

## **HS Target P**

### **Domain, Target, Standards, DOK, Vertical Alignments, Achievement Levels, Evidence Required, Vocabulary, Response Types, Materials, Attributes, Question Types, and Question Banks (Examples)**

[Content Domain: Statistics and Probability](#)

[Target P \[s\]: S-ID.A Summarize, represent, and interpret data on a single count or measurement variable.](#)

[Standards included in Target P: S-ID.A, S-ID.A.1, S-ID.A.2, S-ID.A.3](#)

[Vertical Alignment](#)

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[Claim 1: Concepts and Procedures \(DOK 1, 2\) Question Banks](#)

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### **Content Domain: Statistics and Probability**

#### **Target P [s]: S-ID.A Summarize, represent, and interpret data on a single count or measurement variable.**

#### **Standards included in Target P: S-ID.A, S-ID.A.1, S-ID.A.2, S-ID.A.3**

**S-ID.A** Summarize, represent, and interpret data on a single count or measurement variable.

**S-ID.A.1** Represent data with plots on the real number line (dot plots, histograms, and box plots).

**S-ID.A.2** Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.

**S-ID.A.3** Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

### **Vertical Alignment**

#### **Related Grade 8 standards**

8.SP.A Investigate patterns of association in bivariate data.

These pages were adapted from open source documents available on the Smarter Balanced Website: <http://www.smarterbalanced.org/assessments/development/> August 2016

8.SP.A.1 Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.

8.SP.A.4 Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?

### **Related Grade 7 Standards**

7.SP.B Draw informal comparative inferences about two populations.

7.SP.B.3 Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability. For example, the mean height of players on the basketball team is 10 cm greater than the mean height of players on the soccer team, about twice the variability (mean absolute deviation) on either team; on a dot plot, the separation between the two distributions of heights is noticeable.

7.SP.B.4 Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations. For example, decide whether the words in a chapter of a seventh-grade science book are generally longer than the words in a chapter of a fourth-grade science book.

### **Related Grade 6 Standards**

6.SP.B Summarize and describe distributions

6.SP.B.4 Display numerical data in plots on a number line, including dot plots, histograms, and box plots.

### **Achievement Level Descriptors**

**Level 1** Students should be able to describe a data set in terms of center and spread and represent data graphically.

**Level 2** Students should be able to describe and use appropriate statistics to interpret and explain differences in shape, center, and spread of two or more different data sets, including box plots, histograms, or dot plots, representing familiar contexts. They should be able to identify the mean and the median and select the appropriate one for representing the center of the data for data sets

**Level 3** Students should be able to use appropriate statistics to interpret, explain, and summarize differences in shape, center, and spread of two or more different data sets of varying complexity and levels of familiarity, including the effect of outliers. They should be able to select the appropriate choice of spread as interquartile range or standard deviation based on the selection of center, and use the standard deviation of a data set to fit to a normal distribution.

**Level 4** Students should be able to interpret data to explain why a data value is an outlier and interpret and explain differences in the approximate areas under the normal curve of two or more data sets.

### **Evidence Required**

1. The student will be able to represent data on the real number line with a dot plot, histogram, or box plot.
2. The student will be able to use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.
3. The student will be able to interpret the differences in shape, center, and spread in the context of the data sets.
4. The student will be able to interpret the effects of outliers on the shape, center, and spread of a data set.

### **Vocabulary**

mean, median, interquartile range, outlier, standard deviation

### **Response Types**

Multiple Choice, single correct response; Hot Spot; Matching Table; Drag and Drop

### **Materials**

data sets (listed, described contextually, or as a table of values), graph

### **Attributes**

None

### **Claim 1: Concepts and Procedures (DOK 1, 2) Question Banks**

Students can explain and apply mathematical concepts and carry out mathematical procedures with precision and fluency.

#### **Claim 1 S-ID.A.1 DOK Level 2**

Represent data with plots on the real number line (dot plots, histograms, and box plots).

