

# Coach for a Day

## Brief Overview:

The students will be presented with a scenario in which they are football coaches who need to select a new player for the team. The students will display, analyze, and evaluate data from a simulation activity with fictional football players using tables and bar graphs. In addition, students will evaluate data relating to mean, median, and range to determine which fictional player would be the best to add to their fictional football team.

## NCTM Content Standard/National Science Education Standard:

Data Analysis and Probability:

- Collect data using tables, surveys, and experiments.
- Represent data using tables and graphs such as line plots, bar graphs, and line graphs.
- Use measures of center, focusing on the median, and understand what each does and does not indicate about the data set.
- Compare different representations of the data and evaluate how well each representation shows important aspects of the data.
- Propose and justify conclusions and predictions that are based on data and design studies to further investigate conclusions or predictions.

## Grade/Level:

Grades 4-5

## Duration/Length:

3 days/ 60 minutes per day

## Student Outcomes:

Students will:

- Collect, organize, and analyze data from a simulation.
- Analyze and describe data using mean, median, and range.
- Create bar graphs.
- Interpret and compare data in bar graphs.
- Evaluate several choices and justify their choice using data from tables and graphs.

## Materials and Resources:

- Snap cubes

- Masking tape
- Footballs (1 per group)
- Measuring tapes with yard measure (1 per group)
- Calculators
- Student Resource Sheets:
  - Student Resource 1: Coach for a Day
  - Student Resource 2: Pre-Assessment “Data” Web
  - Student Resource 3: Football Simulation Data Table
  - Student Resource 4: Football Simulation Data Table for Reteaching
  - Student Resource 5: Football Simulation Data Table for Range
  - Student Resource 6a: Free-Agent Running Back Data Table
  - Student Resource 6b: Free-Agent Running Back Data Table Questions
  - Student Resource 7: Blank Bar Graph (3 copies per student)
  - Student Resource 8: Free-Agent Evaluation
- Teacher Resource Sheets:
  - Teacher Resource 1: Football Background Information
  - Teacher Resource 2: Sample Data Web
  - Teacher Resource 3: Football Simulation Data Table Sample Answers/Reteaching Answer Key
  - Teacher Resource 4: Football Simulation Data Table for Range Answer Key
  - Teacher Resource 5a: Free-Agent Running Back Data Table Answer Key
  - Teacher Resource 5b: Free-Agent Running Back Data Table Questions Answer Key
  - Teacher Resource 6: Sample Bar Graphs
  - Teacher Resource 7: Free-Agent Evaluation Answer Key

## **Development/Procedures:**

### **Lesson 1**

#### **Pre-Assessment**

Students will complete the “Data” web using Student Resource 2 (Embedded in the Launch section.).

#### **Launch**

- Present the football scenario (Student Resource 1).
- Distribute the “Data” web (Student Resource 2). Allow 3-5 minutes for the students to add prior knowledge to the web (Refer to Teacher Resource 2 for a sample web.).
- Discuss the students’ responses on their concept web. Create a large class web on the board, chart paper, or video visualizer.

#### **Teacher Facilitation/Student Application**

- Explain to the students that before they decide which running back would be best for their team, they need to know what a running back does and how the data is collected. Ask students to share what they may already know about

running backs. Discuss the job of a running back on a football team and how the data is collected. (Refer to Teacher Resource 1 for background information on football.)

