE TYKRT FDUVZ QXKLC OPTCA UBFAG QPANE GATDZ IWUSU NDJEZ
LDUOS KYRQK OITNA OAHAS DFUPC ZYIDG YBGGK CFIFC VREBA

IZW DE CUM 7720KCS 230913T USM-99/00121

9552 0223 0740 6530 9054 2601 0956 8927

DDHAA CGPLL KJPFK FOBSU VFWRS VYWPQ MEKKA AIJPD KJGZH KQIGW
JMBBR DZTKX PEVJT SOZCY UJMCB USBMO IRMTI RSTQK ELBCY HVAIA
MZFUL VILMM OMKDI EFTFV YZHAM GBWPU AJUQM CPGSH ZDKQN UCZLE
SKCFY UMEMI NIKKC IKSKB WEADR SJIOY WLAFG FGKTP FJBEK FSNAP
QFPAU AJUNY COVBY IGUJF IJXMF ZKXFP WNEFD XIKVG FXUJU YRMBT
KXRDD OOLBL UZMAL QDDMM NDLPX MURYP INTLB LPUOB DHABH ZEYLP
RPAUR HDEZQ BLVYZ BQVLY ZYZRJ CRXKP KZLEJ FGVLY UCZII WKCFR
MUUUX NEICW KYCNK AMKUI DMCKY VINOW TOGQM WWPZB USMLN VUDSF
XPGQY RGIQK XRTBF MPKJN KKLSP QIOSK TPFXX DDHAA CGPLL

ZIC DE FSD 6680KCS 230930T USM-99/00122

2546 5523 0825 4775 0420 1161 5726 3122

HDBED AYWEP JCBAC PSYKJ ZLGBS FUYLR KFKQD UCAMU PRAXA QEDHW
JCIEL RIGCU KMAYS VFKNB QOPFJ YEDSG JOAKD VKOBD LWAGK RJDCB
FVRJM NYDRZ AVLDU BKRUJ JNANQ QZVBJ KKIITA UTHIF LAUAY HDBED
AYWEP

SFV DE MCP 7320KCS 230953T USM-99/00123

0545 9823 0900 9942 2664 6625 5320 6034

DJNDJ GYKPV OBVZY LFWOB VHYQW JISCW IMEFO WCGAZ KBRTY BAVBT
EKEPI BKMAA RTKCE HIUDJ IEMFI ZGDUM QKACD QUSGC ELREY QMJUF
QJIBM FAFPG ULPQU SGTEK EHIUD FUBQO USGCE LRKQZ KJUFO JIBMH
YQMGU IPQUB GTEKE ZUMSQ IPPQU SGCEL RJIBM CYTVJ ISCJI ZKTEK
EZUWS QIFPQ USGCE LRJUF QJIBM HYQWJ ISCPA VEDEN UKYGA JUFQJ
IBMCI YDJIS CFAVE DENUL EFTJU FOJIB MCIYD JISCK DJNDJ GYKPV

ZHK DE POH 7640KCS 230917T USM-99/00124

9516 2723 0800 2750 7263 2340 3151 7738

DDHAA RZGBD JABQM IIEZH CUAIC GZSBJ HERRY FWIBX SGYDL YQCA
GYJGM YKIOY CRDLP THQEK WFKXJ CBQES IMTYS VUBJR GSMFS SMBKB
DEKIV PZLKC IVTBP MKRCK SBQHD JWQKJ XZQKA UGFBY PTMXV IMFHA
MELHZ HYTFU ZLRGY WUBZZ HECXB MYLDG HDQKN XCKZF PVPVH BTBTL
VDDMJ BBUAJ NEMBY QFQIZ AKCFE TVQIJ WLBWU SNFON UOZUJ YTKED
MAXWN RKSBL RISCPCFGH JIJOL BMQEV XICCY KMTXK OPTYL JSMNV
HMFYI KZKKT NKRKA YHMPG LJKCD NORBE NCRV KFWSR ZLULM BJDBA
HYKJY RUSHV FWUQC OQTFY CFXKX DDHAA RZGBD

ZZZ DE DYO 6260KCS 230929T USM-99/00125

5038 3223 0900 9192 4803 9541 3755 4546

ABCAB TWVEJ GPMPP ZYZWI ZBQWT ULFXJ UHUZG KGLQK YHCTM QZDFR
DKUEZ HMOUE DFTJD IVUFP KZEM IYUFI UJWEN IXOJU PJZHW MSWCK
WNTCW TDYDG PCVTJ MQVOK PKMMB EJJMT MKPTL VAVFK EBHTX ITLZM
IKVFM CGLLM ZSOCH VEHC EKEEM YBVCK QQTZ ESUPZ JWNPF HOKID
EQZPT RGMWL FLPBP ABCAB TWVEJ

ZIC DE EDH 6170KCS 230809T USM-99/00126

1554 8923 0730 1561 3698 6977 5726 3443

BQIBG NKURF MGURE ISPOY WASLG ZBADE LKLIUP CYVDW DANER LYSVE
LPEGT WWCY GYZEN OYXZN JRDYI GZMAY XVERA BEOYB KQNOV DZJUG
JVLAG DQZVM EREBU VBLTQ SZPYB JRYOD UNIRS RMPRI MKXAR KBBQZ
CRMVZ AVXCT BQIBG NKURF

RBU DE NVT 6340KCS 230822T USM-99/00127

5046 1923 0600 3731 9054 7525 5726 8728

FFBGG TDMRK CLUDA FFRFU EJHAB UABNO FBIRR BHWIM MAVRT JSFBS
KMCVO WIKSN FNPBO WGOIS USQAP LNVFZ IPGCK HNJBN RSLIT PEKRT
TIUWB OQKGC QKXFI BEIJV HPIUR CLLBE KZTYN WWPBQ TBRWU KZDLO
XGVBG YTXCT OTKRQ QPKUY JGSTD MDTET VXPKN TOEKB FQPIF WUOLE
SSSDH OACMV FBNM NGNLI BCLRS SKLLX NAYZP ZSKLF BFFZY ETNRT
CRHYV SVVQF EJRVI GAKMZ BOORB BPUAY FRQSO JIJBN ZSZUE OCWEL
HJESH UPZER AURBF KDZKW IECOE IQGHP VIZSY XLEAJ ISWBW QXTC
CCKFX FNFDS WFLH STUFE EKNKZ XBJI VSCYI YJUDN WVKGW FKNQQ
VZPJC KIMOW MZLKL IDEWI VMCKK FFBGG TDMRK

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CVR DE KTR 4045ACS 231031T USM-99/00146

7526 4323 0440 0121 3456 3565 0172 4426

FFBGG XIBBO WZSZT NKXGK LSMOR BWIFJ NMDYM TLJGY FOGEM IPLVG
 VS-ITA OVFPD ZHFPK THCMC CBNPH LNUIC QBRMR SCSSA HSRKJ CTEDO
 HJRHB BGYIA VHTNO PSCMV CPYZY LHMGL NQZYX GBOYQ GZPJS UKQTV
 FGNKL VVZQD BOHDK LCCYNU YQGHF UBYUJ CYKFS LKSRD PPERW ZNVBG
 XGQBM BRYXX FFBGG XIBBO

VKI DE FZK 7720KCS 231106T USM-99/00147

6012 1423 1020 9329 2239 7741 3070 4018

HBJHB FVFAB YXVXT QAVFB ERZNX KODDU FZCKP OKHBJ ZFJBS YVIBI
 XNAZO QVROP OLLAR WBRKI RKJLD WZGCD RBNQV JZKRS JPIW EISCU
 VFTFM ZVQGA WNMTC LJDBR FGNEN SYDOL AAJTD KJBIT TCSNC DMSKT
 UJYBF GVJPC MOYX UGDTI KPFHD ENSPH ADPRT FCAWO HBJHB FVFAB

YWP DE UBT 6890KCS 231058T USM-99/00148

6545 0123 1025 1120 3456 6832 4718 4632

AEFEA MOTFS ULBGU VEMUC ONOLD BEFUG OMICA MTFID LMYLV WBUKD
 AIRLI CFWRP NWELE DOGMB AELBO NQCUY BMBUR CERXK OCYDI TZMES
 GTIQK TAGCX YEYKY LIMOT FCAMT FIDLM YLVNE ZPKOM WFOFU XEFDL
 UYINU ERMOP SDEGO CAMTF IDLTA WBNAC ACUOR KOBCP YCFPU UZFEV
 DMOHU TYQQQ UDSGU NTECX AEFEA MOTFS

YWP DE UBT 6890KCS 231106T USM-99/00149

6555 0223 1030 2750 7263 6832 4718 4837

CCFII NNUSJ ZATKH JMWZB MFRHJ ZHREX CYHKT YAUGB VWIRO QSJXB
 DMOFH QBNXJ UZFLK HJTYN FVLJF VPKWE IYXDA DWBQI KUORL WROEF
 CBKJT CFZMV UROLE ZEBWA ZMECK ELEYL ADWEQ IKUPM TPGRP YPKOF
 AJUDU ZATKH JLMGL MZBYI BNVNO BOMIU JQNXO LBFER OQPMR GAKSH
 GCZQR BHPF FZVMI UWAEL KSRZB ADKXX CCFII NNUSJ

ZCA DE MRS 6900KCS 231158T USM-99/00150

7588 3823 1100 3731 3456 8669 1081 3736

HBJHB FUGMH UMYWY IBVEZ XPEGX LAQBQ INDJY YFGYK FXOCY ZOHEK
 IQBPU KXJEO ZHOMU NUPBP AGYRI CUCIK PSEBQ LAQEP UKOKU MVRUM
 TWYIB VEBXP EGKLA QSHYQ WGYXP KOCYX OCYZO HEPER STAMH QEDVP
 UKXNI NBBEZ EPUKX VEIEP EZQXX HBJHB FUGMH

WNN DE MRB 6900KCS 231032T USM-99/00151

9028 3323 0945 9942 1470 8609 8406 3330

HBJHB BYIKP ENDZU DZJUX FZYUO GOOVC YTVJY YFQAL DRAEV JTYFJ
 YYFRU EUGUF MROTK NUMIR OMCTI TNPVK XQIND HYQWG YKPMY SCPFK
 XBUNK CANUT EBMQI NDJYY FQALD GYKBY ULDDA VOROM CGUFM QYBKM
 OZFKX HBJHB BYIKP

BFV DE MKP 7320KCS 231136T USM-99/00152

0606 0723 1040 6530 1476 6625 5320 4532

DJJDJ BYRBS YDTDU MQXER PFONT ZYLFB ETYKO ZKOYK PFONS QYPCB
 OZCJI BMEG BLUCN BYRSV OOHFO MBSBY SBOZC JISCP OOCRE LDBET
 YGAKZ KADRB YRSKU NBJUE NVEQM VEWMP YPBFI SCFOZ FNRBU PYPBM
 ERFTS XSDAC YDUMQ XERPF ONTEY LFRBN XRAYB BYRST ACYJI BMGEB
 LMAXW QUOCD LKXX DJJDJ BYRBS

FBI DE MKP 7320KCS 231012T USM-99/00153

4516 0023 0925 3731 0611 6625 8327 4326

DJJDJ QULZV YFXSE DMDUQ UTOVO XYORB OZCSI CVHYQ WCYTV JTYFJ
 YTFPI XEMER FGAKZ XERPM UBVGA LVTIG AJIMW VEDZC ASZNO NAJVO
 WTACY FYKWM AGWJI SCZOX UKERP WYTTT UIASI QIXAO NCBGA TOKCH
 YQWY KPJY FJYX JISCR UMBPI CSPYK KDARZ TEBK EDQVE DZCAS
 ZSYR DJJDJ QULZV

NIO DE TTY 7400KCS 231024T USM-99/00154

1518 2223 0913 3442 7263 2025 2125 5132

CFIFC QOEMS ANEZY GBQYP CJAOA WEVST URIMU BVHEV IQIKO GOIQQ
 YKLGJ ALJAO AMUKV BESKR IMDWY EKVUI BJYOV DOKPV UKCKE RPKIX
 OJICN JAOAK UBOPO OCKOI BUDX XERPS YZPCA UBGUE LQYKL QAQVG
 OHBDO YDJLD OFYX CAUBR IYQMA EUSAN HFAXH FUBWK UROCI HNZYG
 BMBV ZIWUS UNDMA EUCLX ONYRC LYMWG UQWMA EUNIN BKOXX CFIFC
 QOEMS

MKP DE MRS 6900KCS 231037T USM-99/00155

5028 3223 0940 5504 3456 8669 5762 6216

CCFII GGRUO SDBYJ ICPAX CPXJZ CTFNM LJUNL UTMJZ AVBZT ADBTU
 PIWKT WFLIR UIUVY CBAZF YWGCE PZVRZ DEYCR UNACU JQMPV UPQDM
 LAMVN TNGI WIFZK BPQJP BNQZL KNWDO NDJGI OFITY TQBEB TUFQE
 NKORA ZQVFP CINOW TRIBC GKZTL SMRAO VTCBA QPFG WIZIX BMPNX
 DYQPO ADKXK CHQHI LPHPS LKXBD JRIEB NDQOM BMRSE FYQJD ILKVB
 JIMLJ MIUYZ XBNKO NDPHI RTUWV MUQDH KMBKO NCMJZ TQUQG WDXCX
 CCFII GGRUO

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POH DE ZHK 6660KCS 231138T USM-99/00173

3060 1923 1100 0121 2645 4212 5942 6823

DDHAA GLSKO XSYRN VFLGE PKZMT TELTI HJWHA LUQSW JODMK LDCBL
ZTGAZ FNSNQ EQARQ LFRWL JOBZZ VBRWG JMBIO BSJBA YFEXF P810H
RCERO OPYLP WMRPE GBJEB WSDME HOODD UVAGW AJLXT SDHTP PRYBT
EZESP NVNDF KNBEJ CIMDF KZUGR WSANK LZSPI JLWZO ITXOF USLEJ
QOOLA EMFFF LPVXU WGXEL FWSJK UORAI DPUQM BYUJL HZYYP L8AGV
JZVLY LEMIC ADYVX YDISS CIDUX MURJT FTKFW UZTQO SMHGV GBYLG
RGMCW AVVTP FEUDJ XYUEW ZTVQI LAXXX DDHAA GLSKO

RBU DP RBW 7120KCS 231112T USM-99/000174

7520 2023 1000 8043 7263 2610 5726 6237

DDHAA HNAVE ZIQQU WXSQU O'EGC XBOJR JBISL HIXFN LGERZ EBUYZ
LUCRZ QOADD TTFBW PWTLS GZIBF IMFYD DODHA QVJBA YRXII CKNOR
TUTSO ISLEU AVINP FXQLJ UVELW RYPMI HRPVD PZLAK ANZUM BOZVA
ULPTV AUFBZ HAIAD IAMA7 JWDY ZLSMZ UJMCB WCCDA CHSQM TNGGC
WADWJ HYKCF HACL5 ULGSL TELMD GYMA LQNIQ ULJPK WQGVN MRABZ
IOBIL BdBET WJULU TL6SL BFUDJ FYFWM HXPSD WFLDL BFMCL LABVO
RCERO WFXXF GCITY N5M5W NMA9V DMQBO IPWFT WLPTE QWJQ FEEPO
PPTVC KMAVO MLKER SPLJT DL6CY TELKR YSMUB FLJMK YGKZG ZAXXX
DDHAA HNAVE

OAL DE RBU 6020KCS 231004T USM-99/0175

8527 7523 0035 3731 7003 0502 7096 6624

FFBGG OJCHL NEMOJ KHALY BLIYQ HTPZO KMKCR VUBJN QZGEU BXBUR
ZNGTF WCKLO LKBID NCTIK VANZZ VVCUD LZYK JTKGX TTBHM ZEZTE
GVLVE JMRVP CURKT KQNLK GFOQZ JERAW DIRBY LGELS UYCUL AHWUJ
AVXHA QLIQC DSIZY XBGOL HOURR JQWEX THCRG ITCFM ORZMI TPKDR
FLASR FMTDF RRNZB QFBMH MURUS NARPE RVXJL PZJKE GDKLM NIKPD
DHXKG LZVGD VDUWC HPISS FYOMM FYRPS FXLHR BORLI CQJQR ZSTLR
LIZCV HNGML MZJMU ZRLXH FFBGG OJCHL

INJ DE GFH 6400KCS 231157T USM-99/00176

4021 0023 1015 6530 0011 4097 1377 5018

CCFII SSMLZ JUMZR YGVCL VYPGO VNXHS C2OND VTRSN RYCFA KLRHZ
ELMCI WUDUC RUCUOP WEMUE W06WD HGWJJ FGMXY BFMGX DEHFO XBOFL
VWMTB UYTUD IKJQL ZMFXV W6QNM BMYGI F5ABU QS4RB CRZSS ZILJA
XAMPD RYGCZ AVZBF JUDVX APIAX W6ROS KSBAT ZVWOK BXEPM YTSBG
CUBVA EL8WC BIJVF DCR3V NEYOK ALXDI GVQOV AKVOX CCFII SSMLZ

YWP DE BOU 6140KCS 231146T USM-99/00177

5552 3623 1100 6530 9054 7101 4716 4429

CCFII QQPMN ALPSQ JZMTQ WBDWH BWHUF TP8FR UESTZ ODJLT BEYEG
BKPFY KJLQK VMXOJ AKFLO WMNGO PDKAN EJACU PCACU AQMVZ EPNOM
IPOGZ VFKOF ZTVKD GJGYF VFIGE PQUVO UPKBL PDYCF BUTMN MRJQV
ODWBU YFNEX LWRGJ HGFKN OHKXQ KAIKA BHALR ZXSMI BLDBJ LZAVT
SNPMW HGXXX CCFII QQPMN

FHI DE FBP 7940KCS 231041T USM-99/00178

5018 3423 1010 4775 8423 4122 8327 2534

80808 76885 03090 13340 95374 11731 97433 13014 41423 59593
40576 84734 69323 79531 21934 86510 13499 05594 28933 23692
95194 55725 24400 80808 76885

MKP DE GWK 6100KCS 231142T USM-99/00179

3518 2423 1110 4775 7046 9893 5762 3332

ECNCE RAPHO BAI01 MMEEL OLFFY GDWCO SAGBX DENCU UTBRI WBHTP
R4JSD LFBNR UNEAO BOABE OEVOG WTRSE NIMCA TTR01 ETRNO PNELE
COOEO RVPIX RRUHN NETTF TOOOI OOREE STZZA RTETD URFWP NOION
AOOWO ECNCE RAPHO

HZY DE MKP 7320KCS 231124T USM-99/00180

5036 0423 1000 2110 8820 6625 6473 9028

95459 06843 02842 23840 27884 42926 31692 31402 24234 23219
97494 98298 02929 70825 01813 38374 29214 54374 49484 16793
11666 4637 21411 97479 91660 84190 13329 90445 81668 64104
25142 92631 69231 30697 44423 84067 44535 67536 96184 66746
52560 44617 44449 70825 01813 37322 31158 94043 99482 76664
20213 21441 34022 42342 32190 74943 39980 12393 22311 58948
30264 64661 46270 74574 27328 42281 30250 99816 39214 11589
4399 80511 23223 11509 48392 64646 66044 79693 04232 78230
10444 74705 73942 16829 20417 44211 32282 58000 95450 06843

INJ DE YWP 7290KCS 231303T USM-99/00181

9015 3423 1220 9518 5442 5833 1397 3820

DPJDF AONGB SOITH BKOBG WVVLS DTWUR VSXKI FILOE GCLRI TPQLD
FYV THISE DIIPB IVFPI WNGPU PnQYM JAKTI YGOAE BBOBJ ZULTU
QNTVA YEAAC VHMMD BSSFN NBHYR CXPFA MQZUF WXBK PYSWE VFKAA
WACE RVRGI VOODV FLMCL DXAAX EDLBR DFJDF AONGB

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FBO DE FOH 7640KCB 23136T USM-99/00182

8526 3923 1210 8140 2645 1639 2549 8342

DDHAA YNFPT BKAFD SCVWQ RCEEK IFRFB BFOFB CIGQD QSEMZ ZAGLT
BBJJA DCILM YCKCM EGLKO SBRKS WGLPK ROARK BMOPO MBWJF RNDMP
QVVIC KQSUZ DTRWG UGHDT OYNKE NDEKC FLPCB YASQM LDKOD WRLPV
FMZBU BBRKO UACKF UWKQV WTAUG QBRIV LKLPB XNLDN BRTQG WSMAL
RMQJO JYUJO ILOPA DJGRF VFRMG KBBLL KMUYI MGHEU GVTIG RSGYU
EPDFB GDUYT DFLWQ DQWNY XRNAD BQRCT QKFCY RCKIF XICJJ NUMQJ
MNCPC HDTPG CKNLB SMZBQ MVD8J BYBLD FFHWS XBBDI VERPZ IOWUO
CPOJF UBLZZ KJYTW ITOMY JDMKM DMJXR XMBAL VXGIM UDETZ VLK0I
DEUJD DDHAA YNFPT

NVT DE RBU 6620KCB 231328T USM-99/00183

6567 9023 1245 7753 5218 8858 3485 6636

DCGDC FLVAF EBBBR BBOVI XOYDN XAVGL NNBGJ BHNKY SSRVK UOIRI
VFZLN RRFJA ZDLMK QUNZK QZJAX SSPNQ VJGOX VOURA AUFPC ZZELI
RUGTF MZAMC UQKSF CMGZT ELDIV XEZRK ZKYRK DQPKF MZBLB EOTEK
EDGDR FPKGT BBJAT YVGZG LURVM BUVQZ QSNWE MLPOX OTFUA ZRYMT
LLYIZ TUJSV RIBBS OBOHH YKONY LNKCK YQJCA LTBAP LEBCB UZYYG
SKQQJ DWCS JRFZB YCBFC ZLAMS NAGVY YJNKM VBJGK BQJUT VCVVA
XURUN RKUMA FQUGB YIMLD DCGDC FLVAF

CUN DE IZW 6260KCB 231318T USM-99/00184

2078 4423 1140 2110 9054 9640 1360 7031

DDHAA PHEKA HOGYT FMZNV FVBNW LYAKU BKNFT NLQXX BNVNC RERYK
QCFZL MLALJ LIQZB HFIFG KVRTA FDKKU AALFI DGMBQ XKPWV LCTYE
RPFKN TWPQQ YUPKT FRGRC MBLCM NIMPT BWANK MITLL BQBRZ ZPFBL
GUJTK UEZTI BSIQO YBGZT NYJTI BCSSI YPAAG GYCLX UJBKX GYVNG
PESBN ZPJPB QBLB GURB NCIYA QBUOZ FJJIU QMJHQ LUPZL BTQVY
KKVGE BPHBM WPTBS ZHPRR JMWIY TYCFV XNPSI JXZKE BZJWV ADPAL
BZBVU WJGHE YKZOW YCTAS HUYGK FKLBZ TRFZB BJJYK DDHAA PHEKA

ZBK DE NIO 6130KCB 231214T USM-99/00185

2521 7023 1100 8943 8820 2124 3151 7901

DDHAA NVMJN HJZEP TLYRI FVXJP CVNKN ERGIT QUBFM RBXEU SQKCK
FVZGZ UBJVC FDLDF VBENK FQISZ XBBUW XZAFB GMHRO OMVEQ SBURN
YIHTI DNLBP LORMB ABWAX RTIYG GQFJQ WLCKI LQRVC XOOPF WMLXK
QUOQB KXLLZ HTRKG NSDLZ OZELC ANBSU TCTRK QVHBC BOYOK MATBQ
UAYTO SOLAX PWADS DZTBE KCPVT UQKXF GOUJT NLMWM GPOGD KYQGR
HFBEL DVULS ZGAUK JEMQR XPDJK RJGTF MCTVT MMLJF BHEFDM CBFBE
PFBIQ FRQFE GBBGV WHPVK CQFUX MFBMJ OHIAW VPEKN VZEUB QJUBB
DTIIS BAOVH CMWVK BHLJB KORPL CQRCH YWSVK DDHAA NVMJN

ALL DE ZCA 4405KCB 231326T USM-99/00186

0010 3523 1210 3749 1663 2610 1081 4302

JILJI BUMCH CVAFB NFNHC TCKNJ MDDLW ITOLL MBFRR JEZLK AKFKD
PPHLS ISOKA MOCVM TWLFV ZKMLQ OEKKE ZTVCP FLMAX QOXTY BAYEK
HMMT MHRQ JSADB IQBEU XELOT LBTYV SZYSS UYJXK KAUMJ LKVFQ
XJIMK AFATF QJHVV BDIKZ MJKJT EBEVR MEMMK DEWSE DFFJT HUNUG
DXGNO JILJI BUMCH

EDI DE VLK 5960KCB 231312T USM-99/00187

0027 0523 1225 1561 3456 6373 3061 7229

FFBGG ZGFFL CVZFA KWKBI BVKQZ DWJJU ABUMA OHQBO YWXQC RCKGT
FUJWV GCBPS KLBEM LTQBR BNLGH PZTSX PGHEZ DKUDF JXTPK LVQSK
YUAGP VLIYJ FCBFB YZUWV WIALA UKWOL PAEUV ITBRO EYXJL QQREY
CFDBZ LYMVS LLEIQ ZMIVU RBNRW YGKDL ZYTDC BMOEZ MGLIM XNCTC
VATPQ HRERL FLOUG XYUBS WBRN QZODD DTFAZ HRCFR FLUFR QMADM
CQJEX XBBAL WAIQZ GSKVJ MZBCV WQRRR RPPEN KIYBE VADDZ ORGLL
GWLSB BOZCC BKBKR FRACN ZVWQ AKQEG BNGYS FKHQZ KITFQ BRICS
FFBGG ZGFFL

FOH DE FBO 6830KCB 231748T USM-99/00188

2095 0323 1705 6530 5445 5121 2666 7928

DDHAA QMBV BRTLY XOFYZ XNQPQ MEKIM YPCKT MCFPX KKKUK XKNFV
BYRYG VMPVY ZKFKB KRLJU LJBGX DGHPI WCYNK VCSQH LVHDC CQTGF
JBQKT RNLED BSGMP LXAUM QMSU WQFNP JKAFK MKYTO ZTFPY ZYIVV
MBQJZ QATBD BFXMT TCWCH LKQRK MBKPZ ELTIF PIMAN CTWBO VBNVC
PHUNY COVYL YZRBY QLNSR BCGFU FHPDU QAQOL KQKYZ BJKKH FNBOP
MMWVM BJRNK VMQWV QABHL BHMGM XYBCK QMVMV VIQXL GQYLP FCXZ
OGPWK UUXCN XMAFT XWDGO BZCQO LLQIQ LVWVO PDMVJ IYSCI NIMJY
OKBLI BZTFU QMVEZ JPPQZ ZGMCS OGBVA BEZZX DDHAA QMBV

ZBK DE FBO 6830KCB 231728T USM-99/00189

9044 9723 1635 2750 7263 7435 3151 9301

DDHAA BCBOI ABGGV OZAGI JXBOY UIOKB YJJXJ XVRBC FDBFQ BWPZZ
DHCGB HCKNS WMCJV ADAJY BALDJ JCBFW ALXQR YRQKI QARAV GFNVC
LABGP GCWEP FJGNT WLFEL AVULS YNJUST CYWOB CYDWE IYEHH PMDH
QOACN LCGGT KCVQQ DJDEK BRAUD WDJUF XBMQK BRTYQ DRELO OBTRE
TFKOK MBKPZ BRIBC XCHIO BRSOD BAOLQ RYHOU QIARR XOHW YHDS
KXZGQ EFROL XPTFH AQHCG YNDOR FCGPP IYWPT MHL0I YZGSA TVBVZ
WLDXG JBDGS DQPEX DFPZO GMEZC PDPFO QLJUU XPFVM DRBAX XQDKR
NXZAM INNCE LVLGG GLVYN SHQFX IVKSV HCBEP PYJOB PCHDY AJBJQ
SIBJH YJLNB OATOY LQBSQ ZYEMW CNMLQ UKMTI CSFGU WDIEV FLFPM
YBCK DDRAA BCBOI

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NZY DE MKP 7320KCS 230905T USM-99/00199

5025 9123 0620 8943 1476 6625 6473 6324

95459 30697 49439 61925 74202 78847 29232 72814 02242 34232
19074 94991 66790 42923 98254 99292 61000 84134 21482 23089
67419 90761 26438 28133 90412 29281 35413 04127 08250 86621
30684 66749 43813 14506 08419 01664 68483 21694 25172 92327
28140 22423 42321 90749 48318 41646 40414 94796 21094 04128
63399 81128 39264 64660 91243 61045 89451 99122 26214 57306
97400 95459 30697

ZIC DE HCO 6030KCS 231219T USM-99/00200

3577 3023 1145 2750 1476 8740 5726 2708

DAREAD SYDIX ERFWA AYQYK FKQZK JAFBR EADJU MUFUM RRYET XYKDS
AQLNO VIFIE MFUMR FULZJ YLSTI BVVOD XMIVI HADPM OQCPA YENOL
YTOIB VOIKL EHZBU GIKIE QKXKX DAREAD SYDIX

HDC DE BWO 7990KCS 231350T USM-99/00201

1046 5823 1035 2750 9054 3565 6707 9110

CFIFC CYYVN IRFVU FYNLR FCYTV CAUBX ERPKO DZBUT VHAZE FIRYL
IBONI OCBAY EKUBN QYDRR ELDWU MFFOZ FJONW VIUFM ARUFO RPFMK
VBQFS ZYLFW UVVQO MBBUT VFOCU MUKYV YEZNE IYMAC SWYTM NAZGW
UBVWY EKXOW SNYDP ZYIDM IKKDE XEBUK VKOBM QJHYC BOXXU ZUCAU
BYKRP HAYTK UBOJI QAGUR WNYEK JIQAX EMUKE FPMOX KBQGY TIMGW
BOLFU WBKUE ONEZP DYTWS OGYWU BWVZE XBEYI ZICAF OZPKE RPZJU
UKOLE MUCOF OOUWO WRZEM VMABU DIXEK AYMCA UBXYI QHOLR JUCLW
YEKIU ITISB UMUCO GAVFB EYDKE RFAU BJADQ KEPRX IROHI BRWOW
RQIBY XIROZ UVRKO ALQIH YNOZN CEKQJ ONWSU QODUE IXKXK CFIFC
CYYVN

TPY DE BWO 7990KCS 231218T USM-99/00202

2056 5823 1035 0121 5445 3565 9713 8510

CFIFC CYYVN IRFVU FYNLR FBRTY CAUBX EYIZI CAPOZ FXERP ZIMUN
UUGSA NBZUB XMAEU KATOK UBOBO FSDOS SGARB FUNBK UBOUJ YKQEN
YDIYE KEDW YMAVA KGBEY ICOPT WUDKJ AOALE CQVIQ LKOZV NAZGW
UBVWY EKBEY IKITE PODKP OZPBE YDGUX OQODT MUCON AZQHY EGMYN
PTOPH JAOAT AKTKE RPKIM UBUSZ KUROP UWBBU TVVOA UDYTW SOKBS
OFKBU BOMER GQTKL CAUBS ANHKE NZHDE NDUOS BYBCW UDMYI EKQAI
BJADA KUBOM OIVZO URNIC RZUVR COFIN AOALE CQRAY KXIAK XERFP
UWBHU KYFUP CRDOW MUYKM UYKZA YWUB VRUON XERPR IYQDE RPAV
FSQFG BEMQC AUBXK CFIFC CYYVN

QFH DE FZX 7720KCS 231254T USM-99/00203

3052 2123 1115 0121 5445 7741 6743 8524

ERBGE KOZKW URYNY IUMUE YCYTV MJTUM EGYTE NEKUE OSANH MODQM
UEQPE BSWGW RXYTN HYDKV IYTLY HRQUC RFINU KUMFV IYTVJ HUMYA
LQATM TOKQK BQYDO QVMBG VZBAZ ROWNF UPLQU WTKOB XBANT DIOUD
IFMNY YIMEG VDOPU MAYOK UBOPO THKAO BNIDS GELUD IOUMY YIMLY
UGAFQ PUFPL YABSA NEMOD QNUNZ VIYTK UWFZO QNDAR ZGELU SOVNR
YBQVI YTLAZ OKIQB MIUIP EBSNY ALQYS FPARZ DQGR QNMY YIQIQ
YFUPL VIYTC ZIFPA SBVEL GHEFD ZEAZP UFLQU WTMOC FWYFB SANHK
UNPCE FSKUS NCFEM JAHUJ ABUQE OFDIF MKAED SANET OQISA NRQIY
FRYBQ VOIXM UIUXK ERBGE KOZKW

UBT DE YWP 7290KCS 231319T USM-99/00204

1025 3123 1145 8943 2664 5833 9803 8710

AEFEA FAPFL IFSWA RPLIF SCYTV KYLTQ OVLJO AKDAC FKQUE LUBMW
UICGA SCDAC PHADP WARPC AMTFI DLBEA FNOXL GUVBQ AOGWI RNDAI
RFTSW KYLTQ OMBRI FFRUA QMYEK GAWGD EGODY MPKAY MZUQM QARAW
OLPBE YDCYF HCUXB RHDWS ULBZA NNMOP SPANE HUKEW BURMU UFKOU
EKYAU RUESV IYTRI TLFUA FPBBS MOPSD AGPCI YDWH DCUYB WIVRJ
UHQBA FMSUL BDAGP LIBEW EQNVU VOKYL TEUFB TOPFG AWGZU FBJAP
BSAOI RITLQ EBESA CXFID LWEUR FBSBW IRNBE OTMOP SKIPC RULAM
LLYDE GOUUV BSULB PEBBV IYTHA TETIO EGAWG HUKEW BURNE LADRG
OBTWA MILYS ULBPE BSKYL TCKXK AEFEA FAPFL

BWO DE TPY 7400KCS 231256T USM-99/00205

7108 2723 1205 4775 5218 2025 8156 3645

ADEAD JRTGE RUIOH SCEVX FWIEB UDFLA WRONZ EDVJS QWJAE WAFVO
UBQSI WLJML RBQUD LYNBJ XNLVN OCEKL GSPNC UVWWS BLTQR KSGKP
IOCKQ QMUBM UTVVJ WUOAC ZFOGE JUATN HZEBJ LJZFE QEPFR SAKNL
BCGXQ LLVYX CMQZQ XODYU ADEAD JRTGE

BWO DE HDC 7080KCS 231312T USM-99/00206

8573 3223 1230 1561 5074 9145 8156 5322

DHBDH LONGH DAAFL NFLGO JIOXU DENQW FEPMH AOVZK UAKKU CZTJD
YFOPF FLVIB QQQRC PATBG FCKOA PMAYE BZWKY YGECT SLDVC
YFNSL ZYZIL NGUUE UIYNY PTOBG VLDVU ZRZRH AKTRU LKFPF ZNYJZ
ACKBF UBBER UFFIQ LPUVZ CNOJD FNLTH CYXKD QXVZT JEVXC BZBGW
CHRAF ZIRBE CGGQL LFKTZ TAULI VCDLJ AGZPD DSINB BYAJD DANUM
VTAJL DHBDH LONGH

MRS DE MXU 6380KCS 231257T USM-99/00207

1516 3923 1210 2110 7263 6616 0091 2832

CCFII AAVLZ SWFKZ FQXVE SLOZS EYHJL PTULZ IPTUB NRYOS CMERK
IARUK BYZAD OYBAN SKAZT LJVVN YCQXV OHLES IHGJN AMKJG QNXSO
NKHKC TUFYO LGCMX ZFBYS FMRPQ HXCKK CCFII AAVLZ

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ZIC DE EDH 6170KCS 231323T USM-99/00208

1594 9223 1145 6530 1476 6977 5726 7935

DABAD HYQNM UAMKI OZMUA MJYYP FUMRB YSTZO KGBAD PPUW PWCZ
OPCSO NBSQIA RDOEK VETED YADCA FWBET YKOZK CYTVX UZUBI UYKAC
BVUSL JLIIR YPWFH AIVYE WJYYP HYQNH YQMDI MSKOZ KOUZU TYWNW
ULKNU UNPAL UGUPV BAZFD DMSJY YFQOM EMULE DIMSL AUIINU BONOL
YGANW KANMZ YGBJY HPPAO PFFME RMDRH YQWKO CYBET YDIMS HYQWQ
OMENU LEDIM BLAUI NUBON OLYGA MTKAN MZYGB JTHPP ANOFFE WERIM
DKYQK DMSJY YYPGO MBWUL ELAUI NUBON OLYQD OCKON INOLY XICZW
UICPA OFZUG GNOLY KOKZJ YYPQI NDDIM SXKKX DABAD RYQNM

ZIC DE EDH 6170KCS 231348T USM-99/00209

1604 9223 1145 6530 1476 6977 5726 7435

DABAD HYQNM UAMKI OZMUA MEYQW FUMRB YQWU ZUFUU HKBOA DIMSG
AMWKA NMEYG BJYEP GYBGN IZOSI UNJYY FYYPF DMSJY YYPRI MEZYP
KZBSN RMDK IMBFE WEFAP PJYYP DIMSJ YPRI MEZYP KHANF HOLYC
IMBFE WEFAP PBYQW DIMSC YTVDE DLGYB GNIZO SIUNG YBOWI ZOSIU
KXOCY DMSH YQMLA RPTEA VCBSY FLSZN IZOVY ASJYE PFANW WAHFJ
YYPFO CYBET YDIMS JYYFQ IINDU ZUMIM ZKBOA VUSLJ IITGY BBNIZ
OSIUM GKXFD IMESI QOKOZ KBOVD MCDQP AUDBI YCREI BVBRK JYYFJ
YYPQI NKXXX DABAD HYQNM

NVT DE OAL 7830KCS 231353T USM-99/00210

0564 1823 1230 9969 5218 5086 4259 6529

CJCCJ CZZID APKPJ QANBV IKNLW YCVTH BQAGT ORWLE YZXUY HKPFSH
ELXIK NRQXK FKKPT OBRYA FFATC MKLKY XEBTN DLRAR RDRQS FG9QV
VMBCR UCLDD ZIBZI KCRMU EETSG QZTJA UYXGN TZDUM RWQAO SBGRN
YNIK NIKJP RLWVC YKPEL KDUKB RZQTB XEBOG HPAEV PBPOM HYJOP
TKOQY YOUNC BBFBK KKNWY BEZIM FFOJU QUBO JCCYG JCTMC SJQOZ
DKBRR NIGLI XMWBO GCPYI FVEXM UTYCZ KQQR XKXV VZMUP BGGYF
ZTSPK UZVPS FVVCJ CJCCJ CZZID

NVT DE OAL 7830KCS 231318T USM-99/00211

0554 1823 1230 9969 5218 5086 4259 8023

CJCCJ CZZAH RFWBU BLRUZ OHUEM DVIYK HSOBS VDCCG WYBSC MRQLY
GJJTF TKQCQ UQJQX EHLRA DPNIF ZURFO ARSJA ONJTB LLDXK QVFBA
FLTQ LLLRR LUKBH CQWGP KOSGQ UNDBE HTHAM BQMGQ KMMAR MVBBA
LGRBU OMVBY CZMCG LGXPT NSLID ONKAD ALFZC YRFUC PATRW AZVKN
XZIRQ LQAFH VZINH PARHY BUXRW KPSOO CJKEM XDFBP LEVY OIFBU
YMLRS OULKN SMRVC RYRIV ANPGD XZLPE TEGDC FGLRI NVRKV BMOVV
AQYCR BDCGR EFCZB ZSGLT SSSZQ CAVNE LUDHD NAQHV SELKJ SMQOE
QICZD PAXDC NIKFI EPTMK RPITH GKDCZ MAZCX AXZEB CJCCJ CZZAH

SFV DE FHI 7510KCS 231332T USM-99/00212

7546 1523 1220 2750 1476 7642 6536 6022

DGCGD JJCCH EDYOW QIBAW YINZQ SCNRF UYKLP QLCTG GAXMZ SOIKS
VOITYW TELNF YBMTQ UDAQF EJPPV JEDBM MCKTW OARMA DKCKE ZETCL
SUMHR IGMDT YEZYR MYQLA DLFCD AIKGF GGBUM EMBEC KNFTO PPTFS
YLSZ AGCCT VDQOI STBCA CWNVY KXZSV FOIUL XQBTZ DOZFW WAKRZ
QFNIE EDHYV ODMVJ QYVLM CZERN JEMOT UJUYU XIKRT MGTUV BPIPR
MZAUN RUMJC YIQNF YINST TATTV QNVIP UELWZ BPKKX DCGCD JJCCH

FZX DE FMT 7340KCS 231208T USM-99/00213

7553 9923 1130 3731 9054 6850 0172 3917

BOBGE SYDTV UHAJU QYTIY SDIBH WIGCW ICYTO YRWIG CCAZG QIQK
OZKCY TRRAW QSUUL MOQCN IYDII FMCAZ GQIQG CYRQX YINRA WQBET
YWETQ MOQCB ETYRE AFDLF MCAZG QIQGV BQKCY XIRAW QWOBW MOQCN
OGUMU IUFOW CSANE CSTZB LEIPA ANOUU UXKCK BSBGE SYDTV

XTG DE OAL 7830KCS 231309T USM-99/00214

6034 1623 1200 0121 7263 5086 6156 5510

FFBGG CNEKH YUDND HEKGL HBVAO FEKYS VCINW IVVVY ZEAFL ZOSZT
KCFPX HPGUT BULWD RSNKC QGLAK ZOKCR EYKAL MNEBU BQBSJ BIRPU
DNYKX VRHLO WZRER YRSKG LZMKA DRWTS ETLRP CUTESL RSBYI JBDCG
NVZXR OMQUU NOCAI UYEOZ DLKBA ODBBK JPCJH YFVRD EKRBW KMWVW
VPSJL WRVPH UHQCY SOMLL AJGFB ZELAJ FQYVN KOADJ YDBCK OKKXK
JVSXO TCINW BRIZX FFBGG CNEKH

MKP DE SFV 4795KCS 231207T USM-99/00215

4104 0123 0730 8943 3456 5086 5762 9233

DJDJD BETTV OBVZY LFMOB VEETY JISQJ IKDJI ONWOW RFPYPT GONUJ
ONWTI GADAR ZPUPC JIITV EBKHA MKRYW LTBGB MIAOS IQINO AOLJC
NKOBK KIOZJ IBMDY IWZUB ZPDSU LUCNL OVGPI CSQAN PSODV QJUVJ
IBMGA LWYID WWLFB WAOMS EDIWO YTLUC NVAUR SAVQN ONAGY BQJIS
CQITK JYKRF OZPVU ZSRIM DGALV YUZSZ AESTA CYPUE KGILT MEIQM
UBNDU MQPCZ FRYKY QRYQS ILTJI BMGAL VREIB SORIR YNLQI TKVED
ZPAEW QJEWZ OLEZU BXWBA XHYPV SEICD IDKJI SCYOD ZQEBT QAKCG
ALVQE WOTJO WQUBW JOMVK IVGQI TKJIS CMUTE DAOMB ONQSA HCKEK
HRLLC ZUBXS AVQCE XREIH RMYTE SAVQN OQLMI OKTEG BLARF CBMEX
DJDJD BETTV

HCO DE ZIC 6620KCS 231438T UEM-99/00225

8067 9423 1350 1101 3698 1963 3791 3927

FHFB GMYEH AQRER UGLHH JHEPL UDPIA DZIDS YWTA QITRF STABP
BKDSM AVQSV TDEVL MFFSU HDAPR LEITP FIDBU PVFGJ JWINV ILLBC
VBSGT BVMKW KYLET VFEFB UVQIX KKPZJ LMDHW EKRDW TQJTD BABSJ
QTOHY AKBER TKUVH BPTZC IREBE PZXPX LUXWJ FHFBS GMYEH

IZM DE CUN 7720KCS 231449T UEM-99/00226

9562 2523 1415 1561 3698 7741 3917 3523

AGHAG STBFG OCBRT KRHEM WPAPD BAZEB PLPCM MFDLJ ORPMU DCOFD
WLPFG TEKAX ILADQ ACTYW JGDYM BQBEK BOOLA XBRQ UNBTJ VRFDS
XPICB ONQWV RQYXP URNWO FEBZB YKMS OQZYN CJUCS OXPKZ JSTIV
BUOTY VRZUZ AALKY AGHAG STBFG

ILL DE ZZZ 6350KCS 231451T UEM-99/00227

1082 0823 1415 0732 3644 4258 5942 6717

IIRFF BINBC HDEJI BDCJ KVEML XKRPO YTGLE QVBEQ HVPET LFRNE
YCFDC YELTC BTQFK VOUTL FJOIE YSQW UQQAQ COMQ NFFMU FICCA
XUCUF BKKTN STELE NLEKY UFEEX HWGFE ODEED UXQDY LVIPD QTRJD
JJPWR IREBJ CWJZY OCIOF NDCZE FMKQI ELFKT KEVBO JPUVL GKLOB
WMPMS ZQJOE RGEDE FJEWI VICDK ZFHBQ NULEN WUZKQ VJQMQ QKCAW
SLZLU PMWYR FPFBR UASMP ONKLP JMWVF QCIZI QMSFJ MBSAJ BATTI
SJHTQ EGGSV FWMKY MPLIM GLZRO IIRFF BINBC

DYO DE ZZZ 6350KCS 231412T UEM-99/00228

4092 0223 1320 5161 9054 6445 7300 9029

IIRFF BGLBC FBSYT QUQZD FFEBG ZKYQO CWDSD TCFVB XINGP GRNBE
CVZER SQMBN YCMMY ISAWK ROMFZ REVGR DCCCY TUDVK YVMSE WJERN
YNDTA SBYII GUQJD ZMVUL XTRMU ZMGLD YERJT GYZMK WMLZW DMQKQ
YCFCS MBUDQ MNYTU KGLAF SLAUD ZQBYO YROZI QPESQ NEEJP KJUVP
GQGBB YNQIZ VFBFV BRFEK NYOJQ QUQZD FFEBG ZKYQO CWDSD TCFVB
XLDND FUMJV XWCVP FLROU UEMIP BECEK BGRUW DUVB8 HPADE HICLJ
YKBJT VIRUP RBTUH TDAQT ZXUFI BQIFA QRADM XLEPS YDDTT GFZFK
HAYDV BSKAB IZXOP LEKLS KYJBE BOVKP NEFBE CKYHF KYTEJ UQB8B
AITPK KNSCR TURRY YKBLM SVNTE MBDHW ROWUV KGFKE IIRFF BGLBC

ZBK DE FOH 7640KCS 231528T UEM-99/00229

9546 5023 1430 3749 6010 2197 8435 8101

DDHAA JQYFL BSJOO QUJCT JEKUO PVCKI HUZSM TPRFK QFITO DGFIO
BKGMZ QBVQS CLXRP FDCXQ XLMWR TIUYZ ONNSO UVGPK OUYWV IZIKP
HACII MOKLF VVZMI CMLQL KRKFS BRQRS GKXGW MCBHE KSHIM ROKTP
LIMCV MBZEF CIUAX FELAK WZEKK VPTVB UFSBY GMERO QMVQJ SBUXC
ZKIFG IXPAH RMOKB MBFBL WDWUR ORLZN SCURJ BAWPY ESWQJ DDDPY
KTBMB KFLBO MSZLE AAJRI KDDFD FURVJ YVZCG ZARQZ TBPXL NPLAK
QZDZE UKFVP ERADM FMSK MCFWO SCZMV GMYRC UNOVR ILVBS ZQUSD
LLJVI KRKKM QJBAY WILVE EJJNE IVEGU PFABP CMWS YTFXX DDHAA
JQYFL

ZBK DE FOH 7640KCS 231556T UEM-99/00230

9556 5023 1430 3749 6010 2197 8435 6601

DDHAA JQYFL BSJOO QUJCT JEKUO PVCKI WRBKB AQMIE OLSZS UMLPN
WKGRZ XDXKO WLOQL CEMWZ UDGNQ JACBP BFZVJ WNVKX XEZVA SQGNW
YAFIN GQPMQ YFBNM NIBPT RNFQZ DRQZF HDKQC ANWZP HVQCZ IAKRO
XLSQJ UNBLK QPKC MVVVP FEPBK ZKCFE RMUVJ PFIWV JENET BVYAJ
IUUCY RMPFI PGBTB AMZJK ZEMRM WLYWV OCBRT BEKQT RLJNR ZBTIJ
BSXSY FVVRT BKBKX NBUCR MUDUK JIGBT QFIWV GSPBK ACKKY ZFZMB
ZKDEZ XUDVL LQMOO XELXX DDHAA JQYFL

FBO DE FOH 7640KCS 231522T UEM-99/00231

8546 4323 1315 3731 5445 8146 3313 9301

DDHAA DFBOX VPKVP QLJEM FVEHY BZSOF MVDZY IIGZX FXCOJ FZRMV
YBOVV CUMER PVCIK NJGHQ MAKWZ LGMCC HPMLL BGFCA YMBGK XVMFB
DJSBY ILAFR RTURQ KQWML EHLIC WFIQP VIBGF QSQLI QLDYF JYKEV
WPKUE DRVJP RPNQY UPPJT NLEFH MGCIB HBSGF JKHGC GSKYV ZOFTV
KICFI DOWKP FZMGG BGIZL BCZDR GAIVC YNLXV VLITK QPOCR XYMOZ
TBEK VEDK IIQDO MGRDP YIDVB PFBBQ ZOUTV SOXDA AKINP NMIRE
ACJRB YWGW LIKEM WEGER BABOK AOSJY NJCVX QCUTE CBLQJ JNLOJ
IETNM KALJW ZKIPR HDGFA FRYZR QHJCV YDINP CCLAY XKVMW EPTVQ
UMKZ OQJUI EPQWZ IXAQO YOMUJ ZBTCP RBEAR TCQKL YLQYW TMBR8
YBWI DDHAA DFBOX

FBO DE FOH 7640KCS 231738T UEM-99/00232

8586 5723 1620 6350 1476 8146 3313 7201

FFBGG MLEDC RBNKD TYBGV KRLFI NIDIW XKSLI BGFYL VIZCE VYXU
WEDGS OGBER BLZMV FEKCD FGLSB ZUYLR BOSOR QMBWZ QLEHA IHWXK
BXTIV CPTEJ VBOGX AQMMZ AYRUO ZUUUJ HRIHP CNCKH LDOZY GOIVJ
DFELU TGLTG ZABQZ JOONO JTYFD OQNMJ RENQR ZNEKH FMQZZ MXFOC
MUSBN BKRUJ DQYEO SKYTH OBEQA WTNLX BQERY BAWTO MIYAK TQJQJ
WJZBQ BBSOR KKUNO EFAVI CCTQJ NGNOF ETWWD IAZEM AASFL ETWWD
JLSFV FKCXY LNZLF XGNAK WSQTY GDUXU EIPAK FATDJ XAWDL STFKX
FFBGG MLEDC

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ZBK DE NIO 6130KCS 231704T USM-99/00233

2561 9623 1625 0121 2664 2124 3151 7401

IDHAA LYPPF DJTNR JJQJD FUVEN CFZUQ HFZSQ AQPPI NZEVI LIIOK
BODMZ WNPVQ AAQBS LPBWT KBBZH UPKLR JGMBB XGNFR KUDPV BKVVQ
KMLGU UTOBL KUQBE JQJZD DCFJT BQXVE VETET EBCMB FMJJI IYJCB
YZASN YWBSB LZWQT FWEVI BMRUM ZAQZQ AKFJY ASBLI XDPWS MOKST
FAMKH EKLBN KZIEB PKVVK CYVDF NDNFZ CABJG DVEAG ZEPGJ RIBWF
TVYVQ EBSOC BOKKC ORYIU RRVER FFKLL FUBIK YUIFT VKBLJ GOAZU
NIREB MEDLP FRUSM ECMQJ MCPNG AETJA VXLEX FBJWM BQJBC CXBKO
FRDMK AXKKK DDEAA LYPPF

POH DE ZBK 6660KCS 231519T USM-99/00234

3070 2323 1430 8943 7803 4212 5942 5937

YFBGG JFOBO YOMCV BKKQU NACHU BZIMH MRJZL UOQMR YBKQI VBATZ
GABTT QISEV HQMDQ OQGEV KMDVO ARYKH CMGKM CPQSY DEJQZ UKCKE
SBICY MCFRD VCNQJ TQNYF QKQBA FDTWQ ALFFI TQCJN KXQZC ZODNM
JWZEA JFRKL YBISL ACPAV WKULD BDEDD BEFSU IADGS EBGJW KZBYI
MCCFW EARRR OIPYH GICXO FBDJY COYRM BTUEN OJXYF FSNFX AWOCG
JBSYA KRDTX RPNZA GIBTO YMBFK MREZD LCXXX YFBGG JFOBO

POH DE ZBK 6660KCS 231536T USM-99/00235

3080 2323 1430 8943 7803 4212 5942 5326

YFBGG GAFLE BYEYR BIRXC BYJVP FFKGB UZEBO KYSGQ BGLVL HRPUG
OKGHL JWURH VTBSL ZGKBO NJZRA EZQEK AWRBD ZSZZK ZEEFZ MXPYU
LYRBE JBRDW NYAKK KFMBS DYRBN KCMOF TUBET EZEDH HPMFY AQEBS
OFCAP PQNTV AWAJR EMBST WZOES ZSCVJ HVPFE WRIBJ UYFYF IUBUZ
LVAIS FBABL ELBLE HLCVD ROVTE JVGUH QKSKC TDRJR VJLFX FYIRH
WXXXX YFBGG GAFLE

WHH DE ZCA 7120KCS 231448T USM-99/00236

2040 2923 1020 6350 2664 2610 8408 8725

HBJRH HYQVY OQKRY UFVOQ KQIND GUPFW EEBDU VZDUT XMLNY QUESW
BAKRE OGDUT XPFEB NYUFH BQASE WQNUW IZEAZ VYYQD BWDZU DZZYZ
UDIMS GUFMR OMCGU MBVUK CHYRK HURJK UMVDI UAGIB SXOPL LUCNK
UFOZA PFCXY EDURV BYEED ALRPU KKHUK EQMEL JYTAB UBOMU NYWEA
KROSI WAKHT UCULY ZISYT IFURK DUTELJ OOKRI YHROS IFADN TUEKR
ICUNY HEDUT XGITE FEMCK OGGGU FMCAN UWICY NYOZJ YIQFE POLIW
IXUCU BEPVM DNASE WQJYT ASYTI ZUDZX KPDPY KXTEL FSNFX KORKK
UMVYV YQWYH ZSYTI WAKES YOMMA BRFSU CHURY QETLJ YEAGY BQKUM
YBQFX KORBH YRBSY TIGUF MXXXX HBJRH HYQVY

HCO DE ZIC 6620KCS 231426T USM-99/00237

8037 7823 0940 9942 2664 1918 8219 9042

DABAD GYKFM UAMCI OZNUA NGYKP FUMRZ YZUSY GMZUB LJIYQ BUXZT
BQBSO NESDU SFIZG DRQKN ATKVI UPDUT XTIVP MIAOT OIBSU BSLOR
CVIQL NYUFD DMSQE YQZUB XZUGC LORCH AKLFE CTRIC UDIMS ZIQOP
IRGPA NBSYR GNUBO RUCSL ORCFA LUVYD VKITQ JYHFF UMRZY ZUDOE
KRYWL TLICT USEZI QOTLI CKUMR KAESN YGSEY HIMUI CFITA NOVIR
YMLDU YCNOL YBYHI DMSZ IQQXI DMNAB CDFYX ZCATF IBVLO FRRIM
DZUGC GUMBR ITLRY LZXID AMUKY FUMRD IGHRY FOWUO EZIQO OIPOZ
UIERI MONIZ OQYES NADUZ YZUFU MHWIS OKABS GYBCK ICZGU MSYVD
VGYEK RILCR OPHYV DVTYF WTYTK BUXER DMDFI SHOCK DABAD GYKFM