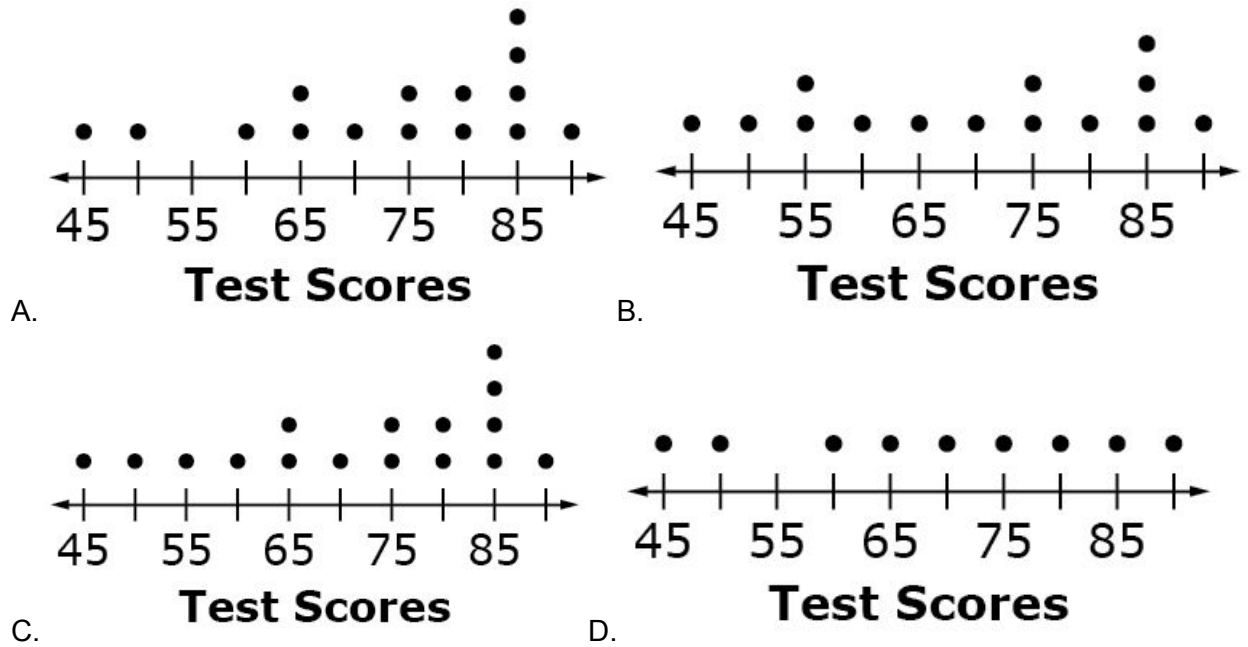
**Evidence Required**

The student will be able to represent data on the real number line with a dot plot, histogram, or box plot.

**Question Type 1:** The student is presented with a contextual data set.

1. Select the dot plot that represents the given test scores.

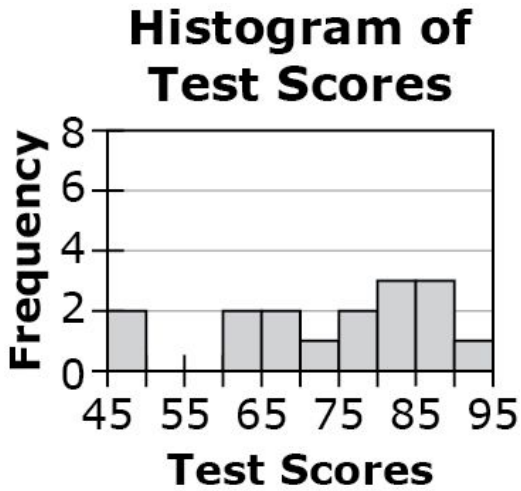
90, 45, 85, 70, 85, 50, 75, 85, 65, 75, 60, 85, 80, 65, 80



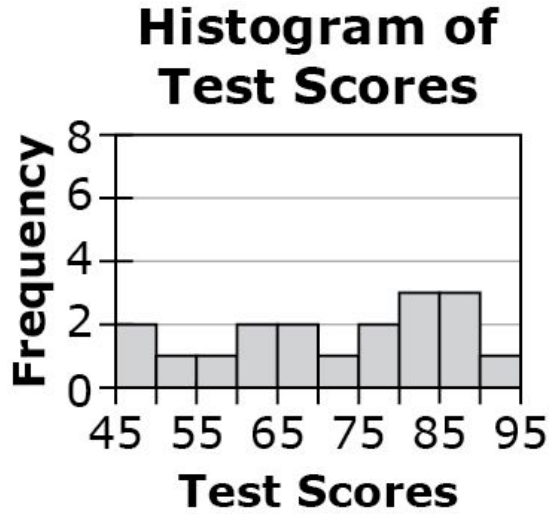
Rubric: (1 point) The student selects the correct option (e.g., A).