- Explain that the class will be simulating how this data is collected by playing a game similar to Tag. They will work in groups of four or five. One student will be the “running back” and stand at a starting line (line of scrimmage) with the football. Mark the line of scrimmage with tape or cones if needed. Also mark the side boundaries. Two or three students will be members of the opposing team and will stand five yards back from the line of scrimmage. Another team member will call, “Go.” The “running back” will try to run as far as he or she can until tagged by one of the students from the opposing team. The “running back” will then stop at that point and put the football on the ground. The team will measure the distance (in yards) from the line of scrimmage to the football and record the information on the data table (Student Resource 3). The team will repeat this process until each player has run and recorded the distance five times.
- After returning to the classroom, model finding the median and mean using snap cubes for the Sample Student listed on Student Resource 3. Provide each team with a container of snap cubes. Model putting together 6 cubes for the first trial of the sample. Have different students or teams put together cubes for the remaining trials. Put a line of masking tape on the floor and have the students arrange the stacks of cubes in order on the line. Ask: *Which stack of cubes represents the middle of the data?* (Center stack with 4 cubes.) Define this middle piece of data as the median of the set and post the definition on the board, chart paper, etc. Ask: *What would you do if there were six pieces of data instead of five? How would you find the median?* You can choose to have the students add another stack of cubes. (Look at the two stacks in the middle. Even them out or find half of the difference.) Ask: *How would it affect the data if the sample student had run 10 yards instead of 6 in the first trial?* (The median wouldn’t change.)
- Direct the students to arrange the blocks so that the stacks are equal. Ask: *How does arranging them in this way help us analyze the data?* (We can find out the mean, or average of all the trials.) Define mean and post the definition on the board, chart paper, etc. Ask: *What other ways could we use to find the mean?* Discuss the calculation method of adding all the numbers and dividing by the number of pieces of data. Distribute calculators and allow the students to see if they get the same mean when calculating it.
- Ask: *Is the median or the mean a more accurate representation of the data? Why?* (In this case, the mean was a better representation because of the higher numbers for trials 1 and 2.)
- Direct the students to work with their group to determine the median and mean of their group data. Have the students complete the analysis questions below the chart.
- As a class, discuss the results of their analysis. Ask: *What do you notice about the data? For your data, is the mean or median a better*

*representation? Why? How would adding a longer run affect the mean? Would it also change the median? If so, how?*

- You may choose to have the students keep all of their Student Resource worksheets in a folder, or collect them and redistribute them as needed.

### **Embedded Assessment**

Assessment is embedded within the lesson through the discussion questions and use of Student Resource 3.

### **Reteaching/Extension**

- Review/Reteach: If students have difficulty determining the median and mean for their data, assist them in a small group. You may use Student Resource 4, which has fictional data. (Teacher Resource 3 has answers for Student Resource 4.)
- Enrich/extend: Rather than explaining the process for collecting data, allow the students to write their own steps and conduct the experiment. The students may also design their own data table instead of using the table on Student Resource 3.

## **Lesson 2**

### **Pre-Assessment**

Students will revise the “Data” web using Student Resource 2 (Embedded in the Launch section.).

### **Launch**

Review Student Resource 3 and the data analysis from the previous lesson. Direct the students to use what they learned the previous day to add to or revise their “Data” webs (Student Resource 2) using a blue colored pencil or crayon. Explain that the color change will help them see how their understanding of data has changed. Discuss the changes the students made and update the class web in blue (Refer to Teacher Resource 2 for a sample web.).

### **Teacher Facilitation/Student Application**

- Ask: *What was your longest run? What was your shortest run? How would I find the difference between the two?* (Subtract the shortest from the longest.) Explain that this is the range of the data. Have them determine and record the ranges for their group members on Student Resource 5. See Teacher Resource 4 for answer key. Discuss the various ranges for the class. Ask: *How does finding the range help us understand the data?* (It tells how consistent a student’s runs are. A smaller range indicates greater consistency.)
- Explain to the students that they will now begin to analyze data from the players that they could choose for the football team.
- Distribute Student Resource 6a and 6b. Ask: *What similarities do you see between the table on Student Resource 6a and the table we used to collect data on Student Resource 3?* (Multiple runs, multiple players/students, mean,

median) *What differences do you notice?* (Range had been added, more runs, some players have more runs than others in a game.)

- Direct the students to find the median, mean, and range for each of the players on Student Resource 6a and answer the questions on Student Resource 6b.
- Discuss the students' responses on Student Resource 6a and 6b. Ask: *What is a better representation of the data for each player, the mean or median? Why?* (Possible Responses: Ben's median was half of the mean because he had a couple of longer runs. Mac's median and mean were close so either would be a good representation.) *What did you notice about data on the table? Based on the data, what would be your initial choice for your team? Why?* (Possible Response: I would choose I am because he had the highest mean number of yards per carry.)

### **Embedded Assessment**

Assessment is embedded within the lesson through the discussion questions and use of Student Resource 5, 6a and 6b. Answer key can be found on Teacher Resource 5 a-b.

### **Reteaching/Extension**

- Review/Reteach: In a small group, the teacher will assist students who have difficulty determining the median, mean, and range for the different players.
- Extend/Enrich: The students can determine other data they might want to know about each player before making their decisions and make a plan of how they would obtain the information.