FSD DE ZIC 6620KCS 231558T USM-99/00238

7067 9723 1510 4775 1871 1963 8741 3728

DABAD SYDTQ ITKMO TPHAD PFIBR KYBKF UMRGY KPNIN BMABR KYQWV
YZRTO IBQIT KQLAR FUMRJ YTFDI MSJYI FCTYV CYTVB IBFCA FWJYI
FDIMS JYTFQ INDCY TVBIB FCAFW ZIQOJ YTFDI MSFYU YBIBF BOXFF
UMHWI SOKAE SBYCD READM UMWXX DABAD SYDTQ

AAA DE CUO 7735KCS 231521T USM-99/00239

2554 5223 1445 8140 5237 4618 7319 6124

IIEFF BKQBC XGYMM UKAZZ URDVM IBMGV MJPWI SCAXE MUVNF CHBDQ
ADLLD UYDUO TQVQN NCKEK LMAFU RIBTR MOKMS VCQPG LOZED TUUPU
ARWVF UDLAR ACFAE FLJHO XLRLQ ZBAKD EPNKW UNRSL LDJBP HIQLL
CPOKD QMKXI WQANT KHFWO OMRND HCKTT JYVGR DVZKB DRQMY PAKUL
ULKOB VLQCP FPLJG GMCHR ABASH IGJGJ IOPVC TDDOR BOMEB TUTKE
TAMTU ICKPL AMJFK ZZQJZ CTORH KVDMB TYNFK KYMLR ZQCSF IIEFF
BKQBC

FZX DE GFH 6460KCS 231552T USM-99/00240

5571 8823 1520 6350 3456 4997 0172 7015

CCFII CCUKL QFRGE CGZKT BORJD QTOQA IXJYC ZEDMI WUDJL TBKPY
ZKYPD BFKLZ QSVKT OHzMP XABPG FKLHL PADGI AZCLZ FCJUQ DHIJM
JYTSL KCBDJ RHJBN DQZXP TRDBH RCNOU PDKVB IGORO ABKRN LKLEJ
MFKJG DJLBS NKODR FJRGT XAUMB OKRLC FNGGJ ZKVTE EDEZN GIARB
NKQEU CBWDE QIKUF EMQKR GJLQV JFMRT DJSMN JUDPE QBRLL TQZAM
OBTJA WKLJO MBOND RBMUQ DEKQO PDUBH TVTBI YWOZC GIWFS ILTKZ
TYKAY UFBYG ARMPQ HILJS CNKLY FYWVW CVFIA TMWMC CCFII CCUKL

YWF DE BOU 6140KCS 231437T USM-99/00241

5562 3923 1350 3731 5445 7101 4718 3226

DCOCD IIMBK FJBGU PBICD WASSH WQSDG FVVEK YBTFC ZGCBP FFWKJ
EAMIV MVEHA RSDWE UUZFU IPADQ DMFZQ MALXY PUQAP UWAUC CQWVA
KABBE KKKBJ QJAMA CLDCR WGAQC RJFFY RBMCQ CPMFG QZFKT TWBVS
DCOCD IIMBK

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MKR DE CUO 7735KCS 231546T USM-99/00242

4534 4523 1505 3749 0665 1549 3278 5326

IIHFF AFMBC ROBOO AYJKP EBBJA MDN06 FBFCZ ACQUE EAVKR YOTKH
JMFBR FJQFG PGGAA BTVPK HBGTO AKLHZ KKIOT VRYJB MKCRC HMDJJ
XEFAG AARGD ENHOK DZPYT URHKO KVMBH EKYNZ QFCUG PIESB NPZEK
CYCSX BCADJ IVNPI BNKTR MKXPN RQZOG JINTI XRRRW PEPIA USBJH
FOAER OIZIQ OKIRA CBMUN HJBTY BEPYM OQFSM LDTVK JQASN FYBYI
OZMML IIHFF AFMBC

MKP DE GWK 6100KCS 231420T USM-99/00243

3538 2623 1245 3731 2664 9893 5762 7624

50505 97483 76807 37527 05989 69668 97549 35857 97490 59691
95247 58919 19825 97096 74697 24737 32987 05293 24799 79062
46985 97479 77687 49067 39369 89659 10473 75777 74209 88934
27960 33974 80698 85919 88744 75279 57373 69558 75799 95210
10129 16059 11111 91597 57999 52389 19873 77604 79098 89577
60249 63198 73570 58988 95047 96945 97964 73539 97488 69873
73689 75387 89896 96397 74206 87491 57059 64777 95807 39879
77591 98605 96743 80000 50505 97483

XJR DE OWN 6850KCS 231418T USM-99/00244

9536 8423 1345 8140 1871 5095 8444 4224

JAAAJ CTFIE NOEFR ERRDO AIVIO NBORS ENPIE OYCTD CAROD EPRIV
ENOEI ODREI VIZZO VEROR GNTII NSONN SZFTI DOTCE VRENP ERDOO
AFAOE OMFPU EHROL TMOED MRSFO SWILF XEONP RMYLD EADNE TWRPA
AOOTE OHACQ CMCTI MRKSI MYNTN LEABA ANUNY FTTWE ENLRC RDLEE
JAAAJ CTFIE

MRS DE MKP 7320KCS 231509T USM-99/00245

6526 1523 1435 8943 5445 6625 0091 5128

CCFII MKXAR KQVHM ZEMDE WILJA Q8LHX BDJRH JBNDQ VJAGO BRYEE
GKFTW BMRWY CUEGA XRNTO VEISA L0YHE GRLJT XASVN DQ8VX TOKHF
YZGCA ZGEPV BKIME XNZBO QUDPE NQ8NE DPHIL PJAMB MGQIJ KBPFB
REORL FIGHO CZKGE PKIHL Q8ZMO UBFSK POGQP LDWEQ IKUSJ FKZBD
XTDMO FNKHS CUZCZ VYJLT QZAMJ NANPG CFFIF JDGPA Q000X CCFII
MKXAR

XJR DE MKP 7320KCS 231553T USM-99/00246

9026 2023 1500 2110 4257 6625 8444 2924

CCFII OOLFPC XWRUZ YTWEP MQDEA LMURD UQNBV JCLTQ ELSRV WOUQD
BLTFR XOVKH GWRDH PGLZA MPKUD WGLPA CBMMK LIWTV LEWCV FIDHF
UOVCV LMLXG OKMCP MSAXY OVANE CKPAX EFCRX CCFII OOLFPC

XTG DE IZW 6260KCS 231433T USM-99/00247

1018 5223 1400 3749 3698 5815 8156 2729

GBIGB WSDAI WZBJZ PLDEY XDKXQ GPMAD VYRZY PLFNF PAFKT SXZOH
QHHDZ OXKLE LLFES FRGAR FAPMW IPGYJ ZRCUN IPCUB XTREY YJMF
ANWAP JUDCI AQJDB UBUQH WHNER GBIGB WSDAI

MLH DE ZZZ 6350KCS 231528T USM-99/00248

3132 1123 1450 3973 1871 8236 4033 8032

FEAFE LLLRI FODZH OWYOY WLYXD XEFSR QMYXT DFMGK ZPTVI EDBAK
ZPJKK FLHAL FHFPE UASGT OSDAI DRVQQ NEXEZ OBNZS KZZWL ATAKF
NPUKA FKDLM SQAFW FSEUK UWKQO NRRBB FTHRG UANVY SSKPO LKDET
PPFGN FYSOB RCHCA QOTNE OTLNS FJWUX EKZQU STYJK NDLJZ OAWCC
XKQHV WATQS XPKLJ IKXBI WZYBQ MMEPI QVQBG TAYBQ DVELK SCJVK
JSJUE ZKMPA MFLXZ FLCMZ KVBGC XSZOG RWZCN KKAZR UYILP ZEBCS
LKQVS LWRKZ HJITO LVNLQ LVVKR FUBOE FTWGT YTFBG OQHFO MWLYB
WIDTB KKBEO GGGUM HAOCZ ZSSWA KHFPM IBONG TIEBV FEAFE LLLRI

MLH DE ZZZ 6350KCS 231541T USM-99/00249

3142 1123 1450 3973 1871 8236 4033 5211

FEAFE PTDPE DSHHT MKKXK GTSJH TSQKM CKPAL FUMEX TAROF IXCYB
LIIKX AQVLP ZLSSM ADTIA HVKUC XVZKM RBJYP TQBRX SCKXL MWKJ
FEMRG DVFVU OXKTN XNGBZ YKZCX CKTMU LQOKQ TRLRH WBLAZ MMACB
RJPJP GCZSJ VIZVE AGBOR GBMNT WDFGO FFWTX FQHPQ DMWFP URDMH
YTOCK ZEKFP NQ8BU U8BOB CVFFP RSEBR DRRKI OURRT ELFGV HMBBP
FEAFE PTDPE

GMW DE MKP 7320KCS 230925T USM-99/00250

2035 9123 0620 5504 3456 6625 9399 4811

ECHCE OIQHR LUATR RHARM EPPDV GSCHT HNCER ETDOL SEHDT ILCMF
SFRPT TLEFR DERDE NRRTE EHATE EYMA SDAOR OARIU IEMMA AROBT
AYSEE EUBER EL8IB OMQOI PROUB RTESP DLMAA GAHBE XEODD ETLEI
DSMRD SDENE ROOOV SEHER ECFAO ETEYN RHRAL RWCME DHRPO LXFVI
UTIEE CRNOT PHDYO OOBXI ARTEE ESTBV ECHCE OIQHR

EOU DE NIO 6120KCS 231585T USM-99/00251

8524 7423 1410 6350 7263 4140 1793 7246

DGCGD KVENR ELDCW NUUVS TGRJH XMPW JLEOM BVBGW XMKPZ WAGLP
CSSUI ZTDIN QHEYX FLNEM MLPKY PLEYF GCURC HDGKT FZPJD TYHLN
FVXSE ENRMS GYQAG OGEXW BGTUB EFEXQ JJLBB OKYFJ PUFWF RDTVQ
UKKJX OEXZA ZOXYV ALKQW VOMLF WUBBT GCQYQ VOGND CSXGA PHQAZ
VYDHT QLJEM VFNPK KDBON FYKZX FMAKR RWGXH STQIO FVNSK YIBWJ
AQSNF TELSX TZZAU PIZYM YTSLY JFUXS LKCFK CQXRM MJSBK KRYJV
VIZSU Q8XMC AKMPQ P88SY BGNRW HSNOF EIID OMFV ZTSWY XJSBJ
DCCGD KVENR

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XYR DE SFV 7830KCS 231611T USM-99/00278

8084 3223 1520 1101 1663 5086 8444 5120

EGBEG JMBDE ALJAB QTSRV VKGYM XOPXY CYOWP XCYLI NOWHI SCFKZ
GQGRB NYRAG HSPVK WKYFP VSSYN PGPSQ TEDMU QSRKG SODZY LKGRP
DVZUO SNKDE GVVXY ILLDU ZCLZP BUCTC ODMWI CKVIS GSYCN YMQCF
JEREN PBIAS MJTYA IVHWG JDENF RUOMP TRDMN CHAQI LGXZC QZYDQ
MQIBV OZPHA XDENY KSKAP LZVFE SPASK GTYZD SDTRN LGYIU EGBEG
JMBDE

NIO DE FBG 6830KCS 231618T USM-99/00279

0544 9423 1505 2110 1476 7435 8912 4301

FFBGG UDKRQ BHTSV INNEE HBVER ORHDI EKZKL JSBPM REVOV VRKMQ
JESTV TQOGE JEDDM DSVAF FUBUY KUOVA DJURB UYABR JSPEB EKPQJ
FSNDN MQJXA EUNFJ YHDYI KONUE QLWBO DPCNS NYCXI WSAQV FUNDL
XVMYH AUNAT SDGJZ HVRUK SPTOO HBTDE QUFBS PJTYA FWTEX VLDXA
ANQNH FFBGG UDKRQ

ZBK DE FBG 6830KCS 231702T USM-99/00280

9034 9523 1610 8943 8820 7435 3151 4835

FFBGG HMTBB QCHND PBFKR JKSBC POGDN EYLMO FRMDS PCNLJ FWMWT
DGBOV KSGND VVKBK KGTZR IDQLD WIKCY YNEZY YTQGE TALJC AOLSO
XPRIL OQDOU EYEVY VNIOD QNLBZ CPAAZ KINTQ EYVDL IGFQS MZTNO
VMEBT LDRWA TICBN BSUVK CQOMA GMBZF MEKBS JPMFF DAYID UFGCN
OZBHU TFZLU VIZXH QLYVM AMVVF NQXXX FFBGG HMTBB

WNN DE ZCA 7120KCS 231622T USM-99/00281

2050 5523 1540 9518 1871 2610 8408 6303

HBJBH HUXEQ ETLQA QZWAH HDIIF DOVLS BWQMY GRQED VTUCU FUENZ
EAZVY YOCLE KFAKT KICOZ UDZDO BGFPG UFRHQ SBQKD YLONY HTEBK
ZKUQZ DBQXM IXLLA QERIC UQEDV NAKAX UNHFO TZZUD ZDUTX GOOVB
AGSNY HMYVY GCLEK BEYDX YXRBA VGGUP MVTYQ FYGLN ECRZE AZSEM
QKQFB KECPT URMIL KWKUM VDEGX LKGMV YQONY VQXJC WJUXF GUPMG
IRZHA GSHEQ ASHWQ RICUZ YLDWY LDMLB FWUZT FUZNJ YHPRU LAHUR
YJTYA HBJBH HUXEQ

FHI DE FBP 7940KCS 231745T USM-99/00282

5048 3823 1650 8943 3456 4122 8327 5434

80808 42831 76992 07747 90885 29674 31134 19556 95070 00562
89310 30525 71955 69444 23393 74078 96157 15142 32219 79065
22913 65559 39674 79088 52967 43177 38117 42930 73353 79064
41979 06519 95533 13581 98976 66151 42322 96502 06379 08671
35869 93920 72913 98933 47884 73534 67953 79738 91217 44338
35475 73000 80808 42831

XYR DE OWH 6850KCS 231613T USM-99/00283

9566 8723 1540 3749 6010 5095 8444 3915

JAAAJ ESTLG BBEKI OALCP SNTST IEDNA FPEST VRTTI ODOFA BDNFB
ESBHN CORRA ISNET EUBNI ONAGK QLPOT BRAOU NNF1H KEIHO RVHAA
OLSGO IMQOA NUABO OCOOB RISDM TYONV UNTWO ETPME OMBRI LALOE
PPTLA REIMI DFBFC RTESM GTFUO NERVB ENGEN JAAAJ ESTLG

XYR DE VLE 6750KCS 231705T USM-99/00284

2067 2823 1550 6350 3456 1260 8444 5137

68486 47525 52198 56057 58212 31265 20240 12069 28484 85375
72252 45242 80765 09403 62905 29953 02275 48607 75498 95874
99778 02314 47518 98492 24282 41366 20212 87059 02252 86775
29383 75189 84944 82549 80505 01851 22541 15470 84615 15247
63199 50579 55275 11525 07237 00185 60165 24123 10544 68486
47525

IXI DE XYR 6070KCS 231612T USM-99/00285

2536 5623 1535 0120 1871 8641 2611 5523

28082 43730 82251 14513 59827 04042 55218 25904 62795 59121
41347 63382 08214 11423 36094 21223 34903 34092 14112 34856
71460 38225 11957 92652 18541 41348 75414 87360 52637 35262
22421 32329 15870 79270 32956 02161 19112 26521 85445 37210
57325 94375 50046 34421 95795 67423 32862 35444 21575 11958
76193 26323 28200 28082 43730

XTG DE CUN 4265KCS 231754T USM-99/00286

4522 2823 1650 8140 2664 7741 8156 7141

FFBGG JIQHL QWPU UOUKC HIMIR IZTYA QKCFY JORFB YWKEM YTOFC
WYGNQ IDZRE LONGN LFRWZ OSVOH TZSMY DQPMI NBRGZ HKOKQ AMBRK
MEXKB UNTRM OVLZU NUCIV MQRAZ FRQZQ COPEI WLRGX YKSUR BQIUJ
TZZCQ OTYRF DBQFO HTRGX FTTBC EBYDL HBNFB ZOONR BWNBC TTBSI
OUXXL OJTYR SCBRN MTTIM QMCIV XLSSS QJESZ SQKDR AHGVD WIBJV
MZEIV VMMWF WDKBI UQILQ VDSDE GLDCO ROHRS MPTLE MEKSR RIKYO
RGRKX QXQPQ WVPFE OIGUH RASIV FUUTN HEDGB LBURP AMKXK FFBGG
JIQHL

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VXI DE FAX 7720KCS 231658T USM-99/00287

6062 2123 1115 9942 3456 7741 3070 9124

EGGGE KOZGW UKYRY IUMUE YKQZK MUIUS ANEJY IQZQO NZARE KQEPH
UXEMU OHKOO KRIRI ZISQP IZPPE HCKUE QHISG HAMCK YTBJI WGRKF
SLYER QUCRR WANDI FAFON TBUIV LYQZK EFSKE WITIN QWUDK DIFMM
YYTBO GCPUI WCANU JAHUL YBLAE FSVAI FDYBE WANLY EAMMU IUSAN
EMOCP VIITYF IXMBU COMXY IPIXE JUKFD OBGKA NAZAY YJITD WIAMK
UWFJI YTOQO PNEBQ ZAYTD IPMAY YDMEG VTESE KUBOS ANEMO DQVBA
WQUCR QOMBN EMBEU TVTYB SIXYB QAMT QKQMU IUFPY TRIFX ZYWRM
YYTPE ULBUP RGEJU ROWNQ IYFPO TBSAN HMIU FICKD OBGRO WMLAB
QBUTV DYMER OWNLA BQTOQ IQQSE PIQFR IKTNI SGZOA XTOSL EGGGE
KOZKW

GPH DE FAX 7720KCS 231723T USM-99/00288

3062 2723 1610 6350 3456 7741 6743 5628

DCGCD AVGLE JOFRY ZKZVR YMWGR LFGIK JLPFK IZPOT QAAKJ IMPIN
BAYXC IDXUN FCHRO HBOOK XAJQA CIZJU EREVO KDUYU MMYJM TOPYG
BLLPQ ILZKE CPAJO DRUTU OQJUV TPTYA QEBIM VQCVJ TOMIN UGQAZ
RQFLD OVEEJ XLMJL YETIS YECZS LKOPK HKSUB FNGLV WMACT TDEKX
UPQIB FTQGR QFADF DQGBT GSJXY VNKYF WCHWA ELBYV NUBZA ACHAV
MGCD CPERO KBADO RCXXX DCGCD AVGLE

XTG DE WNN 5455KCS 231742T USM-99/00289

5545 5323 1630 2110 3456 5833 8156 8018

FFBGG BJKDJ M/FKX CNKUK JHYXJ VKJVI TYLQB XYLJT MOPTH MCTNG
JCKNE IJIOA QGEAV QFTUE JURNL XIYLS KKIUM IIMVK QZERC BJNMA
ABUJO YFIRP JFKIT YOUPF DVINT DJLVI HVAJH NEZRF WMDIU TSYTC
EJFUP XIRBG ZOGDD ROKXK UYFED GLBVP NEMNY SZOVP JIRCF SOYXZ
GHPUZ TKYIU YLNEB CKNL VIKMY GLJHY UABOA ZQFLM KRYKK XAOCU
KIARA GEZUI AKUAB VMNSB KNEBB YFGVP RZELP ULVCO QKQYR BIZYZ
QFFZP SMYEB YLPHK KLDZE XVELU EPVCA SYSEK TMBBS SPGFX IGTOS
EGEJK HVEUI PJYEB SSRWF AZURY UGKIF CGNOG CEXX FFBGG BJKDK

RBV DE NVT 6340KCS 231602T USM-99/00290

5076 5023 1520 9329 4094 7525 5726 4329

DCGDC DEOFB LMAUN PRYRS JAMWZ JRZEM BADQE XABWQ EFLLY MIZIA
VRUPP FEYZE APBKL LESXV GLEHW JGEIX IKNL MCYCO KCHBU FKPSI
JYMFC JFYRY CKCEB IMUSE TBWIO JTYQS QJRES SQFFS RDKQR TIZEK
AUEKH HCVX IJGOF WINAB BVNDI ZAYFU ATQRZ YVMSD TPDCA OBTJF
RPHOR DCGDC DEOFB

CUN DE WNN 7290KCS 231704T USM-99/00291

3515 5123 1600 2750 5445 5680 2396 6410

FFBGG BECSF ZICVX EMLJF GLFMG FUMSQ TUAGJ XNTYU MUTNF XCRPE
YLKWB SYLGM DTEMT KYNZD KPSEK DROUJ TLAKU IMVCC XUTNH ABRPA
SIZPL SRZCP IWPVL QGXJI JCKEM JTAFR JFNGW NAKUG KKOVA LIGAD
WWBSG BUYKN EDQSU AMYZW ILLRF MLONS LPNHA OBUVU RRHPG RQMKZ
XMEGX CWOHX JRGGG QRVAF GOGSH IWQSB CMKDD FYSCQ KELOK KFBGG
AMFED TDECF HNOPE IETKZ ZDJKK ICJJW FRRUN NREOS XNFAG LXILJ
ZWIKR GADXX FFBGG BECSF

INJ DE YWP 5455KCS 231754T USM-99/00292

9075 3123 1145 5504 8820 5833 1397 9010

AEFEA FAFPL IFSWA RPLIF SFAPP KYLTP EBSFY PHLIF PKILE DEBIN
URMQA KCBAB LRZLU NUWIS AOIGO MVIYI TRUXE WUMFJ UIRKA YMLLE
RMEQN BAFNM OFBLU OYHIF PCUJA KAYMP YERFU LQRQW XMOFS DEGOQ
EZRPA TLGCK EHUPW MUZLK AYQMY UEBUA CBEFL CUYBK YLTFE BSHID
NDAGP HOSAG ELUDE GOROS APYFB RIASH OLFPE TDRAY EZURQ BAFMW
IRNDA GFSOQ HFOPT QSOFM OFPDE GORIT LRULA VITYP EBSCA MZYBN
OJUBQ CUXAZ QONLE GUXEZ XHAAM LILKK YLNEA TBSIW AMEGD DEGOC
UCFZY FKJUH QVANK WEURP EBSKY LQJYM ZRIAS NOIWE FIDZO QNBUA
CNOIW KOWGC YRTBU ACHYU AXIMI HUXEB OMPQI LBKXK AEFEA FAFPL

MRS DE ZCA 4405KCS 231744T USM-99/00293

1070 6423 1700 5161 4094 9523 2594 4421

EDIED JLPHE XKCBV DWAVD RZACE YSOEW EDNET OYBSI NMSZE NKAGT
NNUEI EDVVD QKASD ZVTOB CRMKC ZAVMR ENAMS LFYFX TCNFV KGNIC
TFMND BOMQG ZFDQV HDCKV JBBCB YKXKL XTYXQ VNFKB KFMNE CZZPM
QOZGG RYEBG VHSYG KJJMS SVORH NPQUZ KBOVK ZZPMP MFMNJ DJEOM
JZPJW YBFPV EDIED JLPHE

UBT DE YWP 7290KCS 231604T USM-99/00294

1035 4723 1520 0120 3698 5833 9803 4413

AEFEA GUVBS IPERE BUVYK BHIDN NUERP IDLVI GBPYA NTUUM BOIMK
YCLRU VLBOB QCUBB FYANM UBQLI CPBYB CVABY XYEYP YANPE ARTUC
UPOFU KYLZN ELACA MDMOT FBYBC DAGPV IGBLO IUSUL HXYDK TAZVD
EGOCU ORPBA CRUEU ZIFNF UCZEE TEFUC HBAFR MEZOK YOWCA ZOWIR
NBOPS HEKUX AEFEA GUVBS

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INJ DE YWP 7290KCS 231719T USM-99/00295

9035 5223 1610 0121 7263 5833 1397 7310

AEFEA KOZKL IFSWA RPLIF SCYTV KYLTH ADPEU XETJU MVLPK SULBK
AYMVI DVXOC YQEPG HIZIS ULBKY ORKYE YKAFE GEDMK OVFFA PFSOK
PMOFS MUEQH AVGDI TZCYT VMESG MOFSD BOKKO VFKOZ KDVMF MOPSM
UEQEA VGDIT ZKOZK KOZKX YLEJO CMKOV FROCY TUUMM OFSMU BQHAV
GDITZ CYTVQ EPQNO XLEBA FQOMB LIFSM EAXHE TDQID UVYBT VUYFC
AMCFI DLBUH QBYBC KMMKX YSYQJ LBKYL THADP QOMB B AYEBE FUMIQ
DHAVG VYDVC YTVFA PFFAF PRETY XAFEG UVBRE KUCAM TZALI WYKKS
IVOKX AEFEA KOZKL

BOU DE YWP 7290KCS 231516T USM-99/00296

8045 3123 1145 6350 9054 5833 1793 8510

AEFEA PAPPZ IFSWA RPLIF SKOZK KYLTH ITRLU LAVTY TPBES CAMTF
UIODA IRBUT VHOXL WIVRD AGPLI ERWEG NVUVO WIRRD AOPNY ZLZBK
WYKAU QABAJ AIVLY ZLPAN EDKXC RAFMS ULBZA RNBOP SNOXL ROWNM
OFBDE GORIT LMAQF CRTZV IYTWE URSOK BLUJOY ROBER OWNDE GOZIV
TLINZ SULBC ORIFE BSCAM TBYKL DAGPW IRNHI FPREU OFPNT ZEGFN
AQEDA QPBAF MBUMY KCLTD AIRZE XWROR EBAYE MLLYB AFMDE GOGUV
BSULB DAGFR OBYXA BAQOH FKOMG TOIBS ULBZA NNHID NMOUG PESSW
IRWKA YMRIR ITRICU NYZLN YZLNU ZFMOP SDEFH PEBBL UYIPE BSVAN
KNAQG CABZK YLTKX AEFEA PAPPZ

NVT DE RBU 6620KCS 231623T USM-99/00297

6598 0023 1550 1523 4606 1080 2198 5028

DCGDC ITEXG LZDSQ BDJTW USYLU ZHCZA JNQOV IZEDA GILLY LAREK
HYUZV OISIV GOONJ IRLME QNUEM ZWYKB SBELJ GDXFI HREBE KPOGP
ABENL BCKDG LCEHD XQTUX PKCZS VLHKK UQEVA HRMJS NWEUK FDEUR
ZMWYX CERGR RYLAN CJXAV VVACC MLCQV MGBKY ZKBSB DVVQJ ANQJR
IBAXK WYLCD SAHWY YDDZT YFJMV ZEMBG TEGVV QLVBA DCGDC ITEXG

ZCA DE WNN 7280KCS 231719T USM-99/00298

9592 9723 1605 9942 7263 4717 1081 7818

BBJBE TAYUQ YTGFE TSHUX EVACZ RICUN YTHWI SODEW DQAYR PUGUH
UXRVA CZQLN DPUCK GYKPM AAXBA VEBUP RKAQD LIHUK IQBBE TWAA
YPUCK HUXEV ACZJY YPFUK XJYYP RANGB AVEBU FRNRC PTUSK XUVQB
YHICY TWJYY FPUCK HUXEV ACZHY QWPUK XKOCY CYTVB AVBSI BUQBD
VNUCP TUSKK IQBJY YFHUX EVACZ GYKPP UKKCY TVGYB GZQFC CERFA
EHJLA QERIC UBUPR NUCPT USKGE MVFEU CVUKC ROBIC YTVJY YFKOZ
KZORE JYIYF AFPGU FMPOM CGOGO HUXEV ACZRI CUPUK XGOOV QINDE
YQHJY YFXKX PPUCK QOACW AFDPV YKCKX BBJBE TAYUQ

MXU DE EDH 6170KCS 231603T USM-99/00299

5525 0323 1515 5504 7803 6977 2558 4420

DCGDC NTIQX BYPAT TVLEB SJBPQ QNJVB JKGSV FYVMQ FBRQR VVKBF
GQONS GFTJQ GZZLV BOBDA ECPAC BLQQP DACHK WBMGP PZSMY YIUOR
IDJZR FFKOC SCYXG LWNZO QSKPZ JBIJS DEGSV SATNM IWFVU QIWHM
AIBSB BUKLU SCUOQ KGQBS RQBRJ LBKYN ORJKH SXUAH XCKPH ZHCJO
VVTIR BZTOH DCGDC NTIQX

SFV DE FBI 7510KCS 231704T USM-99/00300

7596 2623 1610 8943 7803 6869 5320 5744

DJDJD SALFZ IAYRU HPPOM BQYPC BOZCJ IEMPO ZFFYN RPYFB TEGSV
ONGDE KEBAN TFALS GAZKH OENDU MQLEN AKOZK JYIYF AFPJI SCBAN
TFAIS GAZKH OERNW LEJUF OCYTV KOZKH YQWJI SCBAN TFALS HOENV
OALME ETSAB CJUEN QKTKX YGACY TVHIZ IJISC BANFY AIGGA ZKHOE
NWAMK QUOCB AMKBY MNJIB MLYCM DUMQX YICRU ERGEL UKREQ GAZKH
IAXLE FTSAB CJIRM FAPPJ ISCKX DJDJD SALFZ

CUO DE MKR 6355KCS 231733T USM-99/00301

6045 6223 1655 3731 0611 3222 7742 4444

IHFHF EONBC UBYLL KYEPE YKIBG FKQIP KYXVC JBQXG IFYYQ ISLZE
GUEIN GSUSG NZBOR TJBYU SSPLB HLBEG JYHQS CTUVM BKAOR YNVEW
OPVFC TQUBV JYGYG PQOSK MSNLP OGMJL MEIRG UFJUY KQJVQ HWWFW
NLKGT LBSDA YKDLV RYMPR ZFAIH OKGSM GQLJF MJVBE POJTI FLXSP
CMGQP FEROX IHFF EONBC

MLR DE DYO 6260KCS 231612T USM-99/00302

4538 5423 1430 2750 3456 9749 2198 6435

IHFHF EBOBC CTQTF UTLEL WIUUR ICYDX JTWID QWZGR YCFBF FSUQM
DQVPA SCRQZ QFRYQ ITWZH DEBBC NDKUK FUCDE KJBJC IWCLE SJTAT
ZFXJU ZMBEN KPKAN BFTOZ SYROM WXFEX CKFLK VVWMI HCMRQ RUZQC
BBQBC LBMUO ZGELA RQTEY WIEUJ KIRGV CUNJK HMKYQ MENLZ DVRDG
SCEFO NIFIO BMBJK ALMNB VAKGH GMMAF VCUMT TWZUX EBOGM INBRT
EVECP TQBRR MRIME EYMKD OFKYK DORPQ RWJCN OMLJN MZPSD BJARS
RAYQC NNWIX IHFF EBOBC

ZZZ DE DYO 6260KCS 231602T USM-99/00303

5108 5323 1420 6530 2664 5815 7094 7429

IHFHF DKPBC XVRPJ CKJGJ ERRIV XGBSL JLGPU AOMSO PIUTO JRTVG
TREZC ZWYRQ AFYZY VQJDR WQVSK JIAMB QXDEX FSUUI EKCCV NZYXE
OMJYZ MJGMP WGFRC BBJDB STKST ZPAEB VTPAW YFAHN KNDYT DPUAW
SBMKI LEYLD QOROP RUSZU YBSZK DMVWN VEPFS WEFYX MYLEJ BATEI
NHDUX ZTBMU AAPKO HHWL SQQCP QKRFW RQYKX ZUMSF BGMVJ DKLMS
AGFFX STJVK DIXGJ FRWDE OYVDR PLJMU ZQKSE LBUSZ ESTYB KSATU
YVXCV NKLLI WFRBG UOYFL SAWLZ DBVVT IREGB EVRBG XGAMM XXALE
NDKGR QOOCK IHFF DKPBC

606

ZZZ DE MLR 6340KCS 231612T USM-99/00304

7216 4623 1330 9942 1476 9109 6644 9920

IIHFF BFQBC GISCG KWSA WDQOO KOJVH TDGXP DRAAV TQZM PFKOZ
KEYCV QQRHU LKLSF TAZRE BULLY KBUBW SDTRA UDLEF EYBLT JRYCX

MLR DE LLZ 7640KCS 231613T USM-99/00305

1526 5423 1500 8140 7803 1639 3485 7041

IIHFF DHBNC DSSQL HEBMT WOGPA DMPHQ BLJAK DVZCA PZPMP BJYRP
BRREA QHAGC BVSBQ URGHZ JMULO TWIDC JKLSI PAVCD MTRDF KIPKM

FMT DE VII 4165KCS 231712T USM-99/00306

7017 5323 1600 3731 2664 6940 2620 7514

CCFLI WGRV AKBAD YEGAY PEKIS BUOEI CRAVF ZTEKG BRKOT WSEIX
MFFUT WQVAB GOPBL EJLSE KIKTF QIRME CZKGL TKPRG CAZDQ WSRDM

OAL DE XTO 7990KCS 231626T USM-99/00307

5096 7323 1510 8943 4257 5653 9038 6233

FFBGG KAKEN MWRGU DRGFS ZEDYL XWHIS ARGRU QPQYO FMJTC ITGXK
MYQVC YTFPX DEJNU FMBJJ QFYW LRLRH WFDJO XGDPL SDYZC QPBG

HDG DE BWO 7990KCS 231642T USM-99/00308

1086 7723 1600 1101 8423 3565 6707 4428

CFIFC BRYDL YHRCU QTEEZ YPIBU DOGMC EKLJR TBZYU PQILB RUODL
YMWCI ENRAY KBUIZ FIOKN IOCDY YBCAU BKERP ZLWUS UNDKI COJAO

RBU DE OAL 3910KCS 231916T USM-99/00309

1534 4223 1825 9329 4257 5158 6824 5014

FFBGG BSARE GPKER YDYQ YYINR BOAIX XNDJ UPONI VAMYL OAVQE
GAZSG UYUKQ PQMGJ YDMQI DELYP ANGAP ALGOW TVICM GMDPC NDABW

XTO DE OAL 4795KCS 231834T USM-99/00310

6084 3923 1745 8140 2664 5158 3557 5608

FFBGG YSKPB EPZMB EIREN CTVBS JFGSW TKNYF JFOQS UTYMV NATCH
BPCCP BYEMN QDANN UDHHI MSHIQ NTLER ESTER DFAYS NTKZT ZHHFN

BWO DE HDG 5045KCS 231802T USM-99/00311

8583 4023 1645 2750 3456 9145 8156 6143

CFIFC GIKSQ ENEZU VRCOP TJAOA FOOCK OLEMU DKOZ KHAWH WAFPM
UCOWU BVNBS OVIOI DOECK YUOXU ZUMUB VVEQM GOGOW UBVNE EUNUU

BWO DE HDG 3200KCS 231930T USM-99/00312

8503 4223 1805 2110 2664 9145 8156 7933

DCOCD CMBKA GCZGP IEMBA NIDDM PJKDC BHAPA OZAFJ WDLIE WJEVQ
LVFZY MJCDC GLMTI IMVCO XECEL RCMNK OUARG BMDGN OKTFL KVMLE

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PSD DE MKP 4925KCS 231416T USM-99/00313

3026 2623 1830 9942 0611 6625 1243 8624

95459 65982 84285 42128 24064 31194 79044 28613 88414 51745
77292 82107 93672 16608 41901 16095 46647 32047 80481 64131
24312 82239 04233 27218 02364 54732 81243 61949 44423 84667
43857 72928 21071 39664 73269 22421 70042 32266 46084 84286
97494 83926 46491 24129 28406 42922 98090 04945 10411 61266
46902 12825 65757 72928 21079 09046 12949 60019 25873 28428
39264 64194 79147 27547 68291 01993 01423 32724 79404 12825
89482 72862 31047 30697 45124 12120 45772 92821 07936 14041
40481 29446 00192 58000 95459 65982

GKW DE MKP 3440KCS 231947T USM-99/00314

2066 2623 1830 2750 9054 6625 9399 9632

50505 17376 89111 89159 79059 64879 69880 58689 75493 79404
27059 09897 96573 98809 09873 97479 79689 19873 84099 59889
57724 77529 67457 25977 50591 39673 63973 75960 32685 72975
73738 75799 95249 37059 09897 96573 63999 59889 59156 91969
88521 39696 96974 79796 89152 73789 89696 06945 98797 95919
86057 30577 73047 79669 75696 96915 93597 09870 57059 09897
96573 98847 75260 98845 97489 19803 33268 91789 89696 79698
80698 86372 98970 68913 14247 59590 98873 77597 03373 97905
91759 65988 42915 20494 55777 05909 89796 57398 80477 47752
60988 95974 89198 03300 50505 17376

BWO DE MIO 2240KCS 231845T USM-99/00315

9564 8123 1730 2750 4257 4140 8156 3133

CFIFC DUCGM OXKSO GYTDM CWBOL FUWBN IOCMO CPQOO DJYOO HRUES
AAVFI AUMAE UCTUM JAQAR AUOHY RXJAO AVIOI DIYEP UPCS A OIWUD
XHUIQ FUWBK EKWZO SPZOU RFUFC ZOSPZ YYZJE OZMVE STURI CFIFC
DUCGM

FBI DE YXR 2310KCS 231856T USM-99/00316

5536 6023 1810 8943 8820 8641 8327 4625

DJDJD TIGAJ IMWJY TASTQ IMAGW TIMPQ ULZVY FXKSD XDUQU KIVGC
UVYDU MQVYT LGAZK SEDND UQUFI XEKER PGLIR GALVG YKFBK TYRYQ
WLENA TOVOS IQDMJ RCGBD XKORR WADBC ESYFI ZGPIZ FKEDQ JUQXJ
ISCGU FVPII YMAKN HADFX ARQTI MPSED XDUQU TGBBH YQWPA TLJ18
CTECB TIGAJ AFSZU TPCCK DJDJJ TIGAJ

OWN DE YXR 5615KCS 231813T USM-99/00317

1026 5823 1700 9942 5445 8641 3872 6643

JAAAJ EHBED DASLT COLBO IERUR IMCST ATUJI CIBTS BRINT TSEER
ESILS MPHAE ANOSE TUREI TIURO QIROA AGTHE EIQRE ROADP EPTTN
NRRNT HBRER NABBU UDATN TROAF NPTCQ DIRTD BEICD ASERN EDINR
SQIEP FBOCG OAKRM ENKDD IBOUU ENTBO CSBOS ANESE MSORI EARER
HTTEP FVLEI OSANC EITFE TAURL TESSP LELOS LEIID TYRNE XPTRE
AITAO RLCEO UIBBO ADSTY TBOIR KRRAF AHDCR DOAAM NSDUB GUITT
TASNS EEMBO ATDOP CNTTM JAAAJ EHBED

TPY DE BWO 3990KCS 231922T USM-99/00318

2086 7923 1830 9942 7263 3565 9713 5922

CFIFC ZAILZ UVRSA AVNUK VDUOS KYHQZ ABHJO NWZLW UPREY SANBK
EKMKA NMHQW WQEDV WACAM AEUCA YFSBT NJIPZ NAMNK YUOZY UPJUH
QCAUB TIALM AEUJA NEMRE TRIND WYKCK YGFUW BVVIO IDIYE PUFCS
ADIMU IDIUU ZBAQW LIMUS UNDMU LEQOO DEEYS JYJFW YEKLY TCJYY
FWBK KYHQV IOIDI YEPUP CSAOI WUDKS OLCCA USSET NPYUG ZIMWJ
UTBSU NDBYR SMAEU QOTYR OSIEU TAMUL EPOAP CFIFC ZAILZ

RTV DE NVU 5950KCS 231802T USM-99/00319

8095 6423 1705 5161 6010 3222 1603 8725

FFBGG ZNTPM NVZPR BKKEY VISPV UFWKK TKLDD JQPTF MPTDZ OQYUD
TSBKQ BOCGU IIITG YKALY HBBTQ AAODQ PSUAQ NNJDP RCINM KRERJ
KKGUS FZEDP HXAST WDMGA PWFEM BUGDZ TISEL CYKRM RRGJR QRQTO
HKJAL ITUDE SKYST KRICY MURGE JSLJR AEFDM TBMWI DCGNB ASEKY
ECLYG ELKCB VKICQ SGJVK AGSMK BMFJF CNCZM FBRQN WUMGL LURFF
BJEWH WRREZ PTREV CLRLY PZSKA RVTIK NUKNK YAHAE FWMOH EPCJQ
VLOKJ HBRER STANK MLFJA OZKAC HLJEZ NBRRC BAKLF DOGJK AMUYS
LQTER ABNKK FUJJP LQPGC ZKQYQ HQVNR LRUNY WMBTA EFPQU PFARB
RLDYS PCWJ LKENJ JDEBK ESMYV FFBGG ZNTPM

POB DE FBG 2910KCS 231956T USM-99/00320

2115 0823 1840 3731 2664 7165 4493 4726

FFBGG LBHBO YFHEB JALFU QSRDZ BRBLX IJUX IEXDO ANZCU NBRGY
USPDK RKZBV HBSUL EYEPK MOBBS ZKCTZ AGKQ5 YOAJX BFPJV OSRGG
FECCT KOGMT ZZBIV DBONW FLKLR DMZMS GOOYM VQLRN FUGYR EHLJK
EYJZY BYVKK Q8BTZ ZYCRS UVFVW KJEAM URKCC XKESR BEBFX WOYZK
SAYLG YLRXU VTMDR XIOHY MUVFO FFBGG LBHBO

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FBI DE SFV 3910KCS 231007T USM-99/00349

6564 0123 0730 5504 9054 5086 8327 6914

DCGCD QUARG SRJVG GPISH KYNLQ BPFQW GCQYF XCFYD NRYEW TMCYZ
FEZUX UODOC OIBMC CUQAK LPTSU UJLEW NRFFE DKXLJ AUPGX MATPQ
NGJMV QMEFX AQNCH BOLGK WPTCS LFLYQ TEOCK TILNN CUBZT HRTYH
QDHTP WFURP QFIKG FFJHI ZMZMP JILMG BWADL QCKCK BSSCS HHPFL
MVLX JKMPA FRACC JJZAD OGBW EMCHK HAVMH FJIMP UZMFK LMKMY
LNRMS ZYXNQ NNCCL LPTCK XOWM9 CPGSV KGOEV JUQMV CTZFS LEJOB
LZPOK QPSXV YSESE ERLVQ OTQIY SPRFR QZJXK DCGCD QUARG

IXI DE XIR 2310KCS 232331T USM-99/00350

2556 6323 2240 5504 8820 8641 2611 5143

68486 51651 42852 51959 58514 50565 16580 31380 08957 22524
52428 07650 50215 79520 22082 95849 79548 45242 13935 84215
26769 29552 41592 18054 11585 38653 66202 12870 56446 52028
54098 02366 50564 46520 28535 46550 51581 07650 56435 84758
21469 07650 56421 52875 56839 12971 57526 67054 40000 68486
59651

NIO DE BWO 3990KCS 232249T USM-99/00351

3106 8023 2130 3731 3456 3565 2125 5019

DCGCD CZWAS KKPIS DFTEL GMYRS CUBFI ZLJVN SXKXT IGYIA PAIUS
OBVXK CQVBU XYEVX STOQC WCZVB TIYVE IDIAJ UQFJV WOUJE UOZYS
BGOXL MZUAH ZXGYU WVZGL MPAIX LYBRC VZKHU LKLDZ NCVVN UUDTV
JLJNH YLGRM RUPPI CSSVL QBUJZ CFWQB XZBWI WZM4J AIBEL GKF8Q
YWAZA KOTUT ITMFX QSUQP FIDGV YKDMO RUSKU LCOCK DCGCD CZWAS

FBG DE NIO 2250KCS 232209T USM-99/00352

8072 0523 2035 9942 7803 2124 3313 8001

FFBGG MDCDH SYHNV LSQOP NYFGM ZSPBQ LOQSM UZTBC ZMPFR BAYZY
YIZMM ISOOA WQZOZ EKIVT CZAFD NGJZD GWNJJ YEBIC KZQSG GUZQE
AJEVK DFWEK EMBQZ YNLGO RLWVP VYNSL RGFUJ FEKRC SONIS ZOYES
TGHZB FJBEKZ IWIML JKBNT ESPUZ QLAYO UFYRX IRYTF JGGEZ GMDGW
QASRR LOQKT UCDIV KKRHL UBFIJ DYHAO GCATG MMDZS BGMCE UJJQK
QUQVR XKOUR FIDQA APOLD IVTQT YCCMN GNQKD NLSLI VTHVK LJDTP
EFBOK QMWH YUCQE GLAOY HGLBQ ZDTQR ULMGU SMTVV RRUVK VMVGN
GCYUX IPBBS MOEYN RRPJK GLXGS XIWDG UKJPL CWLXK FFBGG MDCDH

NIO DE FBG 2910KCS 232352T USM-99/00353

0555 1123 2300 5504 7803 7435 8912 3525

FFBGG IQTKD GDXGP ATDCC ITTBB SKCLL VVASU BLISH LKUEU TZKRL
DKPWF IXNRP DSNBR SXBXF ONAQK GFTAL YCCBP QNZQH JEALR UFDKS
ENPYE WJEEQ ZKRVB FWPIJ RHWFW BEPKN GZKPO SELJY NYZAFV CKRID
NGRTD QYWJP TZPOK FFBGG OQKED

NIO DE ZHK 2420KCS 232247T USM-99/00354

3560 3623 2135 2110 9054 9208 4637 4524

FFBGG BVRJD YRSEA OFLIK QVCXV KESBK UGBWD IYJAZ BSEBS GXBIM
FSUGW GKMKX LTFMZ YOYER XUOMF XEQOZ RVULR NTRSY TDRFK VGOYU
QMGVW LYODU GWRRR RBOJZ AGZCB VZNRK BWCXK KYTEL FTAVJ SAEFX
UMSCP MIYES VRTQD YZBSG ZALET GKFNR BWCV VTCBL FTATV XEAWY
TRVFN VADSL RDKAB FFBGG BVRJD

FBG DE ZHK 2420KCS 232247T USM-99/00355

1530 3523 2040 1120 1476 4212 3313 3601

FFBGG DQFRO ASSEV FWING DINUC XMIFD YWIAU BCQUJ QABIC VTBRY
DBUVB GOBLR ABIDW SVEZY ZNPQE MIMXT EPIFN IHQLR OQZGS KESFZ
EZEKR GLWBU AGJVO PDVFB EZVTK WNLMG YENNL NVUOH EVAZL RVKPU
DEYXK ZNCFO ESNRA ZDTGK FFBGG DQFRO

NVU DE XZJ 3255KCS 232306T USM-99/00356

1134 1023 2220 9329 2645 2683 1676 6327

DDHAA OYUQM YWODE LFCWL FFAJC UBIIT OFADE KWAPF PKYJQ BEBDC
BJXCJ VFBOO XLQYX GUZLJ VFGSX DLXIC JINVB NFPNI SVRJV YILMR
BJOWN GFZQS CJBUZ DBUXL UOXPJ MROBU ZIUES YEKHT IVMPY VVRYQ
MEFAM NRCZS POLFD QNYDM CFMKQ GQNLQ LJBST QCRBT YODFQ CJWIS
EKQFU QCQCY IOJVM WANGR ALRJJ LABKK YWZFY YBNAW HPTTY MBIGG
ZELMR NVTQD GJVD RHWIP JLAKE MVZAB FLQSN DZGKZ DIYFD MNLIQ
UXLQK DDHAA OYUQM

HCO DE ZIC 2460KCS 232348T USM-99/00357

8108 1123 2235 5504 1476 1918 8219 4330

DARAD DYCFK LAMKA FECIL QSEIC KAESF AYHFI TATIB VVQDX RYUIK
AESZO FCQOW MWURL DOOTJ OQZBI INBUV XTOAT NOVIK IDPZY EZDUO
ERONO BPTOI BSONE KAAON ETIQE VNZIQ OZUEK DUAEF UZSNO VISOM
DCIFU DARAD DYCFK

NIO DE POH 3520KCS 232021T USM-99/00358

7596 6423 1900 6530 0611 8146 8912 5331

FFBGG IFUDQ FINKQ VVPBH JZMLJ ICEQA XLJOC VCFDH OOOBE RDNIF
SCASR DKPKF LDFIK TSTBD CNLWV XUTOY VKONO FRUWN EKMLC SPQEM
LOYSL IVODO SQYBJ TEJMC YTEKH OLSWE YRWJW ZDXBO RZOKH CEORS
QBIDJ MIIKL UYNJJ CEJH PVPFF DMOOT ORGZD KMEVS ZYWLI MDKAZ
ZCJFB WKFJV ODGFQ WYUGZ XVBZS QBSAQ CFNLK QFKCD PTFAE AOHVG
QRXBR FFBGG IFUDQ

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LIZ DE ZZZ 6350KCS 231746T UEM-99/00368

1112 3323 1710 9518 0664 9000 4178 7715

HAIBA FDRDE GCBKX SGCYH KDKVY AXUXQ LSYUZ JQZAD PWFQC PJDXG
VBRDF SGOXC CJNQM FRGDM LWFRT IVDKG GAFBC FWFDO FWQPH WDRHP
WBUKI YNAQF XDGAW EIVYH OBRKQ UUVVC YDGBZ BSEIV RJLAA QUYDM
WRAPT LBJXE JBIRE BBRBY EUBOS YZLHI QDBHC LGMUL BRZBP FUGLF
TANWZ BUIDZ RYFZC NBCEL RCRQP LFCBT DBNGL UGWKX HESLM AYRDM
QUDQB TYDPH BEMKQ ZSAJR OZQAQ EYVKC NQVJQ GRDOY QMSKH CPTKK
QJBSV YNRPA DMRFV CYNGR SZZAQ XUQEV BXKXZ KXJKO REGEN XBCBC
YDJKK CBZZI LBSFU YIZEX RYBZX HAIBA FDRDE

FBG DE NIO 4895KCS 231913T UEM-99/00369

8042 0123 1825 2750 9054 2124 3313 9801

DDHAA GQRWV NKQLR KSPFX JZJZU VIFRP SBWRS ERQAS YKOLQ GGGWZ
FIGWP DOVGM JUTZL OOCKG SKYNV UJLMB FXHAX BPREN IEHET HFBET
BQAWW JYFLY JSAME EIGGW FBREY GEMDO BYTUB CJTAK CRZJC TDFWV
VDPFO NFKJY KQAIR ESTYQ DRLRY SBCKM MPJQM ISLJL PKQPA VOULE
AABEC JUFWD DVIAN XFVCI JRADT ERQKV BWPBK OULIN OAOQG GBSVD
KJMBZ KQSWJ IWHKC EIDBG IDGSA AKSPE KCJFW CRZJC ZEVAK GYJAL
VKYEN VYFEN JLAKE TFFSQ IXQJY ZNFOT BXZWO WKKFW IRVJY DCKRN
ZOLLE PFIHY XCACD DFKCB XMTQ IWKRC GVYEW ZTUCV OQPMW BFFJD
BEVKP QBEVE DUXFR JKVEA BRPZO LIJVB QXYSZ DEARL BHMVD NFMZS
ZRYZW FARUB PHLCC VCNZV BFKQG NZBCK DDHAA GQRWV

NVU DE RVW 2515KCS 232347T UEM-99/00370

4172 8223 2250 4775 6010 7994 3278 7045

DDHAA WQZQK GSPHY OANFD UTUNK RZEHL QBJMZ DEDTG JSJKI ZEUTI
HOAME FRMGJ QJBEY JOTHO MKEUM RBCKX TYZMR KLEVD IZQOJ GAWFH
WFMJT EIKHA UPCWK LCMQX KLKOC JCRUS OOLLA MCKUG LMURK IGFNF
IZAAX WOPAF SOJZI GIQTD HBUMK QDSFP EBNFY UVTEP YYAJR EPTLA
SEMND PFOSO BJAGJ JFCHA ATEZB IFTGV QQPZZ HMWBD FBRDM WGLZQ
TQAMM KEIPW QEYGL HLDMM RSEYO UNFOX XZCQS GKDJF TWCTM NJRKK
QJFUQ UYBLF QNBQV KCRSZ SMCXP BZXPK ISTEG GXAEH DDHAA WQZQK

FBG DE ZBK 2420KCS 231902T UEM-99/00371

1520 2823 1745 2750 4257 4212 3313 5701

FFBGG KJDEB ZVQFP RVONA XKEEP SBOHO YXEGA UGGOM RSBUM MNODF
ASXJZ YDWKV KEDZU ZABSW JOMQC BQCKR ALSVP OZAOH WRQYY ANNGZ
JJFEE FDRPZ WDTAB BSBMQ BCSIE TOITP YMRNJ TGGSD JSBET KONIB
MZYFN BGYQC RQWEM IDBYI EKSLF AMIDE UVERV NKEKM FZWCQ FAKKP
WSOU1 RSEET RSVXB EHLAF XRMEM USSPI HZEKQ ACFDA XAAOU BAMVL
BUXEB KOXEM GVCCA KCIQM AYBRG FFBGG KJDEB

DYO DE MLE 2020KCS 231921T UEM-99/00372

3526 5223 1705 6530 0611 7525 3917 7616

LIHFF BRLBC MPFGX KVJEB ZJUBI ZIBLQ LAKMX MPQMS DZFWO HDAJB
PQQJV GREJC FDIJG UPQUP FJLJF AZUNR EJAEB TFRYP JOMUX AASKO
STVDM NMIKU RVBWP AKRYT YNMBQ WZFOG WKFLE YQOVB DGLSH QRMLE
WUSRI CYPMX GCZSZ WYBZR QFAGM QKOKI YKXKY CYKLY ZKESF ONFIT
PKRBM UAQNX QDFCM YWBCW DTFUO HJWVF ORGKZ HPOFD UMVQV BMBQH
ZUPHW IXCBN NHHDM HTKZL SYCAG DJJDE KPFOJ TMHBC FWTR1 VEJKL
SLCMA YAOFA WSGPE DQKHM VNCJL IKSIB CITEQ RQMUR TNCYI IUIKO
ORBOA URDUH SPEDA SJVEX LIHFF BRLBC

NIO DE BOU 2220KCS 232010T UEM-99/00373

4522 4323 1935 6350 3456 7101 2125 5324

DCGCD GMSWV QOUPS AMUYZ RDDYD BAQCQ FQPCZ KDGBB JAVJL TFRWM
ERYZW SKGAI SJJFW TBLR YFUOC DMQK JBSYJ BTFGS CBUZL FSHGL
RIEFD VGFPM YDUQZ IPOJY SEDQG LAMUZ WCHWC ZENFB LAMZC PKRKL
AGFRC GBWPF HBGEL JRVQO AAZKB YGHHX CGEFU EBACC JTITE LKQVR
UICFD KCFPI VLRUT BXQRT UVEYO SBTQZ DAFJR MNRUH CTURJ VCFPG
MRAFX DCGCD GMSWV

KDH DE MXU 2700KCS 232312T UEM-99/00374

0526 6023 2200 5504 5445 6616 5267 5518

CCFII ZZYTF NEDGQ TALKB AIRQV MCBYS MVUFM BVKFB CAKDT HDALX
HOLAM ICKYV DYNPV LJFPO YPWCE WQVNC BYSMV UCDEK LJGCQ XDKIM
OFRUY HDWPI TRLMR LJTYF HLKNT XZJAB APDVF GIWBO DYBCK FBPWM
BRUDP GKOKI ADRDF HQSWN UBOFS YOKLV SLIWA JMFJY YAUMS IGRZS
MREFT HMLSM ROEFC GSTAL VJKBC GZQYP YGMQO UNOIN TCCWV VYZCH
OBTCA DMYPG IWIFZ CCFII ZZYTF

FBG DE ZBK 2420KCS 232309T UEM-99/00375

1540 3823 2225 3731 7263 1774 2549 3622

FFBGG FLIQI BOKMC FNGAM AVRIB MJKOL KNSFG KWIBO UVMUT AZTGY
LVIFB KVYNE MKYFZ IEXFJ NKEEB LZIQI DSKXI TEPXL GVSXZ TCMFR
RVSFK RRCII QVYEM IWQMB VNJZW RSKBC XVTRB RPIRT DPAQJ LEXFM
YOWPH TCZOG VSZRA GOUKT FFBGG FLIQI

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~~CONFIDENTIAL~~C. Digest of Zendian operator chatter, 23 December

0317T ???/??? ???/3990KCS (BROKE IN)
 DE ??? -FIER LAST NIGHTS TRBL THE CAFE FEMINA HR IN LIVORNO IS
 OFF LIMITS - HENRIKO WAS PULLED IN BY MILPOLS AR
 * * * * *

0332T OAL/ZCA ???/3160KCS
 DE ZCA. C ON MY CALL SIGN - SHD BE RHW RPT RHW QTC 1
 * * * * *

0427T GFH/FZX ???/3760KCS
 DE FZX I JUST LOOKED IT UP - 333 REGT BASE TRINOME IS 467
 - SO HIS TRINOME TODAY IS 824

0429T DE FZX DONT MENTION IT - ANYTIME AR
 (OP. NOTE - CALL SIGNS HRD ONLY ON INITIAL CONTACT)
 * * * * *

0532T FMT/VXI ???/2860KCS
 DE VXI HELLO - WHERE HV U BEEN LAST 2 DAYS?