2. Select the histogram that represents the given test scores.

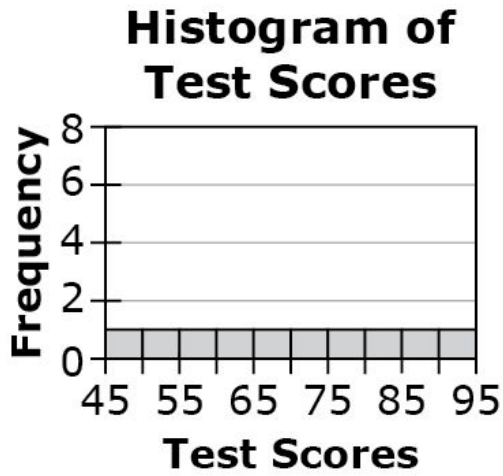
91, 48, 86, 73, 86, 49, 77, 86, 64, 78, 64, 82, 68, 82, 68, 82



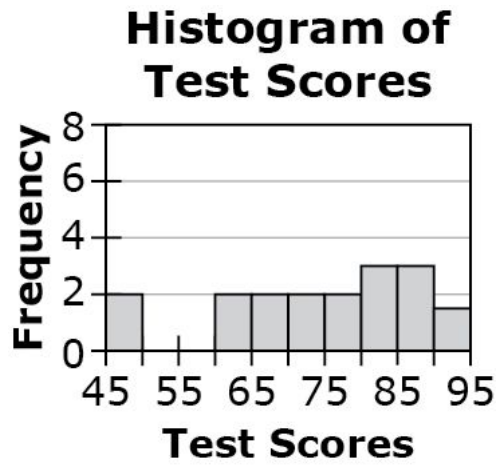
A.



B.



C.

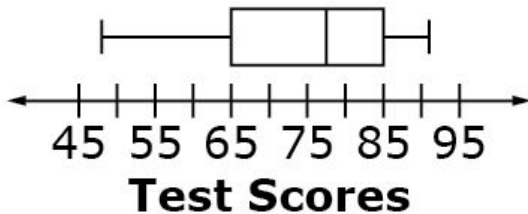


D.

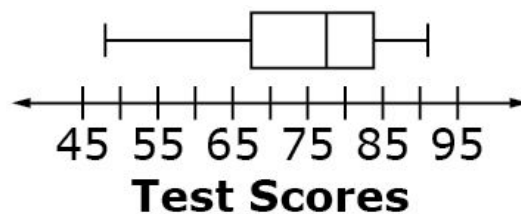
Rubric: (1 point) The student selects the correct option (e.g., A).

3. Select the box plot that represents the given test scores.

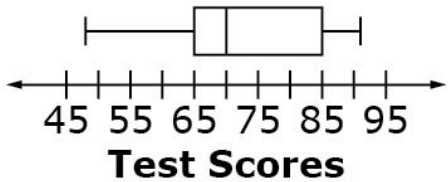
48, 50, 64, 64, 68, 68, 73, 77, 78, 82, 82, 82, 86, 86, 86, 91



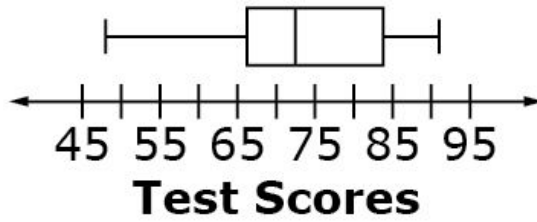
A.



B.



C.



D.

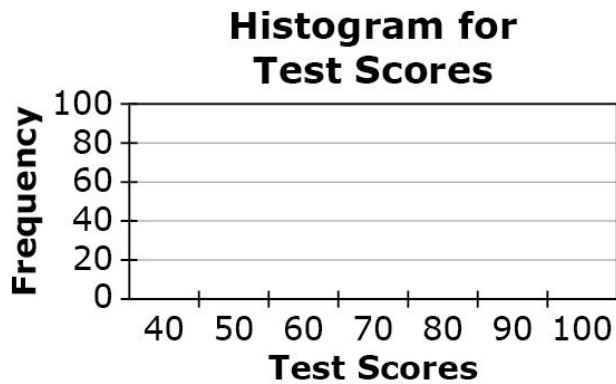
Rubric: (1 point) The student selects the correct option (e.g., A).

Response Type: Multiple Choice, single correct response

**Question Type 2:** The student is presented with a contextual data set and a blank histogram to be completed in order to represent the data.

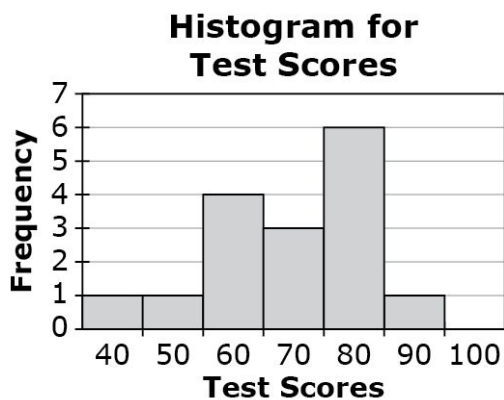
1. Click above the line to create a histogram for the given test scores.