## **Lesson 3**

### **Pre-Assessment**

Students will update the "Data" web using Student Resource 2 (Embedded in the Launch section.).

### **Launch**

Direct the students to use what they learned the previous day to add to or revise their "Data" webs using a red colored pencil or crayon. Ask: *What are some ways we can show data besides using a table?* (Tally chart, bar graph, pictograph, circle graph, line plot, line graph.) Direct the students to add their responses to their webs. Update the class web with the student responses.

### **Teacher Facilitation/Student Application**

- Explain that we will be using our data on the different players to create graphs of the mean, median, and range of the four players. Review the data table in Student Resource 6. Ask: *Would a line graph be appropriate for this data? Why or why not?* (No. A line graph is best for showing changes over time.) *Would a bar graph be appropriate? Why or why not?* (Yes. It allows you to compare the data for the players easily.)

- Distribute three copies per student of Student Resource 7. The students will need three copies of Student Resource 7 to create three bar graphs. Model creating a bar graph of the median for each player on the board, chart paper, or video visualizer while the students create their own on Student Resource 7. Be sure the graph has a title, labels, even intervals, and space between the bars.
- Direct the students to create separate graphs for the mean and range of the players on the remaining two copies of Student Resource 7. When they finish their graphs, they should compare their graphs with a partner to check for all the parts of a graph. See Teacher Resource 6 for sample bar graphs.
- Discuss the graphs as a class. Ask: *What display did you prefer to use to analyze the data, the table or the bar graph? Why? What trends do you notice on the graphs?*

### **Embedded Assessment**

Distribute Student Resource 8. Direct the students to select the player they would want to have on their team and justify their response. After the students have completed Student Resource 8, discuss their responses. Ask: *Which player would you choose for you team? Why? Was this different from your choice yesterday? If so, what influenced you to change your mind?*

### **Reteaching/Extension**

- Review/Reteach: If students are having difficulty creating their graphs, the teacher will work with them in a small group.
- Extend/Enrich: The students can create triple bar graph that shows all of the information for each player.

### **Summative Assessment:**

The students will complete the Assessment Activity (Student Resource 8). They will apply their knowledge of data analysis, tables, and graphs to evaluate and justify their choice of running back for their football team.

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### Football Background Information

Running back – A football player that receives the ball (usually from the quarterback) and runs toward the end zone of the other team (where you score points).