0534T DE VXI YES - THATS QUITE A FEW - SAY - I THINK LUNAR CAUSTIC WILL
 DO THE JOB FOR U - IT WORKED REAL WELL WITH 1 I HAD

0535T DE VXI THATS OK - HOPE IT WORKS AR
 * * * * *

0618T OAL/NVT ???/5945KCS
 DE NVT QTC 1561
 * * * * *

0706T DYO/ZZZ ???/6350KCS
 DE ZZZ C GR 6-7 WTB DV YPYNF - PLS NOTE THIS MSG TOPSEC
 * * * * *

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0738T XTG/IZW ???/6260KCS
 DE IZW HEY PLS ASK BARTOLOMEO KARADINO IN 312TH WHEN HES GOING TO
 COME ACROSS WITH THE 10 SPESMILOJ HE OWES ME - DANKON AR

(OP. NOTE - CALL SIGNS HRD ONLY ON INITIAL CONTACT)

* * * * *

0811T TPY/BWO ???/7990KCS
 DE BWO UR LAST MSG - C GR 58?
 DE BWO R - HEY BARTOLOMEO - KLARENCO IS WORRIED ABOUT HIS 10
 SPESMILOJ - OPS AT 3 CORPS HAD BIG CHEMIN DE FER GAME
 LAST NIGHT AND KLARECHJO LOST HIS SHIRT

0813T DE BWO OK ILL TELL HIM AR

* * * * *

0924T ZZZ/DYO ???/6260KCS
 DE DYO QTC 1 URG

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0932T POH/ZHK ???/6660KCS
 DE ZHK UR NR 951 - C ORIG 2340?

* * * * *

0948T ???/YRG ???/7595KCS
 DE YRG YES - GR ON MY LAST MST SHD BE 72

0949T DE YRG OH HES NO LONGER HR - WAS TRFD TO 4 CORPS STN AND
 RODRIGO ASGD YEST TO 62 DIV AR

* * * * *

0952T ???/FBP ???/7940KCS
 DE FBP OUR CALL SIGN YSTDY WAS SAME AS MY BROTHERS INITIALS, WNT

0954T DE FBP YES, AND DID U NOTICE LTRS IN TOP STRIP THAT SORT OF LOOKED
 LIKE NAME OF A DUTCH PORT?

0957T DE FBP OK OK. SORRY. NO HARM DONE

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1005T FZX/VXI ???/6860KCS
 DE VXI C GR 59?
 DE VXI R - WHAT U NO ABOUT FIRST ARMY POLICY RE CHRISTMAS FURLO
 FOR US JOKERS? NIL HRD YET FROM DIV HQ BY US IN 321ST

1007T DE VXI OK OK - DIDNT SAY ANYTHING
 DE VXI SORRY - OK NO MORE CLEAR TALK - QTC?

1008T DE VXI R AR

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1005T PVK/AAA ???/6405KCS
 DE AAA OUR LEADER JUST CAME THRU ON TOUR WITH GEN CAMPAGLIANO -
 MARSHAL SALASIO COMPLIMENTED HIM ON GEN APPEARANCE AND
 HIGH MORALE OF EM AT SECOND ARMY HQ

1008T DE AAA YES - AND TO THINK THAT THE AMERICANS WOULD INVADE
 OUR BELOVED SHORES ON VERY ANNIVERSARY OF SALVO SALASIOS
 BIRTHDAY - HR CMS WATCH CHIEF - LETS GET OFF AIR AR

* * * * *

1013T EDH/HCO ???/6030KCS
 DE HCO IF OUR REGT MOVED ANY FURTHER WEST WE'D BE IN THE PACIFIC

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1029T INJ/GFH ???/6460KCS
 DE GFH NO, FMT IS ON MY RIGHT

* * * * *

1042T DYO/ZZZ ???/6350KCS
 DE ZZZ THINGS SURE ARE HUMMING HR SINCE GEN KIRCHENFALL TOOK
 OVER - OFF AND EM ALIKE AT FIRST ARMY HQ HV TO STAY
 ON BALL WITH GORGEOUS GOTTFRIED AROUND AR

* * * * *

1132T XTG/OAL ???/7830KCS
 DE OAL WE IN 23 DIV GETTING DAILY REPLACEMENTS - HOWS YR OUTFIT?

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1235T SFV/MKP ???/7320KCS

DE MKP AFTER COL FULGURITO PUT OUT REGTL ORDER ON PASSES IT LOOKS LIKE I WONT GET IN TO KALEDONIO TO C U AR

(OP. NOTE - OPR AT MKP USES VVV FOR TUNING INSTEAD OF STANDARD ZZZ AS USED BY OTHER OPS)

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1239T ???/MLH ???/6340KCS

DE MLH ISNT YR CORPS SCHEDULED TO BE COMMITTED SOON?

DE MLH OH, ONLY 13 DIV. WHEN?

* * * * *

1327T NVT/RBU ???/6620KCS

DE RBU ? GR 1-2 UR 623 OF 231240

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1348T HCO/EDH ???/6170KCS

DE EDH SUPPLY JUST GOT SHPMT NEW TYPE OVERCOATS - HOPE WE GET THEM BEFORE CHRISTMAS - HOW ABOUT U BOYS?

1350T DE EDH WELL KEEP HOPING - TELL FERDINANDO I GOT ANOTHER LTR FM HIS SISTER - SHE LIKES HER NEW JOB IN BONAREO AR

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1429T ???/UNK ???/6220KCS (OP. NOTE: BROKE IN)

DE UNK U BOYS IN REGT HQ OUGHT TO GET OUT OF UR EASY CHAIRS AND SEE WHAT GOES ON WITH US COMBAT TROOPS AR

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1519T FBG/POH ???/7640KCS

DE POH OUR CG JUST GOT A BUMP - THOSE 3 STARS SURE LOOK GOOD ON GEN VESPASIANO AND THEY GO BETTER WITH HIS JOB

1521T DE POH NO I DIDNT NO THAT

1522T DE POH SURE I WILL - SOON AS I GET CHANCE AR

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1529T NVT/RHW ???/7120KCS
 DE RHW RENALDO GOT GIGGED YSTDY FOR USING WRONG PAD

1530T DE RHW JUST CARELESS, I GUESS
 * * * * *

1537T ???/??? ???/6070KCS
 DE ??? SURE, TPY IS JUST EAST OF ME BUT IM NOT ALLOWED TO CALL HIM DIRECTLY
 * * * * *

1548T DYO/MLH ???/6340KCS
 DE MLH LUDOVIKO JUST LEFT FOR ARMY HQ TO HELP OUT ON RADIOPRINTER LINK
 * * * * *

1608T EOU/UBT ???/6890KCS
 DE UBT I HR OUR REGT WILL TEAM UP WITH U BOYS IN THE 331ST FOR ELIMS IN THE 33 DIV CHESS TOURNEY - HV U HRD ANYTHING RE THIS?

1610T DE UBT SAY HELLO TO NIKOLO FOR ME - WONDERED WHY I DIDNT HR HIM LAST 2 DAYS - SORRY TO HR HES IN HOSP AR
 * * * * *

1805T ZHK/NIO ???/6130KCS
 DE NIO QSY 4895?
 * * * * *

1814T WNN/ZCA ???/3160KCS
 DE ZCA WHEN U CMG BACK TO ESTAMINO? SURE MISS U SINCE U TRFD TO 212TH

1820T DE ZCA TOUGH - WELL THATS THE ARMY AR
 * * * * *

1848T IZW/CUN ???/4265KCS
 DE CUN C CLASS 7837?
 * * * * *

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1922T ???/VXI ???/2860KCS

DE VXI MY BUDDY LEONARDO ON MTN PATROL SAYS THE NEW FEMMIGAN
ISNT BAD AT ALL - GUESS THAT JOBS GETTING POOR LEONCHJO

1923T DE VXI NO I HAVENT HAD ANY IN A LONG WHILE

1925T DE VXI GUESS SO - THINGS TOUGH ALL OVER AR

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2024T TPY/HDG ???/3200KCS

DE HDG CASUALS ARVD TODAY FM MY HO-- --WN - WISH I WERE
BACK -N VALONO

2026T DE HDG NO I D--T THINK SO - THEY CANT GET AN--HER OPR HR

2027T DE HDG WELL THERE GO SIRENS AG-IN - THOSE AM--ICANS KEEP US
BUSY RUNNING IN AND --T OF SHELTERS EVEN IF THEY DONT
DROP MUCH XCPT LEAFLETS -

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2107T FBG/NIO ???/2250KCS

DE NIO HR Ø1 AUTHS GOING OUT FOR PRAC TFC

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2219T NVU/XZJ ???/3255KCS

DE XZJ HR THAT 53 DIV IS MOVING UP TMW - WE ARE ALL ITCHING
TO GET CRACK AT THE AMERICANS AR

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2248T TOJ/FHI ???/3670KCS

DE FHI STARTING TMW MORN FILE TIMES ARE TO BE GIVEN IN EXACT
TIMES, NOT NEAREST 5.

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2312T KYR/VLH ???/2990KCS

DE VLH AHA - THE FALKBEER! WELL - HERES MY ANSWER - 2 KEESE
PEQ4 3KPKP

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~~CONFIDENTIAL~~D. Callsign listing, 23 December

00143	AAA	AAA	5820	231018	003	251	230940	0120	0420	9262	7319	49	19	I IHFF
00087	CUO	AAA	6405	230806	753	243	230745	3749	1663	9262	7742	37	06	BEGBE
00016	PVK	AAA	2685	230317	602	215	230235	9969	7046	9262	3061	48	08	I IHFF

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00221	GXW	BWO	4095	231448	001	668	231400	4775	3058	3565	8156	39	17	JCCJC
00201	HDG	BWO	7990	231350	104	658	231035	2750	9054	3565	6707	91	10	CFIFC
00308	HDG	BWO	7990	231642	108	677	231600	1101	8423	3565	6707	44	28	CFIFC
00038	NIO	BWO	4095	230536	301	640	230455	1561	6442	3565	2125	67	12	CEHCE
00120	NIO	BWO	7990	230913	302	647	230825	9518	6010	3565	2125	49	28	CFIFC
00254	NIO	BWO	7990	231427	306	658	231035	1120	7803	3565	2125	87	10	CFIFC
00351	NIO	BWO	3990	232249	310	680	232130	3731	3456	3565	2125	50	19	DCGCD
00024	TPY	BWO	3990	230337	203	632	230210	5504	1476	3565	9713	59	30	CFIFC
00202	TPY	BWO	7990	231218	205	658	231035	0121	5445	3565	9713	85	10	CFIFC
00318	TPY	BWO	3990	231922	208	679	231830	9942	7263	3565	9713	59	22	CFIFC

10

00036	IZW	CUN	4265	230557	952	195	230515	1101	5074	2241	9083	58	38	AGHAG
00121	IZW	CUN	7720	230913	955	202	230740	6530	9054	2601	0956	89	27	DDHAA
00226	IZW	CUN	7720	231449	956	225	231415	1561	3698	7741	3917	35	23	AGHAG
00159	WNN	CUN	7720	231018	254	207	230900	6350	3456	4366	3395	54	42	FFBGG
00286	XTG	CUN	4265	231754	452	228	231650	8140	2664	7741	8156	71	41	FFBGG

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00239	AAA	CUO	7735	231521	255	452	231445	8140	5237	4618	7319	61	24	I IHFF
00242	MKR	CUO	7735	231546	453	454	231505	3749	0665	1549	3278	53	26	I IHFF

2

00266	LLZ	DYO	6260	231541	653	855	231450	8140	2645	9749	4493	91	41	I IHFF
00218	MLH	DYO	6260	231358	452	850	231315	0732	5218	5815	4259	74	29	I IHFF
00302	MLH	DYO	6260	231612	453	854	231430	2750	3456	9749	2198	64	35	I IHFF
00326	MLH	DYO	2100	231936	454	858	231700	6530	5445	5815	4259	55	34	I IHFF
00125	ZZZ	DYO	6260	230929	503	832	230900	9192	4803	9541	3755	45	46	ABCAB
00135	ZZZ	DYO	6260	231156	504	840	231105	4775	8820	9749	6644	53	22	I IHFF
00267	ZZZ	DYO	6260	231511	508	849	231300	9942	7263	9640	8110	86	32	I IHFF
00268	ZZZ	DYO	6260	231404	507	847	231235	0121	1476	9541	3755	76	27	I IHFF
00303	ZZZ	DYO	6260	231602	510	853	231420	6530	2664	5815	7094	74	29	I IHFF
00327	ZZZ	DYO	2100	231910	511	857	231625	3731	4257	9749	6644	76	40	I IHFF

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00113	FSD	EDH	6170	230939	452	487	230900	0121	3456	6977	7238	28	41	DAEAD
00299	MXU	EDH	6170	231603	552	503	231515	5504	7803	6977	2558	44	20	DCGCD
00015	ZIC	EDH	2210	230212	153	480	230125	4775	1663	6977	5726	44	37	BGIBG
00126	ZIC	EDH	6170	230809	155	485	230730	1561	3698	6977	5726	34	43	BGIBG
00208	ZIC	EDH	6170	231323	159	492	231145	6530	1476	6977	5726	79	35	DAEAD
00209	ZIC	EDH	6170	231348	160	492	231145	6530	1476	6977	5726	74	35	DAEAD

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00373	NIO	EOU	2220	232010	452	243	231935	6350	3456	7101	2125	53	24	DCGCD
00344	NIO	EOU	2220	232148	453	245	232105	2750	2664	7101	2125	37	28	CCFII
00093	UBT	EOU	4565	230609	952	225	230435	2110	8820	7101	9803	31	23	CCFII
00012	YWP	EOU	2220	230313	552	221	230240	3749	0420	7101	4718	37	28	CBECB
00057	YWP	EOU	2220	230528	554	224	230435	1101	7046	7101	4718	58	39	AEFEA
00177	YWP	EOU	6140	231146	555	236	231100	6530	9054	7101	4718	44	29	CCFII
00241	YWP	EOU	6140	231437	556	239	231350	3731	5445	7101	4718	32	26	DCGCD

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00279	NIO	FBG	6830	231618	054	494	231505	2110	1476	7435	8912	43	01	FFBGG
00353	NIO	FBG	2910	232352	055	511	232300	5504	7803	7435	8912	35	25	FFBGG
00364	POH	FBG	6830	231305	206	483	231130	9942	3456	7435	5942	57	22	FFBGG
00052	POH	FBG	2910	230408	204	468	230320	3749	4257	7165	4493	56	20	FFBGG
00170	POH	FBG	6830	231458	207	490	231415	6350	0611	7435	5942	75	28	DDHAA
00171	POH	FBG	6830	231536	208	493	231445	1120	7820	7435	5942	97	18	DDHAA
00188	POH	FBG	6830	231748	209	503	231705	6530	5445	5121	2666	79	28	DDHAA
00320	POH	FBG	2910	231956	211	508	231840	3731	2664	7165	4493	47	26	FFBGG
00189	ZHK	FBG	6830	231728	904	497	231635	2750	7263	7435	3151	93	01	DDHAA
00280	ZHK	FBG	6830	231702	903	495	231610	8943	8820	7435	3151	48	35	FFBGG

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00359	FHI	FBP	4105	231820	506	840	231735	6530	4257	4122	8327	83	20	80808
00366	FHI	FBP	7940	231558	503	837	231525	3749	1871	4122	8327	59	30	80808
00178	FHI	FBP	7940	231041	501	834	231010	4775	8423	4122	8327	25	34	80808
00282	FHI	FBP	7940	231745	504	838	231650	8943	3456	4122	8327	54	34	80808

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00105	FBP	FHI	7510	230836	852	612	230600	0121	7803	6869	5447	96	22	28082
00106	FBP	FHI	7510	230851	853	612	230600	6530	5445	6869	5447	82	22	28082
00212	SFV	FHI	7510	231332	754	615	231220	2750	1476	7642	6536	60	22	DCGCD
00252	SFV	FHI	7510	231451	757	619	231345	0121	7263	6869	5320	77	44	DJDJD
00262	SFV	FHI	7510	231518	758	619	231345	0121	7263	6869	5320	80	44	DJDJD
00300	SFV	FHI	7510	231704	759	626	231610	8943	7803	6869	5320	57	44	DJDJD
00069	TOJ	FHI	5335	230712	651	612	230600	2110	0611	6869	5609	83	23	80808
00070	TOJ	FHI	7510	230723	652	612	230600	2110	0611	6869	5609	59	46	GIFIG
00025	UNK	FHI	3670	230208	451	608	230115	9942	3456	6869	7904	60	29	80808
00107	UNK	FHI	7510	230804	452	612	230600	3731	4257	6869	7904	71	36	GIFIG
00108	UNK	FHI	7510	230816	453	612	230600	5504	8820	6869	7904	63	42	80808

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00109	FZX	FMT	7340	230823	753	394	230745	0121	2664	8678	1360	65	29	EGBGE
00213	FZX	FMT	7340	231208	755	399	231130	3731	9054	6850	0172	39	17	EGBGE

2

00046	HCO	FSD	5805	230549	351	650	230500	2110	7803	1161	8219	34	05	DAEAD
00013	ZIC	FSD	2400	230354	251	647	230310	8140	7487	1161	5726	46	25	HDBHD
00122	ZIC	FSD	6680	230930	254	655	230825	4775	0420	1161	5726	31	22	HDBHD
00157	ZIC	FSD	6680	231037	256	662	231000	4369	5218	1161	5726	35	27	DAEAD
00253	ZIC	FSD	6680	231550	259	668	231435	6530	2664	1161	5726	45	05	DAEAD

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00035	FMT	FZX	3760	230513	501	191	230420	9518	7487	7741	2620	44	18	GHEGH
00162	FMT	FZX	7720	231052	502	210	230945	2750	7263	7741	2620	64	27	CCFII
00255	FMT	FZX	7720	231406	503	221	231115	3731	0611	7741	2620	84	24	EGBGE
00334	FMT	FZX	3760	232114	507	230	232000	5504	4257	7741	2620	63	32	EGBGE
00203	GFH	FZX	7720	231254	305	221	231115	0121	5445	7741	6743	85	24	EGBGE
00288	GFH	FZX	7720	231723	306	227	231610	6350	3456	7741	6743	56	28	DCGCD
00361	LYD	FZX	4265	230751	001	199	230700	3749	0420	7741	0172	48	12	JAAJA
00147	VXI	FZX	7720	231106	601	214	231020	9329	2239	7741	3070	40	18	HBJHB
00160	VXI	FZX	7720	231119	604	212	231000	8943	7803	7741	3070	41	24	EGBGE
00161	VXI	FZX	7720	231138	605	212	231000	8943	7803	7741	3070	66	24	EGBGE
00287	VXI	FZX	7720	231658	606	221	231115	9942	3456	7741	3070	91	24	EGBGE

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00269	DYP	FZY	7735	231452	663	449	231400	0120	3644	4618	3494	69	38	FFBGG
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00325	FMT	GFH	5285	231829	652	191	231750	3731	5445	4997	2620	46	16	DCGCD
00003	FZX	GFH	2620	230103	551	167	230025	1101	4606	4997	0172	44	11	CIBCI
00055	FZX	GFH	2620	230406	554	169	230310	5504	4257	4997	0172	50	25	EGBGE
00056	FZX	GFH	2620	230424	555	169	230310	5504	4257	4997	0172	56	25	EGBGE
00240	FZX	GFH	6460	231552	557	188	231520	6350	3456	4997	0172	70	15	CCFII
00176	INJ	GFH	6460	231157	402	180	231015	6530	0611	4997	1397	50	18	CCFII
00094	VXI	GFH	5285	230612	051	172	230535	8943	7803	4997	3070	65	20	CCFII

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00179	MKP	GKW	6100	231142	351	824	231110	4775	7046	9893	5762	33	32	ECHCE
00243	MKP	GKW	6100	231420	353	826	231245	3731	2664	9893	5762	76	24	50505

2

00119	EDH	HCO	6030	230822	402	723	230730	9518	8423	8740	5267	51	05	DAEAD
00004	ZIC	HCO	2350	230104	053	718	230020	1561	2239	8740	5726	45	07	FBHFB
00045	ZIC	HCO	5895	230553	054	720	230435	0121	3456	8740	5726	61	03	DAEAD
00200	ZIC	HCO	6030	231219	057	730	231145	2750	1476	8740	5726	27	08	DAEAD

4

00073	BWO	HDG	5045	230618	853	321	230520	5504	1476	9145	8156	40	21	CFIFC
00206	BWO	HDG	7080	231312	857	332	231230	1561	5074	9145	8156	53	22	DHBDH
00311	BWO	HDG	5045	231802	858	340	231645	2750	3456	9145	8156	61	43	CFIFC
00312	BWO	HDG	3200	231930	850	342	231805	2110	2664	9145	8156	79	33	DCGCD
00118	NIO	HDG	7080	230917	701	328	230825	8943	7263	9145	2125	45	32	CCFII

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00370	NVU	HVW	2515	232347	417	282	232250	4775	6010	7994	3278	70	45	DDHAA
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00033	MKP	HZY	2750	230248	701	765	230135	9942	8820	8623	5762	61	12	95459
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00100	EOU	INJ	7450	230918	452	818	230825	6530	7803	1864	1793	47	24	AEFEA
00027	YWP	INJ	3330	230249	751	811	230215	9329	2645	1864	4718	64	09	AEFEA
00028	YWP	INJ	3330	230331	752	812	230240	1120	7263	1864	4718	40	04	AEFEA
00110	YWP	INJ	7450	230812	754	816	230705	8943	2664	1864	4718	52	21	CCFII

4

00058	XYR	IXI	3170	230449	101	802	230420	5161	2645	0586	8444	37	30	68486
00133	XYR	IXI	7130	230923	103	805	230815	2110	9054	0586	8444	54	26	68486

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00363	CUN	IZW	6260	231124	204	837	231010	3731	1476	5815	0172	59	24	DDHAA
00132	CUN	IZW	6260	230903	201	824	230640	6350	3456	9749	2396	81	24	DDHAA
00184	CUN	IZW	6260	231318	207	844	231140	2110	9054	9640	1360	70	31	DDHAA
00001	NCM	IZW	5385	230136	001	809	230100	1101	3644	5815	3917	80	12	JGGJG
00002	NCM	IZW	5385	230157	002	809	230100	1101	3644	5815	3917	80	24	JGGJG
00021	NCM	IZW	5385	230212	003	809	230100	1101	3644	5815	3917	34	22	JGGJG
00130	NCM	IZW	5385	230908	005	828	230800	9942	5445	5815	3917	86	09	DDHAA
00131	NCM	IZW	5385	230939	006	828	230800	9942	5445	5815	3917	84	09	DDHAA
00165	NCM	IZW	5385	231004	007	828	230800	9942	5445	5815	3917	80	09	DDHAA
00032	WNN	IZW	2100	230252	302	810	230130	0121	8820	5815	4718	94	22	DDHAA
00088	WNN	IZW	5385	230623	305	816	230515	8943	7803	5815	4718	69	16	DDHAA
00166	WNN	IZW	6260	231008	308	829	230820	2750	7263	9640	5230	83	11	DDHAA
00247	XTG	IZW	6260	231433	101	852	231400	3749	3698	5815	8156	27	29	GBIGB

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00347	GFI	LAN	3095	232256	606	527	232210	1101	1871	5644	1324	37	25	DDHAA
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00329	DYO	LLZ	4965	231814	551	659	231715	5161	3644	8146	3917	72	31	IIHFF
00305	MLH	LLZ	7640	231613	152	654	231500	8140	7803	1639	3485	70	41	IIHFF
00017	ZZZ	LLZ	3520	230236	601	612	230140	9329	5074	8146	7094	80	17	HAIHA
00018	ZZZ	LLZ	3520	230259	602	612	230140	9329	5074	8146	7094	60	28	HAIHA
00060	ZZZ	LLZ	3520	230542	606	617	230355	3731	9054	8146	7094	00	39	IIHFF
00272	ZZZ	LLZ	7640	231419	608	645	231330	7753	0889	8146	7094	80	32	IIHFF

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00153	FHI	MKP	7320	231012	451	600	230925	3731	0611	6625	8327	43	26	DJDJD
00071	GKW	MKP	4925	230634	201	588	230515	8943	7263	6625	9399	75	28	95459
00250	GKW	MKP	7320	230925	203	591	230620	5504	3456	6625	9399	48	11	ECHCE
00314	GKW	MKP	3440	231947	206	626	231830	2750	9054	6625	9399	96	32	50505
00116	HZY	MKP	7320	230815	501	596	230750	9329	1871	6625	6473	26	20	50505
00180	HZY	MKP	7320	231124	503	604	231000	2110	8820	6625	6473	90	28	95459
00199	HZY	MKP	7320	230905	502	591	230620	8943	1476	6625	6473	63	24	95459
00335	HZY	MKP	3440	232057	506	626	231830	1120	7263	6625	6473	70	14	ECHCE
00245	MRS	MKP	7320	231509	652	615	231435	8943	5445	6625	0091	51	28	CCFII
00117	PSD	MKP	7320	230849	301	591	230620	3731	3456	6625	1243	70	24	28082
00313	PSD	MKP	4925	231916	302	626	231830	9942	0611	6625	1243	86	24	95459
00072	SFV	MKP	7320	230725	052	593	230645	0120	3698	6625	5320	69	26	BCEBC
00123	SFV	MKP	7320	230953	054	598	230900	9942	2664	6625	5320	60	34	DJDJD
00152	SFV	MKP	7320	231136	060	607	231040	6530	1476	6625	5320	45	32	DJDJD
00163	SFV	MKP	7320	231004	055	598	230900	9942	2664	6625	5320	73	34	DJDJD
00246	XYR	MKP	7320	231553	902	620	231500	2110	4257	6625	8444	29	24	CCFII

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00301	CUO	MKR	6355	231733	604	562	231655	3731	0611	3222	7742	44	44	IIHFF
00372	DYO	MLH	2020	231921	352	652	231705	6530	0611	7525	3917	76	16	IIHFF
00346	DYO	MLH	2020	232037	355	655	231830	3731	9054	9109	7300	56	22	IIHFF
00063	LLZ	MLH	6340	230718	251	616	230545	2110	7263	7525	5942	58	24	IIHFF
00367	ZZZ	MLH	6340	231441	711	646	231330	9942	1476	9109	6644	92	27	IIHFF
00020	ZZZ	MLH	2020	230347	702	590	230315	3973	7487	7525	7094	90	28	FEAFE
00059	ZZZ	MLH	2020	230551	703	594	230430	4775	2239	7525	7094	63	30	IIHFF
00064	ZZZ	MLH	6340	230659	704	611	230525	8140	3644	4447	0127	96	31	IIHFF
00137	ZZZ	MLH	6340	231008	705	627	230830	8943	4257	4339	8110	70	24	IIHFF
00138	ZZZ	MLH	6340	231023	706	627	230830	8943	4257	4339	8110	56	24	IIHFF
00219	ZZZ	MLH	6340	231354	709	640	231230	5504	3456	7525	7094	53	20	IIHFF
00220	ZZZ	MLH	6340	231337	707	638	231215	1120	5445	7895	9119	84	37	IIHFF
00270	ZZZ	MLH	6340	231539	720	646	231330	9942	1476	9109	6644	95	40	IIHFF
00271	ZZZ	MLH	6340	231426	710	643	231305	2750	4257	9109	6644	80	33	IIHFF
00304	ZZZ	MLH	6340	231612	721	646	231330	9942	1476	9109	6644	99	20	IIHFF

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00155	MKP	MRS	6900	231037	502	832	230940	5504	3456	8669	5762	62	16	CCFII
00151	WNN	MRS	6900	231032	902	833	230945	9942	1476	8669	8408	33	30	HBJBH
00078	ZCA	MRS	4845	230623	753	825	230540	4775	3644	8669	1081	43	38	HBJBH
00111	ZCA	MRS	6900	230927	755	829	230810	1120	2664	8669	1081	43	18	HBJBH
00150	ZCA	MRS	6900	231158	758	838	231100	3731	3456	8669	1081	37	36	HBJBH

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00374	EDH	MXU	2700	232312	052	660	232200	5504	5445	6616	5267	55	18	CCFII
00207	MRS	MXU	6380	231257	151	639	231210	2110	7263	6616	0091	28	32	CCFII
00331	WNN	MXU	2700	232026	352	658	231935	6350	3456	6616	8408	58	21	DCGCD
00360	ZCA	MXU	2700	230310	653	629	230215	1561	1663	6616	1081	43	13	GEBGE
00259	ZCA	MXU	6380	231506	657	642	231420	9969	8423	6616	1081	59	36	HBJBH

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00260 ZCA MXU 6380 231528 658 642 231420 9969 8423 6616 1081 42 36 HBJBH
6

00075 BWO NIO 4885 230630 953 465 230525 9942 2664 4140 8156 46 48 CFIFC
00315 BWO NIO 2240 231845 956 481 231730 2750 4257 4140 8156 31 33 CFIFC
00251 EOU NIO 6120 231525 852 474 231410 6350 7263 4140 1793 72 46 DCGCD
00369 FBG NIO 4895 231913 804 201 231825 2750 9054 2124 3313 98 01 DDHAA
00338 FBG NIO 2250 232106 805 203 231910 1561 8423 2124 3313 60 49 FFBGG
00352 FBG NIO 2250 232209 807 205 232035 9942 7803 2124 3313 80 01 FFBGG
00168 POH NIO 6130 231152 104 169 231045 9969 8423 2124 5942 84 01 DDHAA
00169 POH NIO 6130 231437 106 186 231350 6350 3456 2124 5942 79 49 DDHAA
00217 POH NIO 6130 231527 108 191 231450 8943 4257 6427 4493 80 42 DDHAA
00337 POH NIO 2250 232013 109 202 231840 0121 2664 2124 5942 65 01 FFBGG
00185 ZHK NIO 6130 231214 252 170 231100 8943 8820 2124 3151 79 01 DDHAA
00233 ZHK NIO 6130 231704 256 196 231625 0121 2664 2124 3151 74 01 DDHAA
00277 ZHK NIO 4895 231808 258 200 231725 6530 0611 2124 3151 73 01 DDHAA

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00083 OAL NVT 5945 230623 604 602 230500 1561 6010 2962 7896 55 43 CJCCJ
00084 OAL NVT 6340 230648 605 619 230600 1120 4257 7525 5320 87 36 FFBGG
00085 OAL NVT 6340 230709 608 624 230640 6960 3058 7525 5320 80 37 CJCCJ
00086 OAL NVT 6340 230714 609 624 230640 6960 3058 7525 5320 36 34 CJCCJ
00127 RBU NVT 6340 230822 504 619 230600 3731 9054 7525 5726 87 28 FFBGG
00290 RBU NVT 6340 231602 507 650 231520 9329 4094 7525 5726 43 29 DCGDC
00019 RHW NVT 2020 230242 102 587 230205 4775 2645 7525 1081 36 38 AJAAJ
00128 RHW NVT 6340 230914 104 619 230600 2750 2664 7525 1081 84 32 DDHAA
00129 RHW NVT 6340 230949 105 619 230600 2750 2664 7525 1081 83 32 DDHAA
00142 RHW NVT 6340 231046 109 632 231010 9518 5237 7525 1081 35 21 AJAAJ
00194 WPX NVT 5945 231351 003 644 231310 9969 4606 7525 4259 35 36 JBBJB
00195 WPX NVT 5945 231208 001 635 231130 5161 7487 7525 4259 51 37 JBBJB
00330 WPX NVT 5945 231902 004 654 231815 3749 5218 7525 4259 58 20 JBBJB

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00319 RTJ NVU 5950 231802 809 564 231705 5161 6010 3222 1603 87 25 FFBGG

00039 NVT OAL 3910 230456 052 390 230410 5161 7487 4556 3485 37 23 CJCCJ
00210 NVT OAL 7830 231353 056 418 231230 9969 5218 5086 4259 65 21 CJCCJ
00211 NVT OAL 7830 231318 055 418 231230 9969 5218 5086 4259 80 23 CJCCJ
00309 RBU OAL 3910 231916 153 442 231825 9329 4257 5158 6824 50 14 FFBGG
00068 RHW OAL 7830 230751 302 399 230700 1561 6010 5086 1081 69 21 DDHAA
00214 XTG OAL 7830 231309 603 416 231200 0121 7263 5086 8156 55 10 FFBGG
00264 XTG OAL 7830 231422 605 420 231250 8943 3456 5086 8156 63 09 DDHAA
00310 XTG OAL 4795 231834 608 439 231745 8140 2664 5158 3557 56 08 FFBGG

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00091 XYR OWN 4235 230620 951 681 230605 7932 8423 5095 8444 68 31 JAAAJ
00244 XYR OWN 6850 231418 953 684 231345 8140 1871 5095 8444 42 24 JAAAJ
00283 XYR OWN 6850 231613 956 687 231540 3749 6010 5095 8444 39 15 JAAAJ

3

00031 FBG POH 3520 230305 851 614 230215 1101 7820 8146 3313 63 26 FFBGG
00182 FBG POH 7640 231356 852 639 231210 8140 2645 1639 2549 83 42 DDHAA
00231 FBG POH 7640 231522 854 643 231315 3731 5445 8146 3313 93 01 DDHAA
00232 FBG POH 7640 231738 858 657 231620 6350 1476 8146 3313 72 01 FFBGG
00276 FBG POH 7640 231524 855 648 231355 9942 3456 8146 3313 70 01 DDHAA
00358 NIO POH 3520 232021 759 664 231900 6530 0611 8146 8912 53 31 FFBGG

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00030	NIO	POH	3520	230321	751	608	230105	2750	7263	8146	8912	77	01	FFBGG
00082	NIO	POH	4965	230628	754	619	230440	8943	5445	8146	8912	63	31	FFBGG
00079	VPO	POH	4965	230613	002	621	230530	5504	4257	8146	5942	86	33	DDHAA
00080	VPO	POH	4965	230644	003	621	230530	5504	4257	8146	5942	84	33	DDHAA
00081	VPO	POH	4965	230715	004	621	230530	5504	4257	8146	5942	82	33	DDHAA
00124	ZHK	POH	7640	230917	951	627	230800	2750	7263	2340	3151	77	38	DDHAA
00164	ZHK	POH	7640	231112	952	632	230935	6530	8820	6210	9074	00	20	DDHAA
00229	ZHK	POH	7640	231528	954	650	231430	3749	6010	2197	8435	81	01	DDHAA
00230	ZHK	POH	7640	231556	955	650	231430	3749	6010	2197	8435	66	01	DDHAA

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00010	MKP	PSD	2960	230053	551	848	230010	5504	1476	6607	5762	61	07	ECHCE
00011	MKP	PSD	2960	230114	552	848	230010	5504	1476	6607	5762	75	16	ECHCE
00089	MKP	PSD	6760	230708	555	851	230600	0121	4257	6607	5762	54	29	ECHCE

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00167	CUO	PVK	6005	231109	202	698	231035	9518	7820	6373	7742	40	21	IHHFF
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00054	NVT	RBU	2460	230437	654	767	230320	0121	7263	1080	2198	71	38	DDHAA
00183	NVT	RBU	6620	231328	656	790	231245	7753	5218	8858	3485	66	36	DCGDC
00297	NVT	RBU	6620	231623	659	800	231550	1523	4606	1080	2198	50	28	DCGDC
00175	OAL	RBU	6620	231004	852	775	230835	3731	7803	8858	7896	66	29	FFBGG
00197	RHW	RBU	6620	231221	452	786	231100	6530	2664	8858	0406	76	33	DDHAA

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00192	NVT	RHW	7120	231219	555	030	231105	2750	1476	2610	4259	93	30	DDHAA
00193	NVT	RHW	7120	231237	556	030	231105	2750	1476	2610	4259	73	30	DDHAA
00223	NVT	RHW	7120	231543	558	052	231500	1561	2645	8371	3485	48	38	AJAAJ
00053	OAL	RHW	3160	230407	202	024	230335	4152	5218	2610	5320	61	21	DDHAA
00174	RBU	RHW	7120	231112	752	028	231000	8943	7263	2610	5726	82	37	DDHAA

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00065	FHI	SFV	7830	230725	652	397	230640	4775	4606	5086	8327	56	18	AIJAI
00103	FHI	SFV	7830	230913	653	401	230730	1120	8820	5086	8327	71	27	DCGCD
00216	FHI	SFV	7830	230942	654	401	230730	3731	4257	5086	8327	84	33	DJDJD
00349	FHI	SFV	3910	231007	656	401	230730	5504	9054	5086	8327	69	14	DCGCD
00029	MKP	SFV	3910	230356	403	388	230300	0120	1871	5086	5762	48	16	DJDJD
00144	MKP	SFV	7830	231124	408	401	230730	8943	3456	5086	5762	87	33	DJDJD
00215	MKP	SFV	4795	231207	410	401	230730	8943	3456	5086	5762	92	33	DJDJD
00067	XYR	SFV	4795	230613	801	394	230525	3749	2645	5086	8444	49	31	DCGCD
00114	XYR	SFV	7830	230929	804	405	230845	9518	5074	4726	1801	28	15	EGBEG
00278	XYR	SFV	7830	231611	808	432	231520	1101	1663	5086	8444	51	20	EGBEG
00333	XYR	SFV	3910	232023	810	445	231910	9942	3456	5086	8444	55	34	DCGCD
00348	XYR	SFV	3910	230936	805	401	230730	6530	7803	5086	8444	69	17	DCGCD
00222	YFT	SFV	4795	231448	001	425	231400	5161	2239	5086	5320	34	33	JDDJD

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00066	FHI	TOJ	6430	230730	751	910	230705	5161	3456	0162	8327	53	21	80808
00102	FHI	TOJ	6430	230915	752	912	230840	3731	9054	0162	8327	39	35	GIFIG

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00008	BWO	TPY	3360	230157	701	811	230120	8943	0611	2025	8156	32	27	CFIFC
00074	BWO	TPY	7400	230722	705	815	230635	1120	3456	2025	8156	54	47	CFIFC
00205	BWO	TPY	7400	231256	710	827	231205	4775	5218	2025	8156	36	45	ADEAD
00043	HDG	TPY	4505	230553	402	813	230450	3731	1476	2025	6707	70	40	CCFII
00154	NIO	TPY	7400	231024	151	822	230915	9942	7263	2025	2125	51	32	CFIFC

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00051	INJ	UBT	4535	230553	152	494	230500	5504	1476	6832	1397	46	23	AEFEA
00026	YWP	UBT	2850	230347	652	493	230310	1561	6010	6832	4718	39	23	AEFEA
00148	YWP	UBT	6890	231058	654	501	231025	1120	3456	6832	4718	46	38	AEFEA
00149	YWP	UBT	6890	231106	655	502	231030	2750	7263	6832	4718	48	37	CCFII

4

00362	FHI	UNK	6220	231006	903	760	230920	1120	5445	1972	8327	32	20	GIFIG
00101	FHI	UNK	6220	230922	901	758	230900	3749	7263	1972	8327	45	16	50505

2

00034	XYR	VLH	2990	230338	201	722	230315	9742	5237	1260	8444	55	24	50505
00092	XYR	VLH	5635	230631	202	724	230610	3973	7820	1260	8444	44	17	28082
00198	XYR	VLH	6750	231202	204	725	231125	9518	2645	1260	8444	37	23	50505
00284	XYR	VLH	6750	231705	206	728	231550	6350	3456	1260	8444	51	37	68486

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00187	EDI	VLX	5960	231312	002	705	231225	1561	3456	6373	3061	72	29	FFBGG
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00306	FMT	VXI	4165	231712	701	753	231600	3731	2664	6940	2620	75	14	CCFII
00049	FZX	VXI	2860	230408	952	735	230325	2110	7263	6940	0172	51	28	EGBGE
00050	FZX	VXI	2860	230431	953	735	230325	2110	7263	6940	0172	36	28	EGBGE
00263	FZX	VXI	6860	231454	957	748	231420	8140	5237	6940	0172	50	38	DCGCD

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00291	CUN	WNN	7290	231704	351	551	231600	2750	5445	5680	2396	64	10	FFBGG
00006	IZW	WNN	3490	230154	851	518	230110	2172	4803	5743	0334	52	26	EIDEI
00077	IZW	WNN	7290	230721	854	526	230540	8943	7263	5833	3917	99	20	DDHAA
00256	IZW	WNN	7290	231419	857	537	231335	9942	1476	5833	3917	69	25	FFBGG
00257	XTG	WNN	7290	231537	552	540	231400	3731	7803	5833	8156	83	24	DDHAA
00289	XTG	WNN	5455	231742	554	553	231630	2110	3456	5833	8156	80	18	FFBGG
00037	ZCA	WNN	3480	230508	951	273	230420	9329	2239	4717	1081	39	09	BFMBF
00112	ZCA	WNN	7280	230856	954	279	230800	1101	8423	4717	1081	40	09	HBJBH
00258	ZCA	WNN	7280	231427	957	291	231345	5161	1871	4717	1081	43	26	HBJBH
00298	ZCA	WNN	7280	231719	959	297	231605	9942	7263	4717	1081	78	18	HBJBH

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00146	CUN	XTG	4095	231031	752	653	230940	0121	3456	3565	0172	44	26	FFBGG
00009	IZW	XTG	3990	230058	651	628	230005	9518	8423	7543	9083	71	35	DDHAA
00047	IZW	XTG	3990	230503	653	638	230415	9329	5445	5653	7300	64	48	DDHAA
00158	IZW	XTG	7990	231104	656	649	230900	8943	1476	0946	0956	87	32	DDHAA
00076	OAL	XTG	7990	230714	504	643	230600	2110	9054	3565	5320	61	27	DDHAA
00307	OAL	XTG	7990	231626	509	673	231510	8943	4257	5653	9038	62	33	FFBGG
00265	WNN	XTG	7990	231506	402	665	231325	6530	2664	5653	3395	61	29	FFBGG

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00104	FHI	XYR	6070	230903	551	646	230815	6350	2664	8641	8327	42	23	DJDJD
00316	FHI	XYR	2310	231856	553	660	231810	8943	8820	8641	8327	46	25	DJDJD
00044	IXI	XYR	5615	230508	251	638	230425	9329	2645	8641	2611	47	24	68486
00285	IXI	XYR	6070	231612	253	656	231535	0120	1871	8641	2611	55	23	28082
00350	IXI	XYR	2310	232331	255	663	232240	5504	8820	8641	2611	51	43	68486
00261	MKP	XYR	6070	231456	802	653	231410	3731	7263	8641	5762	46	25	DJDJD
00317	OWN	XYR	5615	231813	102	658	231700	9942	5445	8641	3872	66	43	JAAAJ
00005	SFV	XYR	2310	230054	351	631	230005	8140	7487	8641	5320	66	30	EGBEG
00014	SFV	XYR	2310	230243	354	636	230200	9518	2239	8641	5320	49	44	EGBEG
00115	SFV	XYR	6070	230812	359	644	230725	2110	4257	8641	5320	43	28	DJDJD
00156	VLH	XYR	6070	231147	601	649	231110	3749	4094	8641	7157	43	43	68486

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00336 VLH XYR 2310 232106 604 662 232020 6530 1476 8641 7157 33 23 JAAAJ
 12
 00332 YRG XYS 2315 232024 505 420 231945 2110 5445 4357 1180 59 09 DDHAA
 00356 NVU XZJ 3255 232306 113 410 232220 9329 2645 2683 1676 63 27 DDHAA
 00321 VLX YEC 3875 231925 210 151 231815 9518 8423 0027 3061 91 25 DDHAA
 00328 YRG YEC 3875 231938 303 153 231850 4775 4094 2511 9939 52 35 FFBGG
 2
 00048 EOU YWP 3490 230507 802 522 230425 8140 0665 5833 1793 51 22 AEFEA
 00296 EOU YWP 7290 231516 804 531 231145 6350 9054 5833 1793 85 10 AEFEA
 00273 FSD YWP 5455 231631 002 550 231540 5161 5218 5833 4718 36 27 JHHJH
 00181 INJ YWP 7290 231303 901 534 231220 9518 6442 5833 1397 38 20 DFJDF
 00292 INJ YWP 5455 231754 907 531 231145 5504 8820 5833 1397 90 10 AEFEA
 00295 INJ YWP 7290 231719 903 552 231610 0121 7263 5833 1397 73 10 AEFEA
 00090 UBT YWP 5455 230618 101 525 230530 3749 4606 5833 9803 57 19 GDAGD
 00204 UBT YWP 7290 231319 102 531 231145 8943 2664 5833 9803 07 10 AEFEA
 00294 UBT YWP 7290 231604 103 547 231520 0120 3698 5833 9803 44 13 AEFEA
 9
 00186 ALL ZCA 4405 231326 001 035 231210 3749 1663 2610 1081 43 02 JIIFI
 00190 MRS ZCA 7120 231217 104 029 231020 6350 9054 2610 0091 91 25 HBJBH
 00224 MRS ZCA 7120 231451 105 041 231415 9329 3644 2610 0091 38 18 EDIED
 00293 MRS ZCA 4405 231744 107 064 231700 5161 4094 9523 2594 44 21 EDIED
 00340 MRS ZCA 3160 232006 110 070 231915 8140 4257 2610 0091 55 17 HBJBH
 00191 MXU ZCA 7120 231352 305 029 231020 6530 8820 2610 2558 85 25 HBJBH
 00323 MXU ZCA 3160 231904 306 061 231635 2110 7803 2610 2558 63 03 HBJBH
 00341 MXU ZCA 3160 232019 308 069 231905 3731 0611 2610 2558 62 25 HBJBH
 00342 MXU ZCA 3160 232158 311 073 232110 9942 5445 2610 2558 35 08 HBJBH
 00236 WNN ZCA 7120 231448 204 029 231020 6350 2664 2610 8408 87 25 HBJBH
 00281 WNN ZCA 7120 231622 205 055 231540 9518 1871 2610 8408 63 03 HBJBH
 00322 WNN ZCA 3160 231910 207 067 231830 2750 5445 2610 8408 42 23 HBJBH
 12
 00355 FBG ZHK 2420 232224 153 035 232040 1120 1476 4212 3313 36 01 FFBGG
 00371 FBG ZHK 2420 231902 152 028 231745 2750 4257 4212 3313 57 01 FFBGG
 00375 FBG ZHK 2420 232309 154 038 232225 3731 7263 1774 2549 36 22 FFBGG
 00354 NIO ZHK 2420 232247 356 036 232135 2110 9054 9208 4637 45 24 FFBGG
 00275 NIO ZHK 2420 231712 355 025 231605 6350 5445 4212 8912 48 24 FFBGG
 00172 POH ZHK 6660 231103 305 016 231015 9942 7263 1774 4754 41 22 FFBGG
 00173 POH ZHK 6660 231158 306 019 231100 0121 2645 4212 5942 68 23 DDHAA
 00234 POH ZHK 6660 231519 307 023 231430 8943 7803 4212 5942 59 37 FFBGG
 00235 POH ZHK 6660 231536 308 023 231430 8943 7803 4212 5942 53 26 FFBGG
 00339 POH ZHK 2420 232113 310 032 231950 5504 2664 4212 5942 70 33 DDHAA
 10
 00196 EDH ZIC 6620 231219 903 778 230940 2750 4257 1918 5267 85 42 DAHAD
 00343 EDH ZIC 2460 232106 905 808 231920 0121 9054 1918 5267 67 50 DAHAD
 00136 EJJ ZIC 5265 231156 002 787 231115 8140 7487 1918 5726 39 52 JFFJF
 00365 FSD ZIC 6620 231537 704 778 230940 1120 5445 1918 7238 85 42 DAHAD
 00145 FSQ ZIC 6620 231052 703 782 231005 3749 2239 1918 7238 35 30 HDBHD
 00238 FSD ZIC 6620 231558 706 797 231510 4775 1871 1963 8741 37 28 DAHAD
 00337 HCO ZIC 2460 232348 810 811 232235 5504 1476 1918 8219 43 30 DAHAD
 00225 HCO ZIC 6620 231438 806 794 231350 1101 3698 1963 3791 39 27 FBHFB

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00237	HCO	ZIC	6620	231426	803	778	230940	9942	2664	1918	8219	90	42	DAEAD
00324	HCO	ZIC	5265	231822	807	804	231715	9329	8423	1918	8219	68	28	DAEAD
			10											
00042	DYO	ZZZ	2030	230409	401	130	230315	4775	8423	4258	3917	00	16	I IHFF
00061	DYO	ZZZ	6350	230704	406	151	230640	6320	5433	3637	1577	77	21	ABCAB
00228	DYO	ZZZ	6350	231412	409	202	231320	5161	9054	6445	7300	90	29	I IHFF
00274	DYO	ZZZ	6350	231629	413	219	231535	9942	8820	6445	7300	58	16	I IHFF
00368	LLZ	ZZZ	6350	231746	111	233	231710	9518	0665	9000	4178	77	15	HAIHA
00007	LLZ	ZZZ	2030	230116	101	121	230040	3973	4094	4258	5942	63	23	I IHFF
00062	LLZ	ZZZ	5955	230619	104	143	230545	2172	6010	6445	4493	65	24	I IHFF
00134	LLZ	ZZZ	6350	231034	106	181	231000	8121	2645	4104	4754	66	33	HAIHA
00227	LLZ	ZZZ	6350	231451	108	208	231415	0732	3644	4258	5942	67	17	I IHFF
00345	LLZ	ZZZ	2030	232118	113	49	232030	0120	8423	4258	5942	85	15	I IHFF
00040	MLH	ZZZ	5955	230557	301	138	230500	1101	7487	3637	1117	76	20	FEAFE
00099	MLH	ZZZ	6350	230822	304	154	230710	9942	7803	4258	4259	97	32	I IHFF
00139	MLH	ZZZ	6350	231051	307	177	230945	8140	8820	4258	4259	91	26	I IHFF
00140	MLH	ZZZ	6350	231118	308	177	230945	8140	8820	4258	4259	90	32	I IHFF
00141	MLH	ZZZ	6350	231136	309	177	230945	8140	8820	4258	4259	92	19	I IHFF
00248	MLH	ZZZ	6350	231528	313	211	231450	3973	1871	8236	4033	80	32	FEAFE
00249	MLH	ZZZ	6350	231541	314	211	231450	3973	1871	8236	4033	52	11	FEAFE
00022	ZZZ	ZZZ	5955	230326	001	126	230200	2750	2664	4258	7094	87	18	I IHFF
00023	ZZZ	ZZZ	5955	230358	002	126	230200	2750	2664	4258	7094	85	10	I IHFF
00041	ZZZ	ZZZ	5955	230431	003	126	230200	2750	2664	4258	7094	83	21	I IHFF
00095	ZZZ	ZZZ	5955	230903	005	165	230830	9742	7837	4258	7094	80	14	JEEJE
00096	ZZZ	ZZZ	5955	230917	006	165	230830	9742	7837	4258	7094	70	13	JEEJE
00097	ZZZ	ZZZ	5955	230931	007	165	230830	9742	7837	4258	7094	80	30	JEEJE
00098	ZZZ	ZZZ	5955	230941	008	165	230830	9742	7837	4258	7094	42	20	JEEJE

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00372	DYO	MLH	2020	231921	352	652	231705	6530	0611	7525	3917	76	16	IIHFF
00346	DYO	MLH	2020	232037	355	655	231830	3731	9054	9109	7300	56	22	IIHFF
00020	ZZZ	MLH	2020	230347	702	590	230315	3973	7487	7525	7094	90	28	FEAFE
00059	ZZZ	MLH	2020	230551	703	594	230430	4775	2239	7525	7094	63	30	IIHFF
00019	RHW	NVT	2020	230242	102	587	230205	4775	2645	7525	1001	36	38	AJAAJ

5

00042	DYO	ZZZ	2030	230409	401	130	230315	4775	8423	4258	3917	00	16	IIHFF
00007	LLZ	ZZZ	2030	230116	101	121	230040	3973	4094	4258	5942	63	23	IIHFF
00345	LLZ	ZZZ	2030	232118	113	249	232030	0120	8423	4258	5942	85	15	IIHFF

3

00326	MLH	DYO	2100	231936	454	858	231700	6530	5445	5815	4259	55	34	IIHFF
00327	ZZZ	DYO	2100	231910	511	857	231625	3731	4257	9749	6644	76	40	IIHFF
00032	WNN	IZW	2100	230252	302	810	230130	0121	8820	5815	4718	94	22	DDHAA

3

00015	ZIC	EDH	2210	230212	153	480	230125	4775	1663	6977	5726	44	37	BGIBG
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00373	NIO	EOU	2220	232010	452	243	231935	6350	3456	7101	2125	53	24	DCGCD
00344	NIO	EOU	2220	232148	453	245	232105	2750	2664	7101	2125	37	28	CCFII
00012	YWP	EOU	2220	230313	552	221	230240	3749	0420	7101	4718	37	28	CBECB
00057	YWP	EOU	2220	230528	554	224	230435	1101	7046	7101	4718	58	39	AEFEA

4

00315	BWO	NIO	2240	231845	956	481	231730	2750	4257	4140	8156	31	33	CFIFC
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00338	FBG	NIO	2250	232106	805	203	231910	1561	8423	2124	3313	60	49	FFBGG
00352	FBG	NIO	2250	232209	807	205	232035	9942	7803	2124	3313	80	01	FFBGG
00337	POH	NIO	2250	232013	109	202	231840	0121	2664	2124	5942	65	01	FFBGG