91, 48, 86, 73, 86, 50, 77, 86, 64, 78, 64, 82, 68, 82, 68, 82



Interaction: Student selects the appropriate frequency for each interval on the histogram.

Rubric: (1 point) Student gets 100% correct (e.g., see below).



Response Type: Hot Spot

**Claim 1 S-ID.A.2 DOK Level 2**

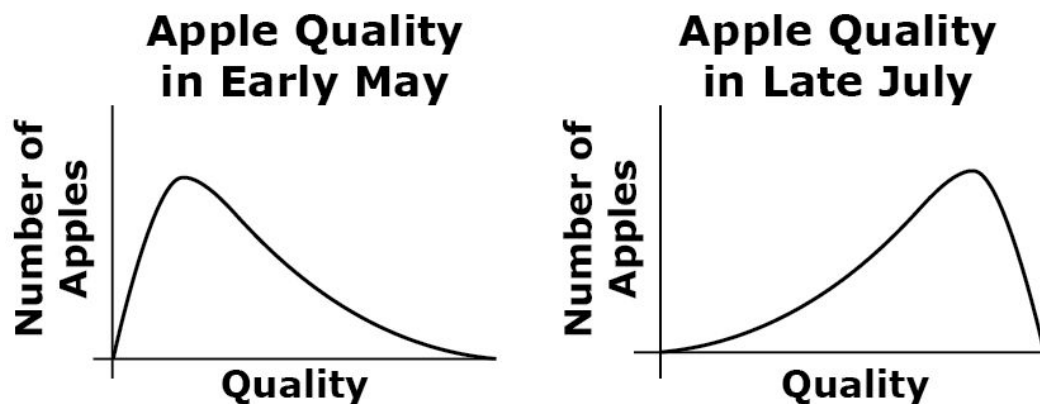
Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.

**Evidence Required**

The student will be able to use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.

**Question Type 1:** The student is presented with two data distributions in which both are skewed or both are distributed normally.

1. Data distributions are shown for the taste quality of a farm's red apples at different points in time during the harvest season.



Which summary statistics would be best to use to compare the two data sets and why?

- A. The median and the interquartile range because the data sets are normally distributed.
- B. The median and the interquartile range because both data sets are skewed.
- C. The mean and standard deviation because the data sets are normally distributed.
- D. The mean and standard deviation because both data sets are skewed.

Rubric: (1 point) The student selects the correct option (e.g., B).

Response Type: Multiple Choice, single correct response

### Claim 1 S-ID.A.3 DOK Level 2

Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

#### Evidence Required

3. The student will be able to interpret the differences in shape, center, and spread in the context of the data sets.
4. The student will be able to interpret the effects of outliers on the shape, center, and spread of a data set.

**Question Type 1:** A car dealership has 41 cars for sale. The least expensive car costs \$11,999. The most expensive car costs \$19,499. Another car, priced at \$33,499, is added to the dealership's inventory. Select whether the value of each statistic, for the prices of the cars, increases, decreases, or cannot be determined when the new car is added.

|                           | <b>Increases</b> | <b>Decreases</b> | <b>Cannot Be Determined</b> |
|---------------------------|------------------|------------------|-----------------------------|
| <b>Mean</b>               |                  |                  |                             |
| <b>Median</b>             |                  |                  |                             |
| <b>Standard Deviation</b> |                  |                  |                             |

Interaction: Student selects the correct box for each statistic.

Rubric: (1 point) Student selects all of the correct options (e.g., Greater for Tuesday's, Equal for Both Days, Greater for Tuesday's; Increases, Cannot Be Determined, Increases).

Response Type: Matching Table

### **Claim 2 Problem Solving Questions Banks**

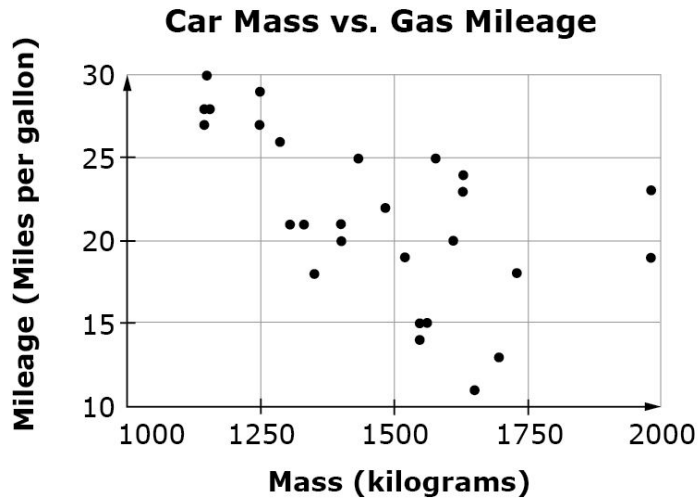
#### [Claim Descriptors and Targets](#)

Students can solve a range of complex well-posed problems in pure and applied mathematics, making productive use of knowledge and problem-solving strategies.