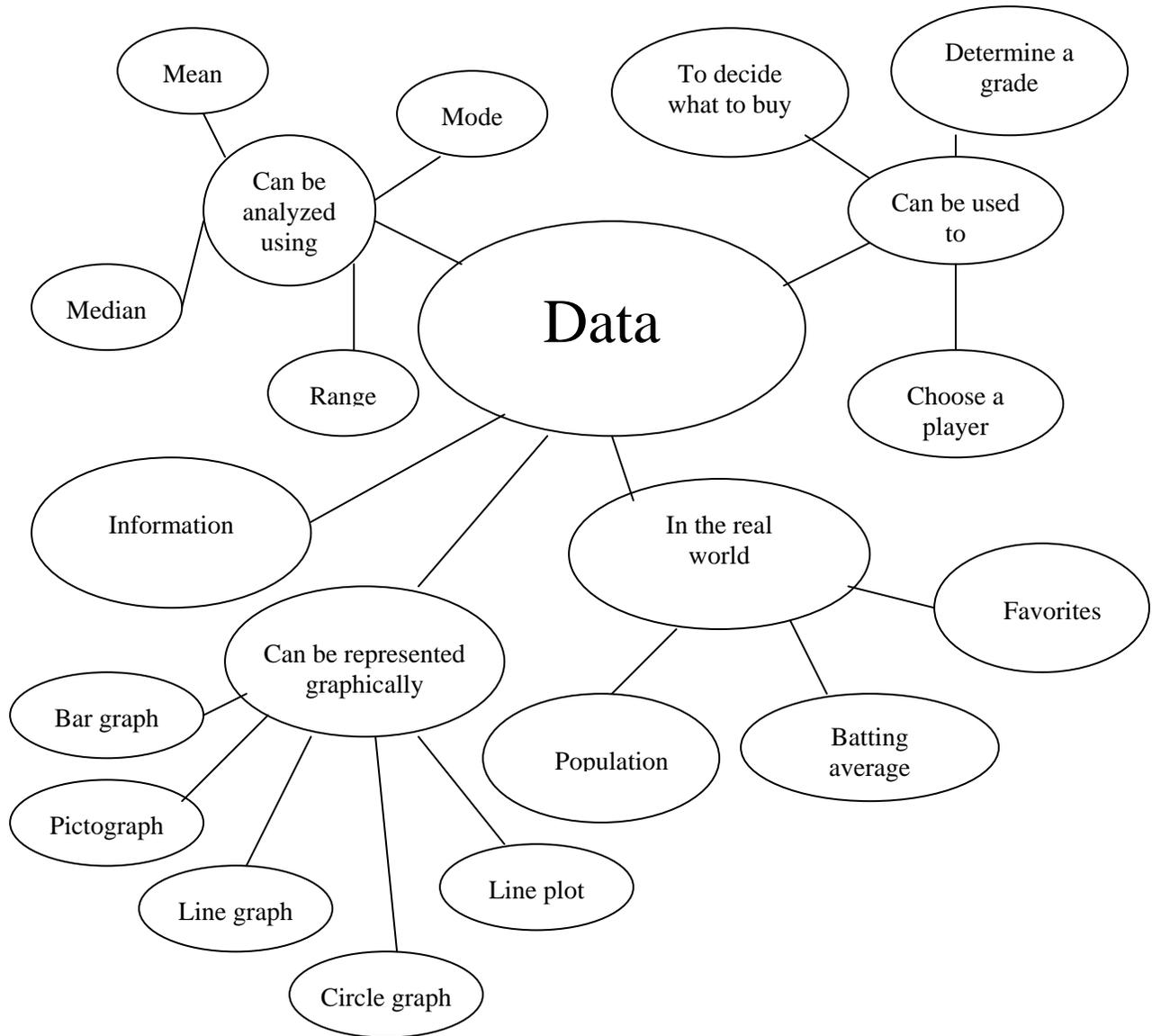
Line of Scrimmage – An imaginary line that separates the team that is trying to score from the team that wants to prevent them from scoring.

Carry – A term used when the running back has the football.

Free-Agent – A football player that is available to be on a new team.



Sample Web



\*Numerical answers are for Student Resource 4. Accept similar, reasonable answers for Student Resource 3.



Football Simulation Data Table

Directions: Using the distances that you ran outside, determine the median and mean (average) for each student in your group. Then, using this information, complete the questions below.

	Sample Student	Student Name: <i>Laura</i>	Student Name: <i>Maurice</i>	Student Name: <i>Tammy</i>	Student Name: <i>Toby</i>	Student Name: <i>Jenni</i>
Trial 1	6 yds	3 yds	7 yds	9 yds	5 yds	6 yds
Trial 2	8 yds	5 yds	7 yds	8 yds	8 yds	2 yds
Trial 3	3 yds	7 yds	6 yds	5 yds	6 yds	1 yds
Trial 4	4 yds	4 yds	2 yds	11 yds	7 yds	9 yds
Trial 5	4 yds	1 yd	8 yds	7 yds	6 yds	8 yds
Median	4 yds	4 yds	7 yds	8 yds	6 yds	6 yds
Mean	5 yds	4 yds	6 yds	8 yds	About 6 yds	About 5 yds

1. What was the longest median run? 8yds
2. What was the shortest mean run? 4 yds
3. If you ran one more time, and it was your longest run, would the mean distance change? yes Explain.

Sample Reponse: The mean distance would change because a longer run will make the total for all the runs higher. For example, if my runs were 5 yds, 4 yds, 6 yds, 7 yds, and 3 yds, the mean would be 5 yds. If I then ran for 10 yds, the mean would change to about 6 yds.



Football Simulation Data Table for Range Answer Key

Directions: Using your Football Data Chart from the previous lesson, complete the chart below to reflect each group member's longest run and shortest run. Then, using this data, determine the range for each group member. Once the chart is finished, complete the questions below.

	Sample Student	Student Name:				
Longest run	8 yds					
Shortest run	3 yds					
Range	5 yds					

1. Which member of your group has the greatest range?

Answers will vary.

2. Which member of your group has the smallest range?

Answers will vary.

3. If your longest run increased, what would happen to the range?

Explain.

**Sample Answer:** The range will increase since the difference between the largest and smallest numbers will become greater.