3

00316	FHI	XYR	2310	231856	553	660	231810	8943	8820	8641	8327	46	25	DJDJD
00350	IXI	XYR	2310	232331	255	663	232240	5504	8820	8641	2611	51	43	68486
00005	SFV	XYR	2310	230054	351	631	230005	8140	7487	8641	5320	66	30	EGBEG
00014	SFV	XYR	2310	230243	354	636	230200	9518	2239	8641	5320	49	44	EGBEG
00336	VLH	XYR	2310	232106	604	662	232020	6530	1476	8641	7157	33	23	JAAAJ

5

00332	YRG	XYS	2315	232024	505	420	231945	2110	5445	4357	1180	59	09	DDHAA
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00004	ZIC	HCO	2350	230104	053	718	230020	1561	2239	8740	5726	45	07	FBHFB
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00013	ZIC	FSD	2400	230354	251	647	230310	8140	7487	1161	5726	46	25	HDBHD
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00355	FBG	ZHK	2420	232224	153	035	232040	1120	1476	4212	3313	36	01	FFBGG
00371	FBG	ZHK	2420	231902	152	028	231745	2750	4257	4212	3313	57	01	FFBGG
00375	FBG	ZHK	2420	232309	154	038	232225	3731	7263	1774	2549	36	22	FFBGG
00354	NIO	ZHK	2420	232247	356	036	232135	2110	9054	9208	4637	45	24	FFBGG
00275	NIO	ZHK	2420	231712	355	025	231605	6350	5445	4212	8912	48	24	FFBGG
00339	POH	ZHK	2420	232113	310	032	231950	5504	2664	4212	5942	70	33	DDHAA

6

00054	NVT	RBU	2460	230437	654	767	230320	0121	7263	1080	2198	71	38	DDHAA
00343	EDH	ZIC	2460	232106	905	808	231920	0121	9054	1918	5267	67	50	DAEAD
00357	HCO	ZIC	2460	232348	810	811	232235	5504	1476	1918	8219	43	30	DAEAD

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00370	NVU	HWV	2515	232347	417	282	232250	4775	6010	7994	3278	70	45	DDHAA
00003	FZX	GFH	2620	230103	551	167	230025	1101	4606	4997	0172	44	11	CIBCI
00055	FZX	GFH	2620	230406	554	169	230310	5504	4257	4997	0172	50	25	EGBGE
00056	FZX	GFH	2620	230424	555	169	230310	5504	4257	4997	0172	56	25	EGBGE
				3										
00016	PVK	AAA	2685	230317	602	215	230235	9969	7046	9262	3061	48	08	IIMFF
00374	EDH	MXU	2700	232312	052	660	232200	5504	5445	6616	5267	55	18	CCFII
00331	WNN	MXU	2700	232026	352	658	231935	6350	3456	6616	8408	58	21	DCGCD
00360	ZCA	MXU	2700	230310	653	629	230215	1561	1663	6616	1081	43	13	GEBGE
				3										
00033	MKP	HZY	2750	230248	701	765	230135	9942	8820	8623	5762	61	12	95459
00026	YWP	UBT	2850	230347	652	493	230310	1561	6010	6832	4718	39	23	AEFEA
00049	FZX	VXI	2860	230408	952	735	230325	2110	7263	6940	0172	51	28	EGBGE
00050	FZX	VXI	2860	230431	953	735	230325	2110	7263	6940	0172	36	28	EGBGE
				2										
00353	NIO	FBG	2910	232352	055	511	232300	5504	7803	7435	8912	35	25	FFBGG
00052	POH	FBG	2910	230408	204	468	230320	3749	4257	7165	4493	56	20	FFBGG
00320	POH	FBG	2910	231956	211	508	231840	3731	2664	7165	4493	47	26	FFBGG
				3										
00010	MKP	PSD	2960	230053	551	848	230010	5504	1476	6607	5762	61	07	ECHCE
00011	MKP	PSD	2960	230114	552	848	230010	5504	1476	6607	5762	75	16	ECHCE
				2										
00034	XYR	VLH	2990	230338	201	722	230315	9742	5237	1260	8444	55	24	50505
00347	GFI	LAN	3095	232256	606	527	232210	1101	1871	5644	1324	37	25	DDHAA
00053	OAL	RHW	3160	230407	202	024	230335	4152	5218	2610	5320	61	21	DDHAA
00340	MRS	ZCA	3160	232006	110	070	231915	8140	4257	2610	0091	55	17	HBJBH
00323	MXU	ZCA	3160	231904	306	061	231635	2110	7803	2610	2558	63	03	HBJBH
00341	MXU	ZCA	3160	232019	308	069	231905	3731	0611	2610	2558	62	25	HBJBH
00342	MXU	ZCA	3160	232158	311	073	232110	9942	5445	2610	2558	35	08	HBJBH
00322	WNN	ZCA	3160	231910	207	067	231830	2750	5445	2610	8408	42	23	HBJBH
				6										
00058	XYR	IXI	3170	230449	101	802	230420	5161	2645	0586	8444	37	30	68486
00312	BWO	HOG	3200	231930	850	342	231805	2110	2664	9145	8156	79	33	DCGCD
00356	NVU	XZJ	3255	232306	113	410	232220	9329	2045	2683	1676	63	27	DDHAA
00027	YWP	INJ	3330	230249	751	811	230215	9329	2645	1864	4718	64	09	AEFEA
00028	YWP	INJ	3330	230331	752	812	230240	1120	7263	1864	4718	40	04	AEFEA
				2										
00008	BWO	TPY	3360	230157	701	811	230120	8943	0611	2025	8156	32	27	CFIFC
00314	GKW	MKP	3440	231947	206	626	231830	2750	9054	6625	9399	96	32	50505

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00335 HZY MKP 3440 232057 506 626 231830 1120 7263 6625 6473 70 14 ECHCE
 2

00037 ZCA WNN 3480 230508 951 273 230420 9329 2239 4717 1081 39 09 BFHBF

00006 IZW WNN 3490 230154 851 518 230110 2172 4803 5743 0334 52 26 EIDEI
 00048 EOU YWP 3490 230507 802 522 230425 8140 0665 5833 1793 51 22 AEFEA
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00017 ZZZ LLZ 3520 230236 601 612 230140 9329 5074 8146 7094 80 17 HAIHA
 00018 ZZZ LLZ 3520 230259 602 612 230140 9329 5074 8146 7094 60 28 HAIHA
 00060 ZZZ LLZ 3520 230542 606 617 230355 3731 9054 8146 7094 00 39 IHHF
 00031 FBG POH 3520 230305 851 614 230215 1101 7820 8146 3313 63 26 FFBGG
 00398 NIO POH 3520 232021 759 664 231900 6530 0611 8146 8912 53 31 FFBGG
 00030 NIO POH 3520 230321 751 608 230105 2750 7263 8146 8912 77 01 FFBGG
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00025 UNK FHI 3670 230208 451 608 230115 9942 3456 6869 7904 60 29 80808

00035 FMT FZX 3760 230513 501 191 230420 9518 7487 7741 2620 44 18 GHEGH
 00334 FMT FZX 3760 232114 507 230 232000 5504 4257 7741 2620 63 32 EGBGE
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00321 VLX YEC 3875 231925 210 151 231815 9518 8423 0027 3061 91 25 DDHAA
 00328 YRG YEC 3875 231938 303 153 231850 4775 4094 2511 9939 52 35 FFBGG
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00039 NVT OAL 3910 230456 052 390 230410 5161 7487 4555 3485 37 23 CJCCJ
 00309 RBU OAL 3910 231916 153 442 231825 9329 4257 5158 6824 50 14 FFBGG
 00349 FHI SFV 3910 231007 656 401 230730 5504 9054 5086 8327 69 14 DCGCD
 00029 MKP SFV 3910 230356 403 388 230300 0120 1871 5086 5762 48 16 DJDJD
 00333 XYR SFV 3910 232023 810 445 231910 9942 3456 5086 8444 55 34 DCGCD
 00348 XYR SFV 3910 230936 805 401 230730 6530 7803 5086 8444 69 17 DCGCD
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00351 NIO BWO 3990 232249 310 680 232130 3731 3456 3565 2125 50 19 DCGCD
 00024 TPY BWO 3990 230337 203 632 230210 5504 1476 3565 9713 59 30 CFIFC
 00318 TPY BWO 3990 231922 208 679 231830 9942 7263 3565 9713 59 22 CFIFC
 00009 IZW XTG 3990 230058 651 628 230005 9518 8423 7543 9083 71 35 DDHAA
 00047 IZW XTG 3990 230503 653 638 230415 9329 5445 5653 7300 64 48 DDHAA
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00221 GXW BWO 4095 231448 001 668 231400 4775 3058 3565 8156 39 17 JCCJC
 00038 NIO BWO 4095 230536 301 640 230455 1561 6442 3565 2125 67 12 CEHCE
 00146 CUN XTG 4095 231031 752 653 230940 0121 3456 3565 0172 44 26 FFBGG
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00359 FHI FBP 4105 231820 506 840 231735 6530 4257 4122 8327 83 20 80808

00306 FMT VXI 4165 231712 701 753 231600 3731 2664 6940 2620 75 14 CCFII

00091 XYR OWN 4235 230620 951 681 230605 7932 8423 5095 8444 68 31 JAAAJ

00036 IZW CUN 4265 230557 952 195 230515 1101 5074 2241 9083 58 38 AGHAG
 00286 XTG CUN 4265 231754 452 228 231650 8140 2664 7741 8156 71 41 FFBGG
 00361 LYD FZX 4265 230751 001 199 230700 3749 0420 7741 0172 48 12 JAAJA
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00186 ALL ZCA 4405 231326 001 035 231210 3749 1663 2610 1081 43 02 JIJI
 00293 MRS ZCA 4405 231744 107 064 231700 5161 4094 9523 2594 44 21 EDIED
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00043 HDG TPY 4505 230553 402 813 230450 3731 1476 2025 6707 70 40 CCFII
 00051 INJ UBT 4535 230553 152 494 230500 5504 1476 6832 1397 46 23 AEFEA
 00093 UBT EOU 4565 230609 952 225 230435 2110 8820 7101 9803 31 23 CCFII

00310 XTG OAL 4795 231834 608 439 231745 8140 2664 5158 3557 56 08 FFBGG
 00215 MKP SFV 4795 231207 410 401 230730 8943 3456 5086 5762 92 33 DJDJD
 00067 XYR SFV 4795 230613 801 394 230525 3749 2645 5086 8444 49 31 DCGCD
 00222 YFT SFV 4795 231448 001 425 231400 5161 2239 5086 5320 34 33 JDDJD
 4

00078 ZCA MRS 4845 230623 753 825 230540 4775 3644 8669 1081 43 38 HBJBH
 00075 BWO NIO 4885 230630 953 465 230525 9942 2664 4140 8156 46 48 CFIFC
 00369 FBG NIO 4895 231913 804 201 231825 2750 9054 2124 3313 98 01 DDHAA
 00277 ZHK NIO 4895 231808 258 200 231725 6530 0611 2124 3151 73 01 DDHAA
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00071 GKW MKP 4925 230634 201 588 230515 8943 7263 6625 9399 75 28 95459
 00313 PSD MKP 4925 231916 302 626 231830 9942 0611 6625 1243 86 24 95459
 2

00329 DYO LLZ 4965 231814 551 659 231715 5161 3644 8146 3917 72 31 IHHF
 00082 NIO POH 4965 230628 754 619 230440 8943 5445 8146 8912 63 31 FFBGG
 00079 VPO POH 4965 230613 002 621 230530 5504 4257 8146 5942 86 33 DDHAA
 00080 VPO POH 4965 230644 003 621 230530 5504 4257 8146 5942 84 33 DDHAA
 00081 VPO POH 4965 230715 004 621 230530 5504 4257 8146 5942 82 33 DDHAA
 5

00073 BWO HDG 5045 230618 853 321 230520 5504 1476 9145 8156 40 21 CFIFC
 00311 BWO HDG 5045 231802 858 340 231645 2750 3456 9145 8156 61 43 CFIFC
 2

00136 EJJ ZIC 5265 231156 002 787 231115 8140 7487 1918 5726 39 52 JFFJF
 00324 HCO ZIC 5265 231822 807 804 231715 9329 8423 1918 8219 68 28 DAED
 2

00325 FMT GFH 5285 231829 652 191 231750 3731 5445 4997 2620 46 16 DCGCD
 00094 VXI GFH 5285 230612 051 172 230535 8943 7803 4997 3070 65 20 CCFII
 2

00069 TOJ FHI 5335 230712 651 612 230600 2110 0611 6869 5609 83 23 80808

00001 NCM IZW 5385 230136 001 809 230100 1101 3644 5815 3917 80 12 JGGJG
 00002 NCM IZW 5385 230157 002 809 230100 1101 3644 5815 3917 80 24 JGGJG
 00021 NCM IZW 5385 230212 003 809 230100 1101 3644 5815 3917 34 22 JGGJG
 00130 NCM IZW 5385 230908 005 828 230800 9942 5445 5815 3917 86 09 DDHAA
 00131 NCM IZW 5385 230939 006 828 230800 9942 5445 5815 3917 84 09 DDHAA
 00165 NCM IZW 5385 231004 007 828 230800 9942 5445 5815 3917 80 09 DDHAA
 00088 WNN IZW 5385 230623 305 816 230515 8943 7803 5815 4718 69 16 DDHAA
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00289 XTG WNN 5455 231742 554 553 231630 2110 3456 5833 8156 80 18 FFBGG
 00273 FSD YWP 5455 231631 002 550 231540 5161 5218 5833 4718 36 27 JHHJH
 00292 INJ YWP 5455 231754 907 531 231145 5504 8820 5833 1397 90 10 AEFEA
 00090 UBT YWP 5455 230618 101 525 230530 3749 4606 5833 9803 57 19 GDAGD

4

00044 IXI XYR 5615 230508 251 638 230425 9329 2645 8641 2611 47 24 68486
 00317 OWN XYR 5615 231813 102 658 231700 9942 5445 8641 3872 66 43 JAAAJ

2

00092 XYR VLH 5635 230631 202 724 230610 3973 7820 1260 8444 44 17 28082

00046 HCO FSD 5805 230549 351 650 230500 2110 7803 1161 8219 34 05 DAEAD

00143 AAA AAA 5820 231018 003 251 230940 0120 0420 9262 7319 49 19 IHHFF

00045 ZIC HCO 5895 230553 054 720 230435 0121 3456 8740 5726 61 03 DAEAD

00083 OAL NVT 5945 230623 604 602 230500 1561 6010 2962 7896 55 43 CJCCJ

00194 WPX NVT 5945 231351 003 644 231310 9969 4606 7525 4259 35 36 JBBJB

00195 WPX NVT 5945 231208 001 635 231130 5161 7487 7525 4259 51 37 JBBJB

00330 WPX NVT 5945 231902 004 654 231815 3749 5218 7525 4259 58 20 JBBJB

4

00319 RTJ NVU 5950 231802 809 564 231705 5161 6010 3222 1603 87 25 FFBGG

00062 LLZ ZZZ 5955 230619 104 143 230545 2172 6010 6445 4493 65 24 IHHFF

00040 MLH ZZZ 5955 230557 301 138 230500 1101 7487 3637 1117 76 20 FEAFE

00022 ZZZ ZZZ 5955 230326 001 126 230200 2750 2664 4258 7094 87 18 IHHFF

00023 ZZZ ZZZ 5955 230358 002 126 230200 2750 2664 4258 7094 85 10 IHHFF

00041 ZZZ ZZZ 5955 230431 003 126 230200 2750 2664 4258 7094 83 21 IHHFF

00095 ZZZ ZZZ 5955 230903 005 165 230830 9742 7837 4258 7094 80 14 JEEJE

00096 ZZZ ZZZ 5955 230917 006 165 230830 9742 7837 4258 7094 70 13 JEEJE

00097 ZZZ ZZZ 5955 230931 007 165 230830 9742 7837 4258 7094 80 30 JEEJE

00098 ZZZ ZZZ 5955 230941 008 165 230830 9742 7837 4258 7094 42 20 JEEJE

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00187 EDI VLX 5960 231312 002 705 231225 1561 3456 6373 3061 72 29 FFBGG

00167 CUO PVK 6005 231109 202 698 231035 9518 7820 6373 7742 40 21 IHHFF

00119 EDH HCO 6030 230822 402 723 230730 9518 8423 8740 5267 51 05 DAEAD

00200 ZIC HCO 6030 231219 057 730 231145 2750 1476 8740 5726 27 08 DAEAD

2

00104 FHI XYR 6070 230903 551 646 230815 6350 2664 8641 8327 42 23 DJDJD

00285 IXI XYR 6070 231612 253 656 231535 0120 1871 8641 2611 55 23 28082

00261 MKP XYR 6070 231456 802 653 231410 3731 7263 8641 5762 46 25 DJDJD

00115 SFV XYR 6070 230812 359 644 230725 2110 4257 8641 5320 43 28 DJDJD

00156 VLH XYR 6070 231147 601 649 231110 3749 4094 8641 7157 43 43 68486

5

00179 MKP GKW 6100 231142 351 824 231110 4775 7046 9893 5762 33 32 ECHCE

00243 MKP GKW 6100 231420 353 826 231245 3731 2664 9893 5762 76 24 50505

2

00251 EOU NIO 6120 231525 852 474 231410 6350 7263 4140 1793 72 46 DCGCD

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00168	POH	NIO	6130	231152	104	169	231045	9969	8423	2124	5942	84	01	DDHAA
00169	POH	NIO	6130	231437	106	186	231350	6350	3456	2124	5942	79	49	DDHAA
00217	POH	NIO	6130	231527	108	191	231450	8943	4257	6427	4493	80	42	DDHAA
00185	ZHK	NIO	6130	231214	252	170	231100	8943	8820	2124	3151	79	01	DDHAA
00233	ZHK	NIO	6130	231704	256	196	231625	0121	2664	2124	3151	74	01	DDHAA

5

00177	YWP	EOU	6140	231146	555	236	231100	6530	9054	7101	4718	44	29	CCFII
00241	YWP	EOU	6140	231437	556	239	231350	3731	5445	7101	4718	32	26	DCGCD

2

00113	FSD	EDH	6170	230939	452	487	230900	0121	3456	6977	7238	28	41	DAEAD
00299	MXU	EDH	6170	231603	552	503	231515	5504	7803	6977	2558	44	20	DCGCD
00126	ZIC	EDH	6170	230809	155	485	230730	1561	3698	6977	5726	34	43	BGIBG
00208	ZIC	EDH	6170	231323	159	492	231145	6530	1476	6977	5726	79	35	DAEAD
00209	ZIC	EDH	6170	231348	160	492	231145	6530	1476	6977	5726	74	35	DAEAD

5

00362	FHI	UNK	6220	231006	903	760	230920	1120	5445	1972	8327	32	20	GIFIG
00101	FHI	UNK	6220	230922	901	758	230900	3749	7263	1972	8327	45	16	50505

2

00266	LLZ	DYO	6260	231541	653	855	231450	8140	2645	9749	4493	91	41	I IHFF
00218	MLH	DYO	6260	231358	452	850	231315	0732	5218	5815	4259	74	29	I IHFF
00302	MLH	DYO	6260	231612	453	854	231430	2750	3456	9749	2198	64	35	I IHFF
00125	ZZZ	DYO	6260	230929	503	832	230900	9192	4803	9541	3755	45	46	ABCAB
00135	ZZZ	DYO	6260	231156	504	840	231105	4775	8820	9749	6644	53	22	I IHFF
00267	ZZZ	DYO	6260	231511	508	849	231300	9942	7263	9640	8110	86	32	I IHFF
00268	ZZZ	DYO	6260	231404	507	847	231235	0121	1476	9541	3755	76	27	I IHFF
00303	ZZZ	DYO	6260	231602	510	853	231420	6530	2664	5815	7094	74	29	I IHFF
00363	CUN	IZW	6260	231124	204	837	231010	3731	1476	5815	0172	59	24	DDHAA
00132	CUN	IZW	6260	230903	201	824	230640	6350	3456	9749	2396	81	24	DDHAA
00184	CUN	IZW	6260	231318	207	844	231140	2110	9054	9640	1360	70	31	DDHAA
00166	WNN	IZW	6260	231008	308	829	230820	2750	7263	9640	5230	83	11	DDHAA
00247	XTG	IZW	6260	231433	101	852	231400	3749	3698	5815	8156	27	29	GBIGB

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00063	LLZ	MLH	6340	230718	251	616	230545	2110	7263	7525	5942	58	24	I IHFF
00367	ZZZ	MLH	6340	231441	711	646	231330	9942	1476	9109	6644	92	27	I IHFF
00064	ZZZ	MLH	6340	230659	704	611	230525	8140	3644	4447	0127	96	31	I IHFF
00137	ZZZ	MLH	6340	231008	705	627	230830	8943	4257	4339	8110	70	24	I IHFF
00138	ZZZ	MLH	6340	231023	706	627	230830	8943	4257	4339	8110	56	24	I IHFF
00219	ZZZ	MLH	6340	231354	709	640	231230	5504	3456	7525	7094	53	20	I IHFF
00220	ZZZ	MLH	6340	231337	707	638	231215	1120	5445	7895	9119	84	37	I IHFF
00270	ZZZ	MLH	6340	231539	720	646	231330	9942	1476	9109	6644	95	40	I IHFF
00271	ZZZ	MLH	6340	231426	710	643	231305	2750	4257	9109	6644	80	33	I IHFF
00304	ZZZ	MLH	6340	231612	721	646	231330	9942	1476	9109	6644	99	20	I IHFF
00084	OAL	NVT	6340	230648	605	619	230600	1120	4257	7525	5320	87	36	FFBGG
00085	OAL	NVT	6340	230709	608	624	230640	6960	3058	7525	5320	80	37	CJCCJ
00086	OAL	NVT	6340	230714	609	624	230640	6960	3058	7525	5320	36	34	CJCCJ
00127	RBU	NVT	6340	230822	504	619	230600	3731	9054	7525	5726	87	28	FFBGG
00290	RBU	NVT	6340	231602	507	650	231520	9329	4094	7525	5726	43	29	DCGDC
00128	RHW	NVT	6340	230914	104	619	230600	2750	2664	7525	1081	84	32	DDHAA
00129	RHW	NVT	6340	230949	105	619	230600	2750	2664	7525	1081	83	32	DDHAA
00142	RHW	NVT	6340	231046	109	632	231010	9518	5237	7525	1081	35	21	AJAAJ

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00061	DYO	ZZZ	6350	230704	406	151	230640	6320	5433	3637	1577	77	21	ABCB
00228	DYO	ZZZ	6350	231412	409	202	231320	5161	9054	6445	7300	90	29	IHHF
00274	DYO	ZZZ	6350	231629	413	219	231535	9942	8820	6445	7300	58	16	IHHF
00368	LLZ	ZZZ	6350	231746	111	233	231710	9518	0665	9000	4178	77	15	HAIHA
00134	LLZ	ZZZ	6350	231034	106	181	231000	8121	2645	4104	4754	66	33	HAIHA
00227	LLZ	ZZZ	6350	231451	108	208	231415	0732	3644	4258	5942	67	17	IHHF
00099	MLH	ZZZ	6350	230822	304	154	230710	9942	7803	4258	4259	97	32	IHHF
00139	MLH	ZZZ	6350	231051	307	177	230945	8140	8820	4258	4259	91	26	IHHF
00140	MLH	ZZZ	6350	231118	308	177	230945	8140	8820	4258	4259	90	32	IHHF
00141	MLH	ZZZ	6350	231136	309	177	230945	8140	8820	4258	4259	92	19	IHHF
00248	MLH	ZZZ	6350	231528	313	211	231450	3973	1871	8236	4033	80	32	FEAFE
00249	MLH	ZZZ	6350	231541	314	211	231450	3973	1871	8236	4033	52	11	FEAFE

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00301	CUO	MKR	6355	231733	604	562	231655	3731	0611	3222	7742	44	44	IHHF
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00207	MRS	MXU	6380	231257	151	639	231210	2110	7263	6616	0091	28	32	CCFII
00259	ZCA	MXU	6380	231506	657	642	231420	9969	8423	6616	1081	59	36	HBJBH
00260	ZCA	MXU	6380	231528	658	642	231420	9969	8423	6616	1081	42	36	HBJBH

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00037	CUO	AAA	6405	230806	753	243	230745	3749	1663	9262	7742	37	06	BEGBE
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00066	FHI	TOJ	6430	230730	751	910	230705	5161	3456	0162	8327	53	21	80808
00102	FHI	TOJ	6430	230915	752	912	230840	3731	9054	0162	8327	39	35	GIFIG

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00240	FZX	GFH	6460	231552	557	188	231520	6350	3456	4997	0172	70	15	CCFII
00176	INJ	GFH	6460	231157	402	180	231015	6530	0611	4997	1397	50	18	CCFII

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00183	NVT	RBU	6620	231328	656	790	231245	7753	5218	8858	3485	66	36	DCGDC
00297	NVT	RBU	6620	231623	659	800	231550	1523	4606	1080	2198	50	28	DCGDC
00175	OAL	RBU	6620	231004	852	775	230835	3731	7803	8858	7896	66	29	FFBGG
00197	RHW	RBU	6620	231221	452	786	231100	6530	2664	8858	0406	76	33	DDHAA
00196	EDH	ZIC	6620	231219	903	778	230940	2750	4257	1918	5267	85	42	DAEAD
00365	FSD	ZIC	6620	231537	704	778	230940	1120	5445	1918	7238	85	42	DAEAD
00145	FSD	ZIC	6620	231052	703	782	231005	3749	2239	1918	7238	35	30	HDBHD
00238	FSD	ZIC	6620	231558	706	797	231510	4775	1871	1963	8741	37	28	DAEAD
00225	HCO	ZIC	6620	231438	806	794	231350	1101	3698	1963	3791	39	27	FBHFB
00237	HCO	ZIC	6620	231426	803	778	230940	9942	2664	1918	8219	90	42	DAEAD

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00172	POH	ZHK	6660	231103	305	016	231015	9942	7263	1774	4754	41	22	FFBGG
00173	POH	ZHK	6660	231158	306	019	231100	0121	2645	4212	5942	68	23	DDHAA
00234	POH	ZHK	6660	231519	307	023	231430	8943	7803	4212	5942	59	37	FFBGG
00235	POH	ZHK	6660	231536	308	023	231430	8943	7803	4212	5942	53	26	FFBGG

4

00122	ZIC	FSD	6680	230930	254	655	230825	4775	0420	1161	5726	31	22	HDBHD
00157	ZIC	FSD	6680	231037	256	662	231000	4369	5218	1161	5726	35	27	DAEAD
00253	ZIC	FSD	6680	231550	259	668	231435	6530	2664	1161	5726	45	05	DAEAD

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00198	XYR	VLH	6750	231202	204	725	231125	9518	2645	1260	8444	37	23	50505
00284	XYR	VLH	6750	231705	206	728	231550	6350	3456	1260	8444	51	37	68486

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00089	MKP	PSD	6760	230708	555	851	230600	0121	4257	6607	5762	54	29	ECHCE
00279	NIO	FBG	6830	231618	054	494	231505	2110	1476	7435	8912	43	01	FFBGG
00364	POH	FBG	6830	231305	206	483	231130	9942	3456	7435	5942	57	22	FFBGG
00170	POH	FBG	6830	231458	207	490	231415	6350	0611	7435	5942	75	28	DDHAA
00171	POH	FBG	6830	231536	208	493	231445	1120	7820	7435	5942	97	18	DDHAA
00188	POH	FBG	6830	231748	209	503	231705	6530	5445	5121	2666	79	28	DDHAA
00189	ZHK	FBG	6830	231728	904	497	231635	2750	7263	7435	3151	93	01	DDHAA
00280	ZHK	FBG	6830	231702	903	495	231610	8943	8820	7435	3151	48	35	FFBGG
7														
00244	XYR	OWN	6850	231418	953	684	231345	8140	1871	5095	8444	42	24	JAAAJ
00283	XYR	OWN	6850	231613	956	687	231540	3749	6010	5095	8444	39	15	JAAAJ
2														
00263	FZX	VXI	6860	231454	957	748	231420	8140	5237	6940	0172	50	38	DCGCD
00148	YWP	UBT	6890	231058	654	501	231025	1120	3456	6832	4718	46	38	AEFEA
00149	YWP	UBT	6890	231106	655	502	231030	2750	7263	6832	4718	48	37	CCFII
2														
00155	MKP	MRS	6900	231037	502	832	230940	5504	3456	8669	5762	62	16	CCFII
00151	WNN	MRS	6900	231032	902	833	230945	9942	1476	8669	8408	33	30	HBJBH
00111	ZCA	MRS	6900	230927	755	829	230810	1120	2664	8669	1081	43	18	HBJBH
00150	ZCA	MRS	6900	231158	758	838	231100	3731	3456	8669	1081	37	36	HBJBH
4														
00206	BWO	HDG	7080	231312	857	332	231230	1561	5074	9145	8156	53	22	DHBDH
00118	NIO	HDG	7080	230917	701	328	230825	8943	7263	9145	2125	45	32	CCFII
2														
00192	NVT	RHW	7120	231219	555	030	231105	2750	1476	2610	4259	93	30	DDHAA
00193	NVT	RHW	7120	231237	556	030	231105	2750	1476	2610	4259	73	30	DDHAA
00223	NVT	RHW	7120	231543	558	052	231500	1561	2645	8371	3485	48	38	AJAAJ
00174	RBU	RHW	7120	231112	752	028	231000	8943	7263	2610	5726	82	37	DDHAA
00190	MRS	ZCA	7120	231217	104	029	231020	6350	9054	2610	0091	91	25	HBJBH
00224	MRS	ZCA	7120	231451	105	041	231415	9329	3044	2610	0091	38	18	EDIED
00191	MXU	ZCA	7120	231352	305	029	231020	6530	8820	2610	2558	85	25	HBJBH
00236	WNN	ZCA	7120	231448	204	029	231020	6350	2664	2610	8408	87	25	HBJBH
00281	WNN	ZCA	7120	231622	205	055	231540	9518	1871	2610	8408	63	03	HBJBH
9														
00133	XYR	IXI	7130	230923	103	805	230815	2110	9054	0586	8444	54	26	68486
00112	ZCA	WNN	7280	230856	954	279	230800	1101	8423	4717	1081	40	09	HBJBH
00258	ZCA	WNN	7280	231427	957	291	231345	5161	1871	4717	1081	43	26	HBJBH
00298	ZCA	WNN	7280	231719	959	297	231605	9942	7263	4717	1081	78	18	HBJBH
3														
00291	CUN	WNN	7290	231704	351	551	231600	2750	5445	5680	2396	64	10	FFBGG
00077	IZW	WNN	7290	230721	854	526	230540	8943	7263	5833	3917	99	20	DDHAA
00256	IZW	WNN	7290	231419	857	537	231335	9942	1476	5833	3917	69	25	FFBGG
00257	XTG	WNN	7290	231537	552	540	231400	3731	7803	5833	8156	83	24	DDHAA
00296	EOU	YWP	7290	231516	804	531	231145	6350	9054	5833	1793	85	10	AEFEA
00181	INJ	YWP	7290	231303	901	534	231220	9518	6442	5833	1397	38	20	DFJDF
00295	INJ	YWP	7290	231719	903	552	231610	0121	7263	5833	1397	73	10	AEFEA

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00204 UBT YWP 7290 231319 102 531 231145 8943 2664 5833 9803 87 10 AEFEA
 00294 UBT YWP 7290 231604 103 547 231520 0120 3698 5833 9803 44 13 AEFEA
 9

00153 FHI MKP 7320 231012 451 600 230925 3731 0611 6625 8327 43 26 DJDJD
 00250 GKW MKP 7320 230925 203 591 230620 5504 3456 6625 9399 48 11 ECHCE
 00116 HZY MKP 7320 230815 501 596 230750 9329 1871 6625 6473 26 20 50505
 00180 HZY MKP 7320 231124 503 604 231000 2110 8820 6625 6473 90 28 95459
 00199 HZY MKP 7320 230905 502 591 230620 8943 1476 6625 6473 63 24 95459
 00245 MRS MKP 7320 231509 652 615 231435 8943 5445 6625 0091 51 28 CCFII
 00117 PSD MKP 7320 230849 301 591 230620 3731 3456 6625 1243 70 24 28082
 00072 SFV MKP 7320 230725 052 593 230645 0120 3698 6625 5320 69 26 BCEBC
 00123 SFV MKP 7320 230953 054 598 230900 9942 2664 6625 5320 60 34 DJDJD
 00152 SFV MKP 7320 231136 060 607 231040 6530 1476 6625 5320 45 32 DJDJD
 00163 SFV MKP 7320 231004 055 598 230900 9942 2664 6625 5320 73 34 DJDJD
 00246 XYR MKP 7320 231553 902 620 231500 2110 4257 6625 8444 29 24 CCFII
 12

00109 FZX FMT 7340 230823 753 394 230745 0121 2664 8678 1360 65 29 EGBGE
 00213 FZX FMT 7340 231208 755 399 231130 3731 9054 6850 0172 39 17 EGBGE
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00074 BWO TPY 7400 230722 705 815 230635 1120 3456 2025 8156 54 47 CFIFC
 00205 BWO TPY 7400 231256 710 827 231205 4775 5218 2025 8156 36 45 ADEAD
 00154 NIO TPY 7400 231024 151 822 230915 9942 7263 2025 2125 51 32 CFIFC
 3

00100 EOU INJ 7450 230918 452 818 230825 6530 7803 1864 1793 47 24 AEFEA
 00110 YWP INJ 7450 230812 754 816 230705 8943 2664 1864 4718 52 21 CCFII
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00105 FBP FHI 7510 230836 852 612 230600 0121 7803 6869 5447 96 22 28082
 00106 FBP FHI 7510 230851 853 612 230600 6530 5445 6869 5447 82 22 28082
 00212 SFV FHI 7510 231332 754 615 231220 2750 1476 7642 6536 60 22 DCGCD
 00252 SFV FHI 7510 231451 757 619 231345 0121 7263 6869 5320 77 44 DJDJD
 00262 SFV FHI 7510 231518 758 619 231345 0121 7263 6869 5320 80 44 DJDJD
 00300 SFV FHI 7510 231704 759 626 231610 8943 7803 6869 5320 57 44 DJDJD
 00070 TOJ FHI 7510 230723 652 612 230600 2110 0611 6869 5609 59 46 GIFIG
 00107 UNK FHI 7510 230804 452 612 230600 3731 4257 6869 7904 71 36 GIFIG
 00108 UNK FHI 7510 230816 453 612 230600 5504 8820 6869 7904 63 42 80808
 9

00305 MLH LLZ 7640 231613 152 654 231500 8140 7803 1639 3485 70 41 I IHFF
 00272 ZZZ LLZ 7640 231419 608 645 231330 7753 0889 8146 7094 80 32 I IHFF
 00182 FBG POH 7640 231356 852 639 231210 8140 2645 1639 2549 83 42 DDHAA
 00231 FBG POH 7640 231522 854 643 231315 3731 5445 8146 3313 93 01 DDHAA
 00232 FBG POH 7640 231738 858 657 231620 6350 1476 8146 3313 72 01 FFBGG
 00276 FBG POH 7640 231524 855 648 231355 9942 3456 8146 3313 70 01 DDHAA
 00124 ZHK POH 7640 230917 951 627 230800 2750 7263 2340 3151 77 38 DDHAA
 00164 ZHK POH 7640 231112 952 632 230935 6530 8820 6210 9074 00 20 DDHAA
 00229 ZHK POH 7640 231528 954 650 231430 3749 6010 2197 8435 81 01 DDHAA
 00230 ZHK POH 7640 231556 955 650 231430 3749 6010 2197 8435 66 01 DDHAA
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00121 IZW CUN 7720 230913 955 202 230740 6530 9054 2601 0956 89 27 DDHAA
 00226 IZW CUN 7720 231449 956 225 231415 1561 3698 7741 3917 35 23 AGHAG

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00159	WNN	CUN	7720	231018	254	207	230900	6350	3456	4366	3395	54	42	FFBGG
00162	FMT	FZX	7720	231052	502	210	230945	2750	7263	7741	2620	64	27	CCFII
00255	FMT	FZX	7720	231406	503	221	231115	3731	0611	7741	2620	84	24	EGBGE
00203	GFH	FZX	7720	231254	305	221	231115	0121	5445	7741	6743	85	24	EGBGE
00288	GFH	FZX	7720	231723	306	227	231610	6350	3456	7741	6743	56	28	DCGCD
00147	VXI	FZX	7720	231106	601	214	231020	9329	2239	7741	3070	40	18	HBJHB
00160	VXI	FZX	7720	231119	604	212	231000	8943	7803	7741	3070	41	24	EGBGE
00161	VXI	FZX	7720	231138	605	212	231000	8943	7803	7741	3070	66	24	EGBGE
00287	VXI	FZX	7720	231658	606	221	231115	9942	3456	7741	3070	91	24	EGBGE

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00239	AAA	CUO	7735	231521	255	452	231445	8140	5237	4618	7319	61	24	IHFF
00242	MKR	CUO	7735	231546	453	454	231505	3749	0665	1549	3278	53	26	IHFF
00269	DYP	FZY	7735	231452	663	449	231400	0120	3644	4618	3494	69	38	FFBGG

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00210	NVT	OAL	7830	231353	056	418	231230	9969	5218	5086	4259	65	21	CJCCJ
00211	NVT	OAL	7830	231318	055	418	231230	9969	5218	5086	4259	80	23	CJCCJ
00068	RHW	OAL	7830	230751	302	399	230700	1561	6010	5086	1081	69	21	DDHAA
00214	XTG	OAL	7830	231309	603	416	231200	0121	7263	5086	8156	55	10	FFBGG
00264	XTG	OAL	7830	231422	605	420	231250	8943	3456	5086	8156	63	09	DDHAA
00065	FHI	SFV	7830	230725	652	397	230640	4775	4606	5086	8327	56	18	AIJAI
00103	FHI	SFV	7830	230913	653	401	230730	1120	8820	5086	8327	71	27	DCGCD
00216	FHI	SFV	7830	230942	654	401	230730	3731	4257	5086	8327	84	33	DJDJD
00144	MKP	SFV	7830	231124	408	401	230730	8943	3456	5086	5762	87	33	DJDJD
00114	XYR	SFV	7830	230929	804	405	230845	9518	5074	4726	1801	29	15	EGBEG
00278	XYR	SFV	7830	231611	808	432	231520	1101	1663	5086	8444	51	20	EGBEG

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00366	FHI	FBP	7940	231558	503	837	231525	3749	1871	4122	8327	59	30	80808
00178	FHI	FBP	7940	231041	501	834	231010	4775	8423	4122	8327	25	34	80808
00282	FHI	FBP	7940	231745	504	838	231650	8943	3456	4122	8327	54	34	80808

3

00201	HDG	BWO	7990	231350	104	658	231035	2750	9054	3565	6707	91	10	CFIFC
00308	HDG	BWO	7990	231642	108	677	231600	1101	8423	3565	6707	44	28	CFIFC
00120	NIO	BWO	7990	230913	302	647	230825	9518	6010	3565	2125	49	28	CFIFC
00254	NIO	BWO	7990	231427	306	658	231035	1120	7803	3565	2125	87	10	CFIFC
00202	TPY	BWO	7990	231218	205	658	231035	0121	5445	3565	9713	85	10	CFIFC
00158	IZW	XTG	7990	231104	656	649	230900	8943	1476	0946	0956	87	32	DDHAA
00076	OAL	XTG	7990	230714	504	643	230600	2110	9054	3565	5320	61	27	DDHAA
00307	OAL	XTG	7990	231626	509	673	231510	8943	4257	5653	9038	62	33	FFBGG
00265	WNN	XTG	7990	231506	402	665	231325	6530	2664	5653	3395	61	29	FFBGG

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00061	DYO	ZZZ	406	151	230640	6320	77	21	ABCAB	HOSHB	QNNLN	VJHLL	FSHIY
00125	ZZZ	DYO	503	832	230900	9192	45	46	ABCAB	TNVEJ	GPMP	ZTZWI	ZBQWT
2													
00205	BWO	TPY	710	827	231205	4775	36	45	ADEAD	JRTGE	RTJOH	SCEVX	FWIEB
00048	EOU	YWP	802	522	230425	8140	51	22	AEFEA	BIEIC	AMTFI	DLTUU	MBOIM
00028	YWP	INJ	752	812	230240	1120	40	04	AEFEA	CAIQF	YTXQA	OGQAK	CFYSW
00292	INJ	YWP	907	531	231145	5504	90	10	AEFEA	FAFPL	IFSWA	RPLIF	SFAFP
00296	EOU	YWP	804	531	231145	6350	85	10	AEFEA	FAFPL	IFSWA	RPLIF	SKOZK
00204	UBT	YWP	102	531	231145	8943	87	10	AEFEA	FAFPL	IFSWA	RPLIF	SCYTV
00294	UBT	YWP	103	547	231520	0120	44	13	AEFEA	GUVBS	IPHRE	BUVYK	BHIDN
00057	YWP	EOU	554	224	230435	1101	58	39	AEFEA	HADPX	AMLMU	COVEN	IWIRN
00295	INJ	YWP	903	552	231610	0121	73	10	AEFEA	KOZKL	IFSWA	RPLIF	SCYTV
00148	YWP	UBT	654	501	231025	1120	46	38	AEFEA	MOTFS	ULBGU	VBMUC	OWOID
00100	EOU	INJ	452	818	230825	6530	47	24	AEFEA	NOXLD	AZHVO	BVBEO	TVOBV
00051	INJ	UBT	152	494	230500	5504	46	23	AEFEA	PASKK	AYMWA	RPVYD	VXOCY
00027	YWP	INJ	751	811	230215	9329	64	09	AEFEA	WIRNP	OZOZO	EBXYV	PVYDV
00026	YWP	UBT	652	493	230310	1561	39	23	AEFEA	XYSMB	ECHDA	IRXYU	OKEER
13													
00226	IZW	CUN	956	225	231415	1561	35	23	AGHAG	STFG	OCRNT	KRNHM	WPAPD
00036	IZW	CUN	952	195	230515	1101	58	38	AGHAG	TPOCG	EZNQQ	WWUUE	MKQHC
2													
00065	FHI	SFV	652	397	230640	4775	56	18	AIJAI	FZTGH	ROUNV	JSOCP	YFHDD
00019	RHW	NVT	102	587	230205	4775	36	38	AJAAJ	LMPDG	GZXF1	PMDVH	XYPSB
00223	NVT	RHW	558	052	231500	1561	48	38	AJAAJ	QANGF	JKHUI	ONGDH	DJLUR
00142	RHW	NVT	109	632	231010	9518	35	21	AJAAJ	YZMCC	FPHXO	NRFGC	TYACE
3													
00072	SFV	MKP	052	593	230645	0120	69	26	BCEBC	MYYBE	GMPKQ	WMKUV	YVLON
00087	CUO	AAA	753	243	230745	3749	37	06	BEGBE	PJBGA	UDQKX	CNXJZ	XWOQG
00037	ZCA	WNN	951	273	230420	9329	39	09	BFHBF	NFIED	NSDJD	SPYYY	JKATT
00015	ZIC	EDH	153	480	230125	4775	44	37	BGIBG	HTQHI	HEFEJ	XSYDJ	NYUHH
00126	ZIC	EDH	155	485	230730	1561	34	43	BGIBG	NXUEF	MGUHX	ISPOY	WASLG
2													
00012	YWP	EOU	552	221	230240	3749	37	28	CBECB	LJEBA	CZMSK	BRERC	UAYJK
00207	MRS	MXU	151	639	231210	2110	28	32	CCFII	AAVLZ	SWFKZ	FQXVH	SLOZS
00162	FMT	FZX	502	210	230945	2750	64	27	CCFII	CCFDT	JKNIV	AEOKV	GLQKA
00240	FZX	GFH	557	188	231520	6350	70	15	CCFII	CCUKL	QFRGE	CGZXT	BORJD
00118	NIO	HDG	701	328	230825	8943	45	32	CCFII	DDQHW	OKLXF	VHXLZ	QHXS
00110	YWP	INJ	754	816	230705	8943	52	21	CCFII	GGOZS	EPIJR	TUQKX	AWDUN
00155	MKP	MRS	502	832	230940	5504	62	16	CCFII	GGRIU	SDBYJ	ICPAX	CPXJZ
00245	MRS	MKP	652	615	231435	8943	51	28	CCFII	MMXAR	KQWHM	ZEMDE	WIXJA
00149	YWP	UBT	655	502	231030	2750	48	37	CCFII	NNUSJ	ZATKH	JLMZB	MFRHJ
00246	XYR	MKP	902	620	231500	2110	29	24	CCFII	OOLFC	XWRUZ	YTWPB	MQDEA
00093	UBT	EOU	952	225	230435	2110	31	23	CCFII	PPAHC	JLJSN	LJNXW	HGWBQ
00094	VXI	GFH	051	172	230535	8943	65	20	CCFII	QQPMN	ALFSQ	JZORF	POHKU
00177	YWP	EOU	555	236	231100	6530	44	29	CCFII	QQPMN	ALFSQ	JZMTQ	WBWDH

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00344 NIO EOU 453 245 232105 2750 37 28 CCFII RRZYD HLEJS XZORF POHKU
 00176 INJ GFH 402 180 231015 6530 50 18 CCFII SSMLZ JUMZR YGVCZ VYPGO
 00043 HDG TPY 402 813 230450 3731 70 40 CCFII UUVDF DBNJM EDOPR UYHTW
 00306 FMT VXI 701 753 231600 3731 75 14 CCFII WGRV AXBAD YEGAY PEXIS
 00374 EDH MXU 052 660 232200 5504 55 18 CCFII ZZYP NHDGQ TAIXB AIBQV

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00038 NIO BWO 301 640 230455 1561 67 12 CEHCE JLXDF UWFKE GHRXR FQEUJ
 00308 HDG BWO 108 677 231600 1101 44 28 CFIFC BEYDL YHRCU QTZEZ YPIEU
 00201 HDG BWO 104 658 231035 2750 91 10 CFIFC CYTVN IRFVU FYNIR FCYTV
 00254 NIO BWO 306 658 231035 1120 87 10 CFIFC CYTVN IRFVU FYNIR FGYKP
 00202 TPY BWO 205 658 231035 0121 85 10 CFIFC CYTVN IRFVU FYNIR FBETY
 00315 BWO NIO 956 481 231730 2750 31 33 CFIFC DUCGM OXKSO GYTYM CWEOL
 00075 BWO NIO 953 465 230525 9942 46 48 CFIFC GIKSB UDFJA OAKEK WZOSP
 00311 BWO HDG 858 340 231645 2750 61 43 CFIFC GIKSQ ENEZU VR COP TJAOA
 00008 BWO TPY 701 811 230120 8943 32 27 CFIFC GIKSX ANMFO MSDAL TNAZQ
 00073 BWO HDG 853 321 230520 5504 40 21 CFIFC LYDNX AVUJY GOC AU BLUKU
 00154 NIO TPY 151 822 230915 9942 51 32 CFIFC QOHXS ANHZY GBQYP CJAOA
 00024 TPY BWO 203 632 230210 5504 59 30 CFIFC SYDTR EVONU IVMOH UQYPC
 00120 NIO BWO 302 647 230825 9518 49 28 CFIFC VEEAQ UZOXO WSLEZ NHAWH
 00318 TPY BWO 208 679 231830 9942 59 22 CFIFC ZAIIZ UVRSA AVMUK VDUOS
 00074 BWO TPY 705 815 230635 1120 54 47 CFIFC ZISQT AYOVA KGFEV DXOCY

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00003 FZX GFH 551 167 230025 1101 44 11 CIBCI WUMIJ HAVAM TYBAG PBKLK
 00211 NVT OAL 055 418 231230 9969 80 23 CJCCJ CZZAH RFVHU BLEUZ OHUEM
 00210 NVT OAL 056 418 231230 9969 65 21 CJCCJ CZZID APXPJ QANBV IKNLW
 00083 OAL NVT 004 602 230500 1561 55 43 CJCCJ DRKJA HAZIL LLDWH VWMPK
 00039 NVT OAL 052 390 230410 5161 37 23 CJCCJ GLNJJ MMHTM PDSUJ DXGMH
 00086 OAL NVT 009 624 230640 6960 36 34 CJCCJ NZBEC GNTUY IWEUC LBYXC
 00085 OAL NVT 008 624 230640 6960 80 37 CJCCJ VLVGG XAGPE IWHKI OUKWE

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00157 ZIC FSD 256 662 231000 4369 35 27 DAEAD CYKMD YHLDI MSSON EQIAR
 00046 HCO FSD 351 650 230500 2110 34 05 DAEAD DOEKZ YZUJI EPNAD UQITK
 00357 HCO ZIC 810 811 232235 5504 43 30 DAEAD DYCFK IAMXA FECIL QSEIC
 00343 EDH ZIC 905 808 231920 0121 67 50 DAEAD GUZFF IQOFI QXNOL YRYPD
 00324 HCO ZIC 807 804 231715 9329 68 28 DAEAD GUZFF IQOXI PMZAZ ZXICZ
 00196 EDH ZIC 903 778 230940 2750 85 42 DAEAD GYKPM UAMKI OZMUA MHYQW
 00365 FSD ZIC 704 778 230940 1120 85 42 DAEAD GYKPM UAMKI OZMUA MJYYF
 00237 HCO ZIC 803 778 230940 9942 90 42 DAEAD GYKPM UAMKI OZMUA MGYKP
 00208 ZIC EDH 159 492 231145 6530 79 35 DAEAD HYQWM UAMKI OZMUA MJYYF
 00209 ZIC EDH 160 492 231145 6530 74 35 DAEAD HYQWM UAMKI OZMUA MHYQW
 00119 EDH HCO 402 723 230730 9518 51 05 DAEAD LYKTL ORCFA FPQIN DBETY
 00113 FSD EDH 452 487 230900 0121 28 41 DAEAD MOWIH UDLCI WBF EW EPAOF
 00045 ZIC HCO 054 720 230435 0121 61 03 DAEAD NUDQN ATKJE WHLAU INOLY
 00253 ZIC FSD 259 668 231435 6530 45 05 DAEAD SONEK AAOTI VPQAN FHIVE
 00238 FSD ZIC 706 797 231510 4775 37 28 DAEAD SYDTQ ITKMO TFHAD PPIBR
 00200 ZIC HCO 057 730 231145 2750 27 08 DAEAD SYDTX ERPWA AYGYK PKOZK

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00333 XYR SFV 810 445 231910 9942 55 34 DCGCD AQZSQ BJGXT GAQWL XUETZ
 00288 GFH FZX 306 227 231610 6350 56 28 DCGCD AVGLE JOFRX ZKQVR YMWGR
 00312 BWO HDG 850 342 231805 2110 79 33 DCGCD CMBKA GCZGP IEMBA NIDXN

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00351	NIO	BWO	310	680	232130	3731	50	19	DCGCD	CZWAS	KKPIS	DFTLZ	GMYS
00373	NIO	EOU	452	243	231935	6350	53	24	DCGCD	GMSNW	GOUPS	AMUYZ	RDDYD
00263	FZX	VXI	957	748	231420	8140	50	38	DCGCD	ITMBX	PJCQU	RMHMD	YVCXP
00241	YWP	EOU	556	239	231350	3731	32	26	DCGCD	ITMBX	PJEGU	PBICD	WASSH
00212	SFV	FHI	754	615	231220	2750	60	22	DCGCD	JJCMH	EDYOW	QXSAW	VYMZQ
00251	EOU	NIO	852	474	231410	6350	72	46	DCGCD	KVENR	ELDCW	NWUVS	TGRJH
00348	XZR	SFV	805	401	230730	6530	69	17	DCGCD	MJCDC	VUKQI	OBNJT	RQCDS
00331	WNN	MXU	352	658	231935	6350	58	21	DCGCD	NJMTQ	UTOHV	QNMCB	LYCRR
00299	MXU	EDH	552	503	231515	5504	44	20	DCGCD	NTIQX	BYPAT	TVLHB	SJBPG
00349	FHI	SFV	656	401	230730	5504	69	14	DCGCD	OUARG	SRJVG	GPISH	KYNLQ
00325	FMT	GFH	652	191	231750	3731	46	16	DCGCD	TOVCT	OLEVN	RUTYN	JCNMK
00067	XZR	SFV	801	394	230525	3749	49	31	DCGCD	TQIDQ	JEGVA	IPVEE	KUUCE
00103	FHI	SFV	653	401	230730	1120	71	27	DCGCD	WSGFI	NTVPQ	QKUDA	OWKWZ

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00290	RBU	NVT	507	650	231520	9329	43	29	DCGDC	DEOFB	LMUAN	PRYRS	JAMWZ
00297	NVT	RBU	659	800	231550	1523	50	28	DCGDC	ITXCG	IZDSQ	BDJTW	USYLU
00183	NVT	RBU	656	790	231245	7753	66	36	DCGDC	PLVAF	ESBSR	BEQVI	XOYDN