#### Example 1

The scatterplot shows the weight and gas mileage for 31 cars.



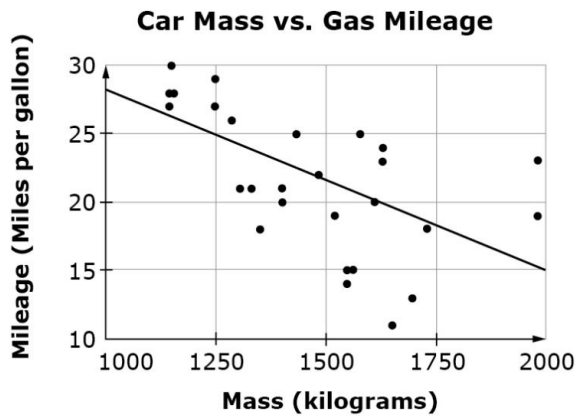


Part A: Use the Add Arrow tool to create a line of best fit on the scatterplot.

Part B: What is the meaning of the slope of the line of best fit in terms of the situation?

- A. For every additional kilogram of mass, the gas mileage is predicted to increase 0.013 miles per gallon.
- B. For every additional kilogram of mass, the gas mileage is predicted to decrease 0.013 miles per gallon.
- C. For every additional kilogram of mass, the gas mileage is predicted to increase 3 miles per gallon.
- D. For every additional kilogram of mass, the gas mileage is predicted to decrease 3 miles per gallon.

Rubric: (1 points) The student adds a line of best fit and selects the correct interpretation of the slope (e.g., see graph on the following page; answer choice B).



Interaction: The student chooses to use the Translate, Rotate, and Reflect Tools before entering the sequence of transformations.

Rubric: (1 point) The student selects a correct series of transformations from the dropdown menu (e.g., Step 1: Rotate 90 degrees counterclockwise around the origin. Step 2: Translate to the right two units. Step 3: Translate up one unit.)

Response Type: Drop-down menu.

### **Claim 4 Modeling and Data Analysis Question Banks**

#### [Claim Descriptors and Targets](#)

Students can analyze complex, real-world scenarios and can construct and use mathematical models to interpret and solve problems.

#### Example 1

This scatterplot shows the income per person (in U.S. dollars) versus the adult literacy rates for 30 countries throughout the world. The adult literacy rate is the percentage of people ages 15 and above who can, with understanding, read and write a short, simple statement about their everyday life.

Part A:

Use the slider to adjust the value for the base for the given exponential model so that it fits the data in the scatterplot.