Free-Agent Running Back Data Table

Directions: Complete the chart showing the stats for each player's best game last season. Then, complete the questions relating to the data on Student Resource 6 b.

Note: The number of carries varies for each player since some running backs don't run with the ball as many times in a game.

Carry #	Joe Slow	Iam Fast	Mac Strong	Ben Brittle
1	2	7	4	8
2	5	2	6	7
3	5	11	3	12
4	2	13	6	2
5	0	2	6	0
6	1	1	3	2
7	7	15	7	0
8	2	4	4	1
9		1	6	
10		4		
Total Yards	24	60	45	32
Total Carries	8	10	9	8
Median	2	4	6	2
Mean	3	6	5	4
Range	7	14	4	12



### Free-Agent Running Back Data Table Questions

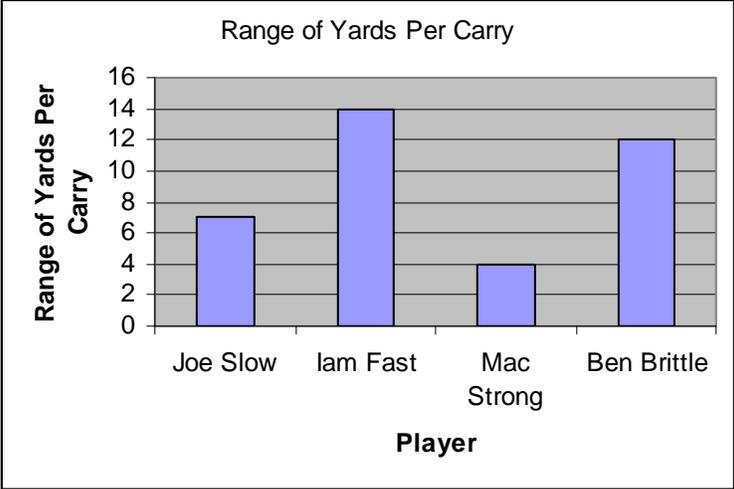
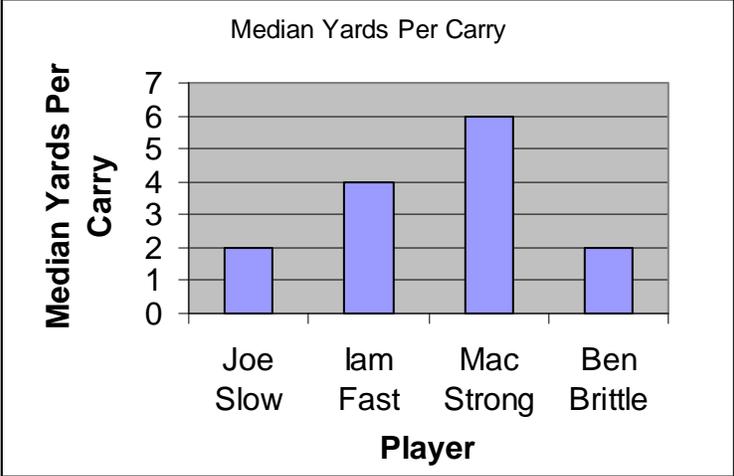
1. Write three sentences about your observations for the data on the chart.

**Sample Responses:** Iam ran for the most total yards. Joe ran for the least total yards. Ben's median distance was less than his mean distance.

2. Based on your data so far, which player would you want to have on your team? Why?

**Sample Response:** Mac Strong would be the best choice. The range for his runs was the smallest, which means that the distances of his runs were consistent. The median distance of his runs was the greatest, so he had more long runs than short runs. Since I want to have a player that will help to score points for the team, I would want a player that will run the ball consistently far each time he has the ball.

Sample Bar Graphs





## Free Agent Evaluation Answer Key

1. Look at the three graphs you created. What do you notice about the graphs? Write a paragraph describing the trends you see.

**Sample Response:** Iam Fast had the highest mean, but his median was not the highest. Mac Strong had the highest median. Mac Strong is a more consistent running back than all the other players.

2. As the coach of the team, you must make a decision that will affect the entire team for the whole season. You must be able to back up your decisions with evidence. Which player would you choose for the football team? Justify your answer using data from the table and/or graphs.