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00339	POH	ZHK	310	032	231950	5504	70	33	DDHAA	ADEXU	VXMAT	XMTLO	BQXXQ
00132	CUN	IZW	201	824	230640	6350	81	24	DDHAA	AYSTX	FPDSG	SYFUC	DJPSX
00189	ZHK	FBG	904	497	231635	2750	93	01	DDHAA	BCBOI	ABGGV	OZAGI	JXSOY
00068	RHW	OAL	302	399	230700	1561	69	21	DDHAA	BQBOF	GLWAT	WIXBY	YXOOI
00121	IZW	CUN	955	202	230740	6530	89	27	DDHAA	CGPLL	KJPFK	FOHSU	VPWRS
00277	ZHK	NIO	258	200	231725	6530	73	01	DDHAA	CXIAM	EXVMY	BUPJG	SGYYP
00231	FBG	POH	854	643	231315	3731	93	01	DDHAA	DFBOX	VFXVP	QLJSM	PVRNY
00197	RHW	RBU	452	786	231100	6530	76	33	DDHAA	FFWLS	ZHRPB	CUUQY	NLYRY
00079	VPO	POH	002	621	230530	5504	86	33	DDHAA	FGRYG	TGGWA	ZBNUV	FAOTZ
00080	VPO	POH	003	621	230530	5504	84	33	DDHAA	FGRYG	TGGWA	ZBNUV	FAOTZ
00081	VPO	POH	004	621	230530	5504	82	33	DDHAA	FGRYG	TGGWA	ZBNUV	FAOTZ
00130	NCM	IZW	005	828	230800	9942	86	09	DDHAA	FPCHA	DSUNP	HVMHH	UNOZZ
00131	NCM	IZW	006	828	230800	9942	84	09	DDHAA	FPCHA	DSUNP	HVMHH	UNOZZ
00165	NCM	IZW	007	828	230800	9942	80	09	DDHAA	FPCHA	DSUNP	HVMHH	UNOZZ
00173	POH	ZHK	306	019	231100	0121	68	23	DDHAA	GLSKO	XSYRN	VFCGE	PKZWT
00009	IZW	XTG	651	628	230005	9518	71	35	DDHAA	GNZME	LWSRZ	FBMTQ	ZFQZA
00369	FBG	NIO	804	201	231825	2750	98	01	DDHAA	GQNKW	NXOLR	KSPIX	JZJZU
00128	RHW	NVT	104	619	230600	2750	84	32	DDHAA	GZCYP	CHYNE	NLLBZ	WPZFO
00129	RHW	NVT	105	619	230600	2750	83	32	DDHAA	GZCYP	CHYNE	NLLBZ	WPZFO
00077	IZW	WNN	854	526	230540	8943	99	20	DDHAA	GZPEQ	MCLAJ	CYQDZ	TGSOC
00174	RBU	RHW	752	028	231000	8943	82	37	DDHAA	HNAYE	ZIQQU	WXSQO	GVEZG
00076	OAL	XTG	504	643	230600	2110	61	27	DDHAA	IFJDI	GVJAA	EMO ID	UGXWB
00264	XTG	OAL	605	420	231250	8943	63	09	DDHAA	JBZNT	PDRTS	WYEAU	FNAEF
00229	ZHK	POH	954	650	231430	3749	81	01	DDHAA	JQYPL	ESJOO	QUKCT	JEXUO
00230	ZHK	POH	955	650	231430	3749	66	01	DDHAA	JQYPL	ESJOO	QUKCT	JEXUO
00276	FBG	POH	855	648	231355	9942	70	01	DDHAA	KVLCC	OVIWL	FXMJV	BZWXW
00088	WNN	IZW	305	816	230515	8943	69	16	DDHAA	LFAQE	DWTVJ	DAGJQ	QMJKP
00047	IZW	XTG	653	638	230415	9329	64	48	DDHAA	LFVCD	LZUXL	HPEWW	XXEKE
00032	WNN	IZW	302	810	230130	0121	94	22	DDHAA	LJTYE	PSJMU	GLZBH	CPRUM
00363	CUN	IZW	204	837	231010	3731	59	24	DDHAA	LUSNJ	VLZMR	TTRUT	HNRST
00233	ZHK	NIO	256	196	231625	0121	74	01	DDHAA	LYPPP	DJTWR	JJQUD	FUVEN
00185	ZHK	NIO	252	170	231100	8943	79	01	DDHAA	NVMJN	HJZEP	TLYRI	FVXJP
00171	POH	FBG	208	493	231445	1120	97	18	DDHAA	NYGEZ	WTAPK	TTSAQ	TNNWU
00217	POH	NIO	108	191	231450	8943	80	42	DDHAA	OAVDQ	DITOV	LVXUR	ODYDN
00170	POH	FBG	207	490	231415	6350	75	28	DDHAA	OPEPL	KUKJE	ZMZTV	KIYGU
00158	IZW	XTG	656	649	230900	8943	87	32	DDHAA	OVFJK	NMCNI	SIVCX	UBZVS

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00356 NVU XZJ 113 410 232220 9329 63 27 DDHAA OYUQM YWODH LPCWL FFAJC
00184 CUN IZW 207 844 231140 2110 70 31 DDHAA PHENA HOGYT FMZNV PVBWW
00347 GFI LAN 606 527 232210 1101 37 25 DDHAA QNRRV NVOJE VIEWM YBSSH
00188 POH FBG 209 503 231705 6530 79 28 DDHAA QOMBV HRTLY XOFTZ XNQPQ
00053 OAL RHW 202 024 230335 4152 61 21 DDHAA RHETB XSHLG PNYHJ XEENE
00169 POH NIO 106 186 231350 6350 79 49 DDHAA RTPEE SHRPB YSTNG KQCPU
00124 ZHK POH 951 627 230800 2750 77 38 DDHAA RZGBD JABQM IIBZH CUAIC
00332 YRG XYS 505 420 231945 2110 59 09 DDHAA SYUBE XKVMD HSTNM JYAGH
00164 ZHK POH 952 632 230935 6530 00 20 DDHAA THVIA XVIBX CYYGN LXBRB
00321 VLX YEC 210 151 231815 9518 91 25 DDHAA UGZLZ BCNSB OCYSA VTXUT
00168 POH NIO 104 169 231045 9969 84 01 DDHAA VDLIU KISLW YQRJX DMHUX
00370 NVU HVW 417 282 232250 4775 70 45 DDHAA WGZQK GSPHY OANPD UTUNX
00054 NVT RBU 654 767 230320 0121 71 38 DDHAA WRDZJ EJIRF IHFES OFTDD
00192 NVT RHW 555 030 231105 2750 93 30 DDHAA WXSQP UVYZK XQRFW JKSMR
00193 NVT RHW 556 030 231105 2750 73 30 DDHAA WXSQP UVYZK XQRFW JKSMR
00182 FBG POH 852 639 231210 8140 83 42 DDHAA YNFPT BKAPZ SCVWQ RCEEK
00166 WNN IZW 308 829 230820 2750 83 11 DDHAA ZKJYS HTMTJ UGOGB FDONS
00257 XTG WNN 552 540 231400 3731 83 24 DDHAA ZWSHW XUWSY LEAEK SCIHZ

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00191 INJ YWP 901 534 231220 9518 38 20 DFJDF AOJGB SOITH BKOBG WWVLB
00206 BWO HDG 857 332 231230 1561 53 22 DMBDH LONGH DAAFL NFLGO JIOXU
00215 MKP SFV 410 401 230730 8943 92 33 DJDJD BETYV OBVZY LFVOB VBETY
00216 FHI SFV 654 401 230730 3731 84 33 DJDJD BETYV OBVZY LFVOB VGYKP
00144 MKP SFV 408 401 230730 8943 87 33 DJDJD BETYV OBVZY LFVOB BHYQW
00152 SFV MKP 060 607 231040 6530 45 32 DJDJD BYRSS YDTDU MQXER PFONT
00104 FHI XYR 551 646 230815 6350 42 23 DJDJD DUMQP IMBSI QISAN HKOZK
00123 SFV MKP 054 598 230900 9942 60 34 DJDJD GYKPV OBVZY LFVOB VHYQW
00163 SFV MKP 055 598 230900 9942 73 34 DJDJD GYKPV OBVZY LFVOB VGYKP
00252 SFV FHI 757 619 231345 0121 77 44 DJDJD GYKPV OBVZY LFVOB VHYQW
00262 SFV FHI 758 619 231345 0121 80 44 DJDJD GYKPV OBVZY LFVOB VGYKP
00115 SFV XYR 359 644 230725 2110 43 28 DJDJD LUDOS IQIHE TDXYI CPYXK
00153 FHI MKP 451 600 230925 3731 43 26 DJDJD QULZV YFXSE DXDUQ UTOVO
00300 SFV FHI 759 626 231610 8943 57 44 DJDJD SALFZ IAYHU HPFOM SQYPC
00316 FHI XYR 553 660 231810 8943 46 25 DJDJD TIGAJ IMWJY TASIQ IMAGW
00261 MKP XYR 802 653 231410 3731 46 25 DJDJD TIGAJ IMWJY TASIQ IMAGW
00029 MKP SFV 403 388 230300 0120 48 16 DJDJD VUKCH IBLKO ZKCYT VHYQW

15

00335 HZY MKP 506 626 231830 1120 70 14 ECHCE FOAOS MBEDN CNHII XRSRO
00250 GKW MKP 203 591 230620 5504 48 11 ECHCE OIQHR LUATR RHAHM EPPDV
00179 MKP GKW 351 824 231110 4775 33 32 ECHCE RAFNO EAIOI MMTL OLFFY
00089 MKP PSD 555 851 230600 0121 54 29 ECHCE RNNNS RESPE EETMO VEECA
00010 MKP PSD 551 848 230010 5504 61 07 ECHCE TNUOS ROIRT APDIU XRDOA
00011 MKP PSD 552 848 230010 5504 75 16 ECHCE TWMUO NOMZT APVLL NEROA

6

00224 MRS ZCA 105 041 231415 9329 38 18 EDIED IOKHF OOOQS GNTQE ZNCYR
00293 MRS ZCA 107 064 231700 5161 44 21 EDIED JLPHE XRXBV DWAVD RZACE

2

00014 SFV XYR 354 636 230200 9518 49 44 EGBEG DZXFQ EENWX BJJNE BYQVK
00114 XYR SFV 804 405 230845 9518 28 15 EGBEG HQDCF LFYWY UUZSN EJZXL
00278 XYR SFV 808 432 231520 1101 51 20 EGBEG JMBDE AIJAB QTSRV VYGMY

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00005 SFV XYR 351 631 230005 8140 66 30 EGBEG PLYGH FHOTZ YQKCM KOKHB
4

00055 FZX GFH 554 169 230310 5504 50 25 EGBGE CYTVW UEYNY IUWUE YBETY
00056 FZX GFH 555 169 230310 5504 56 25 EGBGE CYTVW UEYNY IUWUE YCYTV
00049 FZX VXI 952 735 230325 2110 51 28 EGBGE CYTVW UEYNY IUWUE YBETY
00050 FZX VXI 953 735 230325 2110 36 28 EGBGE CYTVW UEYNY IUWUE YCYTV
00160 VXI FZX 604 212 231000 8943 41 24 EGBGE CYTVW UEYNY IUWUE YCYTV
00161 VXI FZX 605 212 231000 8943 66 24 EGBGE CYTVW UEYNY IUWUE YBETY
00255 FMT FZX 503 221 231115 3731 84 24 EGBGE KOZKW UEYNY IUWUE YBETY
00203 GFH FZX 305 221 231115 0121 85 24 EGBGE KOZKW UEYNY IUWUE YCYTV
00287 VXI FZX 606 221 231115 9942 91 24 EGBGE KOZKW UEYNY IUWUE YKOZK
00109 FZX FMT 753 394 230745 0121 65 29 EGBGE NECSM EAPSI XQLUU EFAIS
00334 FMT FZX 507 230 232000 5504 63 32 EGBGE NUWIW YKCDO QVKOZ KHIZI
00213 FZX FMT 755 399 231130 3731 39 17 EGBGE SYDTV UHAJU QYTIY SDIBH

12

00006 IZW WNN 851 518 230110 2172 52 26 EIDEI RLXHB GUHHI XYUOL WOVJE

00225 HCO ZIC 806 794 231350 1101 39 27 FBHFB GMYEH AQBRB UGLHH JHSPL
00004 ZIC HCO 053 718 230020 1561 45 07 FBHFB KZVEJ KHIGO QDBXN ZUQIA

2

00248 MLH ZZZ 313 211 231450 3973 80 32 FEAFE LLLHI FODZH OWY0Y WLYXD
00249 MLH ZZZ 314 211 231450 3973 52 11 FEAFE PTOFE DSHTT MXKGX GTSJH
00040 MLH ZZZ 301 138 230500 1101 76 20 FEAFE SOJFH SCYZR LLZTU XHVPL
00020 ZZZ MLH 702 590 230315 3973 90 28 FEAFE TZSIG QPXUZ PCYLK TIIXR

4

00291 CUN WNN 351 551 231600 2750 64 10 FFBGG BHCSF ZICVX BWLJF GLFMG
00309 RBU OAL 153 442 231825 9329 50 14 FFBGG BSAEE GPXBR YDYYQ YYINR
00354 NIO ZHK 356 036 232135 2110 45 24 FFBGG BVRJD YRSEA OFLIK QVCXV
00214 XTG OAL 603 416 231200 0121 55 10 FFBGG CNEKH YUDND NEKGL HSVAG
00082 NIO POH 754 619 230440 8943 63 31 FFBGG DAOSM BLBRH PSABO AYTBS
00355 FBG ZHK 153 035 232040 1120 36 01 FFBGG DQFHO ASSEV FNTNG DINUC
00031 FBG POH 851 614 230215 1101 63 26 FFBGG FKTNA CUGNE VRFCR HMQTO
00375 FBG ZHK 154 038 232225 3731 36 22 FFBGG FLIQI HOKMC FNGAM AVBIS
00235 POH ZHK 308 023 231430 8943 53 26 FFBGG GAFLH EYEYR BIRXC BYJVP
00289 XTG WNN 554 553 231630 2110 80 18 FFBGG HJKDJ MWF XK CNKUK JHYJY
00280 ZHK FBG 903 495 231610 8943 48 35 FFBGG HMT HB QKHND PBFKR JKSEC
00172 POH ZHK 305 016 231015 9942 41 22 FFBGG IDOOD ANWWS GHJAU FCAFA
00358 NIO POH 759 664 231900 6530 53 31 FFBGG IFUDQ ETNKQ VVPBH JZMIJ
00353 NIO FBG 055 511 232300 5504 35 25 FFBGG IQTKD GIXGP ATDCC ITTHB
00286 XTG CUN 452 228 231650 8140 71 41 FFBGG JLQHL QLWPU UOUKC HIMIR
00234 POH ZHK 307 023 231430 8943 59 37 FFBGG JPOBO VOMCV RGKQU NACHU
00159 WNN CUN 254 207 230900 6350 54 42 FFBGG JQCHA ETIFD SZHVS WTHQQ
00307 OAL XTG 509 673 231510 8943 62 33 FFBGG KAKSN MWHGU DRCFS ZBDYL
00371 FBG ZHK 152 028 231745 2750 57 01 FFBGG KJDHB ZVQFP RVONA XXEHP
00320 POH FBG 211 508 231840 3731 47 26 FFBGG LPHSO YPEHD JALFU QSBZD
00352 FBG NIO 807 205 232035 9942 80 01 FFBGG MDCDH SYHNV LSQOP NYFGM
00232 FBG POH 858 657 231620 6350 72 01 FFBGG MLRDC RHNKD TYBGV KBLFI
00338 FBG NIO 805 203 231910 1561 60 49 FFBGG MSJQC TYGNK LPTNE NOWMD
00275 NIO ZHK 355 025 231605 6350 48 24 FFBGG MSKRA IAPJM SKQIP GYPGZ
00328 YRG YEC 303 153 231850 4775 52 35 FFBGG MUPBA XAOTV MIGMK DJCBO
00269 DYP FZY 663 449 231400 0120 69 38 FFBGG NNCBB GPYPF RDBOV KNHZZ
00175 OAL RBU 852 775 230835 3731 66 29 FFBGG OJCHL NHMON KBZLK BLIKQ

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00256 IZW WNN 857 537 231335 9942 69 25 FFBGG RADEF JNWHI ACONH SMIXB
 00030 NIO POH 751 608 230105 2750 77 01 FFBGG SHRIH MSYCG YMDUK QWGSW
 00265 WNN XTG 402 665 231325 6530 61 29 FFBGG SPMQD POXBM AETXX MLTFC
 00084 OAL NVT 605 619 230600 1120 87 36 FFBGG TDMRK CLUDA PUADO RRTAT
 00127 RBU NVT 504 619 230600 3731 87 28 FFBGG TDMRK CLUDA FFRFU EJHAB
 00337 POH NIO 109 202 231840 0121 65 01 FFBGG TGHLN ZEHDO IRMRW FZULL
 00279 NIO FBG 054 494 231505 2110 43 01 FFBGG UDKRQ BHTEV IHNEE HBVEO
 00364 POH FBG 206 483 231130 9942 57 22 FFBGG VPHJN FGVYA UKSXX ZXHOC
 00146 CUN XTG 752 653 230940 0121 44 26 FFBGG XIBEO NZSZT NXIGK LSMOR
 00052 POH FBG 204 468 230320 3749 56 20 FFBGG XPRJD IFRAN WDGIF JOPYB
 00310 XTG OAL 608 439 231745 8140 56 08 FFBGG YSKPB EFZWB EIRHN CTVSS
 00187 EDI VLX 002 705 231225 1561 72 29 FFBGG ZGFPL CVZFA KWKBI BVKQZ
 00319 RTJ NVU 809 564 231705 5161 87 25 FFBGG ZNTFM HVZPR RBKEY VISPV

40

00247 XTG IZW 101 852 231400 3749 27 29 GBIGB WSDAI WZBJZ PLDZY XHXXQ
 00090 UBT YWP 101 525 230530 3749 57 19 GDAGD BIPEA OOTSY FELLV VLIDM
 00360 ZCA MXU 653 629 230215 1561 43 13 GEBGE BHMFE EPMOW ZBJHV XBMDG
 00035 FMT FZX 501 191 230420 9518 44 18 GHEGH CWIHE VHWIS UROFR RDEEU
 00362 FHI UNK 903 760 230920 1120 32 20 GIFIG EOUEE MMVLN SFEDS ACIER
 00102 FHI TOJ 752 912 230840 3731 39 35 GIFIG ERBEW MGEUC GVTDS NADEE
 00107 UNK FHI 452 612 230600 3731 71 36 GIFIG WGOAR SSRGM OUAUA LLYPP
 00070 TOJ FHI 652 612 230600 2110 59 46 GIFIG WGOID EECGM TMNMV MTMPP

4

00134 LLZ ZZZ 106 181 231000 8121 66 33 HAIHA CEGAC VGHMG XSDWE GHPXO
 00368 LLZ ZZZ 111 233 231710 9518 77 15 HAIHA FDHDE GDBMX SQCYH KDKVY
 00017 ZZZ LLZ 601 612 230140 9329 80 17 HAIHA FLVBI UYGKK RRHAA BOCKY
 00018 ZZZ LLZ 602 612 230140 9329 60 28 HAIHA FLVJE CLFSP KXELU UWFAK

4

00340 MRS ZCA 110 070 231915 8140 55 17 HBJBH BYIKP ENDZU DZJUX FSYGW
 00151 WNN MRS 902 833 230945 9942 33 30 HBJBH BYIKP ENDZU DZJUX FZYZU
 00342 MXU ZCA 311 073 232110 9942 35 08 HBJBH DEWDG UGNZE AZXYX RBYEF
 00112 ZCA WNN 954 279 230800 1101 40 09 HBJBH DUEIL ICPPO APBYM NZOCZ
 00322 WNN ZCA 207 067 231830 2750 42 23 HBJBH FOWCW AWUHE GASEW QQEZR
 00150 ZCA MRS 758 838 231100 3731 37 36 HBJBH FUGMH UMTWY IBVEB XPEGX
 00258 ZCA WNN 957 291 231345 5161 43 26 HBJBH GEBLQ INDHY QWXOC YFAFP
 00323 MXU ZCA 306 061 231635 2110 63 03 HBJBH HUXEQ ETLQA GZWAK HDIIP
 00281 WNN ZCA 205 055 231540 9518 63 03 HBJBH HUXEQ ETLQA GZWAK HDIIP
 00190 MRS ZCA 104 029 231020 6350 91 25 HBJBH HYQWV OQKNY UFVOQ KHYQW
 00191 MXU ZCA 305 029 231020 6530 85 25 HBJBH HYQWV OQKNY UFVOQ KJYYF
 00236 WNN ZCA 204 029 231020 6350 87 25 HBJBH HYQWV OQKNY UFVOQ KQIND
 00259 ZCA MXU 657 642 231420 9969 59 36 HBJBH JYYFV OQKNY UFVOQ KQIND
 00260 ZCA MXU 658 642 231420 9969 42 36 HBJBH JYYFV OQKNY UFVOQ KJYYF
 00111 ZCA MRS 755 829 230810 1120 43 18 HBJBH MIQDS YGWFA FPQIN DXOCY
 00341 MXU ZCA 308 069 231905 3731 62 25 HBJBH QEMDZ YZUFO WCGOO VMESG
 00078 ZCA MRS 753 825 230540 4775 43 38 HBJBH SALFZ YZUXO CYXOC YGYKP
 00298 ZCA WNN 959 297 231605 9942 78 18 HBJBH TAYUQ YTGFE TBHUX EVACZ

18

00147 VXI FZX 601 214 231020 9329 40 18 HBJBH FVFAB YXVXT QAVFB ERZNX

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00122	ZIC	FSD	254	655	230825	4775	31	22	HDBHD	AYWEF	JGBAC	PSYKJ	ZLGBS
00145	FSD	ZIC	703	782	231005	3749	35	30	HDBHD	ECREG	AMCZT	SLJIK	JKSCI
00013	ZIC	FSD	251	647	230310	8140	46	25	HDBHD	PESDI	AMCQV	VBHEX	JCCBU

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00138	ZZZ	MLH	706	627	230830	8943	56	24	IIHFF	AFLBC	CLQRU	EOUCI	OXYUB
00242	MKR	CUO	453	454	231505	3749	53	26	IIHFF	AFMBC	ROEGO	AYJKP	EBBJA
00062	LLZ	ZZZ	104	143	230545	2172	65	24	IIHFF	AFPBC	GFYFG	RJBUZ	SXKSY
00329	DYO	LLZ	551	659	231715	5161	72	31	IIHFF	AGLBC	NZOOZ	MQUUQ	CSMPJ
00023	ZZZ	ZZZ	002	126	230200	2750	85	10	IIHFF	AGOBC	VRROS	MCSAU	PCXGQ
00060	ZZZ	LLZ	606	617	230355	3731	00	39	IIHFF	AGPBC	YAASM	SCUOJ	FRZKD
00099	MLH	ZZZ	304	154	230710	9942	97	32	IIHFF	AGQBC	CUPMM	KDQOF	EKJQZ
00042	DYO	ZZZ	401	130	230315	4775	00	16	IIHFF	AGQBC	HVSMW	EOEJL	RHZJR
00267	ZZZ	DYO	508	849	231300	9942	86	32	IIHFF	AHMBC	BQYOT	XIURX	CLKXL
00346	DYO	MLH	355	655	231830	3731	56	22	IIHFF	AHRBC	JNUEL	LPKYQ	FXGME
00140	MLH	ZZZ	308	177	230945	8140	90	32	IIHFF	AJOB	BCTSR	FQIOO	MWVKX
00022	ZZZ	ZZZ	001	126	230200	2750	87	18	IIHFF	AKLBC	TOLCL	NYMFI	YNDHI
00271	ZZZ	MLH	710	643	231305	2750	80	33	IIHFF	AKMBC	YRDOV	CLUDH	QDMCI
00374	ZZZ	MLH	721	646	231330	9942	99	20	IIHFF	BFQBC	CISCG	KGWSA	WDQOO
00372	DYO	MLH	352	652	231705	6530	76	16	IIHFF	BHLBC	MPPGX	KVJHB	ZJUBI
00327	ZZZ	DYO	511	857	231625	3731	76	40	IIHFF	BHQBC	YJXAF	OHGKR	QHCZU
00227	LLZ	ZZZ	108	208	231415	0732	67	17	IIHFF	BINBC	HDEJI	EMDCJ	KVSML
00041	ZZZ	ZZZ	003	126	230200	2750	83	21	IIHFF	BIRBC	TCMPE	LNXLJ	VQUZY
00064	ZZZ	MLH	704	611	230525	8140	96	31	IIHFF	BJMBC	MPQEK	VTAUJ	SFLKF
00016	PVK	AAA	602	215	230235	9969	48	08	IIHFF	BJOBC	JCMUK	LDXWV	NLOQF
00266	LLZ	DYO	653	855	231450	8140	91	41	IIHFF	BKLBC	SBWJH	KAMVA	BXTNU
00139	MLH	ZZZ	307	177	230945	8140	91	26	IIHFF	BKPBC	DGECE	TQHDJ	JZUIC
00239	AAA	CUO	255	452	231445	8140	61	24	IIHFF	BKQBC	XGYWM	UKAZZ	URDVN
00272	ZZZ	LLZ	608	645	231330	7753	80	32	IIHFF	CFOBC	GETJN	MACQM	OARIF
00218	MLH	DYO	452	850	231315	0732	74	29	IIHFF	CGMBC	UUUBZ	YDRJY	RHEZU
00137	ZZZ	MLH	705	627	230830	8943	70	24	IIHFF	CHNBC	NJBFT	PANCU	URLMY
00219	ZZZ	MLH	709	640	231230	5504	53	20	IIHFF	CHOBC	UAGSR	JHOSH	ZUWBB
00167	CUO	PVK	202	698	231035	9518	40	21	IIHFF	CILBC	ISQXK	BKWC	UPUKQ
00326	MLH	DYO	454	858	231700	6530	55	34	IIHFF	CJNBC	IVMSO	KMOLI	LGJLB
00007	LLZ	ZZZ	101	121	230040	3973	63	23	IIHFF	CJRBC	MJUKM	LNVPW	JQIFG
00135	ZZZ	DYO	504	840	231105	4775	53	22	IIHFF	DFLBC	LOVIZ	SOMHA	WLWOE
00220	ZZZ	MLH	707	638	231215	1120	84	37	IIHFF	DFMBC	LYWHF	OMXEG	ICMUA
00274	DYO	ZZZ	413	219	231535	9942	58	16	IIHFF	DFPBC	YNZCY	JCFJM	ULFYX
00305	MLH	LLZ	152	654	231500	8140	70	41	IIHFF	DHNBC	DSSQL	HBBMT	WOGPA
00141	MLH	ZZZ	309	177	230945	8140	92	19	IIHFF	DIMBC	JJHVL	IFZRT	HCYJF
00367	ZZZ	MLH	711	646	231330	9942	92	27	IIHFF	DJNBC	TIMBX	VKDTX	WNUZZ
00059	ZZZ	MLH	703	594	230430	4775	63	30	IIHFF	DJOB	RMHUK	DWXP	XGBHL
00303	ZZZ	DYO	510	853	231420	6530	74	29	IIHFF	DKPBC	XVRPJ	CKGJG	ERRXV
00268	ZZZ	DYO	507	847	231235	0121	76	27	IIHFF	EFQBC	ZRFIQ	GOZXR	HPSJF
00228	DYO	ZZZ	409	202	231320	5161	90	29	IIHFF	EGLBC	FBSYT	QUQZD	FPEXG
00302	MLH	DYO	453	854	231430	2750	64	35	IIHFF	EHOBC	CTQJF	UTLBL	WIUUR
00143	AAA	AAA	003	251	230940	0120	49	19	IIHFF	EHQBC	PJMJV	TIDOE	UHKOJ
00270	ZZZ	MLH	720	646	231330	9942	95	40	IIHFF	EILBC	ISCEO	OCRWJ	PMYQJ
00063	LLZ	MLH	251	616	230545	2110	58	24	IIHFF	EIPBC	ETESX	FMCCQ	AYKBC
00345	LLZ	ZZZ	113	249	232030	0120	85	15	IIHFF	EJNBC	JTCQQ	JQIYW	HZMVW
00301	CUO	MKR	604	562	231655	3731	44	44	IIHFF	EKNBC	USYYL	KTEPE	YXIEG

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00244	XYR	OWN	953	684	231345	8140	42	24	JAAAJ	CTPIE	NOEFR	ERRDO	AIVIO
00317	OWN	XYR	102	658	231700	9942	66	43	JAAAJ	EHBED	DASLT	COIEO	IERUR
00283	XYR	OWN	956	687	231540	3749	39	15	JAAAJ	ESTLG	BREEI	OALCP	SNTET

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00091 XYR OWN 951 681 230605 7932 68 31 JAAAJ EUEBD OETDN GXAWR SUTEU
 00336 VLH XYR 604 662 232020 6530 33 23 JAAAJ TROHO LEAHN INHAI PMUMQ

5

00361 LYD FZX 001 199 230700 3749 48 12 JAAJA OZXGF IGFHD RXSIY NBMJH

00194 WPX NVT 003 644 231310 9969 35 36 JBBJB CTVIA OSGMO LDHDS VOAYB
 00330 WPX NVT 004 654 231815 3749 58 20 JBBJB GQJCE QZATN KOBAC LYVFP
 00195 WPX NVT 001 635 231130 5161 51 37 JBBJB ORPFH FMSDE ICFKO VMNKY

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00221 GXW BWO 001 668 231400 4775 39 17 JCCJC BPZFC DVRHG IUKRD HSRMY

00222 YFT SFV 001 425 231400 5161 34 33 JDDJD FLCIG UQCSN RPZOC GWJID

00098 ZZZ ZZZ 008 165 230830 9742 42 20 JEEJE AOSEJ XOMRH IGXTV MSIHN
 00095 ZZZ ZZZ 005 165 230830 9742 80 14 JEEJE JRGCB FIORN HCJXP OASIC
 00096 ZZZ ZZZ 006 165 230830 9742 70 13 JEEJE JRGJH LNEMW TSGST SBYKR
 00097 ZZZ ZZZ 007 165 230830 9742 80 30 JEEJE LTTHD JMJZR UBIED RYCTN

4

00136 EJJ ZIC 002 787 231115 8140 39 52 JFFJF NUNBJ BHDOH EWVMP YMBXB

00002 NCM IZW 002 809 230100 1101 80 24 JGGJG BRDAJ TWSPR ZFYUZ JWADS
 00021 NCM IZW 003 809 230100 1101 34 22 JGGJG BRDIF VJHFQ ZFKBE ENGKI
 00001 NCM IZW 001 809 230100 1101 80 12 JGGJG DZBDD XJXUF TWLIM XOPAF

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00273 FSD YWP 002 550 231540 5161 36 27 JHHJH IDRGD STCWH FOZZW WKRIU

00186 ALL ZCA 001 035 231210 3749 43 02 JIIJI EUMCH CVAFH NFNHC TCNKJ

00092 XYR VLH 202 724 230610 3973 44 17 28082 21848 52164 96410 22149
 00117 PSD MKP 301 591 230620 3731 70 24 28082 22132 65415 26226 12240
 00285 IXI XYR 253 656 231535 0120 55 23 28082 43730 82251 14513 59827
 00105 FBP FHI 852 612 230600 0121 96 22 28082 50021 00464 81416 57350
 00106 FBP FHI 853 612 230600 6530 82 22 28082 50021 00464 81416 57350

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00314 GKW MKP 206 626 231830 2750 96 32 50505 17376 89111 89159 79059
 00101 FHI UNK 901 758 230900 3749 45 16 50505 77602 49639 77420 73974
 00034 XYR VLH 201 722 230315 9742 55 24 50505 77620 98696 91537 27597
 00198 XYR VLH 204 725 231125 9518 37 23 50505 79470 98895 99600 69633
 00243 MKP GKW 353 826 231245 3731 76 24 50505 97483 76807 37527 05989
 00116 HZY MKP 501 596 230750 9329 26 20 50505 98870 57309 89560 56891

6

00156 VLH XYR 601 649 231110 3749 43 43 68486 40721 81198 84853 75524
 00058 XYR IXI 101 802 230420 5161 37 30 68486 40721 86550 38848 53779
 00044 IXI XYR 251 638 230425 9329 47 24 68486 40752 20265 14472 54875
 00284 XYR VLH 206 728 231550 6350 51 37 68486 47525 52198 56057 58212
 00350 IXI XYR 255 663 232240 5504 51 43 68486 51651 42852 51959 58514
 00133 XYR IXI 103 805 230815 2110 54 26 68486 90057 58182 12029 40286

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00108 UNK FHI 453 612 230600 5504 63 42 80808 09147 98937 09852 96743

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00069	TOJ	FHI	651	612	230600	2110	83	23	80808	10893	70985	29674	37389
00025	UNK	FHI	451	608	230115	9942	60	29	80808	42831	71157	33931	99675
00066	FHI	TOJ	751	910	230705	5161	53	21	80808	42831	71157	74793	46985
00282	FHI	FBP	504	838	231650	8943	54	34	80808	42831	76992	07747	90885
00359	FHI	FBP	506	840	231735	6530	83	20	80808	74793	46985	29293	34311
00178	FHI	FBP	501	834	231010	4775	25	34	80808	76885	03090	13340	95374
00366	FHI	FBP	503	837	231525	3749	59	30	80808	91595	97914	92424	93475

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00180	HZY	MKP	503	604	231000	2110	90	28	95459	06843	02842	23840	27884
00199	HZY	MKP	502	591	230620	8943	63	24	95459	30697	49439	61925	74202
00071	GKW	MKP	201	588	230515	8943	75	28	95459	39028	18861	13145	04423
00313	PSD	MKP	302	626	231830	9942	86	24	95459	65982	84285	42128	24064
00033	MKP	HZY	701	765	230135	9942	61	12	95459	68942	32654	13390	43054

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00597	AAA	AAA	5700	241635	002	306	241530	1300	1420	9389	5681	79	08	IIHFF
00455	EEA	AAA	7025	241040	609	294	241018	7302	6036	9389	1559	86	21	IIHFF
			2											
00629	NVT	AYP	3580	241826	304	097	241746	3702	6631	2728	0938	73	34	HBJBH
00656	NVT	AYP	3580	242035	306	098	241955	2939	0215	4186	7391	81	28	HBJBH
00672	UBT	AYP	3580	242319	105	108	242209	2958	3618	2728	0208	73	20	EDIED
00505	UBT	AYP	7580	241235	102	083	241020	5360	4833	2728	0208	46	21	HBJBH
00409	YKD	AYP	4045	240741	202	080	240621	8349	5661	2728	6789	86	29	HBJBH
00410	YKD	AYP	4045	240747	203	080	240621	8349	5661	2728	6789	82	15	HBJBH
00575	YKD	AYP	7580	241539	205	091	241444	4154	4022	2728	6789	59	19	HBJBH
			7											
00457	PJX	BEA	7590	241041	102	808	240950	5360	4022	8984	0983	48	24	68486
00614	PJX	BEA	7590	241717	104	810	241613	9707	7236	8984	0983	29	29	JAAAJ
			2											
00624	MXV	BJL	3575	241807	308	295	241728	8546	1629	9460	8778	84	29	FFBGG
00640	MRS	CHJ	3970	241851	658	718	241716	4154	9865	1936	2387	62	19	DDHAA
00415	MRS	CHJ	7930	240817	653	694	240728	9915	5895	1936	2387	60	47	DDHAA
00477	MRS	CHJ	7930	241127	655	704	241032	5343	9865	4032	5672	53	23	FFBGG
00448	MRS	CHJ	7930	241028	654	699	240943	8546	4022	9343	9353	49	28	DDHAA
00474	SSZ	CHJ	7930	241120	506	701	241015	0770	7236	1936	5753	65	23	FFBGG
00377	SSZ	CHJ	3970	240147	501	686	240117	7395	1629	5914	6248	37	31	FFBGG
00665	YKD	CHJ	3970	242120	402	731	242030	8383	2258	5914	6608	72	30	DDHAA
			7											
00621	HOT	DYO	6640	241738	707	851	241619	1300	3618	3277	1036	53	28	HDBHD
00674	HOT	DYO	2440	242350	710	861	242240	0770	6407	0289	4484	79	24	DAEAD
00544	HOT	DYO	6640	241415	706	845	241335	9121	3212	0289	4484	65	26	DAEAD
00482	IZW	DYO	5485	241135	004	829	240910	4154	4022	0289	4097	43	27	JFFJF
00650	NJG	DYO	2440	242006	905	854	241926	8725	5858	0289	3638	37	35	DAEAD
00668	NJG	DYO	2440	242144	906	858	242009	1715	7236	0289	3638	45	21	DAEAD
00535	ZNM	DYO	6640	241348	807	842	241223	2958	1629	8731	2260	45	33	DAEAD
00439	ZNM	DYO	5485	241011	804	831	240956	4154	4833	0289	6680	80	30	FBHFB
00568	ZNM	DYO	6640	241524	809	841	241219	1715	9865	0289	6680	55	17	DAEAD
			9											
00522	HDG	EDH	6160	241311	802	752	241230	9707	4022	5310	8994	54	16	EGBGE
00444	MKP	EDH	6160	241023	953	750	240948	4181	3212	5310	5870	69	26	EGBGE
00612	MKP	EDH	6160	241714	955	755	241612	9915	7236	5310	5870	82	32	DCGCD
			3											
00539	PJX	EUZ	6050	241406	201	731	241250	9915	4634	9668	0983	63	37	68486
00596	PJX	EUZ	6050	241630	202	732	241525	8349	7236	9668	0983	42	15	JAAAJ
			2											
00647	WDU	FIB	3675	241959	106	417	241918	2958	4634	6139	3647	73	32	FFBGG
00431	MRS	FMT	7340	240928	952	239	240847	2958	1629	2458	5672	42	35	AGHAG
00333	MRS	FMT	3420	240402	951	235	240328	1976	9865	0612	7454	45	41	AGHAG
			2											
00664	AAA	FNL	3435	242116	255	469	242035	2958	4022	4177	7067	73	14	IIHFF
00401	OHG	FNL	7355	240632	452	461	240617	3702	1266	9947	1658	82	26	IIHFF
			2											

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00623	NIO	FSD	6680	241758	156	059	241723	2939	9234	2593	4529	34	51	FFBGG
00438	NIO	FSD	6680	241009	152	048	240844	5360	5661	1882	8499	80	27	DDHAA
00503	WCB	FSD	6680	241232	303	052	241142	8546	7236	0847	2224	59	48	FFBGG
00408	WCB	FSD	6680	240741	301	045	240615	1715	4022	2593	4538	81	33	FFBGG
00515	WCB	FSD	6680	241300	305	054	241220	8383	1042	2593	4538	95	13	DDHAA
00519	WCB	FSD	6680	241305	306	054	241220	8383	1042	2593	4538	90	16	DDHAA
00622	WCB	FSD	6680	241744	309	062	241740	4154	3436	2593	4538	54	21	FFBGG
00376	XNW	FSD	2400	240138	352	043	240049	4181	3212	1882	2936	86	31	DDHAA
00574	XNW	FSD	5805	241530	354	057	241440	9194	1420	2593	6167	46	26	DDHAA
00435	XNW	FSD	6680	240958	353	047	240823	9915	9234	2593	6167	82	50	DDHAA

10

00652	NCM	GEP	2990	242024	906	594	241935	0770	6407	4302	9795	62	43	DCGCD
00580	NCM	GEP	5635	241552	903	584	241507	2939	9234	4302	9795	55	27	AEFEA
00606	NCM	GEP	6750	241703	904	586	241623	5576	0215	4302	9795	43	13	AEFEA
00559	VXI	GEP	5635	241506	105	583	241450	8349	9865	4302	8174	48	26	AEFEA
00412	VXI	GEP	6750	240753	102	564	240722	8339	9865	4302	8174	65	30	CCFII
00490	VXI	GEP	6750	241204	104	572	241035	1300	5661	4302	8174	59	39	AEFEA
00549	XBS	GEP	6750	241437	802	579	241312	2958	3266	4302	0163	32	24	AEFEA
00605	XBS	GEP	6750	241657	803	585	241617	9194	4833	4302	0163	46	19	CBECB
00405	XBS	GEP	6750	240706	801	562	240620	4181	1629	4113	2765	62	29	DCGCD

9

00384	OLY	GKS	3970	240408	101	689	240322	8349	3212	1936	7436	28	41	CFIFC
00479	OLY	GKS	7930	241131	104	702	241016	2958	5661	1936	7436	56	22	CFIFC
00554	OLY	GKS	7930	241452	107	711	241327	9987	7236	1936	7436	45	17	DCGCD
00553	OLY	GKS	7930	241449	106	713	241349	2532	4833	8830	7436	38	24	DHBDH
00422	WID	GKS	7930	240906	205	695	240831	9121	3618	8830	0280	81	33	CFIFC
00470	WID	GKS	4295	241107	206	698	240942	5360	3212	1936	8084	48	15	CFIFC
00400	WID	GKS	7930	240630	202	692	240536	1715	4022	1936	8084	51	37	ADEAD
00586	WID	GKS	7930	241608	208	715	241502	4181	1042	1936	8084	26	35	CFIFC
00654	XNW	GKS	4295	242031	305	721	241936	1300	9234	1936	0497	37	38	CEHCE
00472	XNW	GKS	7930	241109	302	697	240940	4154	4022	1936	0497	28	32	CFIFC
00590	XNW	GKS	7930	241618	304	716	241513	9915	0215	1936	0497	43	30	CEHCE

11

00508	MKP	HDG	7080	241241	554	195	241205	9987	5661	3466	5870	54	28	DCGCD
00512	MKP	HDG	7080	241253	555	193	241143	5360	2258	3466	5870	38	04	EGBGE
00639	NCM	HDG	3200	241848	406	199	241750	4154	1042	3466	9795	46	45	EGBGE

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00627	DYO	HOT	2380	241822	259	679	241702	9915	0476	9569	4097	73	38	HDBHD
00487	DYO	HOT	6700	241157	255	670	241043	1300	1629	9569	4097	53	40	DAEAD
00502	DYO	HOT	6700	241230	256	673	241120	1976	9865	9569	4097	69	03	HDBHD

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00556	MDR	IBF	7810	241504	853	657	241345	4154	3266	4393	2305	33	44	80808
00513	OFW	IBF	7810	241258	606	655	241213	9707	9234	4393	8570	25	37	DCGCD
00382	PJX	IBF	3690	240359	401	643	240324	8349	5661	4393	0983	58	16	DJDJD
00661	WPB	IBF	3690	242103	455	669	242005	9915	9234	4393	6275	29	15	GIFIG
00601	WPB	IBF	7810	241649	453	661	241540	2958	0215	4393	6275	59	24	GIFIG
00423	XTG	IBF	7810	240911	752	647	240836	2939	4833	4393	5753	60	19	AIJAI
00520	XTG	IBF	7810	241308	755	656	241217	7395	3212	4393	5753	84	35	DJDJD
00523	XTG	IBF	7810	241314	756	656	241217	7395	3212	4393	5753	83	26	DJDJD
00485	XTG	IBF	7810	241142	754	652	241026	1715	1420	4690	6437	51	12	DJDJD
00633	YTG	IBF	3690	241837	656	664	241732	5360	9865	4393	3971	46	25	80808

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00399 OFW JIF 6060 240609 552 853 240519 9987 3618 9974 8570 54 26 95459
 00576 OGN JKR 6240 241540 453 899 241450 8546 3212 8038 1865 46 35 I IHFF
 00385 ZZZ JKR 2120 240413 501 866 240314 8349 3618 8038 2134 48 15 I IHFF
 00644 ZZZ JKR 2120 241935 511 908 241745 9915 4022 4285 3890 69 34 I IHFF
 00451 ZZZ JKR 6240 241031 503 879 240951 5576 1050 4285 3890 66 03 I IHFF
 00491 ZZZ JKR 6240 241209 504 885 241136 9987 9637 4285 3890 40 46 I IHFF
 00543 ZZZ JKR 6240 241415 507 897 241340 1399 3436 4285 3890 41 27 I IHFF
 00593 ZZZ JKR 6240 241621 509 903 241521 2939 8810 4285 3890 91 25 ABCAB
 00660 ZZZ JKR 2120 242052 512 913 242002 1976 7236 5824 6581 27 14 I IHFF
 00560 ZZZ JKR 6240 241507 508 895 241328 4154 5858 5824 6581 56 36 I IHFF

9

00570 MJZ JLJ 6245 241526 304 294 241401 7395 2455 3051 6239 90 03 FFBGG
 00416 IBF MDR 7720 240820 503 843 240735 2939 0215 0775 5979 56 38 80808
 00516 IBF MDR 7720 241302 504 845 241220 0770 9865 0775 5979 42 25 GIFIG

2

00540 JLJ MJZ 7355 241408 657 465 241243 5360 7236 3088 8183 95 09 DDHAA
 00592 OSB MJZ 4610 241619 003 467 241529 9707 8810 3088 6239 52 21 FFBGG

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00645 EDH MKP 3420 241945 602 264 241825 4181 9234 6238 1540 33 45 DCGCD
 00588 EDH MKP 4605 241612 601 259 241515 1715 5661 6238 1540 36 14 EGBGE
 00636 HDG MKP 3420 241839 308 263 241743 4154 4022 6238 8994 80 24 EGBGE
 00446 HDG MKP 7340 241024 302 245 240934 8546 3618 6238 8994 72 28 DCGCD
 00565 HDG MKP 7340 241517 306 253 241348 7395 7236 6238 8994 74 22 CCFII
 00484 MWC MKP 7340 241140 505 248 241040 5782 8810 6238 0992 88 25 EGBGE
 00486 MWC MKP 7340 241145 506 248 241040 5782 8810 6238 0992 87 29 EGBGE
 00550 MWC MKP 7340 241445 507 254 241350 1976 4833 4744 5889 65 33 GHEGH

8

00402 CHJ MRS 6240 240643 101 869 240528 2958 6631 8092 2026 70 30 DDHAA
 00537 CHJ MRS 5145 241353 105 886 241154 5360 4237 8038 4376 46 21 GBIGB
 00579 CHJ MRS 6240 241544 106 901 241501 3343 0286 4285 6527 58 23 DDHAA
 00616 FMT MRS 6240 241723 207 906 241622 3343 0286 4285 5870 72 20 FFBGG
 00488 FMT MRS 6240 241158 206 882 241033 1715 9234 8092 6112 50 26 AGHAG
 00421 TPY MRS 5145 240905 002 872 240840 9987 1690 4285 2387 26 25 JGGJG
 00673 YKD MRS 5145 242346 308 919 242300 9194 5661 4285 3098 44 42 EIDEI
 00585 YKD MRS 6240 241608 307 902 241513 3343 0286 4285 3098 63 28 FFBGG
 00442 YKD MRS 6240 241018 305 873 240848 7395 7082 8038 6608 70 09 DDHAA

9

00499 EDH MWC 6800 241225 903 412 241146 7395 3266 1495 1540 38 30 EGBGE
 00517 HDG MWC 6800 241302 152 413 241217 9194 4833 1495 8039 53 25 EGBGE
 00380 MKP MWC 2920 240328 751 407 240253 5576 9234 1495 5870 73 28 EGBGE
 00632 MKP MWC 2920 241831 755 418 241729 1715 0215 1495 5870 59 18 CCFII
 00456 MKP MWC 6800 241040 754 411 240934 8349 1420 1495 5870 42 21 EGBGE

5

00417 PKP MXV 6375 240821 605 716 240711 9915 9865 4753 8354 56 34 DDHAA
 00445 GEP NCM 7430 241024 752 833 240915 9915 3212 0351 3098 62 20 AEFEA
 00567 GEP NCM 7430 241522 755 841 241406 2958 5895 0351 3098 64 26 CCFII
 00649 HDG NCM 3350 242003 204 842 241938 8339 4833 0351 8994 75 13 DCGCD

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00628 FSD NIO 2250 241823 909 514 241732 9707 2258 5806 1531 40 24 FFBGG
 00454 FSD NIO 6130 241037 904 502 240957 9987 9865 5806 1531 37 27 DDHAA
 00495 FSD NIO 4895 241214 905 503 241030 0770 0215 9433 9777 64 32 FFBGG
 00547 WCB NIO 6130 241431 205 505 241242 1300 9234 5536 2963 47 30 FFBGG
 00391 WCB NIO 2250 240446 201 497 240406 0770 4833 5806 4538 45 18 DDHAA
 00418 WCB NIO 6130 240840 202 500 240810 5576 5661 5806 4538 53 36 DDHAA
 00620 WCB NIO 6130 241733 206 512 241507 4181 7027 5806 4538 79 18 FFBGG

7

00428 DYO NJG 6410 240922 152 504 240832 9707 0215 5356 4097 58 51 BGIBG
 00545 HOT NJG 6410 241422 451 511 241327 2939 4833 4096 0019 47 26 DAEAD
 00657 NVT NJG 2690 242036 553 514 241948 4154 4634 5356 0938 40 32 DCGCD
 00507 ZNM NJG 6410 241240 603 508 241150 8546 9234 0298 0244 71 23 DAEAD

4

00534 AYP NVT 5845 241343 655 661 241253 0770 4022 1765 9489 54 18 HBJBH
 00447 AYP NVT 7000 241025 652 656 240945 3343 5661 1765 9489 93 29 HBJBH
 00450 AYP NVT 7000 241030 653 656 240945 3343 5661 1765 9489 88 22 HBJBH
 00481 UBT NVT 7000 241132 154 657 241026 8349 3618 1765 0208 46 19 HBJBH
 00625 YKD NVT 2720 241809 352 665 241749 9345 0286 1873 5203 61 25 HBJBH

5

00425 IBF OFW 6780 240914 452 641 240834 8546 9865 5635 5979 83 36 DJDJD
 00655 JIF OFW 2940 242034 309 664 241949 4154 7236 5635 9641 73 25 50505
 00480 JIF OFW 5185 241131 304 648 241045 8339 4833 5635 9641 57 39 ECHCE
 00546 JIF OFW 6780 241429 307 653 241317 9915 4022 5635 9641 54 26 28082
 00589 RME OFW 5185 241612 502 658 241523 8339 4833 5635 4844 57 40 ECHCE
 00388 XTG OFW 2940 240421 051 631 240346 9194 4022 5635 5753 37 13 BCEBC
 00528 XTG OFW 6780 241330 054 652 241215 9915 5895 5635 5753 96 28 BCEBC
 00531 XTG OFW 6780 241336 055 652 241215 9915 5895 5635 5753 79 21 BCEBC
 00468 ZYV OFW 5185 241102 205 644 241020 8339 4833 5635 7779 57 25 95459
 00413 ZYV OFW 6780 240808 202 639 240719 0770 0215 5635 7779 42 23 DCGCD

10

00564 JKR OGN 6320 241514 351 703 241425 1300 4237 5897 2387 60 33 IHHFF
 00378 ZZZ OGN 2040 240200 700 658 240025 2958 1042 5897 3890 27 38 FEAFE
 00631 ZZZ OGN 2040 241831 713 710 241710 9915 3436 5897 3890 46 09 IHHFF
 00634 ZZZ OGN 2040 241838 714 708 241639 0770 1050 5897 3890 63 18 IHHFF
 00532 ZZZ OGN 6320 241337 711 692 241217 1976 5802 5897 3890 35 04 IHHFF
 00506 ZZZ OGN 6320 241237 709 682 241142 8339 5661 7471 4295 59 06 IHHFF
 00630 ZZZ OGN 2040 241828 712 712 241748 8546 5858 6247 7481 48 21 IHHFF
 00669 ZZZ OGN 2040 242158 715 718 242102 4181 6631 6247 7481 62 23 IHHFF
 00467 ZZZ OGN 6320 241102 707 669 240843 9915 3212 6247 7481 44 29 IHHFF
 00504 ZZZ OGN 6320 241234 708 678 241026 0770 4833 2827 8525 84 13 IHHFF

10

00449 FNL OHG 6335 241030 603 582 240913 8349 3212 3619 6031 67 42 IHHFF
 00404 GKS OLY 7540 240705 851 343 240630 5360 8810 8425 6527 38 23 CFIFC
 00478 GKS OLY 7540 241127 853 348 241042 8339 7236 8425 6527 49 22 DCGCD
 00584 WID OLY 7540 241559 503 351 241513 3343 4022 8425 8084 61 34 CFIFC

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00607 JKR PDV 7660 241704 555 724 241624 8339 6631 6517 2387 25 23 IHHFF
 00397 OGN PDV 3500 240558 151 682 240516 9194 7027 4564 2503 34 27 IHHFF
 00459 ZZZ PDV 7660 241043 608 698 240943 8339 1050 6517 3890 98 34 IHHFF

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00460	ZZZ	PDV	7660	241047	609	698	240943	8339	1050	6517	3890	89	39	IIHFF
00462	ZZZ	PDV	7660	241052	610	698	240943	8339	1050	6517	3890	86	10	IIHFF
00387	ZZZ	PDV	3500	240417	601	675	240347	1976	5858	6698	7481	56	43	HAIHA
00646	ZZZ	PDV	3500	241953	615	727	241853	5576	9234	6698	7481	47	29	HAIHA

7

00635	BEA	PJX	2590	241839	255	695	241754	1976	3618	8137	2729	41	17	50505
00473	BEA	PJX	6510	241119	252	675	241013	9915	1629	8137	2729	75	41	68486
00572	BEA	PJX	6510	241527	254	687	241438	4181	9865	8137	2729	68	46	68486
00489	EUZ	PJX	6510	241202	603	681	241310	2939	4022	8137	5627	52	25	68486
00461	XFL	PJX	6510	241052	103	671	240957	7395	0215	8137	2251	73	41	JAAAJ
00437	XTG	PJX	6510	241008	354	670	240923	5576	9234	0180	0749	52	22	CCFII
00394	XTG	PJX	2590	240515	351	667	240440	1715	5661	8137	5753	46	25	DJDJD
00527	XTG	PJX	6510	241328	355	676	241238	7302	1042	8137	5753	39	20	DJDJD

8

00577	HDH	PPA	7235	241541	603	534	241437	4181	9234	4023	9722	57	23	DDHAA
00548	MJZ	PPA	7235	241437	404	532	241335	4154	3212	4023	6239	65	18	DDHAA

2

00456	OFW	RME	6970	241101	702	773	241026	8349	1629	6995	8570	39	23	ECHCE
00531	OFW	RME	6970	241553	703	774	241508	4181	8810	6995	8570	68	20	95459

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00619	CHJ	SSZ	7970	241732	607	492	241512	1300	0215	1224	6527	32	24	FFBGG
00582	VPO	SSZ	4475	241554	154	489	241434	4181	7236	1224	4097	71	31	FFBGG
00511	WDT	SSZ	7970	241250	057	481	241150	8339	0476	2926	1865	62	38	CJCCJ
00398	WDT	SSZ	7970	240601	052	465	240521	0770	9865	2052	3250	49	32	JCCJ
00452	WDT	SSZ	7970	241031	056	472	240946	8725	9637	1224	8390	53	30	DDHAA
00555	WDT	SSZ	7970	241452	058	484	241247	9915	3212	1224	8390	62	16	DDHAA

6

00411	AYP	UBT	6880	240753	752	849	240713	9987	1629	3899	7913	68	27	HBJBH
00599	AYP	UBT	6880	241643	753	854	241532	1300	9865	7011	9489	45	36	EDIED
00509	OFW	UBT	6880	241243	502	851	241148	7762	0215	7011	8570	36	34	DCGCD
00578	YKD	UBT	6880	241541	902	853	241426	4181	9234	7011	6789	51	42	HBJBH

4

00562	WDT	VPO	6640	241511	655	844	241320	7395	5661	7200	1865	76	25	DCGDC
00406	WDT	VPO	6640	240723	653	825	240643	3702	1050	0289	8390	34	20	DCGDC
00609	WDT	VPO	6640	241707	656	849	241538	8349	3266	0289	8390	82	17	DDHAA

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00381	GEP	VXI	2870	240333	651	507	240302	4181	3618	5202	3098	55	22	CCFII
00525	GEP	VXI	6870	241316	653	511	241240	1976	4022	5202	3098	69	31	AEFEA
00558	NCM	VXI	6870	241504	153	513	241425	8546	7236	5202	9795	57	27	AEFEA
00658	XBS	VXI	2870	242037	054	515	241937	0770	4634	5202	0163	28	35	AEFEA

4

00663	FSD	WCB	7660	242112	960	729	242042	2939	2455	0108	0532	83	32	FFBGG
00643	FSD	WCB	5225	241923	958	726	241810	8383	9098	6517	1531	71	31	DDHAA
00494	FSD	WCB	7660	241213	954	708	241137	1722	0286	6517	1531	55	12	DDHAA
00573	FSD	WCB	7660	241529	957	719	241439	3343	2258	6517	1531	38	22	DDHAA
00529	FSD	WCB	3500	241333	955	717	241228	4154	3618	7697	9777	59	52	DDHAA
00471	NIO	WCB	7660	241108	852	704	241038	1722	0286	6517	4529	55	28	FFBGG
00675	NIO	WCB	7660	242353	855	730	242308	9707	1690	6517	4529	78	31	FFBGG