$y = -100 \cdot b^x + 100$

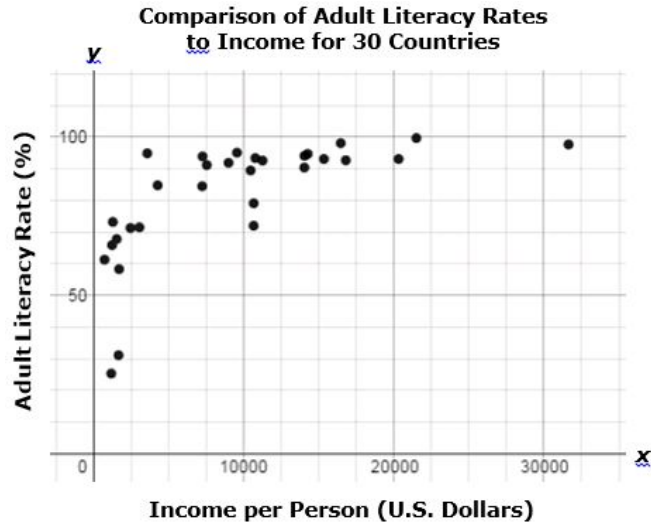
$b = 0.995$

.995 • .9999

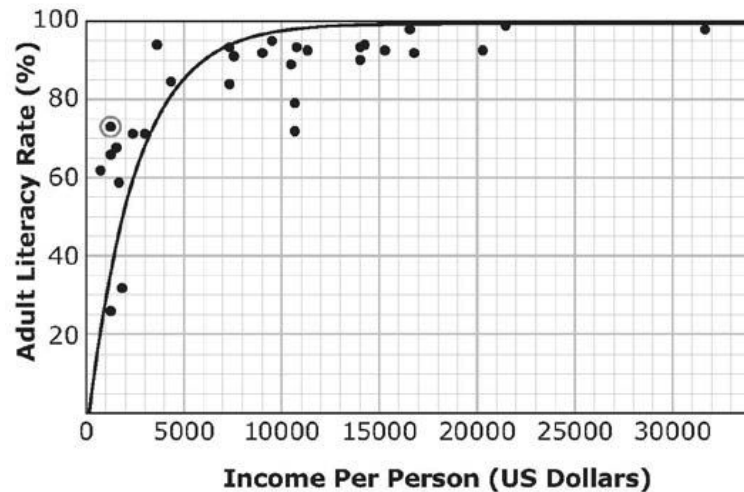
Part B:

Your model predicts the literacy rates in some countries better than others. Which country's literacy rate is least well predicted by your model?

Click on the point in the scatterplot to indicate your choice.



Rubric: (1 point) the student adjusts the graph so it fits the scatterplot reasonably well (see exemplar below). At a minimum, at least five of the data points must be above the graph and at least five must be below the graph. The student then clicks on the point that has the greatest vertical distance from their graph.



Response Type: Graphing

Data for the scatterplot:

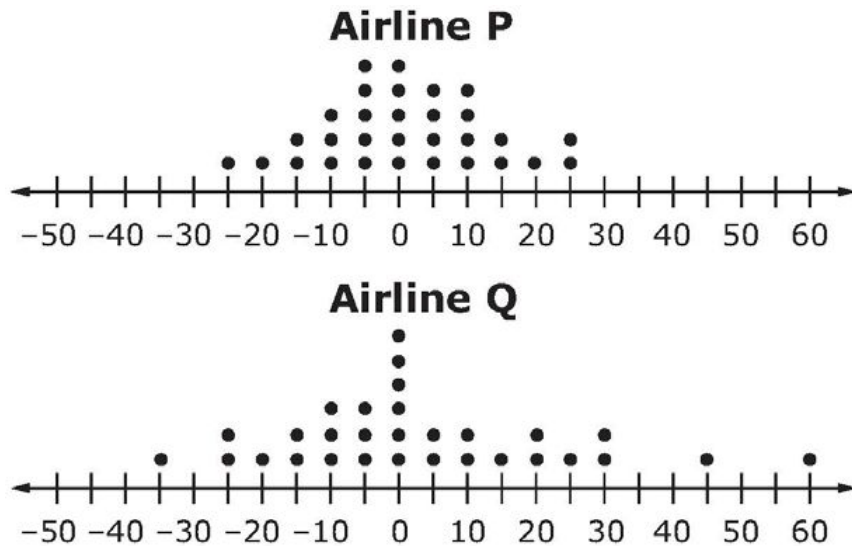
| Country             | Malawi | Guinea | Rwanda | Mali  | Cameroon | Ghana | Honduras | El Salvador | Paraguay | Sri Lanka | Ecuador | China |
|---------------------|--------|--------|--------|-------|----------|-------|----------|-------------|----------|-----------|---------|-------|
| Income Per Person   | 737    | 1,184  | 1,238  | 1,669 | 2,463    | 3,063 | 4,277    | 7,240       | 7,264    | 7,546     | 8,995   | 9,556 |
| Adult Literacy Rate | 61     | 25     | 66     | 31    | 71       | 71    | 85       | 84          | 94       | 91        | 92      | 95    |

| Country             | Dominican Rep. | Egypt  | Colombia | Jordan | Brazil | Panama | Mexico | Malaysia | Russia | Spain  | Bahrain | Oman   | Singapore |
|---------------------|----------------|--------|----------|--------|--------|--------|--------|----------|--------|--------|---------|--------|-----------|
| Income Per Person   | 10,463         | 10,669 | 10,782   | 11,260 | 14,042 | 14,050 | 15,346 | 20,319   | 21,501 | 31,636 | 40,044  | 52,799 | 70,455    |
| Adult Literacy Rate | 90             | 72     | 93       | 93     | 90     | 94     | 93     | 93       | 100    | 98     | 95      | 87     | 96        |

Example 2

These pages were adapted from open source documents available on the Smarter Balanced Website: <http://www.smarterbalanced.org/assessments/development/> August 2016

Two airlines each made 30 flights. The dot plots shown compare how many minutes the actual arrival times were before or after the scheduled arrival times of these flights.



- Negative numbers represent the minutes the flight arrived before its scheduled time.
- Positive numbers represent the minutes the flight arrived after its scheduled time.
- Zero indicates the flight arrived at its scheduled time.