**Sample Response:** As coach, I would choose Mac Strong as the team's running back. He has the smallest range, which means he is consistent in the number of yards he carries. His median is the highest, so he had more long runs than the other players. His mean is the second highest, so he has a fairly good average. To help the team score more points, I want a player that will run consistently and run longer distances with each carry.

## Coach for a Day



Have you ever wondered what it would be like to manage your own football team? Believe it or not, the coach uses math to help make decisions about which players to add or take away from the team! Over the next few days, you will be analyzing football statistics for three running backs that are free-agents for the upcoming season. You will have the job of the coach and decide which player you would choose for the team.

When a coach chooses a new running back to add to the team, one of the statistics he considers is the player's total yards per carry. To help you choose the best running back to add to the team, you will receive a data sheet that lists how far each player ran per carry in their best game from the previous season. You will then use this data to determine the average (mean) number of yards per carry, the median yards per carry, and the range of the data. Finally, you will use this information to decide which player you feel is the best to add to the team.

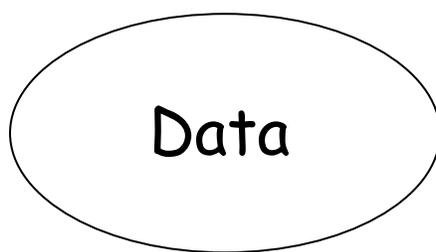
Glossary:

Running back – A football player that receives the ball (usually from the quarterback) and runs toward the end zone of the other team where you score points.

Free-Agent – A football player that is available to be on a new team.

Carry – A term used when the running back has the football and runs it down the field toward the goal.

Pre-assessment Web





Football Simulation Data Table

Directions: Using the distances that you ran outside, determine the median and mean (average) for each student in your group. Then, using this information, complete the questions below.

	Sample Student	Student Name:				
Trial 1	6 yds					
Trial 2	8 yds					
Trial 3	3 yds					
Trial 4	4 yds					
Trial 5	4 yds					
Median						
Mean						

4. What was the longest median run? \_\_\_\_\_

5. What was the shortest mean run? \_\_\_\_\_

6. If you ran one more time, and it was your longest run, would the mean distance change? \_\_\_\_\_ Explain.

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Football Simulation Data Table for Reteaching

Directions: Using the distances that you ran outside, determine the median and mean (average) for each student in your group. Then, using this information, complete the questions below.

	Sample Student	Student Name: <i>Laura</i>	Student Name: <i>Maurice</i>	Student Name: <i>Tammy</i>	Student Name: <i>Toby</i>	Student Name: <i>Jenni</i>
Trial 1	6 yds	3 yds	7 yds	9 yds	5 yds	6 yds
Trial 2	8 yds	5 yds	7 yds	8 yds	8 yds	2 yds
Trial 3	3 yds	7 yds	6 yds	5 yds	6 yds	1 yds
Trial 4	4 yds	4 yds	2 yds	11 yds	7 yds	9 yds
Trial 5	4 yds	1 yd	8 yds	7 yds	6 yds	8 yds
Median						
Mean						

7. What was the longest median run? \_\_\_\_\_

8. What was the shortest mean run? \_\_\_\_\_

9. If you ran one more time, and it was your longest run, would the mean distance change? \_\_\_\_\_ Explain.

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Football Simulation Data Table for Range

Directions: Using your Football Data Chart from the previous lesson, complete the chart below to reflect each group member's longest run and shortest run. Then, using this data, determine the range for each group member. Once the chart is finished, complete the questions below.

	Sample Student	Student Name:				
Longest run	8 yds					
Shortest run	3 yds					
Range						