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00598	NIO	WCB	7660	241638	854	721	241517	1715	9865	0577	7733	59	40	DDHAA
00396	NIO	WCB	3500	240555	850	683	240522	0371	4022	0108	8499	60	49	DDHAA
00496	XNW	WCB	7660	241216	756	703	241036	4154	8810	9334	1423	83	05	FFBGG
00498	XNW	WCB	7660	241222	758	712	241152	8725	4237	6517	6167	84	26	DDHAA
00501	XNW	WCB	7660	241227	759	712	241152	8725	4237	6517	6167	79	02	DDHAA
00424	ZHK	WCB	5225	240912	002	694	240817	8546	5895	6517	4538	74	47	FFBGG

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00653	SSZ	WDT	2040	242025	605	714	241950	9707	9098	5897	5753	56	31	CJCCJ
00569	SSZ	WDT	6320	241525	603	702	241320	5576	2210	1332	6248	47	24	DDHAA
00677	SSZ	WDT	2040	242358	606	720	242319	4181	6407	7471	7418	84	40	FFBGG
00533	VPO	WDT	5865	241338	504	697	241308	5303	1420	9028	3232	73	44	DDHAA
00587	VPO	WDT	6320	241610	507	704	241520	5576	2210	9028	3232	47	16	DDHAA
00536	VPO	WDT	6320	241350	505	684	241151	7395	1690	5897	4097	39	42	DCGDC
00615	VPO	WDT	6320	241717	508	706	241630	9194	9234	5897	4097	42	22	FFBGG
00500	YLV	WDT	5865	241226	002	672	240958	1715	9865	5897	8390	79	18	JBBJB
00552	YLV	WDT	5865	241448	003	695	241232	0770	1629	5897	8390	85	25	JBBJB
00395	YRF	WDT	5865	240546	101	663	240440	7395	0215	1332	8804	64	29	AJAAJ
00464	YRF	WDT	6320	241057	103	677	241022	7302	2455	5897	9489	43	12	DDHAA
00613	YRF	WDT	6320	241714	105	705	241622	5576	2210	5897	9489	47	27	FFBGG

12

00440	GKS	WID	7380	241013	702	834	240923	0770	6407	0397	6527	47	24	ADEAD
00551	GKS	WID	7380	241448	703	835	241347	1800	5661	0397	6527	35	14	ADEAD
00583	OLY	WID	7380	241555	401	839	241520	9987	4833	0397	5078	56	08	CFIFC
00666	XNW	WID	3380	242126	153	841	242018	4181	3212	0397	0497	75	24	DCGDC

4

00419	IBF	WPB	6200	240856	901	765	240815	2958	0476	0441	5979	63	43	GIFIG
00557	IBF	WPB	6200	241504	903	767	241414	3343	1629	0441	5979	55	16	80808

2

00602	GEP	XBS	6420	241654	555	253	241608	1300	0476	5176	0965	39	09	DCGDC
00476	GEP	XBS	6420	241124	551	245	241019	1715	9865	5455	3098	41	33	AEFEA
00571	GEP	XBS	6420	241526	554	249	241426	9121	0215	5455	3098	80	45	CCFII
00475	NCM	XBS	6420	241120	252	246	241045	5576	1629	5455	9795	53	21	AEFEA

4

00483	PJX	XFL	6150	241139	952	688	241038	1715	3618	5211	0983	37	22	68486
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00611	FSD	XNW	6450	241713	255	213	241632	9733	0476	0496	1531	29	20	DDHAA
00469	FSD	XNW	6450	241103	252	201	240925	9915	9098	3538	6257	27	34	FFBGG
00429	GKS	XNW	6440	240922	952	482	240839	1715	5895	2638	6527	73	32	CFIFC
00463	GKS	XNW	6440	241055	953	484	241027	9733	7082	2638	6527	59	20	CFIFC
00518	GKS	XNW	6440	241304	955	486	241150	2958	3618	2638	6527	42	23	CCFII
00538	NIO	XNW	6450	241405	805	204	241250	8339	7236	0856	2512	61	39	DDHAA
00630	NIO	XNW	6450	241647	806	210	241610	9733	0476	0496	4529	29	36	DDHAA
00648	OLY	XNW	2640	241959	604	493	241914	4181	1629	2638	5078	36	16	CFIFC
00591	WCB	XNW	5515	241619	105	208	241549	4773	3618	4915	2963	51	25	DDHAA
00667	WCB	XNW	2650	242141	107	216	242116	5576	6407	0496	4538	33	29	FFBGG
00403	WCB	XNW	6450	240703	102	197	240518	4154	1629	0496	4538	65	29	DDHAA
00420	WCB	XNW	6450	240903	103	198	240833	1976	2455	0496	4538	76	07	FFBGG
00604	WCB	XNW	6450	241655	106	211	241620	9733	0476	0496	4538	29	15	DDHAA

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00436	BWO	XTG	4475	241005	003	471	240920	5576	1629	1224	5753	32	40	JDDJD
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00526	BWO	XTG	4475	241326	005	483	241236	7302	1690	1224	5753	48	11	JDDJD
00637	IBF	XTG	3930	241842	658	495	241738	0770	3212	1224	5979	99	49	DJDJD
00638	IBF	XTG	3930	241848	659	495	241738	0770	3212	1224	5979	94	02	DJDJD
00641	IBF	XTG	3930	241853	660	495	241738	0770	3212	1224	5979	86	08	DJDJD
00493	IBF	XTG	7970	241212	654	475	241032	5360	3618	1224	5979	83	43	AIJAI
00603	IBF	XTG	7970	241654	656	493	241540	9915	4022	1224	5979	27	11	CCFII
00651	OFW	XTG	3930	242012	410	504	241902	1715	3618	0144	4475	47	27	DJDJD
00389	OFW	XTG	3930	240422	404	462	240328	8349	5661	1224	8570	29	06	CCFII
00433	OFW	XTG	7970	240946	405	468	240841	4181	0215	1224	8570	56	11	DCGCD
00521	OFW	XTG	7970	241310	411	482	241200	9987	9234	5031	8813	72	22	DJDJD
00670	PJX	XTG	3930	242215	803	508	242150	5790	4237	0144	0181	47	46	CCFII
00642	PJX	XTG	3930	241854	801	501	241809	1976	4833	9929	8543	65	35	DJDJD

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00610	FIB	YEC	7865	241710	302	375	241612	8339	1629	4636	7995	81	26	DDHAA
00392	KOT	YEC	3865	240458	401	371	240420	5360	6631	4636	5014	56	19	FFBGG

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00453	AYP	YKD	6740	241033	951	294	240943	3343	1629	3097	9489	72	26	BFHBF
00530	FMT	YKD	6750	241335	353	576	241240	9707	3212	5987	9137	58	37	DDHAA
00492	MRS	YKD	6750	241211	856	573	241121	8339	1420	4302	2387	94	25	FFBGG
00497	MRS	YKD	6750	241216	859	573	241121	8339	1420	4302	2387	92	21	FFBGG
00434	MRS	YKD	6750	240949	852	568	240843	1715	3618	5987	7454	43	28	DDHAA

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00541	SSZ	YRF	7580	241408	203	087	241143	7395	9234	6724	6248	65	42	DDHAA
00458	VPO	YRF	7580	241042	752	082	240931	1300	3212	6724	4862	59	10	DDHAA
00386	WDT	YRF	3580	240415	551	078	240320	1722	8810	2728	8390	37	37	FFBGG
00432	WDT	YRF	7580	240942	553	081	240832	1722	8810	2728	8390	43	28	DDHAA
00595	WDT	YRF	7580	241627	555	094	241517	0770	5661	2728	8390	28	19	AJAAJ

5

00465	IBF	YTG	5535	241059	752	919	241007	9121	7082	8560	5979	52	18	50505
00594	IBF	YTG	7050	241623	753	921	241522	4154	9865	8560	5979	47	36	80808
00608	IBF	YTG	7050	241705	754	922	241632	5360	9234	8560	5979	63	16	50505

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00542	DYO	ZNM	6550	241413	053	741	241248	8349	7082	7110	4097	47	44	DAEAD
00566	DYO	ZNM	6550	241518	054	746	241529	2958	4022	7110	4097	69	27	DAEAD
00414	HOT	ZNM	6550	240813	851	738	240738	5576	3618	7110	4484	42	10	DAEAD

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00659	OFW	ZYV	2620	242041	351	832	241942	2958	6407	8362	8570	75	19	28082
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00561	JKR	ZZZ	6330	241510	410	334	241340	1715	3436	6841	2387	44	24	I IHFF
00390	JKR	ZZZ	2050	240427	401	273	240356	0371	3868	8399	2387	46	30	I IHFF
00671	JKR	ZZZ	2050	242303	415	385	242108	8349	7236	3330	2819	34	23	I IHFF
00626	JKR	ZZZ	2050	241812	412	377	241742	9194	3212	8155	7454	53	17	ABCAB
00676	OGN	ZZZ	5875	242355	321	390	242250	5360	8810	4816	0578	44	26	I IHFF
00379	OGN	ZZZ	6330	240249	303	266	240214	2939	9865	4816	0578	55	28	I IHFF
00662	OGN	ZZZ	2050	242109	320	382	241920	9915	6407	8155	1865	43	19	FEAFE
00563	OGN	ZZZ	6330	241513	314	345	241453	1399	6270	8155	1865	76	27	I IHFF
00514	OGN	ZZZ	5875	241259	308	302	241134	2958	1629	6841	8390	28	26	FEAFE
00407	OGN	ZZZ	6330	240733	304	277	240658	0371	3868	8399	8390	46	45	I IHFF
00617	OGN	ZZZ	6330	241725	316	361	241648	5782	2455	8399	8390	57	32	9 IHFF
00510	OGN	ZZZ	2050	241249	307	326	241229	9987	3618	6148	9515	91	31	I IHFF

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00524 OGN ZZZ 2050 241314 309 326 241229 9987 3618 6148 9515 90 22 IHHFF
 00393 PDV ZZZ 2050 240513 101 275 240458 0371 3868 8399 4538 46 20 HAIHA
 00426 PDV ZZZ 6330 240917 103 279 240711 1300 1690 8399 4538 92 11 IHHFF
 00427 PDV ZZZ 6330 240920 104 279 240711 1300 1690 8399 4538 87 25 IHHFF
 00430 PDV ZZZ 6330 240926 105 279 240711 1300 1690 8399 4538 64 37 IHHFF
 00441 ZZZ ZZZ 5875 241015 003 285 240925 9121 7082 8399 3890 87 08 JEEJE
 00443 ZZZ ZZZ 5875 241020 004 285 240925 9121 7082 8399 3890 79 41 JEEJE
 00618 ZZZ ZZZ 5875 241727 007 358 241615 4154 4022 8399 3890 33 14 JEEJE

20

00843 MWD AAA 3285 251825 752 322 251711 4785 2690 2304 9380 70 51 IHHFF

00744 JKR ALL 6570 251053 054 754 251027 6331 7416 5491 9173 86 33 DAEAD

00861 XGC BJK 3560 252150 205 138 252009 8745 8604 1099 4123 86 26 DDHAA

00678 YXH BJK 3560 250244 551 111 250216 6331 6246 8326 3548 43 28 FFBGG

00732 YXH BJK 7600 251027 556 118 250943 8745 7416 1099 6761 91 18 AJAAJ

00748 YXH BJK 7600 251103 558 121 251020 7330 2248 1099 6761 67 24 FFBGG

00784 YXH BJK 7600 251258 560 129 251157 3399 3635 5103 0352 66 32 FFBGG

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00722 GKS CHJ 4115 251003 002 532 250927 9356 3850 1017 4123 43 29 JDDJD

00701 NOR CHJ 7950 250852 651 529 250815 2560 5282 1017 4321 47 25 AIJAI

00795 NOR CHJ 7950 251349 653 544 251240 5315 6246 1017 4321 72 40 CCFII

00831 NOR CHJ 7950 251709 654 548 251535 3191 2042 1017 4321 88 12 DJDJD

00844 RHW CHJ 3950 251828 806 550 251743 8311 2826 1017 2710 73 31 DJDJD

00858 RHW CHJ 3950 252103 807 552 251917 2561 7416 1017 2710 56 40 DCGCD

00692 RHW CHJ 7950 250755 802 528 250720 1372 5461 1017 2710 42 10 DJDJD

00775 XME CHJ 7950 251242 406 538 251110 5351 8055 1017 7049 57 49 DJDJD

00789 XME CHJ 7950 251303 408 539 251122 5531 1070 1017 7049 62 22 DJDJD

9

00715 RHW COG 7610 250947 102 813 250916 5531 7416 7354 2710 82 41 JAAAJ

00740 LYD DSM 6840 251047 704 848 251028 7330 6246 8795 5546 84 24 ADEAD

00710 XME DWL 6500 250939 552 858 250918 8311 4662 8353 7049 84 34 95459

00742 HCO EDH 6170 251051 653 525 251030 9356 6246 6715 1108 73 26 AEFEA

00741 NOR FDW 6180 251050 903 770 251036 1372 6246 8849 4321 59 08 GIFIG

00728 LYD FTV 7060 251017 953 496 250936 5315 4662 1008 5546 84 20 CFIFC

00816 LYD FTV 7060 251559 955 504 251452 3399 0846 1008 5546 59 25 DCGCD

00724 YWP FTV 7070 251013 104 223 250950 8311 6813 8894 2882 56 27 DDHAA

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00702 UBT FZX 7710 250858 652 740 250824 1723 8604 0315 0758 27 19 GBIGB

00834 NVU GKT 7915 251721 204 173 251602 5351 9800 2755 7157 92 19 DDHAA

00718 HIR GRU 6040 250953 952 303 250820 1723 2042 1107 8976 87 36 BFHBF

00757 HIR GRU 6040 251138 954 305 251017 5315 0854 0702 9812 32 30 HBJBH

00690 UBT GRU 6050 250650 851 602 250632 2560 9800 2674 0758 83 15 FFBGG

00776 UBT GRU 6050 251244 855 612 251115 3399 1070 2674 0758 64 27 EIDEI

00798 VXI GRU 6040 251400 405 308 251250 1562 0846 1107 8606 46 24 CCFII

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00755 NOR GYM 7340 251132 504 848 251038 3399 8055 0126 4321 67 11 28082
 00695 EDH HCO 6050 250824 102 604 250850 7330 7874 2674 6554 49 23 AEFEA
 00800 EDH HCO 6050 251406 105 615 251352 2561 0846 2674 6554 67 33 CCFII
 00803 TPY HCO 6050 251415 907 614 251226 3399 8639 9640 2837 76 30 CCFII
 00853 TPY HCO 2330 252038 909 619 251956 7330 4662 2674 8264 53 30 AEFEA
 00725 TPY HCO 6050 251014 904 608 250913 1562 8055 2674 8264 84 28 DCGCD
 00768 XZI HCO 6050 251212 805 610 251058 5351 0846 1152 7355 36 16 AEFEA
 00822 XZI HCO 6050 251632 808 617 251523 3191 2826 2674 8561 57 39 CBECB

7

00750 GRU HIR 7600 251109 205 122 251022 7782 2826 1099 5375 74 27 HBJBH
 00769 GRU HIR 7600 251213 208 126 251115 3399 6813 1099 5375 68 23 BFHBF
 00711 VXI HIR 7600 250940 104 114 250847 5531 6813 0009 4899 59 22 HBJBH
 00805 VXI HIR 7600 251422 107 132 251243 7782 3850 0009 4899 81 03 HBJBH
 00686 VXI HIR 7600 250606 102 112 250538 7123 0846 1099 8606 55 43 HBJBH
 00813 VXI HIR 7600 251534 109 135 251450 1309 8604 1099 8606 43 12 HBJBH
 00847 WDT HIR 3560 251901 307 137 251726 3191 1070 1099 1045 46 21 CCFII
 00719 WDT HIR 7600 250954 303 116 250920 1309 2042 1099 1045 74 33 HBJBH
 00859 WDT HIR 3560 252130 309 134 251424 5351 2042 2557 5861 53 34 HBJBH

9

00856 YWP HOT 2380 252050 309 075 251952 1562 4662 0252 1595 65 34 DDHAA
 00717 YWP HOT 6700 250952 304 069 250925 7330 8604 1062 2882 38 05 FFBGG
 00777 YWP HOT 6700 251245 307 072 251143 2560 0846 1062 2882 48 22 DDHAA

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00632 BWP IBG 3695 250516 201 421 250438 2560 6246 4519 7652 66 11 DDHAA

00681 ALL JKR 2420 250454 801 867 250426 5944 8055 5257 5050 62 30 DAEAD
 00747 PVJ JKR 6660 251102 705 878 251011 4785 6246 5257 3296 84 14 DAEAD
 00835 PVJ JKR 6600 251721 707 886 251547 1562 1070 2322 8237 45 07 DAEAD
 00731 WPX JKR 6660 251025 904 872 250936 3399 7416 5257 6149 56 23 DAEAD

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00817 XME KZE 7080 251621 355 836 251540 3191 6813 6733 7049 56 29 ECHCE

00713 NOR LNB 7510 250943 752 925 250847 8745 2826 2278 4321 83 46 80808
 00785 NOR LNB 7510 251258 755 927 251202 3191 1826 2278 4321 76 26 GIFIG

2

00862 DSM LYD 3790 252206 206 755 251546 4785 2042 0315 5096 54 37 ADEAD
 00791 DSM LYD 7710 251308 204 750 251127 5351 2248 0315 5096 82 27 CFIFC
 00849 FTV LYD 3790 251928 307 760 251843 2561 6246 7309 4682 56 25 CEHCE
 00807 FTV LYD 7710 251425 305 752 251314 7782 7416 0315 8895 39 32 CFIFC
 00759 PDV LYD 4635 251144 003 748 251041 1562 6813 0315 5546 48 38 JCCJC
 00683 SFV LYD 3790 250525 101 737 250457 8311 6813 0315 3458 48 21 CCFII
 00734 SFV LYD 7710 251032 103 743 250938 8745 8604 0315 3458 63 28 DCGCD
 00839 SFV LYD 7710 251743 106 758 251619 5531 1826 5932 3458 75 27 CFIFC

8

00779 ZZZ MEN 6220 251248 504 932 251214 8914 1070 2656 2369 95 28 IHHFF
 00782 ZZZ MEN 6220 251252 505 932 251214 8914 1070 2656 2369 91 14 IHHFF
 00706 ZZZ MEN 6220 250931 502 925 250832 3191 6246 6409 0488 34 36 IHHFF

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00810 WCC MEO 6225 251450 405 303 251241 3191 3635 1521 0406 73 12 DDHAA

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00696 MWD MKR 6355 250826 202 738 250732 2561 0079 3222 4600 39 10 IHHF
 00726 UBT MWC 6800 251016 954 271 250942 6331 0079 4609 0758 86 23 AGHAG
 00730 UBT MWC 6800 251021 955 271 250942 6331 0079 4609 0758 88 42 AGHAG
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 00826 AAA MWD 6815 251643 254 475 251535 3191 0846 6805 1955 68 40 IHHF
 00707 MKR MWD 6815 250932 352 472 250912 9309 5073 1459 5276 75 36 IHHF
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 00771 OFW NJG 6400 251232 954 764 251138 3399 0846 7822 4240 84 25 HBJHB
 00772 CHJ NOR 7790 251235 754 682 251139 7782 2042 2863 4123 72 27 DJDJD
 00836 CHJ NOR 7790 251727 756 685 251623 4785 2042 3079 4907 85 29 CCFII
 00736 FDW NOR 7790 251040 453 674 250939 3191 7416 2863 4655 48 22 28082
 00746 FDW NOR 7790 251101 455 678 251017 3399 8604 2863 4655 82 25 GIFIG
 00705 GYM NOR 7790 250907 852 672 250828 8914 6830 2863 0118 58 32 80808
 00851 LNB NOR 3710 251947 654 688 251842 1562 1070 2863 2350 76 26 80808
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 00703 OFW NUB 6100 250858 752 423 250817 1723 8604 9893 4240 69 13 GHEGH
 00780 WOG NVU 5950 251248 002 741 251219 0101 1070 3222 5276 83 22 FFBGG
 00766 RHW NXA 6530 251210 204 736 251130 2560 9800 2511 2710 75 06 68486
 00697 NJG OFW 6800 250837 602 268 250810 1723 6813 4609 9948 35 25 EGBGE
 00840 NJG OFW 6800 251746 608 284 251638 5531 8055 4609 9948 74 31 EGBGE
 00781 NUB OFW 6800 251248 505 276 251142 3191 7668 4609 9399 48 21 DCGCD
 00818 OLY OFW 6800 251621 307 282 251527 5315 4662 4609 7364 57 32 EGBGE
 00790 OLY OFW 6800 251303 305 280 251217 4785 2826 4195 8228 65 24 EGBGE
 5
 00827 OFW OLY 7540 251644 557 211 251528 2561 2042 1837 4240 47 48 DCGCD
 00763 OFW OLY 7540 251151 553 205 251047 7782 5282 1837 4240 38 06 EGBGE
 2
 00809 OGO OMR 7545 251439 503 436 251356 5315 4877 2089 4600 75 30 DDHAA
 00811 JKR PVJ 6000 251504 255 689 251438 1309 2690 6382 9173 62 31 DAEAD
 00855 ALZ RHW 3170 252042 106 718 251943 3191 4662 6481 9524 73 12 68486
 00788 ALZ RHW 7130 251259 103 711 251152 7782 3635 6481 9524 59 22 JAAAJ
 00756 CHJ RHW 7130 251135 353 707 251026 2561 8055 5329 7094 76 37 EGBEG
 00685 COG RHW 3170 250559 251 698 250525 1372 0846 6481 1090 64 20 28082
 00793 COG RHW 7130 251331 254 713 251217 3191 6813 6481 1090 85 15 68486
 00716 NXA RHW 7130 250951 602 704 250910 7782 8604 6481 3999 44 37 50505
 6
 00828 GKT RHX 7135 251648 603 437 251525 8745 8604 1080 2909 56 26 FFBGG
 00727 GXX RHX 7135 251016 504 434 250935 1309 1070 1080 7959 48 45 DDHAA
 2
 00814 FTV SFV 7840 251545 704 360 251438 4785 6813 7552 8895 76 18 DCGCD
 00758 LYD SFV 7840 251142 853 356 251150 5351 4418 7552 5546 92 31 CFIFC
 00761 LYD SFV 7840 251146 854 356 251150 5351 4418 7552 5546 89 28 CFIFC
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00842 XME SSF 2790 251804 705 779 251728 1562 1070 9505 7049 73 30 95459
 00804 HCO TPY 7410 251422 754 849 251346 8745 2826 8759 1108 59 41 AEFEA
 00829 FZX UBT 6220 251652 106 936 251516 5315 2860 2656 5546 56 25 DDHAA
 00770 FZX UBT 6220 251220 104 928 251049 7782 7874 6562 0398 82 18 DDHAA
 00738 GRU UBT 6220 251045 304 927 251016 1560 2826 2656 1108 43 24 FFBBG
 00688 GRU UBT 6220 250636 301 923 250536 5351 0854 6409 9975 39 38 FFBBG
 00838 MWC UBT 6220 251739 205 937 251640 1562 8055 2656 4240 28 28 FFBBG
 00841 WID UBT 4865 251803 004 939 251720 9356 4047 2656 0758 39 19 JGGJG

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00792 WNN VRG 6300 251328 254 745 251237 1372 8604 9730 1595 42 06 IHHF
 00689 ZZZ VRG 6300 250642 701 730 250615 9356 2826 4276 2369 53 40 FEAFE
 00820 ZZZ VRG 6300 251630 705 751 251540 3191 2042 4276 2369 89 29 IHHF
 00823 ZZZ VRG 6300 251634 706 751 251540 3191 2042 4276 2369 85 20 IHHF

4

00694 HIR VXI 6860 250804 752 863 250738 6331 6813 5482 8976 34 38 HBJBH
 00825 HIR VXI 6860 251640 756 870 251614 7123 7271 5482 8976 38 35 DCGCD

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00852 MEO WCC 3055 252026 506 540 252006 0552 2826 8371 6536 82 27 FFBBG

00845 GRU WDT 2740 251836 356 680 251732 8745 6246 0135 5375 49 26 HBJBH
 00721 HIR WDT 6980 251001 654 672 250920 7123 4877 3394 6284 58 14 DCGCD
 00773 HIR WDT 6980 251240 656 676 251145 5531 8604 0135 8976 74 26 CCFII

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00680 VRG WNN 3480 250447 151 733 250427 0380 6246 8506 0352 75 41 IHHF
 00708 ZZZ WNN 7280 250933 602 735 250846 2561 5282 4898 2369 98 39 IHHF
 00709 ZZZ WNN 7280 250938 603 735 250846 2561 5282 4898 2369 87 46 IHHF
 00801 ZZZ WNN 7280 251409 605 748 251311 4785 6813 7868 2431 94 19 IHHF
 00802 ZZZ WNN 7280 251412 606 748 251311 4785 8055 7868 2431 93 02 IHHF

5

00723 JKR WPX 7030 251003 153 519 250932 7592 1070 3826 9173 83 18 DAHAD

00749 BJK XGC 7950 251108 305 535 251017 2561 4418 3989 4989 89 32 DDHAA
 00796 YXH XGC 7950 251356 059 542 251211 5315 8055 4258 6626 47 04 DDHAA
 00765 YXH XGC 7950 251154 057 536 251038 3399 4662 1017 6761 91 48 CJCCJ
 00737 YXH XGC 7950 251041 055 534 250955 4785 0846 1017 6761 87 17 FFBBG
 00684 YXH XGC 3950 250551 051 526 250515 7592 4662 3989 0352 65 26 DDHAA
 00830 YXH XGC 7950 251653 062 547 251527 2561 3256 3989 0352 35 51 FFBBG

6

00774 CHJ XME 6080 251242 055 679 251141 4785 7416 5437 3377 78 45 DJDJD
 00729 CHJ XME 6080 251020 053 675 250926 8745 2826 0270 3953 62 19 CCFII
 00837 DWL XME 6080 251736 304 689 251632 5315 6246 4005 5825 72 29 95459
 00797 KZE XME 6080 251358 203 683 251312 5351 2826 4005 6121 55 17 ECHCE
 00691 RHW XME 6080 250725 901 670 250648 8311 7271 4005 2710 43 27 DJDJD
 00704 SSF XME 6080 250900 502 672 250819 1309 1070 4005 0505 64 28 50505

6

00751 YWP XNW 6450 251110 206 523 251042 1723 2042 3385 2882 47 09 FFBBG
 00806 YWP XNW 6450 251425 208 526 251326 7782 6830 3385 2882 63 21 DDHAA

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00778 HCO XZI 7040 251248 553 262 251206 7592 1070 3925 1108 67 27 AEFEA
 00821 HCO XZI 7040 251631 555 265 251525 5351 8055 6931 4349 52 23 CCFII

2

00754 FSD YWP 5445 251130 003 741 251010 3191 0079 4898 2882 34 13 FFBGG
 00787 FTV YWP 7280 251259 753 745 251134 8745 9800 4898 6590 47 20 DDHAA
 00794 FTV YWP 7280 251340 754 747 251239 1562 6244 4898 6590 83 52 DDHAA
 00712 HOT YWP 7280 250942 951 737 250913 7123 6813 7840 6923 69 21 FFBGG
 00824 HOT YWP 7280 251636 956 751 251520 3399 1826 8506 8930 43 37 FFBGG
 00762 HOT YWP 7280 251149 953 743 251103 5351 8604 4898 9939 92 33 DDHAA
 00764 HOT YWP 7280 251153 954 743 251103 5351 8604 4898 9939 90 17 DDHAA
 00848 XNW YWP 3480 251907 854 753 251842 0101 7416 4898 2891 28 30 FFBGG
 00714 XNW YWP 7280 250946 852 738 250917 2560 2826 4898 2891 62 15 DDHAA

9

00783 BJK YXH 6300 251255 107 743 251204 9356 4877 9730 4989 78 16 FFBGG
 00854 BJK YXH 2060 252042 112 755 251940 2561 1070 4276 8976 52 29 FFBGG
 00698 BJK YXH 6300 250839 102 733 250723 5315 7668 4276 8976 82 11 AJAAJ
 00760 BJK YXH 6300 251145 105 739 251019 8745 0846 4276 8976 43 45 FFBGG
 00815 BJK YXH 6300 251550 109 750 251532 8391 4662 5644 9209 65 35 DDHAA
 00699 EVW YXH 5745 250842 002 735 250810 1372 7271 4276 6761 63 42 JBBJB
 00846 XGC YXH 2060 251854 608 753 251728 4785 2690 4276 4123 47 32 FFBGG
 00863 XGC YXH 2060 252233 609 756 252108 5351 7416 7606 3953 56 27 DDHAA
 00767 XGC YXH 6300 251212 606 741 251116 7123 8055 7606 3953 45 24 DDHAA
 00743 XGC YXH 6300 251052 603 738 250954 8745 6813 4276 4123 84 25 DDHAA
 00745 XGC YXH 6300 251055 604 738 250954 8745 6813 4276 4123 87 22 DDHAA
 00735 ZHK YXH 6300 251035 503 737 250946 5531 3020 4276 9173 59 24 DDHAA
 00808 ZHK YXH 6300 251430 507 748 251406 0552 0846 4276 9173 61 35 DDHAA

13

00857 YXH ZHK 2420 252058 656 890 251937 5531 2826 5257 6761 38 26 DCGDC
 00700 YXH ZHK 6660 250850 652 870 250821 7592 8639 5257 6761 77 36 FFBGG

2

00860 MEN ZZZ 2070 252140 416 471 252122 4323 3635 5220 0758 86 10 ABCAB
 00799 MEN ZZZ 6310 251402 413 447 251237 3399 0846 5220 0758 47 31 IHHFF
 00850 MEN ZZZ 2070 251939 415 468 251850 7782 5461 6760 0758 56 17 IHHFF
 00720 MEN ZZZ 6310 251001 409 411 250841 2561 1070 6760 0758 83 23 IHHFF
 00687 VRG ZZZ 6310 250610 302 403 250520 5315 1070 5220 6761 29 43 IHHFF
 00733 VRG ZZZ 6310 251030 306 415 250926 8745 7416 6760 6761 46 26 IHHFF
 00833 VRG ZZZ 6310 251718 316 466 251702 9309 4418 6760 6761 58 44 IHHFF
 00786 VRG ZZZ 6310 251258 309 438 251140 3191 4662 4465 9326 45 47 IHHFF
 00812 VRG ZZZ 6310 251509 314 458 251413 5351 2042 6526 0352 77 08 IHHFF
 00679 WNN ZZZ 2070 250418 104 399 250349 6331 2826 0324 1333 82 50 HAIHA
 00819 WNN ZZZ 6310 251628 114 461 251533 5531 3256 6526 1595 34 29 IHHFF
 00752 WNN ZZZ 6310 251121 109 425 251023 5315 6830 6760 2882 94 16 IHHFF
 00753 WNN ZZZ 6310 251125 110 425 251023 5315 6830 6760 2882 93 20 IHHFF
 00693 ZZZ ZZZ 5755 250802 002 408 250730 1309 5073 6760 2369 52 34 JEEJE
 00739 ZZZ ZZZ 5755 251045 004 418 250942 4785 6246 6760 2369 46 13 JEEJE
 00832 ZZZ ZZZ 5755 251717 006 463 251613 1562 8604 6760 2369 64 26 JEEJE

16

00936 AAA AAA 5340 261017 001 352 260926 7376 2457 9280 3412 75 47 IHHFF
 01185 NUC AAA 3305 261841 758 358 261735 6152 6246 0117 0884 63 27 IHHFF
 01078 ZJV AAA 7465 261355 907 354 261218 3579 4283 4500 0280 49 28 IHHFF

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01041	EJJ	CUN	7730	261257	056	579	261206	5369	1889	8399	5636	46	28	FFBGG
01000	EJJ	CUN	7730	261201	052	571	261038	0752	8667	7750	5906	93	40	CJCCJ
01004	EJJ	CUN	7730	261204	053	571	261038	9988	8667	7750	5906	86	28	CJCCJ
01205	EJJ	CUN	3770	262013	058	605	261917	3579	5265	7507	8750	71	44	DDHAA
00976	GXW	CUN	7730	261120	301	565	260917	0149	4473	7750	7328	57	21	DDHAA
01139	GXW	CUN	7730	261607	302	588	261533	2182	1232	7750	7328	66	20	DDHAA
00988	MKP	CUN	7730	261143	603	570	261024	0752	9403	7750	1702	43	34	FFBGG
01024	MKP	CUN	7730	261230	604	576	261140	4360	6246	8399	9010	38	25	FFBGG

8

00964	GSL	EDH	6160	261101	502	892	261017	0193	5265	3853	5410	74	20	DCGCD
00908	LAM	EDH	6160	260910	752	879	260811	9988	0610	3853	7328	42	35	DCGCD
01168	LAM	EDH	6160	261738	756	897	261649	6945	5652	3853	7328	68	40	HBJBH
01099	LAM	EDH	6160	261422	754	894	261320	8366	2600	8722	7571	92	48	HBJBH
01152	LAM	EDH	6160	261649	755	896	261548	4712	0459	0621	8165	77	15	HBJBH

5

00934	MEN	EEZ	6370	261010	253	695	260908	4712	0459	4735	7643	56	24	DCGCD
00951	MEN	EEZ	6370	261038	254	696	260934	0752	2600	4735	7643	82	13	DAEAD

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00984	CUN	EJJ	6280	261133	604	783	261008	0149	6488	2746	0776	45	28	FFBGG
01086	CUN	EJJ	6280	261406	606	802	261321	2182	1232	2746	0776	84	24	CJCCJ
01222	CUN	EJJ	2080	262257	609	815	262202	4712	4473	2250	2530	80	49	CJCCJ
01200	CUN	EJJ	2080	261939	608	814	261824	0752	2832	1422	3890	71	17	CJCCJ
00881	FSD	EJJ	2080	260545	502	767	260526	7103	6001	7976	1928	59	52	DDHAA
01115	FSD	EJJ	6280	261458	505	803	261354	3579	5652	1422	4916	95	34	DDHAA
01187	FSD	EJJ	2080	261849	509	812	261719	6152	7450	2746	7643	54	23	DCGDC
01040	FSD	EJJ	6280	261256	504	796	261215	3766	2457	2746	7643	83	26	DCGDC
01061	GXW	EJJ	6280	261325	106	798	261239	3171	7443	8119	3476	87	15	FFBGG
01174	GXW	EJJ	6280	261758	109	811	261652	6152	7443	1422	4826	36	50	DDHAA
01043	GXW	EJJ	6280	261259	104	791	261138	2182	3230	2746	7328	83	25	FFBGG
01045	GXW	EJJ	6280	261302	105	791	261138	2182	3230	2746	7328	96	38	FFBGG
01138	GXW	EJJ	6280	261602	108	806	261427	2336	5632	1738	8165	78	22	AJAAJ
00891	INJ	EJJ	5585	260724	001	770	260648	5773	2600	2746	5906	50	26	JBBJB
00999	INJ	EJJ	5585	261201	003	785	261032	9988	0459	2746	5906	55	19	JBBJB
01070	INJ	EJJ	5585	261343	004	795	261207	3145	0250	2746	5906	63	35	FFBGG
01163	INJ	EJJ	5585	261720	005	808	261526	6945	4283	2746	5906	68	34	DDHAA

17

01058	INK	EKC	5590	261324	003	614	261148	6945	6246	2098	7887	72	23	FFBGG
01131	NOS	EKC	6295	261537	704	616	261423	4712	5265	0469	8147	85	25	FFBGG
01214	VRH	EKC	2095	262101	906	618	262002	9988	1889	4546	1234	93	02	DDHAA

3

01012	ORI	EOU	6140	261219	704	858	261143	2182	5652	7174	1702	50	20	CCFII
01105	ORI	EOU	6140	261437	705	860	261258	0193	3814	7174	1702	63	11	CFIFC
01166	ORI	EOU	6140	261730	706	863	261628	9988	2600	7174	1702	44	39	CFIFC
00923	XTG	EOU	6140	260956	402	855	260902	6945	7443	7174	3566	82	43	CFIFC

4

00915	HPK	FHI	7500	260933	451	278	260904	0319	6246	2296	7274	71	25	AEFEA
01149	ZNM	FHI	7500	261638	555	282	261549	0149	2457	2296	0767	49	18	CBECB
00887	ZNM	FHI	7500	260704	553	272	260621	0752	6894	5284	6059	60	16	AEFEA

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01018	EJJ	FSD	6680	261225	655	910	261140	8366	6246	3772	5636	48	29	FFBGG
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00880 EJJ FSD 2400 260537 651 893 260452 0752 4473 3600 5906 46 18 DCGDC
 01198 EJJ FSD 2400 261933 658 932 261907 4712 0457 3961 6806 39 25 DCGDC

3

01079 GEP FTV 7070 261357 205 538 261233 0319 7443 1800 1261 69 29 FFBGG
 01147 GEP FTV 7070 261637 206 540 261542 3579 3230 1800 1261 55 22 FFBGG
 00900 GEP FTV 7070 260841 202 531 260715 0149 5652 6418 4439 34 36 DDHAA
 00986 HPK FTV 7070 261139 052 535 261029 3560 8251 1800 4961 53 24 FFBGG
 01104 HPK FTV 7070 261436 053 539 261358 3145 2600 5301 9803 39 27 DDHAA
 00916 PVJ FTV 7070 260937 902 533 260910 6321 2230 1800 8282 76 48 FFBGG

6

01084 GSL FZX 7730 261403 407 584 261310 5369 2457 7750 5410 88 33 DJDJD
 01089 GSL FZX 7730 261407 408 584 261310 5369 2457 7750 5410 79 30 DJDJD
 01204 GSL FZX 3770 262005 411 601 261846 4712 0610 5428 5654 44 22 DJDJD
 00963 GSL FZX 7730 261100 405 564 260912 9988 1232 7255 7058 91 29 CCFII
 00938 LYD FZX 4275 261018 001 566 260919 7376 5652 7750 0776 59 23 JDDJD
 01178 LYD FZX 4275 261820 003 593 261632 3579 7443 7750 0776 53 35 DJDJD
 00993 TDU FZX 7730 261155 654 574 261103 2182 5426 7750 2701 35 24 DJDJD
 01217 TDU FZX 3770 262120 660 608 262022 3560 0457 7255 3089 87 26 AIJAI
 01190 TDU FZX 3770 261852 658 596 261740 9375 2600 8399 8732 62 50 AIJAI
 01030 YRF FZX 7730 261238 807 572 261054 6945 5265 7750 1180 55 27 EGBEG
 01220 YRF FZX 3770 262239 811 610 262125 2336 0459 5428 2314 63 22 DJDJD
 01066 YRF FZX 7730 261336 808 580 261225 0319 4283 8399 7076 85 41 DCGCD

12

01026 FTV GEP 6740 261232 855 787 261058 3579 6246 0379 3980 76 33 DDHAA
 00902 FTV GEP 6740 260850 852 769 260739 0149 2457 6878 5221 69 21 DDHAA
 01046 FTV GEP 6740 261302 856 803 261212 5962 8296 0801 7346 86 46 FFBGG
 01206 FTV GEP 2980 262013 858 829 261942 6375 4473 3240 9740 45 10 DDHAA
 01226 FTV GEP 2980 262329 859 831 262204 6152 1232 3240 9740 53 18 FFBGG
 00918 HOT GEP 5625 260942 002 775 260811 3579 5652 3240 1261 37 16 FFBGG
 01054 HOT GEP 5625 261315 003 806 261235 3145 7244 3240 1261 74 27 DDHAA
 01211 HOT GEP 5625 262053 004 827 261838 0752 5265 3240 1261 53 36 DDHAA
 00968 HPK GEP 6740 261108 754 780 260923 2336 5265 3240 4961 74 37 FFBGG
 01073 HPK GEP 6740 261345 757 813 261304 2182 6894 3240 4961 91 24 DDHAA
 01160 HPK GEP 6740 261712 758 822 261508 9375 3814 6878 9803 64 32 DDHAA
 00890 HPK GEP 6740 260721 752 764 260527 3560 7443 8272 9876 55 31 DDHAA
 01036 PVJ GEP 6740 261247 956 801 261208 6321 0457 6067 1522 79 28 DDHAA
 01095 PVJ GEP 6740 261412 957 817 261335 2182 2600 8272 5294 44 04 FFBGG
 01019 PVJ GEP 6740 261225 955 796 261144 0193 3230 0801 6617 28 03 FFBGG
 00905 PVJ GEP 6740 260856 952 776 260820 7924 3076 3240 8282 48 41 DDHAA
 00995 PVJ GEP 6740 261155 953 784 261017 5369 0459 3240 8282 98 30 DDHAA
 00997 PVJ GEP 6740 261158 954 784 261017 5369 0459 3240 8282 89 26 FFBGG

18

00965 SFV GFH 6460 261102 155 437 261011 9375 0459 8362 0055 73 23 CCFII
 00906 SFV GFH 6460 260907 152 434 260813 2336 7244 6166 1397 67 17 DCGCD
 01031 SFV GFH 6460 261408 156 443 261334 3579 2600 0685 3098 63 08 DCGCD
 01032 WPX GFH 6460 261240 903 441 261145 6945 5652 8362 8318 59 26 CCFII
 01179 XME GFH 2620 261822 758 446 261728 9988 1232 8362 1612 86 27 EGBEG
 00940 XME GFH 6460 261026 754 435 260952 7376 8667 8362 1612 73 22 DCGCD
 00872 XME GFH 2620 260408 751 431 260329 3560 5265 6184 6671 75 26 EGBEG
 01110 XME GFH 6460 261450 757 445 261419 8366 6488 0685 9029 86 34 EGBEG

8

00975 EDH GSL 6480 261120 652 700 261011 2336 1232 8678 3241 80 08 DCGCD

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00899	EDH	GSL	6480	260836	651	695	260728	9375	3814	4681	5537	72	30	DCGCD
01094	FZX	GSL	6480	261412	057	716	261321	2182	4473	8678	2323	24	44	DJDJD
01142	FZX	GSL	6480	261613	058	719	261512	3560	6246	9794	3278	83	17	DJDJD
01025	FZX	GSL	6480	261232	055	705	261143	5369	2457	9983	0776	69	32	BCEBC
01203	HMX	GSL	2600	262004	206	725	261902	9988	2600	9983	5618	96	22	95459
01062	HMX	GSL	6480	261326	203	709	261218	0319	5265	9983	5618	73	40	50505
01167	HMX	GSL	6480	261734	205	720	261620	6945	2230	9983	5618	61	02	28082
00907	OFU	GSL	6480	260909	301	697	260813	4712	5652	9983	4312	75	27	28082
01126	OFU	GSL	6480	261524	304	718	261445	0752	7443	9983	4312	84	26	50505
00959	PIC	GSL	6480	261053	502	699	260932	0149	7244	9983	7580	47	37	ECHCE

11

01049	CUN	GXW	7620	261310	202	156	261132	5369	5265	9497	0776	83	23	FFBGG
01158	CUN	GXW	7620	261658	203	178	261538	0149	8667	8452	3890	30	26	FFBGG
00928	EJJ	GXW	7620	260959	553	145	260819	3579	2600	8452	5636	64	12	DDHAA
01181	EJJ	GXW	3540	261826	558	179	261732	0149	3814	9497	5906	69	23	AJAAJ
01034	EJJ	GXW	7620	261242	556	157	261151	0319	5652	9497	5906	52	19	AJAAJ
00956	EJJ	GXW	7620	261048	554	147	260907	0752	7443	8407	6806	83	37	DDHAA
01201	FSD	GXW	3540	261941	753	181	261825	6152	0655	3691	7562	69	27	DDHAA
01108	FSD	GXW	7620	261449	752	170	261333	0193	0459	9497	7643	52	25	FFBGG

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01057	GSL	HMX	7540	261324	353	838	261243	3145	3473	5112	5410	78	47	ECHCE
01111	GSL	HMX	7540	261452	354	840	261402	4712	2457	5112	5410	59	04	95459

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01068	FTV	HPK	7530	261340	803	239	261305	3145	6246	9136	4574	28	28	DDHAA
01135	FTV	HPK	7530	261548	804	240	261413	9988	4473	7273	9740	48	22	DDHAA
00947	GEP	HPK	7530	261035	103	235	260954	8366	6001	7273	1261	94	26	DDHAA
00974	GEP	HPK	7530	261118	104	235	260954	2336	6001	7273	1261	95	14	DDHAA
01157	GEP	HPK	7530	261656	107	241	261641	4700	0459	0522	9308	84	23	FFBGG
00879	GEP	HPK	3650	260532	101	231	260428	6945	1889	6832	9993	56	31	FFBGG
01008	ORI	HPK	7520	261212	953	516	261140	7709	6246	9406	1702	98	36	CFIFC
01010	ORI	HPK	7520	261217	954	516	261140	7709	6246	9406	1702	76	27	CFIFC
00914	PVJ	HPK	7530	260932	251	233	260817	0752	2600	2412	6617	49	30	DDHAA
00991	PVJ	HPK	7530	261147	253	237	261032	4712	1232	7273	8282	51	13	FFBGG

10

01083	EEZ	HVV	6590	261403	853	768	261255	3145	5265	3844	3287	43	51	DAEAD
00913	MEN	HVV	6590	260931	053	763	260823	9988	7450	3844	7643	85	42	CCFII
01027	MEN	HVV	6590	261232	056	766	261038	6945	1232	3844	7643	87	10	DAEAD
01125	MEN	HVV	6590	261520	057	769	261416	2336	4473	3844	7643	78	43	DAEAD

4

00896	YRF	IEO	7150	260830	202	739	260742	6945	7244	8948	1180	52	34	68486
01225	EDH	LAM	3540	262305	108	184	262146	6152	0459	8407	3241	42	04	HBJBH
01097	EDH	LAM	7620	261418	106	169	261312	7709	3473	8452	5537	51	25	DCGCD
01031	EDH	LAM	7620	261240	103	155	261109	0319	5652	9497	6978	61	25	EDIED
01056	EDH	LAM	7620	261321	105	166	261242	1317	8251	9497	6978	62	21	CCFII
00920	EDH	LAM	7620	260947	101	144	260806	3560	2600	5978	7832	46	45	EDIED
00998	PWB	LAM	7620	261201	204	152	261016	2336	7443	8407	2198	64	37	HBJBH
01148	PWB	LAM	7620	261637	207	177	261528	9375	7244	0937	2972	87	33	HBJBH
01212	PWB	LAM	3540	262053	208	183	262003	6945	0250	9497	3728	43	17	HBJBH
01067	PWB	LAM	7620	261340	205	163	261215	7709	3230	9497	3728	71	38	BFHBF
00985	RBU	LAM	4665	261136	002	154	261048	7376	2230	9497	7328	55	35	HBJBH

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01129 YXH LAM 7620 261536 308 175 261455 7709 2457 8452 3737 39 2A GEBGE
 00957 YXH LAM 7620 261048 303 148 260924 0752 1232 9497 9443 94 31 HBJBH
 00958 YXH LAM 7620 261052 304 148 260924 4712 1232 9497 9443 89 36 HBJBH
 00960 YXH LAM 7620 261056 305 148 260924 9988 1232 9497 9443 57 16 HBJBH

14

00932 LYE LLA 7655 261008 509 342 260843 9375 6246 5941 2693 58 49 DDHAA
 01182 YRG LLA 3535 261831 704 347 261728 0752 6001 5941 5195 73 25 FFBGG

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01064 YRG LYE 7695 261333 403 180 261316 0713 2457 4384 5195 65 33 FFBGG

01128 EEZ MEN 6680 261534 708 919 261420 2336 5632 3600 3287 84 15 DAEAD
 01133 EEZ MEN 6680 261541 709 919 261420 9375 5632 3600 3287 92 21 DAEAD
 01074 EEZ MEN 6680 261348 706 913 261219 4360 5265 3961 6798 51 26 CCFI1
 00937 EEZ MEN 6680 261017 704 901 260943 5962 5652 3772 7904 72 29 DAEAD
 00927 HVV MEN 6680 260958 802 898 260823 6945 5426 3600 3430 32 24 DAEAD
 01155 HVV MEN 6680 261651 806 920 261532 9988 1232 3600 3430 45 20 FBHFB
 01189 HVV MEN 2400 261851 808 928 261810 7376 0459 2188 8138 55 32 DAEAD
 00982 UBT MEN 5805 261126 001 902 261016 6152 3230 3600 7643 99 28 JFFJF
 01013 YLV MEN 6680 261220 905 908 261135 7376 7244 3600 4493 52 22 DAEAD
 01037 YLV MEN 6680 261247 906 903 261048 3560 2600 3600 4493 50 11 BGIBG
 01107 YLV MEN 6680 261446 908 916 261328 3579 5652 3600 4493 64 30 DAEAD
 01151 YLV MEN 6680 261648 909 923 261614 4360 7443 3772 7652 36 26 DAEAD

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01183 CUN MKP 3450 261835 503 803 261730 9988 7450 8713 0776 75 24 FFBGG
 01005 CUN MKP 7330 261208 502 789 261117 3145 4473 5671 2323 86 31 DDHAA
 01180 NUB MKP 3450 261826 752 802 261711 2336 5265 8713 1612 46 17 FFBGG
 01060 PWB MKP 7330 261325 402 791 261214 7709 1232 8713 0767 91 29 DDHAA
 00970 VXI MKP 7330 261112 653 787 261027 0193 6246 4401 0974 59 32 FFBGG
 00892 VXI MKP 7330 260734 651 773 260628 6152 3230 8713 9155 48 29 GBIGB
 01069 VXI MKP 7330 261342 655 792 261238 6746 6894 8713 9155 67 27 DDHAA
 01153 VXI MKP 7330 261650 659 797 261532 0752 2457 8713 9155 43 25 DDHAA

9

01116 TDU MKV 6380 261459 903 775 261428 0149 2600 7219 2701 49 35 80808

00969 WID NJG 6410 261109 152 538 261015 3579 5265 7318 6635 49 16 AEFEA
 00874 ZNM NJG 2690 260421 651 531 260330 2336 5426 7318 0767 52 29 AEFEA
 01035 ZNM NJG 6410 261244 655 539 261143 6945 4473 7318 0767 48 28 DCGCD
 01141 ZNM NJG 6410 261613 656 541 261528 3560 1232 5086 2585 85 07 AEFEA

4

01159 GKT NOS 7795 261702 205 435 261637 6746 0459 2980 6004 84 15 FFBGG

01100 MKP NUB 6100 261425 452 313 261310 3145 4473 4131 1702 62 24 DDHAA
 01208 VXI NUB 2260 262038 957 328 261950 6152 3076 4780 7968 37 23 DDHAA
 00962 VXI NUB 6100 261057 953 304 260948 6945 2457 4131 9155 75 09 AGHAG
 01150 VXI NUB 6100 261638 955 317 261502 2336 6246 6959 9687 64 19 AGHAG

4

00904 GSL OFU 7120 260855 551 861 260826 4360 6246 6823 5410 43 12 ECHCE
 01106 GSL OFU 7120 261442 553 863 261348 0752 4473 6823 5410 62 15 28082

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01137 ZJV OHG 6335 261558 305 753 261445 0149 8296 1594 7887 82 13 IHHF

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01224	EOU	ORI	3450	262303	209	811	262201	3560	7244	8713	5212	54	35	ADEAD
00911	EOU	ORI	7330	260920	202	779	260835	6152	0459	8713	5212	82	30	CFIFC
00935	EOU	ORI	7330	261012	206	785	260906	0149	0250	8713	5212	46	29	CFIFC
00871	HPK	ORI	3450	260353	301	766	260317	9988	5632	8713	7274	72	37	CFIFC
00992	HPK	ORI	7330	261148	305	788	261029	3560	3473	8713	7274	56	15	CFIFC
01102	HPK	ORI	7330	261428	307	794	261329	2182	3230	8713	7274	86	20	CFIFC
01161	HPK	ORI	7330	261714	308	800	261608	9375	6246	8713	7274	43	28	CFIFC
01044	XTG	ORI	7330	261302	106	790	261150	8366	2600	8713	3566	75	26	DCGCD
01196	XTG	ORI	3450	261916	109	807	261822	4712	5652	8713	3566	83	25	DHBDH
01143	XTG	ORI	7330	261613	108	796	261451	2336	7443	8713	3566	91	39	CFIFC

10

00952	GSL	PIC	6930	261041	703	781	260956	0149	4283	7859	5410	93	39	ECHCE
00955	GSL	PIC	6930	261046	704	781	260956	6152	4283	7859	5410	79	32	95459

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01080	FTV	PVJ	6000	261357	153	086	261243	3145	2457	8650	5221	51	28	FFBGG
00954	FTV	PVJ	6000	261045	151	081	260916	0149	4283	9460	9740	70	33	FFBGG
01113	GEP	PVJ	6000	261457	305	087	261323	5369	1232	9659	0037	92	40	FFBGG
01114	GEP	PVJ	6000	261457	305	087	261323	5369	1232	9659	0037	92	40	FFBGG
01219	GEP	PVJ	2360	262218	308	089	262109	6152	0610	9460	1261	71	27	DDHAA
01140	GEP	PVJ	6000	261608	307	088	261534	7709	0459	9460	1261	82	26	DDHAA
01088	GEP	PVJ	6000	261406	304	084	261151	3579	9403	8650	9993	36	27	FFBGG
01039	HPK	PVJ	6000	261254	353	085	261203	8366	4473	9460	4961	32	16	DDHAA
01028	HPK	PVJ	6000	261233	352	082	261028	6152	6246	7336	8192	54	39	FFBGG

9

01207	EDH	PWB	2560	262016	403	321	261910	2336	7443	0766	6978	63	03	DCGCD
00875	LAM	PWB	2560	260422	951	312	260345	4360	3230	0766	7328	96	31	BFHBF
00876	LAM	PWB	2560	260425	952	312	260345	4360	3230	0766	7328	84	34	BFHBF
00983	LAM	PWB	6520	261131	954	317	261017	9375	6246	0766	7328	37	39	CCFII
01009	MKP	PWB	6530	261213	551	641	261127	6746	5884	1053	1702	96	31	DDHAA
00884	NUB	PWB	6530	260617	352	627	260528	0752	0459	1053	1612	68	38	FFBGG
01144	NUB	PWB	6530	261619	354	652	261507	0149	5652	2737	5988	85	17	FFBGG
01169	VXI	PWB	6530	261740	858	656	261634	6152	5265	9550	0677	43	34	FFBGG
01121	VXI	PWB	6530	261505	857	645	261341	3579	3076	8957	7968	54	26	DDHAA
01001	VXI	PWB	6530	261201	855	640	261115	8366	1232	1053	9155	35	23	DDHAA
01101	YXH	PWB	6520	261427	803	319	261328	7376	8251	0766	9443	65	11	HBJBH

11

00878	GFH	SFV	3880	260509	651	215	260426	3579	6246	1864	0262	67	37	DCGCD
00977	GFH	SFV	7840	261120	654	223	261035	6152	0250	0216	7779	48	13	EGBGE
00994	GFH	SFV	7840	261155	655	225	261120	4360	2457	0216	7779	52	46	EGBGE
01112	WPX	SFV	7840	261453	053	229	261354	0149	4473	0216	8318	59	35	CCFII
01218	XME	SFV	3880	262145	556	235	262109	0193	3230	0216	1612	86	29	EGBGE
00888	XME	SFV	7840	260710	552	217	260631	2336	7443	0216	1612	55	25	EGBGE
00926	XME	SFV	7840	260958	553	219	260914	9375	5652	0216	1612	48	33	CIBCI
01170	XME	SFV	7840	261743	555	233	261702	4712	0457	0748	6671	63	41	EGBGE