Assuming you want to arrive as close to the scheduled time as possible, from which airline should you buy your ticket? Use all three drop-down menus to respond to this question.

I should choose [Airline P/Airline Q] because the distribution of flights for Airline P has a center that is [greater than/about the same as/less than] the center of the distribution of flights of for Airline Q, and the distribution of flights for Airline P has a spread that is [greater than/about the same as/less than] the spread of the distribution for Airline Q.

(2 points) The student chooses Airline P, about the same as, and less than.

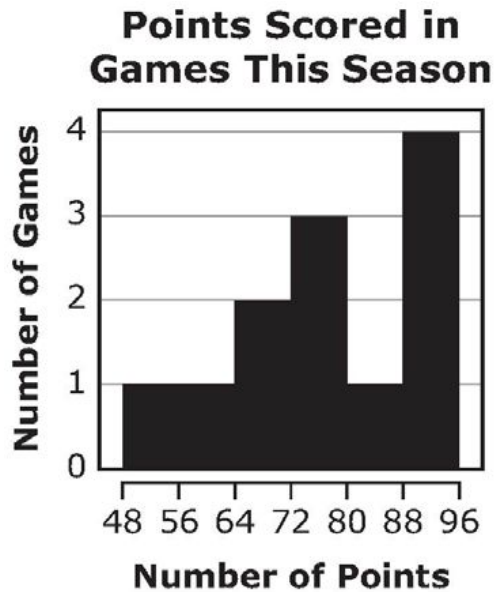
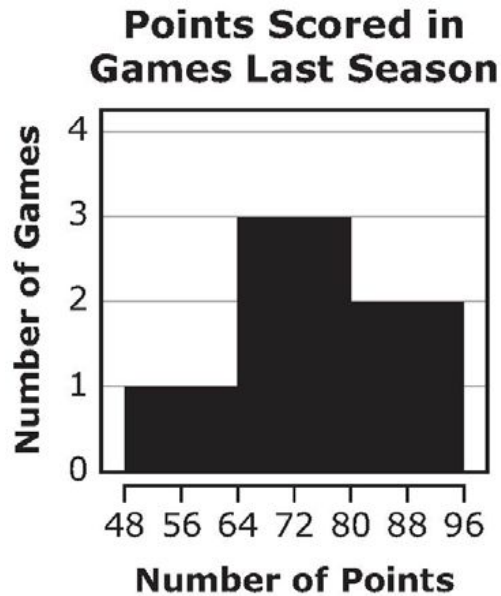
(1 point) The student chooses Airline P and one of the correct choices for the other two menus.

Response Type: Drop-Down Menu (GI)

Example 3

Dirk wants to compare the performance of the school basketball team last year with its performance this year. Decide whether he will use the mean or the median number of points earned in a basketball game to make the comparison. Either measure is acceptable, but you must choose one.

Dirk will use the [mean, median] number of points scored in a game.



Based on the measure of center Dirk will use, which of the following is the best comparison between the performance of the school basketball team last season and this season? You can choose to view the data sets on which the histograms are based if you think it will help you choose.

[Click here to show the data set]

The basketball team performed [better, about the same, worse] this year than last year based on the fact that the [auto-populated with student's choice of mean or median] is [higher, about the same, lower] this year.

Rubric: (1 point) the student selects mean or median, and then selects the answer choice that is best given their selection.

If the student selects mean, then the correct response choices are better and higher. If the student selects median, then about the same should be selected for both choices.

Response Type: Drop-down Menu

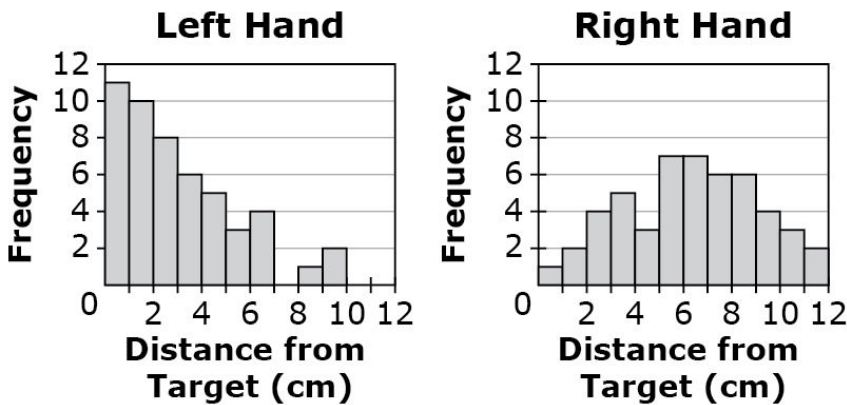
Data Set that displays:

| Game # | Scores Last Season | Scores This Season |
|--------|--------------------|--------------------|
| 1      | 75                 | 73                 |
| 2      | 68                 | 71                 |
| 3      | 89                 | 94                 |
| 4      | 61                 | 67                 |
| 5      | 74                 | 72                 |
| 6      | 83                 | 85                 |
| 7      | 92                 | 94                 |
| 8      | 74                 | 62                 |
| 9      | 55                 | 54                 |
| 10     | 66                 | 75                 |
| 11     | 85                 | 90                 |
| 12     | 71                 | 90                 |