4. Which member of your group has the greatest range?

\_\_\_\_\_

5. Which member of your group has the smallest range?

\_\_\_\_\_

6. If your longest run increased, what would happen to the range?  
Explain.

\_\_\_\_\_

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\_\_\_\_\_



Free-Agent Running Back Data Table

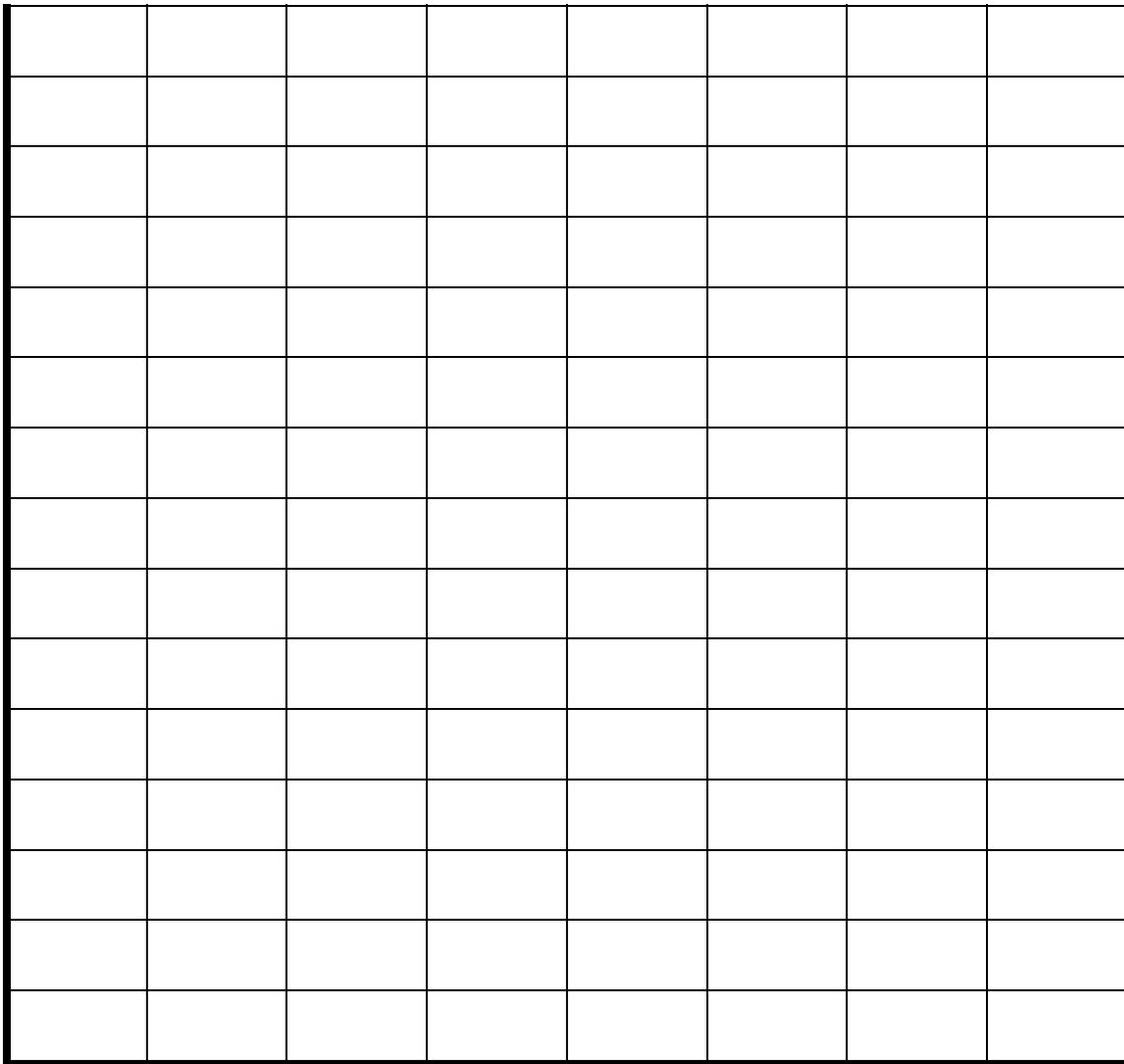
Directions: Complete the chart showing the stats for each player's best game last season. Then, complete the questions relating to the data on Student Resource 6b.

Note: The number of carries varies for each player since some running backs don't run with the ball as many times in a game.

Carry #	Joe Slow	Iam Fast	Mac Strong	Ben Brittle
1	2	7	4	8
2	5	2	6	7
3	5	11	3	12
4	2	13	6	2
5	0	2	6	0
6	1	1	3	2
7	7	15	7	0
8	2	4	4	1
9		1	6	
10		4		
Total Yards				
Total Carries				
Median				
Mean				
Range				



Blank Bar Graph





Free-Agent Evaluation

1. Look at the three graphs you created. What do you notice about the graphs? Write a paragraph describing the trends you see.

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2. As the coach of the team, you must make a decision that will affect the entire team for the whole season. You must be able to back up your decisions with evidence. Which player would you choose for the football team? Justify your answer using data from the table and/or graphs.

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