8

00950	YWR	SFW	7845	261037	702	443	260922	6152	7450	1468	8804	67	28	DDHAA
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01033	FZX	TDU	7770	261241	756	708	261142	0149	2457	1233	0776	56	09	DJDJD
00980	FZX	TDU	7770	261124	755	706	261035	0752	6246	1549	3278	64	19	DJDJD
00886	FZX	TDU	7770	260650	752	696	260516	6945	4473	8803	3890	58	38	DJDJD
01210	GSL	TDU	3730	262051	603	724	262005	2336	1232	1233	5410	86	34	DCGCD

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00939 MKV TDU 7770 261019 453 703 260925 4712 0459 1233 3007 75 24 80808
 01081 MKV TDU 7770 261400 455 712 261250 0149 5652 1233 3007 68 31 GIFIG
 01186 UPP TDU 3730 261846 656 719 261748 6152 2600 1233 0820 75 26 80808
 01098 UPP TDU 7770 261420 653 715 261326 3579 0459 1233 0820 46 44 28082
 00917 ZHY TDU 7770 260937 852 701 260833 3560 0655 1233 8516 35 12 GIFIG
 00990 ZHY TDU 7770 261146 854 707 261112 9375 5265 1233 8516 43 15 50505

10

00946 YRF TTT 7630 261034 102 817 261013 2182 9403 5734 1180 38 04 68486
 01093 YRF TTT 7630 261410 104 819 261314 9988 7443 5734 1180 46 22 JAAAJ

2

01227 ZIC UMF 2160 262330 452 993 262241 0149 0459 7345 5906 63 32 IHHFF
 00865 ZZZ UMF 2160 260240 502 945 260220 5773 5265 7345 0730 42 24 IHHFF
 00921 ZZZ UMF 6200 260952 505 957 260817 2336 7443 7345 0730 39 18 IHHFF
 01090 ZZZ UMF 6200 261408 509 979 261328 9375 0655 7345 0730 83 41 IHHFF
 00897 ZZZ UMF 6200 260833 504 954 260743 3560 3230 9767 5014 93 27 IHHFF
 01122 ZZZ UMF 6200 261511 512 981 261402 6746 2230 5185 8886 70 39 IHHFF

6

01007 TDU UPP 7810 261210 753 931 261109 3560 0459 0649 2701 49 19 80808

00942 YRF VUS 7050 261030 952 694 260946 6152 5652 0388 1180 53 48 JAAAJ

01021 DSM VXI 4545 261225 001 971 261139 6746 3230 7345 9155 93 31 JGGJG
 01052 MKP VXI 6200 261313 108 976 261239 3766 6246 7345 1702 72 07 GBIGB
 01014 MKP VXI 6200 261220 107 972 261140 6746 5265 5185 4673 53 37 FFBGG
 00981 MKP VXI 6200 261126 106 967 261024 0752 3473 4825 6077 77 26 DDHAA
 01193 MKP VXI 2160 261902 112 986 261658 3579 5652 9767 9407 86 47 DDHAA
 01103 NUB VXI 6200 261432 204 980 261351 5369 4473 7345 1612 61 12 AGHAG
 01215 NUB VXI 2160 262103 208 990 261934 3560 1232 4933 5393 75 21 AGHAG
 01156 NUB VXI 6200 261656 207 983 261516 7376 6894 9767 9029 48 43 FFBGG
 00925 PWB VXI 6200 260958 303 963 260926 0319 2457 7345 0767 96 42 FFBGG
 00931 PWB VXI 6200 261003 306 963 260926 0319 2457 7345 0767 92 25 FFBGG
 01154 PWB VXI 6200 261651 309 984 261542 7709 7450 6364 2585 84 10 EIDEI
 01202 PWB VXI 2160 261943 310 988 261737 9375 2600 5185 8354 66 30 DDHAA

12

00885 YLW WDU 5870 260644 001 751 260620 5773 4473 1594 3647 76 24 FFBGG

01042 FHI WID 7390 261258 453 863 261217 5369 2600 7129 2279 38 42 CCFII
 00912 SFV WID 7390 260931 202 857 260846 0752 6001 7129 0055 39 23 DCGCD
 01120 ZNM WID 7390 261505 755 866 261421 9988 0610 7129 0767 73 39 DCGCD
 01177 ZNM WID 3390 261817 757 869 261729 4712 0459 9686 7742 50 30 AEFEA

4

00903 XME WPX 7020 260854 953 772 260825 6746 7443 6175 1612 61 37 HBJHB
 01015 XME WPX 7020 261222 954 778 261016 9988 3230 6175 1612 66 32 CCFII

2

00961 UNY XLN 6115 261057 653 479 261011 0193 7244 9857 5005 59 35 FFBGG

01195 GFH XME 2260 261913 508 326 261812 9375 5652 4780 0262 42 32 EGBGE
 00882 GFH XME 6100 260601 502 296 260516 6945 3230 6959 2855 46 22 EGBGE
 01221 GFH XME 2260 262254 510 330 262208 2182 7443 2566 6086 94 29 EGBGE
 01136 GFH XME 6100 261550 506 315 261455 0319 3076 4131 7779 58 15 DCGCD

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01055	SFV	XME	6100	261320	307	309	261210	7376	2600	4780	1397	47	08	EGBGE
00866	SFV	XME	2260	260256	301	291	260222	3560	1232	4131	0055	85	27	EGBGE
00867	SFV	XME	2260	260303	302	291	260222	0149	1232	4131	0055	97	25	EGBGE
00971	SFV	XME	6100	261113	305	307	261019	5369	0459	6959	3098	45	34	CIBCI
01199	SFV	XME	2260	261937	310	320	261738	3579	6001	2566	4745	63	19	CCFII
01192	WPX	XME	2260	261856	606	318	261642	3560	0250	4780	0992	75	46	CCFII
00898	WPX	XME	6100	260833	602	299	260735	0149	6246	4131	8318	57	35	DCGCD
01065	WPX	XME	6100	261335	604	310	261231	8366	2457	4131	8318	53	42	HBJHB

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00989	HPK	XTG	7980	261143	701	370	261045	6152	2457	5923	7274	75	25	CFIFC
00919	ORI	XTG	7980	260943	852	367	260902	9375	3230	5923	1702	68	33	DCGCD
00972	ORI	XTG	7980	261116	854	369	261022	3560	6001	5923	1702	83	21	CFIFC

3

01134	ZIC	YKD	6740	261544	155	820	261438	6945	2600	3420	0442	53	12	IHHFF
01053	ZIC	YKD	6740	261314	154	795	261142	0193	5265	3240	5906	61	24	IHHFF
01173	ZIC	YKD	6740	261755	156	824	261634	9988	9403	3240	5906	71	36	IHHFF
01048	ZZZ	YKD	6740	261307	624	804	261216	8770	4473	7282	0686	89	22	IHHFF
00929	ZZZ	YKD	6740	261026	612	779	260915	3560	1232	3240	0730	67	21	IHHFF
00869	ZZZ	YKD	2980	260341	603	759	260319	8366	6246	3240	0730	50	11	IHHFF
00870	ZZZ	YKD	2980	260345	604	759	260319	8366	6246	3240	0730	85	35	IHHFF
00948	ZZZ	YKD	6740	261036	612	779	260915	3560	1232	3240	0730	67	21	IHHFF
01016	ZZZ	YKD	6740	261223	620	794	261136	6746	0663	3240	0730	87	25	IHHFF
01123	ZZZ	YKD	6740	261515	629	819	261410	4360	8251	3240	0730	49	47	IHHFF
01082	ZZZ	YKD	6740	261402	627	816	261327	2702	1889	6355	0811	59	40	IHHFF
01145	ZZZ	YKD	6740	261625	632	823	261526	3579	0459	6355	0811	91	19	IHHFF
01171	ZZZ	YKD	6740	261748	634	825	261653	0752	5652	0379	4105	35	45	IHHFF
00987	ZZZ	YKD	6740	261141	616	782	260942	4712	3230	6067	5014	54	18	IHHFF
00924	ZZZ	YKD	6740	260957	609	777	260846	6152	2457	6878	8886	85	29	IHHFF
01003	ZZZ	YKD	6740	261203	618	792	261119	0149	3473	6878	8886	58	27	IHHFF
01209	ZZZ	YKD	2980	262038	633	826	262017	5141	4641	8335	9722	94	20	IAJIA
00944	ZZZ	YKD	6740	261032	611	784	261003	5141	4641	8335	9722	84	41	IAJIA
01085	ZZZ	YKD	6740	261405	628	817	261334	5141	4641	8335	9722	98	44	IAJIA
01132	ZZZ	YKD	6740	261540	630	821	261512	5141	4641	8335	9722	73	30	IAJIA

20

01194	EEZ	YLV	3290	261905	452	546	261741	2336	5652	2197	3287	84	41	DAEAD
00889	MEN	YLV	7490	260714	152	531	260638	6746	1889	2197	7643	36	17	DAEAD
00910	MEN	YLV	7490	260915	154	534	260810	3560	7443	2197	7643	35	30	DCGCD
01146	MEN	YLV	7490	261633	157	544	261527	9375	3230	2197	7643	87	33	BGIBG
01051	YXH	YLV	7490	261311	552	542	261153	9988	4473	2197	9443	51	18	DCGCD

5

01071	FZX	YRF	7590	261345	356	739	261249	7709	2457	4861	0776	63	28	DJDJD
00864	FZX	YRF	3590	260233	351	722	260200	9375	6488	7075	2323	87	45	DJDJD
01216	FZX	YRF	3590	262115	359	750	262014	3579	4473	7075	2323	69	18	DJDJD
00949	FZX	YRF	7590	261036	354	732	260937	6152	6246	0810	3278	58	45	DJDJD
01184	IEO	YRF	3590	261840	605	747	261742	0149	5652	4861	2378	65	32	JAAAJ
01029	IEO	YRF	7590	261236	603	735	261116	3579	7443	4861	2378	43	19	68486
01076	TDU	YRF	7590	261350	552	740	261315	3145	1232	4861	2701	92	21	DCGCD
00883	TTT	YRF	7590	260614	252	725	260533	9988	2600	4861	9498	94	06	68486
01047	TTT	YRF	7590	261304	254	738	261205	0193	0459	4861	9498	86	09	50505
01165	TTT	YRF	7590	261725	255	746	261621	4712	0250	4861	9498	77	42	68486
01002	VUS	YRF	7590	261201	103	733	261043	6945	8667	4861	9957	65	36	JAAAJ
01124	VUS	YRF	7590	261517	104	744	261428	3560	5265	4861	9957	78	25	28082

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01109 SFW YWR 7275 261450 603 547 261413 3766 5265 6724 2260 81 38 DDHAA
 01175 LAM YXH 2760 261812 658 699 261708 6152 0459 8533 7328 56 49 GEBGE
 00945 LAM YXH 6960 261033 653 691 260924 0752 2600 8533 7328 85 30 GEBGE
 01020 LAM YXH 6960 261225 655 694 261116 3579 1232 8533 7328 65 14 HBJBH
 01075 LAM YXH 6960 261349 656 695 261240 6746 5265 8533 7328 36 38 DCGCD
 01176 PWB YXH 2760 261814 352 700 261735 7709 4473 8533 3728 48 14 HBJBH
 00894 YLV YXH 6960 260746 051 688 260648 3560 4283 1774 7652 82 24 CCF11

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00901 TDU ZHY 6800 260842 502 852 260816 0193 5265 8524 2701 57 45 GIFIG
 01164 TDU ZHY 6800 261722 504 854 261640 3579 6894 8524 2701 60 12 80808

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01130 UMF ZIC 6280 261537 353 805 261416 3560 6246 7976 2404 25 32 I1HFF
 00978 UMF ZIC 6280 261121 352 786 261042 0193 4473 2746 9155 48 51 I1HFF
 00996 YKD ZIC 6280 261158 254 787 261048 2336 2600 2746 1261 58 05 I1HFF
 00933 YKD ZIC 6280 261009 253 775 260814 9375 8667 7976 9731 93 20 I1HFF
 00973 ZZZ ZIC 6280 261118 708 781 260953 4712 2457 2746 0730 37 07 I1HFF
 01023 ZZZ ZIC 6280 261230 712 790 261131 3145 0459 2746 0730 46 33 I1HFF
 01059 ZZZ ZIC 6280 261325 714 799 261243 6961 2230 2746 0730 88 42 I1HFF
 01063 ZZZ ZIC 6280 261329 715 799 261243 6961 2230 2746 0730 93 25 I1HFF
 00873 ZZZ ZIC 2080 260416 702 762 260317 9988 6246 1738 5014 43 09 I1HFF
 01191 ZZZ ZIC 2080 261853 717 813 261738 6945 4641 5842 7102 35 13 I1HFF
 01006 ZZZ ZIC 6280 261208 710 789 261124 7376 1232 8119 8886 75 28 I1HFF

11

01188 FHI ZNM 2570 261851 806 657 261757 9375 9403 4618 0604 43 13 CCF11
 01072 FHI ZNM 6530 261345 804 643 261255 4360 2230 1053 2279 47 27 AEFEA
 01213 FHI ZNM 2570 262057 807 659 262006 6945 6246 9550 5735 65 48 DCGCD
 00941 NJG ZNM 6530 261027 103 634 260943 0319 2457 1053 5023 93 18 AEFEA
 00943 NJG ZNM 6530 261031 104 634 260943 0319 2457 1053 5023 82 28 AEFEA
 01050 NJG ZNM 6530 261311 106 642 261220 7376 2600 8957 5320 49 16 CCF11
 00979 WID ZNM 6530 261123 904 636 261002 9988 3230 4618 2017 68 32 AEFEA
 01011 WID ZNM 6530 261217 905 638 261058 4712 5652 1053 6635 82 33 DFJDF
 01127 WID ZNM 6530 261528 908 648 261417 6152 6894 1053 6635 53 36 AEFEA

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00909 UMF ZZZ 6290 260911 405 495 260731 6945 0655 5545 0974 49 39 I1HFF
 01077 UMF ZZZ 6290 261351 410 564 261216 6746 5652 2962 3494 37 43 ABCAB
 01087 UMF ZZZ 6290 261406 413 572 261325 7709 5426 5905 9155 97 14 I1HFF
 01092 UMF ZZZ 6290 261409 414 572 261325 7709 5426 5905 9155 89 02 I1HFF
 01096 UMF ZZZ 6290 261413 415 572 261325 7709 5426 5905 9155 93 06 I1HFF
 01162 UMF ZZZ 6290 261716 417 592 261649 4566 3814 0063 9687 48 19 I1HFF
 00868 YKD ZZZ 2090 260308 102 482 260237 0713 4473 5905 1261 45 08 I1HFF
 00966 YKD ZZZ 6290 261103 110 535 261016 7376 0610 5905 1261 95 17 I1HFF
 00967 YKD ZZZ 6290 261108 111 535 261016 7376 0610 5905 1261 87 30 I1HFF
 00895 YKD ZZZ 6290 260817 104 496 260742 7103 6441 3718 6031 91 27 IAJIA
 01118 YKD ZZZ 6290 261503 116 580 261428 2702 8296 3718 6031 86 06 IAJIA
 01197 YKD ZZZ 2090 261932 117 595 261746 6152 3230 3457 7607 86 23 I1HFF
 01038 YKD ZZZ 6290 261253 114 559 261205 8366 5631 0063 9308 36 14 HAIHA
 00953 YKD ZZZ 6290 261042 107 523 260953 3579 5265 5545 9993 93 26 I1HFF
 00930 ZIC ZZZ 6290 261002 308 515 260910 9988 2600 2962 0442 83 16 I1HFF
 00877 ZIC ZZZ 2090 260503 302 485 260418 0149 7443 5905 5906 44 44 I1HFF
 01117 ZIC ZZZ 6290 261500 316 582 261433 4350 6488 5905 5906 94 34 I1HFF
 01119 ZIC ZZZ 6290 261504 317 582 261433 4350 6488 5905 5906 96 23 I1HFF

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01022	ZIC	ZZZ	6290	261229	312	552	261153	1317	0459	3141	7698	68	26	IIHFF
00893	ZIC	ZZZ	6290	260739	304	489	260643	0752	6246	3196	8273	55	15	IIHFF
01223	ZIC	ZZZ	2090	262301	321	600	262220	4712	4283	3457	9272	39	31	FEAFE
00922	ZZZ	ZZZ	5595	260955	001	502	260826	2336	1232	5905	0730	39	38	IIHFF
01017	ZZZ	ZZZ	5595	261223	003	548	261138	4360	2230	5905	0730	44	29	JEEJE
01172	ZZZ	ZZZ	5595	261752	004	588	261555	9375	7443	5905	0730	91	20	JEEJE

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APPENDIX 9

PROBLEMS--MILITARY CRYPTANALYTICS, PART II

The problems in this appendix are grouped into ten sections, paralleling the sequence of the text, with scopes as follows:

- Section A--Repeating-key systems with standard alphabets; Porta and Gronsfeld systems
- Section B--Repeating-key systems with mixed alphabets, I; direct symmetry
- Section C--Theory and principles of indirect symmetry of position
- Section D--Repeating-key systems with mixed alphabets, II; indirect symmetry
- Section E--Special solutions for periodic ciphers
- Section F--Progressive alphabet systems
- Section G--Repeating-key systems with unrelated alphabets
- Section H--Polyalphabetic bipartite systems
- Section I--Monome-dinome systems with cyclic additives
- Section J--Periodic digraphic systems; miscellaneous polyalphabetic systems

The portion of the text which should be read by the student prior to solving the problems in each section is indicated in the section heading.

This set of problems is also available as a separate publication in a loose-leaf book of ten lessons. This book, entitled "Problem Book--Course, Military Cryptanalytics, Part II", contains the cryptograms which for the most part have been arranged in proper worksheet form, obviating the necessity of recopying; and frequency distributions are also appended to reduce the amount of time spent on the purely clerical labor incidental to solution.

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PROBLEMS--MILITARY CRYPTANALYTICS, PART II

A. Repeating-key systems with standard alphabets; Porta and Gronsfeld systems
(embracing Chapters I-IV, inclusive)

1. Solve the following cryptogram and recover all keys:

BYKSJ	HBKFS	IRDCW	JUSGS	DMGLN	TTRPN	FRBLM	HGLST	TEKIX	LCWMH
FICPG	KDEMI	KLAVY	SKACK	IDZYF	BTYTF	GVMHG	LSTAQ	FAELF	JARGE
AZHIQ	RZTWY	SGAVM	SLPZC	NILUQ	TWKFI	WTDVAV	ZELXA	SKIRD	XXRHP
BKDMI	LXJOK	QWMOE	YSGAV	MSLPZ	COSFP	AFKZF	LVUGY	SEFVX	GJSOK
USGSP	ZFVSE	KDHIF	VMOWO	LUCWM	FLECA	SVEWM	OEYSG	AVMSB	BGKNI
IRIWO	IQHBN	IPAVF	SKEPJ	VKTML	HTHRH	GEKTT	YGSKK	AEIOW	IPEGD
TPUYF	LXNIO	RRKSY	TWLAF	ZXASI	VDTAR	MECAG	FRXAI	HTSJE	EZELP
ZCNII	AHZSU	ARMOP	SZJGF	HRSBP	RFINN	XAGJF	SIFTS	ZVDWV	OAPBW

2. Solve the following cryptogram and recover all keys:

QDIQR	ZIJQD	VKSJR	WWPTN	JTVZS	COPAK	GDPPD	FUAQZ	XZWNC	PPPJA
OHFUU	EAOAP	BZYME	QJJD	EVIKJ	EILHQ	CXEMW	YOSKP	UAJQU	PZZGZ
XSXNU	UDFXP	YPEIK	EJAFV	TJKZU	QGEOC	DZBZU	MEDIR	UUQKK	EYVKO
AZUOA	PBZPT	RKHNC	PPPJL	LDEQT	JRWEL	VDNPO	OZGUD	QHGGP	GERAW
YEDFX	VCQFK	AEYLF	ZZDJW	UBOYY	EIKMA	OPQMA	RZPEV	IKJUA	QKZYM
EQWYO	SDVXZ	JORDG	EUPEG	ZNAOE	AVDCQ	RVINC	OUQKZ	UKDPU	ADDRP

3. Solve the following cryptogram and recover all keys:

40313	71236	39244	43045	21393	61128	39284	33540	45391	03413
29381	31240	25421	13034	25421	24443	29372	91210	21444	01342
34314	31211	29353	34542	39321	23842	34424	24445	40313	33010
40383	43645	25284	21536	32353	32711	28273	71536	39324	34314
29354	03132	39444	44542	38433	33329	45124	31445	40414	34443
39421	24443	45381	31145	25303	74232	34431	53839	32243	21528
34263	31342	34281	54136	34281	12440	29353	31232	21421	24433
38382	93337	41373	11336	35372	62526	24241	13729	21343	31110
40384	44332	43421	34543	32123	23443	35432	91330	38381	11245
35243	21226	20211	11342	36152	52418	29423	31743	25261	23431
28381	31142	26241	01136	42244	04433	26321	01211	40412	93841

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4. Solve the following cryptogram and recover all keys:

ILEKM	TKNIF	HDBVG	OHHDO	UGIKH	DFEAB	BGMVD	XZQHR	FWWGB	VQPHG
TFUBT	QIRCZ	BMDVM	YBGXZ	OTEEZC	LBOHQ	YWFOK	XVAIT	VXHQY	FRAAI
YHCOC	AGQED	SOKBG	AUCUU	VSTBS	RAWFY	SKFPZ	NDKIZ	AOGKR	PVZRC
ESHHK	MHEDA	XQUID	DRASP	FKITT	AGSDS	KZLRT	GMAII	RLAGG	QYOID
EFQWL	BMUMU	GHQYH	RWAIE	FMGHQ	WVYMD	UTNRT	GGFPZ	GEQBP	WIUVQ
GPSHR	KITFT	ZSBQB	PHLSH	CAUOX	XMSZR	HRRVM	RAAIF	USHHS	KVEHE
TIGER	QGQNN	GAURH	KPIMB	MUKNQ	YHRWA	ZYLQC	FWVND	KIZAO	RYHRW
AGBYI	TQYXN	DKIUG	TELWR	WATAB	TPRHU	DNUGE	HQOMP	CHOQR	UVLWP
VSAUG	QBMUY	POZYV	SUYLX	QIEYG	CPHML	YACFN	QXMHQ	UOGNY	VPRNZ
PFABP									

5. Solve the following cryptogram and recover all keys:

SJMC	IEKUB	XFDKZ	KCRIK	GWCJE	WCSCI	OEYSN	JOGMW	LJSEY	VTKOA
PJCWJ	ZHIMO	WKKSJ	NSJYI	TVBEW	JOXKC	AIXKI	BMJAU	EFJCP	USCEJ
UOEKX	XMIPA	HIEUS	JYBCF	ELLSL	ZVRWP	MOEUV	QXJZJ	WMMOX	CPJLG
EPPUJ	WHVWJ	LKHZV	CERDX	ZSRKE	ALAEF	FKAMD	KOLIW	SIFLL	GRQEP
HYXYX	PCSCO	XAYKC	FQUR	WWICU	PTEOW	ZWRKS	JAINN	HQPIK	EQVGN
OCIFP	QNKEA	YAXJJ	BMJAJ	SGHXU	RZVKK	CRIKG	WCJRR	BWTBF	AYADN
NUYAX	IOCHS	XZEDK	KCFFR	NSLZX	LSSLJ	ICHKR	FWLSW	ENHVI	JCKPK
SQMAI									

6. a. The following cryptogram was enciphered with direct standard alphabets; solve it and recover all keys.

PLCAK	YWKEU	TZNPV	LMLTR	ESGJN	HVWAM	EDLYG	KGOLN	FLXLM	CCVZG
YIMAD	TYRGL	TXVDS	KORWF	TRRHR	RNPYM	ADIEE	HMYVX		

b. The following cryptogram was enciphered with reversed standard alphabets; solve it and recover all keys.

ZIVDB	CDFXM	NJJBH	XVTTC	LKOZH	IZPVZ	OQNTS	EGHQM	JBAOI	MIFDN
NDYDR	WAXBU	XKOOF	NFDQC	IZZWU	RTRWT	RPLQD	PVNVG	OECFF	RYKDA
WLXBU	XXBNC	LKOZH	MKJMJ						

7. The cryptogram below was enciphered by periodic polyalphabetic substitution employing direct standard alphabets, with the number of alphabets between 45 and 50. Calculate the observed and expected plaintext and random values of the ϕ 's or I.C.'s for each hypothesis and show these data in a diagram; determine the correct period, solve the text, and recover all keys.

NHBRK	ECDIT	BPQEO	XRLXI	FFTNO	HOEFU	MOSIA	AVRWU	KXXOE	WJWCM
SLJST	SSIIA	JMWZH	VLXHZ	KCUAA	UEISM	VTRHQ	ICPKK	VWGM	VUEFD
BZUOO	KIRVD	DWVVR	YZAZD	ARZSZ	FWULL	EKSMC	SWNLE	TBJNW	CAWSK
LWUJH	XOCUW	GZRGH	VATLI	ISCZL	XEHMY	EAUGF	YVHKJ	RJRZH	RRGQZ
DNPVH	IFFGR	OMASI	DRLQD	QSMKT	PIHWJ	LPRZF	YBUTF	UBUOG	JIHZL
UGKSP	ERKWK	VRQGO	KLMGX	CLXJN					

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8. a. The following cryptogram, enciphered with direct standard alphabets, is suspected of containing the probable word GREENVILLE. Solve it and recover all keys.

ODPHN VVMCE WEAVP MGVAC EPVIR KRNRE KZSRW TRRGR JZOYE NVDSI
RRITJ XHYUR EMGVC

b. The following cryptogram, enciphered with reversed standard alphabets, is suspected of containing the probable word NEWTON. Solve it and recover all keys.

XDOAA QUYAQ TQDRU PKVFR EZKHE GREVK XFNZG QUNLO YSNNN

9. a. The following naval message is in the Porta system, and contains the probable word COLLISION. Solve it and recover all keys.

MPHSY XBLAM IZXJK GKGJD WNRQM MGSIR GAKFH MYGVH ETEEX NQXDE
AXMDR KGRXU AYEYX QMSNO EXIMQ SELWR FGWJR XKDPT EELPA GCWOJ

b. Solve the following Porta cryptogram and recover all keys:

VAMNA ERWRM VBEFX RRBTA ZFKWI RNCKZ QVJWK ANQAU APNFX CNWZL
GRINV AWSOU TRYFR AUUCY QPKFK AWSOU TRZNU NWBVX YBJKS EJURD

10. The following naval message, known to be a Gronsfeld cipher is suspected of containing the probable word DIESEL. Solve it and recover all keys.

XSKFS CUZTS NVBOX UVVCT SMC PK MKKXH QNDLU RKOAX RQEDY RQINP
UMAHC LXHXX

B. Repeating-key systems with mixed alphabets, I; direct symmetry
(embracing Chapter V)

1. Solve the following cryptogram and recover all keys:

JJYMF NQWQQ YOGHN JVTJF DECMR ABMKE BJLCN XNTEI GIWMT ABLTG
SSETT YMCKT AXETN ZHJPH SIGOF PRHRK WECEP YHMJY CPAZM TBLJK
SIKLF EHJFW NVBEB HWGZF YNGOF PRHRK WEMCN TSHXG NHVCZ NXHVE
TYEPV WCNQE JDEWV KVLJG GEYLF KJMFC SUKDN VOWJK GNWKL NBFPT
DWVRL ABLTW TVGOJ NBCNN TUYTN IALCU WITIZ VCLAU NXETE VNKGO
WRZMT DMKFG BUQCK PMWKF RSZLP AULNA BYAUL JHMI NECKL POEAI
GHMFP KWYFK NOLOD FKCYT XJZLX KJHKA QOGER SVLJG NXBJK VXZQE
JSZLP AULNA BECKL PHMI NQAKN ABLTK WJMNV NCEYU AXGNX VUWXX
OJMWX WXLZW SIMHG PEHKI TIGOL JHBKG SPATP NFWGK ARMVR SXWKF
ITALF MHZNG VEHLF PCLXQ RUBJN IDFDG IJLHR SAMAG SIWMT

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2. Solve the following cryptogram and recover all keys:

TMXHP	IVSEI	KHRCO	SIOYB	DTECO	NAQTE	XAHNP	LEJMI	VKACF	DVBII
HGQGG	WECAU	OWQPO	DWHL	ISUVW	IVBIW	TEJJK	VKOYB	DTECO	TEJNT
IAOYR	MVQAN	DFRHI	KJJJK	OWQPO	DWEGY	VZJTE	FPHWO	DWHYI	AKSAF
IHJK	LAQEZ	BWGIY	OZBNY	SMERU	MZJZU	IVQPS	IEJVP	AMHHG	JWQFG
YASSP	SWLPS	IECFP	ICBFG	TEJNK	IYTYM	VAOHI	HSBFW	SGBCU	MZPYD
IVSGZ	INOAQ	AKSJH	VWQJH	OWOEG	WZRHQ	PDDGO	MXCTM	GGFLR	MSACU

3. Solve the following cryptogram and recover all keys:

YRDKR	OKSAX	XJFZK	MWXRF	DJFWI	TNKYD	JAEZC	AQGGQ	LEDMU	ABJSZ
SKURC	AZFWI	FWGSR	UEJX	XFOTQ	BDYKK	KQYX	RYTQO	ZJLOY	REHGT
JSRUE	AFCUM	CZKST	TVFZG	ELKCU	KPRLG	LLZTA	YTSFZ	KMYM	HDCNP
GEGEG	LLZEJ	HKCLG	AXKDR	LYTKU	JLEGT	NKYNK	YFOKT	KLJRT	PGEGE
DJALZ	FXTPP	PRCEA	PXGLW	FOXQB	RIBZF	KLAKK	VJCST	PPQJS	FRCGE
VSZFW	AOTGY	TKUQJ	UTQOZ	MOJKS	NGLIW	CLCZR	CYODJ	SJFYI	FXSFL
DTJYP	ROGFX								

4. It is suspected that this cryptogram contains the same signature present in Problem 2. Solve it and recover all keys.

18200	32215	10011	41510	20041	20802	07221	12513	16172	50406
22201	71510	20011	02106	20121	00413	18200	71423	07210	30318
12191	70508	10261	21607	20082	42013	25091	21626	25110	52203
19151	10906	22172	20525	20032	20605	22192	21607	04251	10511
24101	00305	18141	12121	19200	61423	25231	21611	12211	02218
12200	52101	25151	72118	25011	00321	14021	12313	13122	50604
25221	62021	14191	31525	07172	12014	09201	71510	20041	02218
23011	42625	17191	70411	26261	62013	17192	50614	26172	21602

5. Solve the following cryptogram and recover all keys:

GMPEM	VCYWH	OKPZA	VQVFN	YSWDO	JQHZW	ADHVF	WALPS	YUTFW	WVHEL
LMMNL	BYGMI	ACWBU	UJHMT	NPSHL	IGVQN	WHOIO	JUZFE	NVYGM	NXXAU
MTONB	OYDXB	QDQRO	JHWEW	HJJHG	XXZZO	QRQWT	IKIGB	KDQJR	DSUMR
NNYZO	DMXOX	NRGVZ	IJRYO	INJJJ	FPWSR	FZJOF	LLNKE	MNZHJ	BTTCM
JSKDH	BBYUV	NRSSY	SGBKD	QJRQL	HKRCV	ZQITP	NPSKR	NMGSV	XDVOS
TRCKH	HOSXK	NVQGX	LJVQV	FNYSK	IAPLJ	UEOKY	HBLZN	OYUVO	HGUUS
AMJUB	VNYLM	VVCYW	AWITF	GHDIG	XLGKJ	RBBSJ	VEXIG	FEYVG	GEQQV
GZFCF									

6. a. The enemy is still using the components of Problem 1, with the periods varying between 10 and 20. Solve the following cryptogram and recover all keys:

BPLOT	CTHQM	JTGMB	TVRKF	MEMMN	RMSFG	YVRHR	KPZOV	QNRHI	BMEHH
MFFXG	NEWNJ	HDKGR	MMVW	NOFXS	JCSPN	LHUCP	CLWOA		

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b. The enemy is still using the components of Problem 2, with the periods varying between 10 and 20. Solve the following cryptogram and recover all keys:

VCZUU PSGZV GDJBT QBXAO NZDHX THKCC NHJIR AJJPS BZHYS BOYRJ
WKJIG PSDGP FBSZZ QDHS BEYGD GJLJB

7. a. The cryptogram below, enciphered with the components of Problem 1, contains the probable word FLIGHT. Solve it and recover all keys.

LFCET LQTEJ JYWIA BLRIB JWWFV FWRVG TNNFS UIJRT AQOBM TOEYZ
TPEZU RFAFG BAECM DVBBT EFWMA YODAV

b. The cryptogram below, enciphered with the components of Problem 2, contains the probable word NAVAL. Solve it and recover all keys.

SORTH LBSST OVFGN VSIVX HTHHA RYEIK MCDZL JVLFE VJZBM VAHOH
DFWKB QVCEV RWDMM EPOQP OPTOX

8. Solve the following cryptogram and recover all keys:

RCCQN XGSRO VBTLM ERCWA YKWEW BBSGL ESWZK CQSF B SYT D JKJSZ
UAOYH LAOSD QPZZT FGYCT OZTET VELTS SMYRS LMZLA RMOMD ENCYX
MTKOZ BPTFI TJLFN CSODE WZYLC JKLPZ YERIP ZTOLB XOGWD RUEWZ
EZGBS HKYEV YOLEM PELAJ YEFKY ZSRKQ CMGLW CYPKL DSSHF ITNFW
IRRQD LSHJC TAOYH CJNIM PELZW CGQHP NSFCY WSYMV PAHEM ETRRE
YTQYE SBOCB CLNFJ CAAOY HSBZY HFPYZ TTFY INVIK ZTMKU TWFVL
CJMZE FVAFT TIFSS RCBFS ROVTL KJYXF UBNKY UTDCB CXIWW RYVTM
DEQFY ZTJTM TMTGB KNWRD DA

9. Solve the following cryptogram and recover all keys:

YWIUP WALRO ZMZKN SUWDO GQJNC GHNB U FFYHV FDNVP QRUT F HOQUT
XHYWW KGDAQ YFDLA PGNDY DIOFL IYKVH FFCFQ FUDTB QXSUF YWQNW
OOVKR EYQJF DJHFN OBSAD KVVOP LHTFD HGBSJ HPHHE TTFTS OCALO
PHDKP OSUFZ WFFBH ZINLH HZPCU SLBBA VHRFD SOOHN BOXBI LNFKZ
JDJQH XJLAM ZLJFJ DBFAR FCAOY YDSW LILTY WZFJB NJQRV YZUFZ
LEFQU MVFTC

10. The following cryptogram is assumed to begin with the words ENEMY RECONNAISSANCE. Solve it and recover all keys.

ZJOKJ TBKYS XSIAO MFVQF CTWMA VNCDY FCWLL KZZUR CUVIS KKWCH
DOYBL SVNYN TBKYS XSIAO MFVQY ACMOX EFEZM YSM

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~~CONFIDENTIAL~~DO NOT WRITE ON THIS PAGEC. Theory and principles of indirect symmetry of position
(embracing Chapter VI)

1. Assumptions made in a polyalphabetic cipher of a period of five have yielded the following pairs of plain-cipher relationships. Reconstruct the primary components and recover all keys.

Pairs from Alphabet 1	Pairs from Alphabet 2	Pairs from Alphabet 3	Pairs from Alphabet 4	Pairs from Alphabet 5
AZ	AR	ER	EI	CP
DO	ET	OW	IV	IX
EW	IF	PO	NX	NY
IA	NH	RC	OB	RG
NK	OM	TU	RN	TH
TQ	PL		SC	UJ
	SI			VL
	TN			

2. The following assumptions have been made in a periodic polyalphabetic cryptogram. Reconstruct the primary components and recover all keys.

<u>123456123</u>	<u>234561234</u>	<u>45612345</u>	<u>1234561</u>	<u>5612</u>
YLKLDNPLX	ZEFUROIZG	LVHYKKJK	WHFQDAA	HGLP
ARTILLERY	BATTALION	INFANTRY	CAVALRY	STOP

3. Analysis of messages containing enemy morning reports has shown pronounced stereotypic beginnings, such as "MORNING REPORT FOR TUESDAY DECEMBER ELEVENTH PERIOD OUR ORGANIZATION..." The following is the beginning of a message believed to contain the morning report for Wednesday, December twenty-sixth. Reconstruct the primary components and recover all keys.

JLVKI HHQFU CCEAW QYABK XQIUS GUXKJ TLNOO NWVQV DCXJQ PAFRG
 CIURA DLEGE YVPIH...

4. The sequence reconstruction matrices below were made during the solution of three foreign-language ciphers. Reconstruct the primary components and recover all keys.

a.	∅	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	F	G	T	B	U	Q	O	N				D	A	R	V	Z	M	I	C	H							L
2	H	N			I			V				C	U	E	A		F	Q									
3	I			Z	H	T								C	E	G	B	D	P								
4				A		H		N		D							U	V	M							I	
5	Q	B		F	Z		O	P									C	E									
6	L	O		H								A	G				Q	S									

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b. \emptyset A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

1	H	J	M	I	N	O	S	F	T	W	G	L	Y	Z	A	U
2	U	Z	W	A	E	R	D	F	G	X	H	Y				
3		X	H	S	U	B	L	A								
4	C	D	P	G	Q	S	V	W								
5	X	M	E	B	L	N	J	A	O	F	H					

c. \emptyset A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

1	C	U	G	Z	P	D	A	B	O	Q	I	S	E	R	J	F	W	L	H	N	M
2	R	G	J	N	H	P	W	Q	F	T	U	L	K	B							
3	W	M	Q	L	U	V	K	B	A												
4		I	P	W	L	Q	B	C	F												

5. The following three sets of data were developed during the solution of certain specialized polyalphabetic problems. Reconstruct the primary components and recover all keys.

a. \emptyset A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

1		O	F	K	I	W	T	D	E												
2	L	S	*	M	V	R	C	G	A												
3		A	B	G	I	S	Z	*	T	J											
4		G	N	S	J	X	O														W
5	K	S	L	X	U	B	F	*													
6		H	P	G	J	U	A														L
7	D	*	Q	K	Y	G	R														

b. \emptyset A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

1		J	N	C	X																
2	H	M	S	F	I	Z	7														5
3	D	E	G	R	U	W	B														
4		M	Q	V	Z	I	K	3	4												
5		K	A	W	Y																9
6	7	8	P	L	O	T	3	R													

c.

	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>
A	38	E 27	A 22	F 12	A 45	A 18	A 35	D 12
D	27	G 15	D 25	I 39	C 21	C 28	D 18	G 26
G	28	I 25	E 18	N 19	D 11	E 34	H 26	K 29
O	11	M 24	F 32	O 21	E 30	L 43	I 23	N 37
R	41	O 17	H 13	R 45	L 35	N 13	O 42	T 19
S	34	P 39	L 10	Z 29	O 38	S 31	R 22	U 44
U	36	T 38	P 40		R 34	T 12	S 19	V 14
		Y 43	R 39		Y 16	V 10	U 33	
			T 35				V 44	
			U 20				Y 24	

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6. From the data in the matrix below, reconstruct the primary components and recover all keys:

∅	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	X		C					B							W	K			F							
2		L	Y	T											F			V	G		O					
3			R					U										E							L	
4										H					B	T		Q	K	O						
5	Z	M	V																			P				
6				D				L			K	X												Z		
7				S								P	J					H	E							

7. From the data in the matrix below, reconstruct the primary components and recover all keys:

∅	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1			A	G				H			M	K	N				U	W								
2	S							E					J	A				R	U		W					
3		P	W	V				M	I			T	Z				E	F		K						
4			C	B				R	U		D	X					O	L	Y							
5	V	R	J		P										Q		I	S								

8. From the data in the matrix below, reconstruct the primary components and recover all keys:

∅	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	M			F				X							B		N	R	K						Q	
2	E		R								V	B					D	Z		H						
3				D				V	W						F	A	O		M	Y	J	L				
4			I	B				Q	S			A												P		
5	T		C												G			A	U	H		W				
6				K				C			Y	J	E												U	
7								O					N	I												

9. From the data in the matrix below, reconstruct the primary components and recover all keys:

∅	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	Q	Z	X	Y	E			C							K	N		A	G							
2			Y	B				H			T				L			C	I	J						
3	H	E		B	D											P		I		W						
4				G		J	T								P					W	K					
5	R		G	F	S							M	O	Q				T	U	N	V					

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10. From the data in the matrix below, reconstruct the primary components and recover all keys:

∅	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	G		E											N	V			J	L	B						
2	U			T					N		A		D				L	I		Q						
3	R	Y	H					E			C	Z	M				B	I							S	
4		W	G				N	S		T							I	D	A							
5		L	N										U	O		V	D	K								
6			F	S								V	Q			D	O	P								

D. Repeating-key systems with mixed alphabets, II;
indirect symmetry
 (embracing Chapter VII)

1. Solve the following cryptogram and recover all keys:

IOQID	ECUYW	AYQGZ	XMRFS	PSXWP	JEBEM	IHMNZ	PFAQI	AZPMW	TSGMI
VMGGQ	EQVOW	AKOUD	RHBMM	PWHEM	YSDAG	IPNSQ	GSMOW	WIMNW	FTDKE
SGMIV	DHEBT	HMTRC	IHQFL	CHWAK	OUSSM	CMLPG	OLDQG	QOAAF	EMRAH
CWGQT	LTARA	PGGNS	MVPGQ	WATLC	HEAGH	FAQIA	ZLJYE	JTAEA	AJETE
UYTRC	IHQTP	QKWMP	WHSHF	WQAGI	PNSQG	IAFVB	OMNKO	NMYUE	SUBWC
OGOEQ	AAKNS	WJPLH	DAAJE	TOIWZ	NAZPD	YEMZK	NZHQT	PVTZO	GKAYG
YPSFZ	EUAMX	YSZFA	FRDSJ	DNJYE	VRAEW	NJQPR	BHIRM	TZQEB	MFYCU
KCVDS	ETXMP	CNOIA	NLZYA	RRAPW	IQVPN	QIANL	ZLGRS	HMKXO	XFCLA
TMAAJ	PNIYC	MNMWO	SVVRE	HZRGN	QMRSI	NKFDD	BKKWP	QAEDU	APLAY
TPDQD	OMPXV	CSVAO	MAKGP	VYLAR	ZXDED	WAEAG	I		

2. The following message was intercepted on the same day as that of Problem 1, but due to operational difficulties only the first 160 letters were received. Solve the text and recover all keys.

MRCVP	TZVCX	SKZWD	TIHAP	OIUQL	WWMZV	RRXYV	OKZXV	IKPWZ	JINCP
LVQIZ	TIBGM	MFJYD	JMHKX	KHZUZ	WIVJO	EWNAZ	FEVTZ	AGNWF	AKXTY
LZLRL	WLLQX	KMFSU	WYAEV	NZZYJ	SZVDF	FQXKV	ZXCRP	OQFSU	WLVGY
KIDWZ	WCHVX...								

3. a. The enemy is still using the components of Problem 1. Solve the following cryptogram and recover all keys:

EHWHB	PVDVS	WFECY	UWHXW	UBIVP	WYVDU	LZICJ	WMRID	MRMCY	KUMIC
ZKWXA	VZVMH	WBSZB	BIMVH						

b. The following cryptogram, suspected of containing the probable word CAVALRY, was enciphered with the components of Problem 1. Solve it and recover all keys.

EQXFI	YWWUS	HZKCP	OHRVA	VLUMI	KDQLP	SBUNT	EFBWV	JDHHA
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4. Solve the following cryptogram and recover all keys:

23G47	7ELZU	AAS9F	8CYRF	6ØYG6	6H477	ELZBJ	SVAF4	1W31Z	6JABY
ZUYGW	6CB7A	B6PC4	AQØYT	AJ9CZ	XC72E	GTA7W	VDUAY	VVY4A	789DY
3G2ØG	TOSAY	ZUYGW	MJ8CA	B6PCL	4S6F8	CYRF6	E5K27	Z47HE	YZ9CA
6M27J	I2F64	6M66D	Y47WV	DDYAC	6FLJM	8HF8C	YRF6E	5K2HZ	YKA2F
WX1Ø2	ØGTGC	RVDX2	4CIQ8	7H2FZ	H9RRY	QSJYV	ZQBOJ	R7Z4I	U2WGB
YM3UB	C4YØB	6YF4	9BS5M	WDY42	4QNB	7IXXX			

5. The following five messages were enciphered in the same general system and specific keys. Solve the text of Message No. 1 and recover all keys.

Message No. 1

NRPWH	FNDWU	RMBNO	KBFMJ	WGHWM	WEZLV	UDOIN	FJPGK	DLASW	HHHZN
INUFP	EQVWB	RSBMQ	HKEWN	UQXKH	ZHBHD	NVREE	ESZBW	WRHEZ	TIDTX

Message No. 2

OWYUW	ZNDQI	AHIWB	RRSJG	IGHXN	LCNFL	THTNJ	FJRZT	WUZSF	OJVVH
TQBAP	TGNHJ	KQADF	GZBLI	LXMOX	EJHOK	BPTRJ	GDYIS	NRLKQ	RLRRU
RZEPB	IVCMC	ENHAX	MIZQL	KDRAS	WTNGK	EWNUZ	JXCJQ	WIBGQ	EZPDZ
IQMPE	HNEJK	QRTKF	ENBQD	XZFVP	HLQDT	YAVRE	ZAPQF	FOJJQ	KWCMK
HZHBH	DNVR								

Message No. 3

MSHZH	LASWH	FGPEB	ABJSX	JKMLP	MCIRE	NWPJI	RLMNY	WBESC	SACJA
TLFXV	FGZUJ	YMNJX	CJYWK	MCHAF	BPZAH	QNWJE	WRAIQ	XJQVD	LLRQU
WJKKN	KBGAE	JUDLL	WCMTG	QDRA					

Message No. 4

KCEWN	UNDRS	JZYHF	NSFLC	BNHBE	BKJWG	KDIRH	QVNVQ	PQIMQ	IASJB
LLLOT	NWZKB	YQRJJ	QVDDI	YTLRM	ECWKS	XJPGK	ZZRWJ	IKEEE	SALTJ
ZDIPL	RLMJC	WLJZW	DTPEH	JJFWQ	JGCCB	EBRIQ	ZAFUH	LWFGT	ALJUT
ZRCSR	EJQXM	WRIAG	UGFYQ	BJIGN	DLLFC	H			

Message No. 5

DQEEW	UKBFM	JWGHV	MNQSJ	CBEBR	DTBQV	SPBIA	ADQOC	JLKQP	TNWZU
LGIFO	NLXHX	XPBPE	ZEBWX	BAMRH	YQZLS	XMQXZ	ULSPQ	XMGKP	ZHSBD
RDHEX	RIQZN	JMLLL	IWODL	KQ					

6. Solve the following cryptogram and recover all keys:

HHHHH	HHHHH	PELLI	QCZUF	HTTYM	HNGLI	HHHHH	HHHLD	LKTKF	RBWBD
ZUUBZ	HLPHN	ENZOZ	EFTDA	QRERE	TVLBD	ZUZHQ	HFVRC	WSQJM	REILF
LKTKF	RVGLD	UTECL	HBFCU	HHHHH	HHHYF	WANNF	UKPQN	TTVIK	HBNZL
IYKOA	XCZEN	LHWA	CNZMN	AUTKG	TLPOF	GYKOA	TVLEG	AZYIF	UYRZN
ENSRU	GHUUD	ZMOVJ	EYDFL	QQUVL	EHDZN	AQPOA	QHWFA	ROPJM	HHHRX
EQLPW	NHVJH	HHHHM	RBZZI	XNYNH	HHHRG	EHLXB	ZBVEJ	ZEPPC	ULKFH
CSKAC	OKRLD	GHYIF	UYRZC	IVWJQ	HHEFT	ENHJL	ZBZPX	EZEJO	HHWFG
HOKRH	SLQML	VLKOV	HHDWI	VTVOJ	BKRMA	ARTTF	BXFMR	CHMZC	

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7. Solve the following cryptogram and recover all keys:

EGQYI	RKCTJ	HRLEP	RAAHP	CKVCH	DHVAJ	KAGXU	NTSEI	KLGMI	KAGAD
IVQLJ	DRHOI	VNMKO	DQYYL	NWES	DBVBL	NBCAU	TTOMP	MRWLK	KAGZP
NTSCA	KLGRV	TTOFP	IMOEO	SMHSL	MNGND	DQGML	HWCTJ	HRLII	LHCCL
RKG'TJ	DJGRP	CQOWX	DNMOT	NMPUM	HWKAJ	ZTPUJ	ITNOT	NBGI I	MACID
VQPIU	OWCNP	VBGKI	NNKAI	BVZIP	FVOOC	DHGLM	VTJEZ	DHVDI	NRGSG
MUWMU	TNWOZ	KSGWJ	IVQND	DRHJA	VNMPL	FWWLR	ZRCTG	KAZKI	ZAHTV
HACES	KGHEQ	ETQZI	MCCRJ	KSGLU	LPHON	HMPII	MNQOX	KSHSL	VKGCJ
KBZZI	OQKLT	MUGMX	NTEKO	ZAZZP	FWCTG	KAZSP	UVQEY	HMPCR	RABAY
HYGTL	MKNLJ	DTJUJ	UVQLJ	XTJHI	LXCRO	LVPZJ	ITNBL	NAGUN	KWVWQ

8. The following cryptogram is suspected of ending with the signature "TRAMPLER COL INF." Solve it and recover all keys.

GLIGV	MQMUO	LVZGG	LRGQS	BZPZB	GSRHC	KYWNF	JSPKP	XOBSZ	YYKIC
XZWPY	GZRIG	VTRCW	NBYRF	MRIGS	OUZWN	LVGLH	UZJBT	YPGXG	QBIZC
ZYKFT	RMNYY	FIZRX	QPSQM	EOFYP	HGLIG	VMKMW	NYKII	GDXGQ	BTJNX
KPKBL	QKQK	GHKCA	FKWJP	QLEXF	MRBCG	LNMGW	AGLQL	WNBYF	KHWSA
WZQLD	SEWIY	PGXGQ	BIZMS	YYKXT	ANBAX	EZICB	ELKWS	IJBPT	JJOZG
RUPNQ	FGNJK	RCJBP	TSQQZ	GZKHI	CJBPT	JJPGG	GBHQP	JZPYR	NNXVJ
RTEHP	WNJFY	EQGOH	GQTUS	XNZES	PGSRJ	RSYKF	BAQOU	YFKHQ	KXVKJ
VDESG	MNGAZ	BKXII	QPKKQ	TMWOF	YPHLN	ZZERG	GGTAB	MY	

E. Special solutions for periodic ciphers
(embracing Chapter VIII)

1. Solve the following isologs and recover all keys:

Message "A"

ARZKK	VCQPY	IOQMO	YTRWP	KTIBV	PKRNR	BZZSX	YVJJW	PNWDM	HKVNK
KATUL	JMAJP	NPDEQ	HSTJI	FIVND	EXOVP	KRZMA	KRJIU	LJMAL	RLRXX
IFABK	JQOBR	IWJEB	PQLOL	SRZOD	ADOLE	EJWDK	OE		

Message "B"

GVRHF	RAITM	CVKWS	MOCSE	PFCJQ	HPZEC	MSROT	IQBOT	JHSMY	CTREC
PEOEH	BYEDW	EHDKK	FLKOD	YGQZI	XTVQH	PZUDG	CNFCB	HBYEH	CHVEH
COGEP	FKVMV	LTDBM	HUIIU	LVRJN	FNFQX	WSSMP	JW		

2. Solve the following isologs and recover all keys:

Message "A"

JKSRB	WNXQK	WIYWB	FJQOV	IIASJ	ZXWKE	BICQO	HODSU	JSCSV	IPCKQ
MAHQO	WATYD	PIPMI	QTBIB	XLN					

Message "B"

YXAES	CIQFU	UMLRX	DYMVO	YPGOY	AFVZH	JNZRV	DNQAN	YEFJJ	FWEZN
OCXMV	PNCEA	UHIUK	MZRYV	MID					

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3. Solve the following isologs and recover all keys:

Message "A"

UPSJE RYQST YPOML NYASN ZKHDP CRKYX KYLBN NCEBW IKQRU EBPFK
 ROPVP STQWP LPQKX WKPZM XNOXK

Message "B"

RXPCF WAJSW VUAPW RNUTI WIVET CXSXH CHCSD YBNBZ DWBVF SDLAE
 PLDUT SZYMY EXHEZ SJIZP LHASV

4. Solve the following naval text isologs and recover all keys:

Message "A"

SFMJI ISCEV JMFMS VEJIP CZUMX IFVZC MEMFS IFERT AIFZP MBCGI

Message "B"

HKDAX LMMMS ATRAZ EAAFY KDPJJ XKFVR XKOKA NPSYI RXKIU EVCWN

5. Solve the following isologs and recover all keys:

Message "A"

KOIPQ IHGIS PQOKD MPVKS YKEQV SKPUS EPPSF KPREE PYVXB PISWY
 ETDQS PIMXK HGFTJ GOGJT XIEQE HPGCG OEOBE YETEW JEEEP UUMDK
 AQVOL MB

Message "B"

KOIPQ IHGIS PQOKP STIHN ENHQP QEQIM CUDTB XRVMF QIEQL RIYCC
 FFWP GDOTG RPUVO COSUG OGGUT FLIOO UUQNK UFFOQ UIMFQ IBYAS
 HSPQB CTV

6. Solve the following isologs and recover all keys:

Message "A"

AFYJV LREWO DUWEZ USEYN KBNFW OCKWX HKBTZ BQRPN BGCNS XXIWX
 HESYK NKBNP KFRCB APEVR DGFLN QWRMJ BBYSB BWRPZ HDGTX VBMMO
 KFWHB ZCNKD DRFRT

Message "B"

TPKDM PPFYF DMGAP EREOU XPORD WPYQL XMIGG YQYYE BVZPR ZIKFG
 LPUIF PBGGJ DUPDA KYDSE QKBOZ CFJEA ETFIM GDECN LZZAE TBWJQ
 PRUQA EQNWG GAPEI

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7. Solve the following cryptogram and recover all keys:

RNDDB	RFEPU	PLCHK	CSDNO	WSJIS	UCYHK	XFHVV	NBCZO	LEMEO	EJHDE
MFVLY	ZFULO	EJHDA	TLCRK	PBHCN	UBBIM	MVWVO	KOFXL	HZMDX	RZSKA
TZEWS	WVXNN	CVXIH	WSXAS	TBZHV	RZTLN	PMBIU	EWJPO	CVDEK	YVMGU
XRKIL	MPAIT	MVMGU	XBCZO	LMFFU	WFTPR	RUAWV	NCCJN	MOURK	TCQHD

8. Solve the first five of the 25 message beginnings given below and recover all keys:

1. LHEDH	BNFPH	WGVFN...	14. LHZKG	FUVXH	DXDQL...
2. CHUSN	LNBW	RGCM...	15. LCKDH	WNFBH	GRHLK...
3. CVDEV	JGZFM	SDVKP...	16. XDHBC	JDDDD	KGVKY...
4. IPVVC	ZGBHG	QQHLK...	17. SPHER	JGOEP	VNUWH...
5. VVNOJ	QIHYF	HRJSX...	18. GVZMD	SROFB	VCVQM...
6. WBSFJ	QFMCA	ULMEC...	19. QIKFD	QFFYA	CDMWI...
7. SSOGE	RGLFR	PGULQ...	20. BVNOF	GNEPH	WGVPK...
8. WHCQD	MRGUO	GRMSW...	21. IDHOU	JXGKB	VQUSD...
9. WHRDJ	KXDMF	HGRCK...	22. WHQEW	QFBFW	SGHXR...
10. XHQHH	LNBW	RGMCJ...	23. ZTVOD	AXWHM	CRYQD...
11. GVNCF	QNGGB	CPBEV...	24. WHTDH	SBHBR	CFSKI...
12. GVBZC	SMVHR	FKEJJ...	25. WDAHU	MDWCC	LGJSX...
13. WEWCK	TNMCZ	DFDJF...			