Example 4

Lisa was throwing a dart at a target. She threw 50 times with her left hand and 50 times with her right hand.

The histograms show the distance Lisa missed the target by each time.



Which statement is an appropriate inference based on the median of each data set?

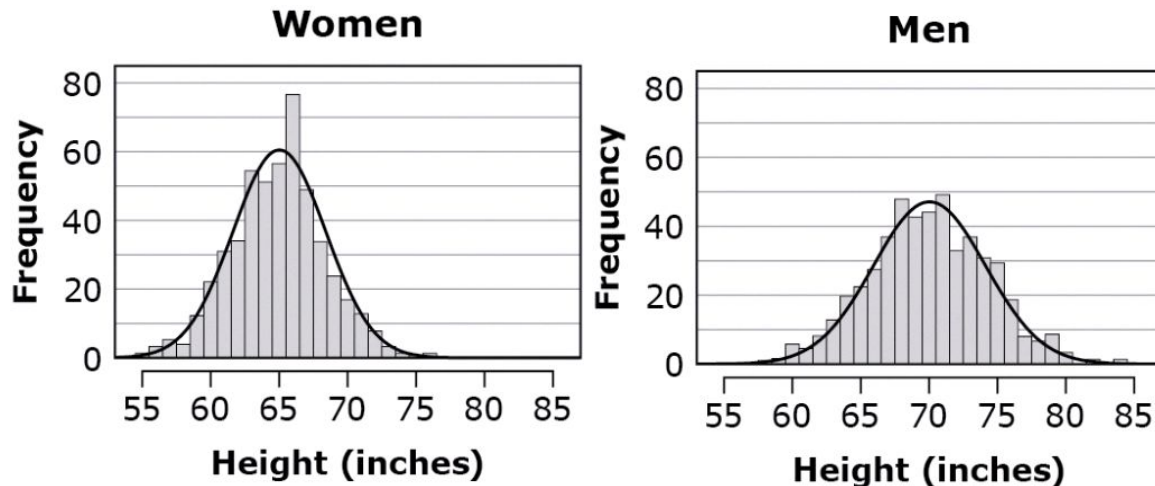
- A. Lisa has better aim with her left hand because the median for her left hand is greater than the median for her right hand.
- B. Lisa has better aim with her right hand because the median for her left hand is less than the median for her right hand.
- C. Lisa has better aim with her left hand because the median for her left hand is less than the median for her right hand.
- D. Lisa has better aim with her right hand because the median for her left hand is greater than the median for her right hand.

Rubric: (1 point) The student selects the correct option (C).

Response Type: Multiple choice, single correct response

Example 5

The distributions of heights of 1000 men and 1000 women selected at random from the population of a large metropolitan area are shown.



Which statement gives an accurate comparison of the heights of men and women shown?

- A. The mean height for women is greater than for men and women's heights vary more than men's heights.
- B. The mean height for women is greater than for men and women's heights vary less than men's heights.
- C. The mean height for women is less than for men and women's heights vary more than men's heights.
- D. The mean height for women is less than for men and women's heights vary less than men's heights.

Rubric: (1 point) The student selects the correct comparison statement (D).

Response Type: Multiple Choice, single correct response

Example 6

Lana wrote an article for the school newspaper about the seniors at her school. There are over 1000 students in the senior class and over 4000 students at her school. Lana asked all 40 of the

seniors on the swim team whether they intend to go to college, and 22 said yes. She reported in her article that 55% of this year's senior class intends to go to college.

How could Lana improve the accuracy of the information she reported in her article about the seniors at her school? Select all that apply.

- A. She could report that this only applies to seniors who are swimmers.
- B. She should check her arithmetic because she made a mistake computing the percentage.
- C. She could ask the guidance counselors what percentage of the senior class went to college last year.
- D. There is no need to improve the accuracy of the information she reported because she did everything correctly.
- E. She could randomly select 40 students at the all-senior assembly and ask them whether they intend to go to college.

Rubric: (1 point) Student selects all correct answer choices (A and E).

Response Type: Multiple Choice, multiple select response