F. Progressive alphabet systems
(embracing Chapter IX)

1. Solve the following cryptograms and recover all keys:

a. POTAE TRRHU TUJXO QEGRE EXXLZ JZCOO TVSSS KKCWD
TKGVJ HJVIS

b. OLGCE YEKEQ SRJZL BSIGE FNFRL RZEGJ USWUA UBRNR
BEJMG

c. SDNQR UMYUC AIXEX UWOLO UARCX BMQVT HEZJI YMLIJ

2. The following cryptogram is suspected of beginning with the opening phrases "ATTENTION ALL SHIPS STOP." Solve it and recover all keys.

ZSUJS XDXKC XYLNP SPQHD YJFTY YQAQQ UTLNC YGZPV MBQPT RUGXG
RMBDD

3. Solve the text of the first of the following messages and recover all keys:

Message No. 1

CTHEW	GXUFW	OHQZV	NIEBQ	SPQKE	UECNY	QAUMZ	DBSZI	ENXGZ	ZUJAY
EMROM	HBFFT	YFRTP	KVBTE	IHFVT	WALZO	IRCLQ	GHSFF	WVDXV	SKRSO
OSUKA	EMMDI	TBCSK	TJFSM	FOHXP	COQLU	MWMLL	RCJHU	JGPGC	DKYNT
BEEQE	JJKAX								

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Message No. 2

YVRDP	LQQMP	KCONU	YRJVE	NDDGX	MHOGY	NIBLF	AZPGX	TQDFV	VTZLV
XZAIG	ZSBSA	VLGLZ	CLYHX	MJYHW	RYDZI	QXWLH	EZGZD	QNPFW	IPFMT
SHQSW	WNYON	DIFFB	CBPVR	TSNTU	DSHLE	CQIFA	GFNUE	JPNSZ	YD

Message No. 3

QBZAY	RACLI	FKXTR	BRRJT	KORAA	LACCH	ITIXE	PGXJS	NBQNG	BDWFF
MINNT	OVRGI	LSWQW	YRNRV	VPBGH	XDIVN	MFGUG	POJRM	VKHEX	KEABG
GYLZJ	KRYZZ	LIWED	FVVEX	SOEER	FRMKV	QBJFZ	KGLWY	RLTEN	XSORM
ZVNUI	ZDAKP	QWRFX	WLURB	OVYWX	FCQFF	DWUYI	OGUNV	ZMHMO	QSLLL
FUDWF	FVZJB	TOVRI	XEPUK	BSEZH	O'TLXW	EFKKV	MRBKR	GMDEY	GAEYY
WJOPL	ZIJWG	DRROG	SFJXQ	FBJVP	PGNYP	XCZTW	IWRCH	MZOSO	IEQPG
UWLZY	UNAJY	AKQHX	HMCNC	ZQHBB	MMBQZ	EIMOV	FOVHO	KA	

Message No. 4

XKOTI	ANZUC	HKKPC	TQWCJ	HEHRR	SOHMN	IOJZJ	SGQEX	VGYHW	RYDZI
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Message No. 5

BLOME	VRHTP	SEFYI	KUJHV	ZGZOO	XWRIE	BTJXW	KDKPL	GLNNE	QSUEE
KHPQE	VLQRS	OVILY	UKTIV	FIEQL	SHHEL	KY			

Message No. 6

XGFFU	FVRHT	PSEFN	PCOBE	DDBJZ	MEURU	EWNY	LWUYI	XPCBH	OIFBJ
AHBQK	UDZUZ	DLZNN	MIPBB	FXDDM	RSCZF	ITAWS	OFLZN	NMJKR	LQOSW
BJVIB	CRG								

4. Solve the first 100 letters of the first of the following cryptograms and recover all keys:

Message No. 1

PHCOK	NQAQL	JQGOX	GRXNE	KPRFY	GXYGG	OKAYG	GJDJO	XGBXQ	TGSIT
NBQOZ	TDKPY	UOODS	ZLLQZ	MAVPJ	TUPWF	MJBLR	JXCED	UTSWR	QJCHJ
YTYLO	HYQXI	RVORW	BGSZC	HZPPD	XFRXB	QOTDX	DTZOR	ODINV	TVOQT
ITVRV	MAPMJ	GNTBM	OSVVI	DAAYZ	DVQKT	HGBHH	VONHC	MOSQW	QYWRQ
TJHOK	YHPBN	FXEJE	WQJUP	TJXCH	WIJMV	RZTMW	JOV		

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Message No. 2

PBCOK	NQAQL	JQGOX	GRKNE	WLLTN	BWLLD	KAGHJ	BEHR	ENWJN	AOPTN
YBSOI	DXKDE	NKC'TO	IRMDH	PIFQA	AVUOQ	DTUUT	WHQVP	KSPLZ	YLCET
VZCKZ	HLIDE	JZRRRT	MUGRY	AKKPI	GFBNC	GOTVO	XNCHJ	WUDOY	SCYFE
WPIEN	TVQTB	OCCIX	TODDM	XCGPP	AWVXL	NGIDU	ILKAI	KFAPR	IYOTG
QAEPR	TUMQN	SDGCR	WAFQA	GKXKW	C'EBVQ	KYGCL	ECWZY	RKULJ	TKGPD
AFMIV	XKNCU	ODFOZ	PIZWE	TSYIP	NSVTB	MFXZV	CMQTB	Q'HLH	CEDUT
SFRLV	FDILK	JUODF	IILDQ	HJLVG	JPFBB	MGBBK	LACZF	IWVKF	INNYE
ELXMG	QJKWP	RNVLY	XUQUN	JYCAO	GUKVW	BBJLT	UORCJ	WFKDO	CRHMZ
ZDZTD	SCQEW	IUFRN	WJPOG	DWCHJ	BDBKO	GAQYR	YIOET	AUPZU	MOXEY
ICYGF	QSYAZ	UWBS'T	ASURO	ULAXN	CLRWV	KFRFV	OXJTB	KPKLQ	FPUGK
PZKLV	PQJVQ	CZDEW	XRXNV	KQIBI	WRCSF	EVUJY	WDFWN	OUYZC	KAMMZ
VKNYT	BEHRG	NEBQN	AYVZD	NMOTT	TKPSY	SCEJK	ZGMIY	ATFKG	BVLOY
UXFPG	DIBQU	DNELN	XUCHS	LT					

5. Solve the text of the first of the following messages and recover all keys:

Message No. 1

QGPQT	RQZFS	HVGDD	QAPBG	ZEUVM	QVTCM	TMNYO	HVYFI	ZRTHQ	GXPYN
PESQJ	GWEPQ	EKUFX	LVZNB	VNKM	DFZOT	PIWEN	FSBJO	KCDYT	DPQRM
NBNQL	FSVXU	UTDVZ	KQZQF	ERUVJ	UZXCB	RKGNM	RNQHS	KCIDL	ERHUA
TDBGX	JMQJI	MRYXK	SIMEN	DEZUL	TFXDE	VAJJU	UMOSD	HXXX	

Message No. 2

QFLTO	BBYZJ	WGFC'T	KSTVD	TBUUN	HYTLP	JAKIV	NQBKO	IYDKY	NGGUM
WJDUM	HBAKE	DWFYB	SXKMO	HQVSL	URQDM	GRQRW	KERKH	GFKKD	AHZXS
KVINY	RHKIS	GYAEX	QJVXD	KOPZE	LWNRY	OYGAK	AWTAN	ELFHE	NLLYP
WYDXG	DXXX								

Message No. 3

JDGJM	ZJLKK	AUQJV	BINKK	EVNLF	BYAEX	LVOUV	ZSISF	HVSHN	ZYNHU
WNINZ	AMGXN	LVASQ	ESLNR	JKENB	LSJRZ	EYRJZ	ZVKTV	OUAOK	

6. Message "B", believed to be an isolog with Message "A", was transmitted in answer to a request for a repetition. Determine the cause of the cryptographic error involved, solve the text, and recover all keys:

Message "A"

VVSIO	PFYD	JJGCW	OMM'L	RVEUH	KXZYP	PBSLX	DIOAA	XOMAL	HMNZB
SJUH	KLJZZ	FRHAO	ATNDH	FZLND	XKOOK	NWZUG	UGEQO	OQGGO	HKUCK
ZWCTU	NUFFN	SC							

Message "B"

VYYPL	ACJLX	OBDCT	FUXVW	GJAMW	IXATX	ZQOTK	XDYZA	ZFUEY	NCOPT
NFUOS	RVJIK	WYXK	ABSLJ	SITNX	PRHOM	SOGDR	EKAJT	HQELJ	JGGPC
PSZNU	QZNGN	OP							

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~DO NOT WRITE ON THIS PAGEG. Repeating-key systems with unrelated alphabets
(embracing Chapter X)

1. Solve the following cryptogram and recover all keys:

FPDNX	SLAFI	ITGSD	WLICK	ZMAXT	ADRLS	TMOXL	ZYPTY	MHCOA	XOALA
RTYNN	LDFIU	JOBOR	PZPNY	EIWRN	MRVOP	NXOSN	ZRXAQ	JOTMR	HTLWR
AWWSX	ALWVO	BOITQ	PDRLI	CXZCO	LCSWB	EIWRN	MINXM	XKOZI	ARTDZ
LRWRZ	JJICK	TOTDB	RKPBP	LCYSU	NWHPZ	KEBNL	NLSBT	IUJOB	WRJJS
DOWSL	WBFTG	NZBRA	XJNCI	OBWSA	GAMFP	CXPIT	LETA	GKDNX	SLAFI
ITGSC	LRMLR	SGEEO	FWRMH	COAXO	ARRLL	WZZIV	COTTC	DWIUJ	NAIYV
UPSLT	NLNQI	FYJPH	QAXTP	OMINX	XKNIU	JOOKI	SWLCC	PJJRL	HEOWB
TLTNL	ZBAPL	UPNLD	BARKN	TZFNA	CNLJR	LHAGT	YDTYS		

2. The enemy is using the system illustrated in par. 75 of the text. Solve the following naval intercept and recover the order of strips used in the encryption:

NPYGN	DVPWR	PSCFD	XYRGU	JEQAS	JNYMQ	AJUSX	XLILM	ESFFO	OAQIN
YUIAN	VARZB	ICDDL	BRGCN	HAWSS	XEZFN	CMMJE	DVFNK	NVMGA	UALJD
DLICA	IKLOM	BNSAS	JNYMA	HRISN	GZKFL	RTRZV	TJPGZ	QOLDO	GAINO
XCCWU	JEGPN	HESWI	OLDOC	YZKOJ	HTKPS	XEZFN	NQGGG	HTKPL	WWSN
DZKOT	QEFWH	ODYMR	NGSDO	GWVPV	AKSSP	NTUUX	YDHMM	TTDOI	QXKOR
PTKPK	OEFAN	JTMJP	TECKX						

3. The enemy is still using the system illustrated in par. 75 of the text. The following cryptogram, intercepted on an administrative net, is suspected of beginning with a stereotype; solve it and recover the order of strips used in the encryption:

KURGD	WFPME	ZOKUN	AWYET	JKTCL	MGMMT	SVKTK	XUDLO	XUEJU	LOPTX
MTGBU	DFKSI	IYKQY	XJKUV	MTLSX	KEYDH	UBEJU	LOPTH	UDDYU	LJYSC

4. The enemy is still using the system illustrated in par. 75 of the text. The following air intercept is suspected of containing the probable word BOMBERS; solve it and recover the order of strips used in the encryption:

XJOAK	SIYOH	XBSVJ	OVERK	MAUWB	LEMDT	SYNTQ	CGUJT	BXYJQ	VNPSE
RGEMT	HOJJY	NOUKZ	QWCMP	KPSAC	WAZRA	PSYOP	SJOED	CGFJX	KPSAC
WAENZ	FYNSV	STUED	OYFNI						

5. The following cryptogram was enciphered by means of the device illustrated in Fig. 84 in the text. Recover the plain text of the message, and establish the numerical key for the order of strips.

IFCYM	DOBKB	YJVAV	UBORU	BDOME	BYDEU	CNESJ	SGUEW	GONYN	OMDMO
ZCJUE	MSQEM	HEBSA	LVUKB	XOUKE	RSPAU	GWACY	RGYDI		

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6. The following five messages, intercepted on 16 December, were enciphered with the Aggressor ZEN-40 cipher machine described in par. 77 of the text. Solve the messages, and submit the plain text to Message No. 5.

Message No. 1

BABAX	HYNVG	RCWTL	HCLSU	JFSVX	BJZPW	HYQTY	MPPER	VMAUN	XMZXX
RRZPW	HMKCE	AJGAJ	TAEHI	DXZKC	DBSIP	GGDCT	AXGSS	MMMTD	WMZLR
UWCZP	QBNNP	PPFHO	MDTLD	YUXBC	VDVGT	MCWUP	ERNDR	BYJUF	TRJNZ
DDTLW	HBDVE	MVXQR	MUKSZ	QDZYO	BPRYX	GHZAN	MYBIG	BCPSP	GPZIM
QTPFW	JCUSS	MLZVZ	GTCGR	XOSAX	RKZRZ	ZBJIN	EPZVZ	GICQN	XOYNL
LLSRW	DEJVN	XSLUZ	BUKSZ	QLOOG	LXINP	HMKRA	URNZC	QYAHX	TRIBQ
LXTRK	MAYMF	BDGTD	HJEMD	VCKZZ	NRRET	KWZGP	IYLUO	YWNJF	WHZLR
DYZYU	GDZAS	FOFWY	FXNMU	JCPAO	XKLGQ	VAQCA	PEKNG	BSKJD	DCFVC
XZGMD									

Message No. 2

VEVEX	OSELD	LVQUX	HYVGG	GKMYT	IESUJ	FSVXG	LGBUR	YPXNF	PGTDQ
NEIHI									

Message No. 3

JUJUX	LHCLS	UYCHT	LOJZH	VJYLV	AUVWT	WSYLV	OTLDA	CXWRO	MRQDN
PPPFH	OMDTL	DCLJS	NLXSI	YVAZM	FBDNI	HQIEK	TQDYB	LHDVQ	GLTHK

Message No. 4

PEPEX	GTEHJ	EMNKN	ZXUYL	TKMY	DWMUV	WTWSY	LBOPN	YERTJ	VQWJA
QSNMV	VVOAY	KQYKV	FZXLP	GKKZH	JCWRN	LAGAM	MZLNZ	DGGEH	

Message No. 5

NONOX	LJAEZ	IBVSN	KKLWZ	QRTVI	EAPOI	RPJDX	NKGWO	QJDBC	TGROB
MLCHB									

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7. Solution of ZEN-40 traffic for 17 December yielded the matrix given below. In this matrix, Alphabet 1 is the alphabet used to encipher the 1st, 26th, 51st,... letters of each BABAX message of the day. Using the matrix below, complete the matrix for 16 December, and show the plugging for 17 December in terms of the matrix for the 16th.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
A	P		P	P	L	I	R	I		Y	T	L	U	M	F	Y	X	Y		W	Y		M	D	Y
B	X		I	P		Y	M	I	W						X	P	I	L		Q				U	P
C	F	W	I	Q	Y		U		T	I		Y		I	D	L				P	F		U		
D	H	E		S					Z		S	S	N		C			S		Z	N	J	G	A	J
E	Q	D	X		X	R	T	X		F	I		L	W	U	F	U	Q	Q	I	P	U	X	I	L
F	C		G	O	G	G			E		H		K	A	E	N	V	V	J	C				K	
G	M	M	F	R	F	F	W		M	X								M	R		W		D	U	
H	D	Q			R	L	L		U	U	R	F	I	X	L	I	L				M	I	Y		
I			C	B	K	A	V	A	B	C	E	N	H	C	J	H	B	K		E	K	H	V	E	
J	U	L	L			M				R	P	T			I	U			T	F		D	T	T	D
K				I								R	F	T		W	I	U	R	I				F	
L		J	J		A	H	S		S	O	A	E	S	H	C	H	B	N			S	Z	O	E	
M	G	G	N			J	N	B	G	N	Z		V	A	Z	O	Z	G	S	N	H		A	S	O
N	Y	T	M	T	U		M	U	Q	M	Q	I	D	T	R	X	F		L	M	D	X	R	Q	W
O		X		F		Q		R	W	Q	L	X	W	P	P	M	P	R	Y	U	U	Q		L	M
P	A		A	A	B		Z		Z	J			O	O	B	O		Z	C	E		S	V	B	
Q	E	H		C		O	S		N	O	N							E	E	B		O		N	
R	S	S		G	H	E	A	O	S	J	H	V	K	V	N	S		O	G	K	Z	V	N		
S	R	R		D	W	Y	Q	L	R	L	D	D	T	L		R	T	D	M			L	P	M	
T		N		N		Z	E	Z	C		A	J	S	N	K		S	J				J	J	Z	
U	J	Z	V		N		C	N	H	H			A	E	J	E		K	O	O	E	C	B	G	
V		Y	U				I	X			R	M	R				F	F			R	I	P		
W		C		S		G		O	B		O	E		K			A	G			Z	N			
X	B	O	E	Z	E			E	V	G		O		H	B	N	A				N	E			
Y	N	V			C	S	B		A	C				A	A	O		A	A	O		A	H	A	
Z		U		X		T	P	T	D	P	M			M	M		P	D	R		L	W	T		

8. a. On 18 December there was intercepted the following Aggressor message, suspected to begin with the words REQUEST CONCURRENCE. Solve the text, and recover the plugging in terms of the matrix for 16 December.

BABAX SOOJS QIKTW KVIIV ETHQW KYEQB ZSSGD RIMQX ECRUQ XVUVV
 URQRC FAQYF RQSKV OBZHV RQHYJ TGSXT VMSLS TRSKI DRHIY CUUHZ
 CUSNN

b. On 19 December the Aggressor message given below was intercepted. It is suspected that the message has a stereotyped beginning of the form "TO COMMANDING OFFICER (number) REGIMENT", where the regiment involved is one of the first 20 regiments, from FIRST to TWENTIETH inclusive. First determine the correct full crib, then solve the remainder of the plain text, and recover the plugging in terms of the matrix for 16 December.

KIKIX ZNDEU AYVNM OFNAW NIOVN VGCNO HZLJW JCIZE XHIES VBOVA
 NBFJD YZUPM AIGWY CHIGW NZOIS ABWJG SFUBT BXKPO OINPV EPKTW

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9. The following beginnings of 35 messages, intercepted on administrative nets, have been encrypted with a complex cipher machine which generates a large number of alphabets. It is furthermore known that an enciphered word spacer is used in the cryptosystem. Since the messages bore identical indicators, it is assumed that the messages are in flush depth; the repetitive phenomena confirm this conjecture. Solve as much of the texts as may be necessary in order to read the plain text of the first five message beginnings, and submit the plain text of these five beginnings.

(1)	WJWHZ	KQDEC	MAJAD	FWYLD	LSDAH	MYCXE...
(2)	CLCCY	IULPB	OLLUV	OLAVI	LCLME	JLXUU...
(3)	FAODB	QVSQE	DCWHP	ZDEXQ	KQOGC	LGYZ...
(4)	NWOAE	KEJTK	QSITC	REKFG	SJDJE	WXYIZ...
(5)	CLODE	WHOQE	WHZFP	BEQEP	FVDDK	XHFJJ...
(6)	RVMSS	WXLIZ	XHHVQ	WIHFQ	OGMJX	WLMEC...
(7)	AFGKD	ZFOOX	GLVTE	OZFBF	PCQPF	NAFSL...
(8)	NWSSE	NYJTK	QEVZQ	EEZJD	NRDNF	IEFLJ...
(9)	UQVKD	GXTFW	IAMTH	KJSTD	TNONF	KNXWP...
(10)	CLZAE	QRLVS	QCPDV	ADQXK	PFSZH	NOMWI...
(11)	NWKWY	GRTSE	PQXQ	WIHFB	PGBGG	JWRXI...
(12)	ITMMX	ZEUBE	XHZFP	NWZEH	NMSAH	AVFTV...
(13)	VODUE	WSETO	MLWTC	JCGYN	PSNOY	MDFAJ...
(14)	QLDZK	WXBFK	XSWEX	BHZYU	PUQVK	ONMHF...
(15)	UQJSD	LRLJR	HEEYN	OHEQR	USDZR	ARTWR...
(16)	YQAYG	WHJFK	XSMCQ	UEZDP	LLRGR	JVXLF...
(17)	CLKAG	KFFSP	DQCYF	OWHSQ	WUKKD	KDBEJ...
(18)	ZJULY	ZFFRN	CHPAR	UMLAD	MSDZR	AWBJW...
(19)	IGVYR	ZEJTK	QSCJP	WASBU	VRYGY	WTVJW...
(20)	CLODE	ZVFHE	DHVKD	DAZPD	YSLCX	ALYIE...
(21)	FKZDP	LUTFO	EQSVX	HZZYE	PTCOZ	IYDGM...
(22)	ITMMW	HXDKX	QPVGF	OATKM	VUQBL	JLXMT...
(23)	GLJGV	NEGNN	OEVVX	BMKQU	TPFGN	HWKZM...
(24)	PLNAE	GHMDD	QOMHM	AJZJJ	PLWNF	AMFMQ...
(25)	OLUDE	GMLVR	KGHAC	DYLNK	PLWFX	LYWWS...
(26)	RJDBZ	JVFHE	MEVDW	YQXQ	QOIOX	AOSZ...
(27)	NWWY	MMBFT	ISQIM	UCVXB	YBYOL	CERP...
(28)	YRMDN	FURFR	HBCFN	JCGYN	PBOEL	IEKWM...
(29)	VHNZN	LRJUP	DQFUP	BEVYN	KREWZ	ALYIE...
(30)	ULJSS	WXLRK	QFWEQ	NXQWO	KEQGE	KYMIL...
(31)	CLCCU	IVJTK	QEVJD	UCQCH	WQSOF	ALBJ...
(32)	YLYDE	WOMYD	ZPEAN	NCSFR	NRMAF	ADPSD...
(33)	ITMSD	XHTFK	XSGLD	OFSSR	YNRMD	TYSWT...
(34)	CLHME	TVFHE	KQMDH	NHWS	PGBGG	MCCAF...
(35)	ZJUJZ	VVMYT	HFVHN	UEAHR	ENIOY	JVDAJ...

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10. Solve the following isologs which were enciphered with two different groups of random, unrelated alphabets.

Message "A"

JLRAZ	HGZMZ	GZLNW	UJCMY	YPRNB	HJCZJ	TGMVI	IDBMZ	GDROS	WYZYL
UGPMM	HHLGA	HVLIF	QMMSJ	DMFDV	UMHOY	UGUPA	SDZMN	LLZOX	EGBHH
LLBQS	UOUZX	OVYCB	TBRQG	DMRJI	QLEDL	DTRVI	KEZYR	WGCZJ	TPDJB
TGYHN	DDUSJ	DMFQG	UJFSB	HMRIS	UVPFI	DHFGG	DKLVG	VWCDL	XULVL
LPRFJ	EWKDR	VPHQX	NVBPB	TGBQX	LHTQY	OGLZI	TPCOY	UDZMN	HVCZJ
TPLVG	VWCDL	XULVL	LPRFJ	EWMMV	ULLIV	LMMDU			

Message "B"

AJWGX	HMUDF	ZITOS	BXFHO	AJMOM	JRTUM	ISSRP	PYJDF	ZPMAA	USDRJ
WBJOB	JZFBJ	NDRSF	LIXCN	PQYSB	BIQJO	WBOER	UNDFW	TJGNU	FMJEY
XHNMA	BKMZH	SHTSM	OSBXD	HOWAP	LNKWR	PUMJD	XODRL	HBUFJ	OAHJR
ISXVQ	OYACN	PQYMC	BXPQS	VQMGW	SDAKO	HBNIS	OAMVD	OFZSV	VRVNJ
RJMTJ	HOYMP	JGTFU	KHJAB	IRNMO	FZITO	SBXFH	OATOQ	MLCHQ	HHHON
IETJC	NUFMJ	EYXHN	MABKM	ZHSHL	RNMZE	XQXSQ			

H. Polyalphabetic bipartite systems
(embracing Chapter XI)

1. Solve the following naval intercept and recover all keys:

42570	87490	95477	48668	61622	39542	82230	62423	81187	80647
05230	53574	53620	99181	96693	63528	40630	99160	06107	98660
50105	88197	41230	48659	42630	87445	91677	63560	97500	99167
42290	97123	53470	97495	96672	98114	62922	99567	01177	80960
57187	37462	01233	68168	60922	49241	32233	48178	67101	43645
91580	60410	61421	89267	45692	53460	53527	90492	92471	83978
81637	37645	42170	93679	53907	88142	82292	92978	57130	68680
97183	58110	57131	88480	42430	80910	81100	68435	41433	48574
87535	33147	47193	48574	50480	99597	42290	97123	41525	89535

2. The enemy has been using a Nihilist system with keys up to 30 dinomes in length. Solve the following cryptogram and recover all keys:

93394	87876	86977	84454	68773	43853	37845	08695	57579	56955
77587	57665	65766	68933	65333	98678	58853	05394	68288	66785
69576	77676	60656	72236	73597	77530	85645	84687	78849	95767
66687	85644	22578	65978	63486	76539	34596	78569	87477	57760
35674	56695								

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3. The enemy has been using a Nihilist system with keys up to 30 dinomes in length. Solve the following cryptogram and recover all keys:

63268	63767	56475	96248	57744	96467	57697	84867	64445	56868
79472	64257	58857	75744	47886	02846	42556	86889	59294	94448
58547	64837	38558	83759	83457	74877	60454	94455	38757	94737
57687	82936	55625	93855	88375	96367				

4. Solve the following modified Nihilist cryptogram and recover all keys:

83246	05488	84539	73862	89553	06393	55595	49672	56937	70389
57266	35454	28529	96432	86566	49965	48249	56530	82706	22494
40748	68746	52542	64054	96662	65346	93678	43822	54346	05687
02447	54003	97845	92482	34298	38884	64555	79258	74665	25467
60560	89253	55770	26663	28459	44627	56669	32287	38847	88470
24525	72873	96666	47538	85668	42656	72265	78278	62538	74673

5. Solve the following cryptogram and recover all keys:

33946	34720	30519	60051	98505	18766	68363	13446	11034	24487
43001	08449	10965	73429	14079	94858	12054	46028	23067	21523
68145	63189	13081	78172	69221	61545	66734	15207	67159	73220
63929	26027	13021	79484	41305	91507	70484	34528	88869	33879
05782	36825	35899	12220	30519	60070	04047	48571	75963	28110
61869	49375	48519	03543	18312	48011	80561	84682	82567	31822
07043	74312	31503	18024	57114	65478	54187	92849	15932	98883
61534	00442	66019	18870	27019	05357	11000	08402	13714	65877
65543	54734	17576	21025	67679	36527				

6. The enemy has been using additive keys between 10 and 15 dinomes in length. Solve the following cryptogram and recover all keys:

41701	90597	76725	80721	11075	44674	07405	73556	20130	78118
44070	25691	38221	74357	41983	47929	76449	79603	81068	67168
88131	64746	13517	82913	34054	26556	55147	24625	81214	41161
85161	64265	52444	10859	26140	09007	30162	80943	51308	91223
82063	23909	49259	81522	88332	66564	42467	65353	28283	31732
41369	62001	41877	26016	31652	83974	49685	19972	24556	31686
33374	28227	58287	09810	14483	19072	78611	96722	92264	43729

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7. The following cryptograms were enciphered with the syllabary square and coordinates illustrated in Fig. 101, in conjunction with an 8-digit cyclic additive. Recover the additive sequence and submit the plain text to Message "B".

Message "A"

48899	07938	73675	71360	84873	89386	64896	88197	16112	18273
27721	58559	75870	07395	02602	06164	90489	50257	82679	36670
87024	65598	02048	96126	29260	58888	35487	93830	03870	11229
90403	64396	00513	24993	90042	99335	26664	31733	62682	39555
46551	11353	99893	77191	95025	06467	34930	20978	23039	07938
73675	71320	61649	07032	64385	80873	50887	70293	46581	44802
81903	48177	02934	65805	88077	21821	73280	34678	73219	21686
45380	50580	81159	80250	17658	73178	72645	96085	70819	32310
73068	64986	57971	05781	82106	68263	58280	60060	18621	06536
90431	18057	02114	76042	21162	72308	43357	67063	44751	08402
10375	72305	88883	54879	38300	38727	93376	74071	82458	94298
87003	77287	38468	43081	34106	98502	13539	08931	82139	38387
89467	44502	70950	21671	04184	69386	86305	59502	04937	20804
01353	03809	24450	98972	73325	56397	89059	08704	59329	29691
55138	92426	5713							

Message "B"

81353	22816	57772	73178	04781	22866	57139	98610	17629	97875
63408	95064	23648	95982	87045	93253	48075	50291	17656	93882
31805	17540	94476	14127	93489	81290	07870	27002	53762	98286
76412	34802	28230	08130	89135	39089	39433	84675	59207	04802
04896	12445	11940	27364	32494	99672	87448	94490	47874	00813
78771	06628	21246	09963	93065	20081	30895	38693	55109	23415
2657									

8. Reconstruct the plain text of the following cryptogram which was enciphered with the syllabary square illustrated in Fig. 101 (but with unknown coordinates) and then superenciphered by a 14-digit cyclic additive.

31902	31274	82175	89569	65675	15668	75529	25950	10946	17039
83832	28419	22846	12476	33272	61108	83508	57574	12844	66610
87161	25950	10946	17039	83207	95647	32733	30521	24770	24888
57839	48195	20141	46533	90793	98679	64778	33618	74115	40805
96898	72418	81844	99243	11835	35742	37046	68622	22072	36790
79473	30712	89957	12161	69125	83716	59734	26505	30795	67541
94899	03095	69577	03666	86222	20723	67903	93911	84761	39576
94702	90888	60556	88332	49551	86531	72200	59895	12496	63248
88578	30390	32760	62021	00245	57304	24575	26424	25132	03929
90781	60201	26684	82317	08468	21789				

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~~CONFIDENTIAL~~DO NOT WRITE ON THIS PAGEI. Monome-dinome systems with cyclic additives
(embracing Chapter XII)

1. The two messages below are known to have been enciphered by additives from 25 to 30 digits in length. Determine the correct period, showing the δ I.C. calculation for Message "A" confirming this period; solve the texts of the messages, and recover all keys.

Message "A"

84487	87282	04146	75217	38872	14493	48491	98022	66292	72796
57822	89370	89441	29688	21057	63760	81858	87270	77563	11717
45185	32991	38991	27876	85455	89707	98551	79260	18477	04156
42238	92763	13007	29821	29865	41224	96608	23650	21522	13303
56213	62296	47851	87451	08789	64230	16170	41467	58411	52182
26752	51998	16069	66165	73132	77099	93798	91136	25234	50910
11409	54636	07797	60622	16298	73650	41787	69808	39722	40048
17891	84621	91619	34838	98027	74740	83381	16056	28812	23915
29775	84939	27100							

Message "B"

84487	87282	04938	25598	73900	69841	25792	80222	47713	57518
59016	62199	00080	68230	71089	06697	88806	38956	57064	43825
60485	72022	25611	53698	86323	84089	67385	75133	33476	60406
22315	76795	17705	96601	05569	68418	14610	51555	25803	96308
86942	55636	53951	74757	70919	35959	16728	64549	55272	79402
16164	80008	15348	07517	35816	99694	33955	87698	00594	92835
83375	87020	07391	42004	17802	79560				

2. The following two cryptograms have been enciphered at different starting points along a keying cycle of 30 digits. Determine their correct superimpositions, showing the ξ I.C. calculation confirming the superimposition; solve the texts of the messages, and recover all keys.

Message "A"

03743	23504	41880	60428	72230	85539	28370	91035	63687	87570
62628	32223	28057	54179	06716	45449	91478	55296	93221	76728
58807	00025	45627	34192	03601	49435	19427	65545	51327	86123
43370	23577	60691	96078	77774	30063	03601	40575	79115	67575
55319	53092	53870	30673	08851	56493	66979	65219	39986	79520
39188	66436	01472	24218	84817	90529	53077	96644	48378	32813
03686	94472	64206	53810	87972	35079	18011	85370	44623	16939
41326	35723	55122	64751	14346	90574	39628	48071	23935	79535
53213	40570	91224	86170	35622	23097				

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Message "B"

94786	26566	74745	13124	25735	85238	06054	84966	33700	93277
65149	38162	41295	16782	44809	95282	46710	32147	99107	28225
52311	37185	42315	36418	97919	01081	97692	98467	55856	44719
15211	91819	75499	60214	80712	52114	84526	27329	53344	70773
66720	86216	46729	12765	93215	14484	41702	66214	45327	28023
29408	73284	62780	38261	50620	85144	06884	25715	94069	32701
26603	86961	05753	61943	93390	96466	91351	94269	24200	78282
49315	95290	38419	25789	94953	69657	60359	48019	97205	66882
69293	15334	40512	03466	55228	89225	50349	56583	54701	56520
40206	08318	64226	63342	97400					

3. The enemy has been using a fixed monome-dinome matrix with invariant coordinates, in conjunction with additives varying from 40 to 50 digits in length. The matrix recovered cryptanalytically is the following:

	9	4	8	1	2	7	6	5	∅	3
-	R	E	P	U	B	L	I	C		
∅	A	D	F	G	H	J	K	M	N	O
3	Q	S	T	V	W	X	Y	Z	.	

Solve the message given below and recover all keys.

66027	78940	97324	21440	23195	80287	74318	97991	87472	64536
62482	70394	94344	33432	71402	33739	14670	24684	23660	03738
31011	80794	65391	31440	23195	85386	44273	00065	36030	69640
38360	76728	24738	57063	44825	80146	37183	04625	06298	90308
28337	90688	34000							

4. The enemy is still using the same matrix and coordinates as in Problem 3, in conjunction with additive sequences from 40 to 50 digits long. Solve the following message, suspected of beginning with the word CRUISER, and recover all keys.

58013	60288	16972	82030	17836	93292	01369	93997	43850	62253
99102	61874	33187	46031	40042	31798	91654	37776	59676	80403
58189	74483	84748	94413	38744	87970	09926	15610	05528	69000

5. The enemy is still using the same matrix and coordinates as in Problem 3. Solve the following messages, suspected of being isologs, and recover all keys.

Message "A"

00589	93906	44731	02895	14974	86770	94330	65158	76009	35134
64211	24146	53648	38207	47076	80779	18433	14330	15794	61194
00653	43552	02359	76862	75391	77195	92805	95211	52602	15218
35866	76686	32078							

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Message "B"

88103	35902	64351	64411	96110	20532	10338	25918	52867	71752
86697	82140	33028	76681	65830	46917	92435	54570	39936	25576
88415	87752	64311	72024	33515	31571	14405	71297	50288	99870
17004	32486	70016							

6. The enemy is still using the same matrix given in Problem 3, but with a different set of coordinates; the additive sequence employed is between 40 and 50 digits long. Solve the following message, suspected of beginning with the words OPERATION ORDER NUMBER..., and recover all keys.

47638	41814	61394	73436	32874	73183	85963	09141	76547	48496
16123	83156	86132	33484	61786	23631	47928	96068	81916	16901
49393	18089	46814	35713	87787	47164	09849	77645	47059	44252
28921	66842	71380	05418	13129	89418	17613	68047	81965	19893
93236	64377	44711	77234	97566	63014	93938	47579	14393	23664

7. Message "B", believed to be an isolog with Message "A", was transmitted in answer to a request for a repetition. Determine the cause of the cryptographic error involved, solve the text, and recover all keys.

Message "A"

63894	47107	17679	77442	67018	70800	79179	41870	32254	87525
35339	51157	41925	46798	78875	68333	05065	83285	68566	57326
61071	19254	67473	42590	41789	66159	39367	03463	29122	72492
47547	74734	24341	74024	22322					

Message "B"

63894	45343	34582	39205	94105	92663	24075	85451	87151	75385
15937	47196	21311	44757	18263	62293	85451	87151	34924	51541
48372	75977	74154	68233	35283	04690	23921	55803	69516	62311
66531	78633	03533	64964	41312					

8. Solve the following isologs, suspected of beginning with the word MOVEMENT, and recover all keys.

Message "A"

64058	08567	87669	38948	04171	80250	87539	54997	46629	21214
64926	91576	59201	87442	46214	04108	18878	35654	37975	83884
63694	78844	89271	67511	83412	51459	42789	72720	06899	78739
60668	88220	52368	76318	04526	47579	09590	68510	37191	68642
56528	37848	15155	06817	12852	40390	38535	59012	34016	29356
97873	96066	55439	45374	90712	05710	02250			

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Message "B"

90657	24475	37594	20789	06683	56543	79750	98245	14974	23036
64352	51492	40051	70934	20316	55374	47160	57798	62743	18386
45894	11404	71862	42504	32696	61600	69318	01942	10224	55564
10840	08263	18350	35493	03875	65989	24617	21449	59305	01129
39078	55068	19411	05076	20351	75218	79550	61775	27938	40799
45556	41084	77433	71973	16620	55645	94090			

J. Periodic digraphic systems; miscellaneous
polyalphabetic systems
 (embracing Chapters XIII and XIV)

1. Solve the following cryptogram and recover all keys:

IQFNP	QJHSI	FAYTI	UVMOD	DLRFI	QCFWY	JUPYY	JEOSL	JUPYY	EOOUV
BFDQE	BMTHK	ARZDD	KLJUV	GLHLT	YNESK	MOMGY	RMUHE	QBDVQ	LWGKU
KBAWZ	WVRTL	FSRRY	QSIUW	FWZUG	UUYUK	UZQUY	WWDSM	AZLBR	QWSKS
FEGRY	QPYUW	FWZBZ	TEBFS	PQZRY	SOHCL	RYCEI	KWSIE	FAGFW	NDQNK
AQYYY	FWVNB	DIDQN	WJKHR	JUKUP	YWKQQ	NSQBN	WMWRP	FSRCD	FTBUW
JUNCI	RWVNU	SLAGR	UHBWU	FWZRJ	XUKHE	BPZDR	UJESR	QBIWK	PDOFC
PQDLS	UOLJL	XTYEE	BMTJR	TQKDA	SOUIO	AOSFN	LVUEU	IYAKO	ZHUPE
JBYYG	QHINTO	KUVDI	LSJGX	YUHHG	NZZFU	EYYDQ	BUOVF	LKENN	SMRSY
TUQBN	WMWRR	ELYHA	AMRSR	QBIWK	PBHEN	SLPYP	QSRHR	KNCEI	KSJGX
TWAVH	ZLCVB	FEGRY	QPYUW	FWWOP	YMKNV	DGOKG	JHOHM		

2. a. The enemy has been using a cryptosystem involving a multiplicity of Playfair squares. Solve the first five of the following message beginnings:

(1) GESKA	KLTSF	BDNSO	QDUPD...	(26) ZKBTL	SRETC	NLTUV	KLCUD...
(2) BRMKK	SRXKV	ZSUTV	PUDYL...	(27) URMVK	TYMFH	ISKPB	NMDKA...
(3) ACQMQ	NSFHC	ISDBS	LPUTM...	(28) DPMVE	QDIRH	FHISC	TWCGA...
(4) BGQPL	XIOSF	HZEAN	LDADW...	(29) ZKBTL	SDIRH	FHISV	KLCUD...
(5) AHSKD	EGZQF	XMLLZ	ODADW...	(30) EGKXB	EXIMF	LSVTL	YRHRK...
(6) CYLPH	BZQUL	TDBNO	ACPZP...	(31) EGKXB	EXLZP	PUULL	IZWMD...
(7) BRGLE	OKRRY	CIXEH	RONFP...	(32) QCETE	LONTD	SVGNK	EZWDP...
(8) SKYPH	LXSID	ICAOW	OQXIU...	(33) QCQOE	DLELF	HCPVV	PAEKP...
(9) KSTNG	XHZYS	BDOAA	OWOCR...	(34) EGQOG	CRTSF	OVSPU	LHRSF...
(10) KSTNI	XMZSF	PILNF	TULIR...	(35) CGNGX	ZRTSF	XPUWI	SFLJI...
(11) STBTL	NGKLT	VIULR	ESAVG...	(36) STBHX	RDELY	BPPON	LZXIU...
(12) STEGO	BAXHF	TDSNC	HPDIR...	(37) STVGK	ZRTFU	YDZHS	LPUCR...
(13) ZKLSK	TLYED	PBWC I	UAFMT...	(38) HITSQ	KDIDI	LIVAE	WRVIU...
(14) EHTDQ	NSFUB	LNFTU	LDOSA...	(39) SKYVT	ZFVTD	HCCWI	SQAKA...
(15) STZOK	TGBIF	VFGXI	VFSER...	(40) WTUIH	RXTOV	DTNYL	IIVNG...
(16) IWPQG	RXRLE	FTKRS	PHRCS...	(41) HKHSK	SAKLT	SDKUM	LRHRU...
(17) WPREF	XMDXR	LTCIH	MLACR...	(42) CQETU	NEWXI	HFIZO	ZRVIU...
(18) WPREF	XMZVF	ISKUO	AASME...	(43) BPKCR	TSFOV	EOUIY	SWTDA...
(19) BRMEZ	XZWPZ	NBLTC	IHMIE...	(44) QPQER	TSFDE	TDWCV	QAQRC...
(20) STZOX	YXIMK	ESVBG	EVRQZ...	(45) GCPTZ	XMFMF	LZUKL	IERPQ...
(21) STQAZ	QYSBC	ZPFOU	LRDIF...	(46) EGMVQ	KTIMK	TDWCM	HPOAP...
(22) QSEQE	LIDTL	ISKUE	KZNGA...	(47) EGOBA	IRQET	DNPOB	EPDOG...
(23) DRSHZ	QYSDE	OTOVD	UHRDE...	(48) HNZOX	QWYCZ	ESULR	HITKD...
(24) GWQHY	ZSFEV	XLZHD	USKFA...	(49) EGEOU	NELDH	PIKUR	EKEAF...
(25) CQETU	NEWXI	LZUKO	VLWUD...	(50) QSHKR	KRQET	DLBUO	AASME...

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b. Reconstruct the method of square generation employed in Problem 2a, above, and solve the plain text of the following message:

GESKA KLTSF BDNSO QDUPD VAEFY HVEEI EWLEA HAQMP VHRYP TZOTU

3. The two following messages, known to be isologs, exhibit rather incongruous phenomena. Determine the nature of the general system in both cases, submit the plain text of the first 100 letters, and recover all key words.

Message "A"

IHMEW	HYOCF	HDEYN	DHCHH	FEKBB	CEDTQ	DVHKQ	SAYTC	PEIYT	YEITN
AEKDK	KMQGI	PBYRL	IHVFB	CYQHG	LCLQX	ACCNB	AEDIM	IHRTC	YTDTN
PBMUL	LIITE	DHRTW	DHMDL	ESMQT	SYPOG	HLCZI	DSOPL	IHCVN	ICLBT
RDITI	AHVFB	TZBDP	IALQL	DHITL	IDAFN	KMQGI	AHQHG	GAHGL	VMYDB
ACKDH	IHMEW	DVHIF	YTDTN	HCMZC	OZPFL	FGKBD	DVHLB	MYEGF	EAHGH
LKHYC	HYKDN	YQXTL	FEYRL	IHVFB	CYYQG	PIEHF	LKHTL	HCQYT	EQHTL
YNOCN	DXAHP	CICSC	VDSKP	BPHBL	CEDDD	HCQEH	LKHLP	GXHTL	YNMFK
BPHBL	HCMLP	TYXDF	GCGUG	YXPHT	MKOCN	CDMQP	EQMUO	TLCVN	RZCKF
MDGAL	VTHTQ	SAITE	DHRTW	XPOKL	OSHC	HLDXL	CMDEL	QLFOQ	SANGX
QEYAC	QNOCD	CDITM	MKXYF	PEXDF	VTHTC	VEBWB	EFAHG	VUAPK	FEKBG
CFQIC	OHQHG	LCOVX	QEDTM	MCITE					

Message "B"

CPOOD	UAJMF	FEMTT	KWJCF	ELGDG	TAQFH	UZEVD	MCMCK	AGMEZ	DOMZG
SHZFC	ZMGDS	MUKUS	VWHUT	GSRLF	BGCIS	CHJKG	AKQFM	CZZUT	DUQZG
DUOFS	DOMBP	CPZZD	CFUDA	AGCBR	USUNF	UHOHM	CEONC	SFCOT	KYASR
WSMDT	VKHUT	ONQMQ	COCUA	TFMZA	OUWCG	ZMGDS	AERSD	USGSV	WKMTG
SGZFF	CPOOD	UWZVD	DUQZG	KTOEE	GECLS	QBGMO	UWZVT	SZKCP	AVGCF
FZZOC	USZMO	LUMAC	CSKZA	VWHUT	HSBXF	ODVCZ	MUZSC	KGZNU	LSZTC
UCJYB	FZFCY	BCJMK	FZTAY	BFGES	HHQOB	VGENF	FZZSM	ROZMV	XXCYM
BFGES	TTCNO	UDMYZ	CSYZQ	LVJDU	MBJYD	DTCBN	DMOZR	OFCCG	SZOVN
KUWGV	BZZLG	TSMBU	CPZZD	LFOZS	AZZCE	PKFAO	HFYQS	WLQBD	GVGRS
TDBGT	FCJDQ	DKMBA	FWDED	EDMMZ	BZZLV	OXPEG	SEFAD	ZHYEU	ESGDD
NKZGD	AERHQ	FGCIS	THQBA	DSMFW					

4. Solve the following cryptogram and recover all keys:

PBTDF	RBMFR	EKIFS	BGCGQ	AOACH	GIQAG	ASNGD	OGUND	CKCON	REBUR
TXLXD	RPADS	EELLD	NPXCL	BATFE	VADCD	NSBQB	IOACC	SULNE	UUKMQ
IUVIN	REFQO	OTCON	FTRUO	LQUGS	ENUPD	NUFMM	EEFLX	OQTPD	STCKD
ITHMT	NEFLE	DNFLH	SUTDS	IWBET	LMBRH	NORPA	ESHGZ	ETBYD	NECRD
DPPCK	IWBQD	PUBPA	ESFQR	UAAEX	TIBQD	HACBU	UBTRD	RTURN	PCIMC
ESFAI									

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5. Solve the following cryptogram and recover all keys:

BFSQQ	PUXGO	AOEID	MGUTL	NOKTX	PEOFZ	ATDCE	JQKNX	YBRRE	RFZKH
DIXYH	KVSIO	YWKEQ	SJPYT	GTEBO	HMIUT	GCISC	WAEQE	LJJKM	XWUCR
ERHSQ	OEOJM	DXGOA	OEIDE	DFOUY	RFSQS	TFYWX	EQSPI	VXPSO	SEKFK
FFLRS	RVYUQ	VEOAE	HAEQE	AAXRK	FYFFA	JRFAQ	SCIUW	FEEUN	WJHMT
DHSIH	THQPF	NHQIT	NRSIL	FKUQE	RTRRW	TTGBS	NKOFT	USLZJ	KUUJL
TQDYV									

6. The enemy is known to be using a Baudot system incorporating two key tapes of lengths between 21 and 35, the tapes consisting of alphabetical characters only, without any of the six function symbols. From analysis of previous traffic, it is known that the first four letters of each message constitute the indicator; a single space is used between all words, and a message center idiosyncrasy is the use of the doubled 3344 for the carriage-return/line-feed operation.

a. It is suspected that one of the messages intercepted in the morning contains the probable word REPORT. Solve the texts of the morning messages; and, after correctly juxtaposing the third message along the keying cycle, recover the plain text to this message.

Message "A"

RDA	DE	IZX	0930Z	17	DEC				
IVIVP	LWPZX	ENO5C	UBHVZ	EKWF	MFN8F	57SDK	XEB4F	VD7F9	CTUMV
YEYUV	QXI5H	HCW4C	KSKO5	YIMHC	FHBWC	C859G	KXVPH	I8AVS	SUU07

Message "B"

RDA	DE	IZX	0945Z	17	DEC				
IVIVU	PEHKV	FVCIU	NINAP	E8WP3	RIVEF	UMGEN	UZIWN	GI5TY	IZVEZ
UD7US	73E4Z	3YVLW	XOOLZ	GM85E	DNNRC	SQ7OB	8IGGM	NQ7MZ	S54TQ
8YXG3	HISII								

Message "C"

IZX	DE	RDA	1425Z	17	DEC				
BMBMY	XYY97	PFPCJ	HBU84	NZY3G	HKLVZ	BR3WE	SARU4	STZ8G	GHKSG
VSU5S	7NN8C	L8HVP	HUZB4						

b. Recover the original key tapes and reconstruct the indicator system from the preceding problem, and solve the text of the following message:

Message "D"

IZX	DE	RDA	1510Z	17	DEC				
JRJRf	UE5YC	C9NJV	U9DM4	OOZDE	NJLUI	U7I5I	ZWPL8	LK8PN	854PC
MDZ9E	DY44U	3NYF8	JIWAD	FTOKE	3ZYWT	8ZVNJ	BSKRB		

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7. Solve the following cryptogram and recover all keys:

IOPTP	TUCIE	XJPFU	GHPXQ	JXWIS	FJAGN	IEUNN	PGHCJ	CEXBY	HERJN
GZLHU	GYJBB	JDGIV	PBOFJ	GIPEN	PFJFO	AKJXZ	FEMJD	TYVXG	BODRJ
DNLIJ	IIXZJ	INODZ	XNJXK	JRBTN	VJREZ	IMJTX	WEVJM	KHFOE	NRPJE
OJCHB	GFHAT	DVJXY	WVCJX	OYGFJ	REZIM	JVFBP	JVLAF	GTFPH	XJXWT
TJIMG	TQJIV	JMKXJ	ZEHDL	HKXKJ	XBJOE	YROSV	VVXNJ	HPRJA	ECVTP
BMJVF	BPJVI	RFIVA	XIJVL	FVOOJ	CSJQB	UHLTP	WUXIK	TPYEY	JIVJM
GLNRS	NNEJX	AJREF	MNJEZ	JDTYV	XGBOD	RJVOI	JPHIW	GOFJF	YNPDF
GJHER	PYSNJ	ALCLK	OJVNJ	CAYVJ	EUNNP	GHJRT	EZJUH	UKFEN	VJLAW
JLIXX									

8. Solve the following cryptogram and recover all keys:

VJFVY	DARDW	NALGS	MALYK	AAQNT	OSSCM	LWPKS	URSKI	KSHVC	NAZKT
LHOBW	OAYDT	SPPOS	TTNUN	ISPPD	LEOYV	IOUQB	VAPSH	KSHVC	NAUSY
THCXS	PALYK	AAQNT	OSSCO	VHCBN	OJECQ	MSDQM	FKGCJ	LLSXC	IABXL
ILHPS	JBJEV	THYGH	NANEM	SOXNQ	AROJV	KPUYY	DUARW	KJYEW	ORESX
RLDGS	MAUYX	UHOBW	OAZKT	LHCXS	PAODI	YJPWJ	JUGGN	KWAKM	LLQCV
NOAIY	JZHYQ	IQBZC	LARKC	YGGQP	CAALL	JQBPQ	NCIPW	KZXVS	LHQAO
KAQNG	UKFWX	RBVQY	FKGCZ	YDLEI	NARNL	AQSOX	LKUCZ	YOXEN	OGFDL
HAESQ	UKFWE	KQQNQ	KUPRN	RIXVQ	OJDNL	LSUSQ	JRFFN	USPIS	JABXB

9. Solve the following cryptogram and recover all keys:

NMGYO	OZIOZ	AYMLZ	POCUZ	LRMBP	JGHOH	FBLGF	TASFX	EWUCK	HVCMR
RFECF	NRBFC	XGGQE	PKDYR	ZGLZA	YBHND	WCAZA	KFRYI	NZHNY	KLMYD
MEWER	YNWPZ	YSHBG	WGJCT	SEGYB	VBQRF	AHMPD	TBPGL	WMHFM	OYROJ
DAMEC	NNLSM	PAKDP	FYKBA	YDWCW	XRYCN	NCYGZ	EOGDJ	COGAT	IHVOP
QGDFI	PXYAB	UGNAM	AAHRZ	AQNUG	FNFIG	MGAYB	OMFMF	OLOOH	BFGQF
AHMPD	TBPGL	WMHFM	OYPHO	UZLLF	KGAVF	PEOZL	NFYMA	QTVYN	ZURBN

10. Solve the following cryptogram and recover all keys:

GUOAC	LFWBP	CQSFO	TYSQH	DFXEH	HUXXQ	KDXYS	CMTJN	HDUBC	FXWAP
HTHCI	PNSBO	EILAV	LSRKE	WGCHL	HKDSC	OWGXP	GVDJL	MKOFH	YBWJN
HOUSL	GUOAF	KHTIS	LOXWY	IZDFJ	KOMWB	KWSQJ	GINKC	KGMSI	ZHSEC
GDYVS	XTXKO	MHJWC	IJSIC	LRWXU	HETZL	ONXIW	DOXQI	MZDMA	BSXAR
JESQY	PEZTK	BSQAA	VMHGY	EEDUA	BMOZP	HSOBY	DZNIH	HIUAV	QSTMW
TXTMM	GNOQS	MWULP	EESUJ	KGDYV	RSPIB	BVJXQ	WJODY	HGOHW	MZDML
YNJKS	HLPXN	MVNEN	FVKLS	XMFOB	ZVTMV	GCDMO	DTEKU	TZMYL	EFDXB
KBKQY	NJSFO	JLEQT	IWXBY	EZLNL	FNKAT	KTKQY	LYLIN	HIUAT	KJBTY
LHYWD	INXXS	HVFXB	PVLXL	ONXMH	SSYWY	MGDWO	MVOJD	DLFMO	HGUGP
BIKIO	MJOIY	ZENEP	BNXFJ	YHHLI	OJVWT	AJGMY	IMSLC	LMQWC	IJNSV
JAMEN	NJOWU	FRFBS	OBBKD	PZNEC	HSXAQ	LAMTV	HJDTV	OEFQY	DAODI
QZDMJ	TJIES	KFMIX	NOSTO	BDTBC	PSEKN	SPZZS	HKZAV	QSKVW	POSBC
IFDIX	IPXOI	FPLIO	JJQDV	WSQXA	NOUXH	EWODS	MRWOP	HEFWU	FRFBS
OBBKD	PZNEC	HSXAQ	RMOBY	EZYGL	KNZQQ	VSHMU	SHTBV	DKDBF	DMFIW
SCSEM	MSKYC	LKMIB	HRYEH	BCWBI	DUXCU	HGCGP	HKZNV	YAMUB	ZVUMY

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