Name: _____ **Class:** _____ **Date:** _____ **ID: A**

Box-and-Whisker Plots

Start Your Day the Right Way
Graphically Representing Data

1. Mr. Follweiller finished grading the quizzes for one of his Algebra 1 classes. The table shown is the recorded grades of the class.

Student	Grade	Student	Grade
A	85	N	53
B	89	O	71
C	66	P	90
D	74	Q	65
E	77	R	55
F	72	S	98
G	64	T	53
H	55	U	62
I	61	V	55
J	52	W	64
K	81	X	62
L	61	Y	56
M	71	Z	87

a. Mr. Follweiller is worried that his students may not have understood the material covered on the quiz. He would like to get a better idea of how the class did as a whole. Would you recommend that he make a dot plot or a box-and-whisker plot to display this data? Explain your reasoning.

b. Construct a dot plot of the data in the table.

c. Describe the distributions of the graph. What do you notice?

d. The students argue that more than half the students failed the quiz, so they think Mr. Follweiller should let them retake it. A grade of 56 is failing.

Construct a box-and-whisker plot of the data.

f. Describe the distribution of the box-and-whisker plot. Explain what it means in terms of this problem situation.

g. Are the students correct? Explain your reasoning.

For problems 2 and 3, construct a box-and-whisker plot of each given data set and include any outliers.

2. The data are 1, 6, 9, 12, 14, 15, 17, 17, 17, 18, 18, 18, 19, and 20.

.

3. The data are 20, 20, 20, 21, 21, 21, 22, 22, 23, 24, 25, 28, and 30.

You Are Too Far Away!
Calculating IQR and Identifying Outliers

4. The table shows the average monthly precipitation in millimeters during the summer for the Southern states.

State	Average Monthly Summer Precipitation (mm)	State	Average Monthly Summer Precipitation (mm)
Alabama	117	Mississippi	109
Arkansas	91	North Carolina	122
Delaware	103	Oklahoma	82
Florida	181	South Carolina	128
Georgia	120	Tennessee	107
Kentucky	106	Texas	69
Louisiana	125	Virginia	101
Maryland	101	West Virginia	111

a. Construct a box-and-whisker plot of the data.

b. Determine whether or not there are any outliers. Show your work.

c. Reconstruct the box-and-whisker plot to show any outliers.

5. The five number summaries for the average monthly precipitation in millimeters during the summer for the Western and Midwestern states are provided.

West	**Midwest**
Min = 7	Min = 68
Q1 = 22	Q1 = 81.5
Med = 33	Med = 99.5
Q3 = 49	Q3 = 102.5
Max = 107	Max = 111

a. Construct box-and-whisker plots of each area's monthly precipitation using the same number line for each.

b. Describe the distribution of both box-and-whisker plots and explain what they mean in terms of the problem situation.

c. Determine if there are outliers in either data set. Show your work and explain how you determined your answer.

d. Chen is considering a long camping trip this summer and hopes to avoid the rain. Would you recommend that he camp in the West or the Midwest? Explain your reasoning.

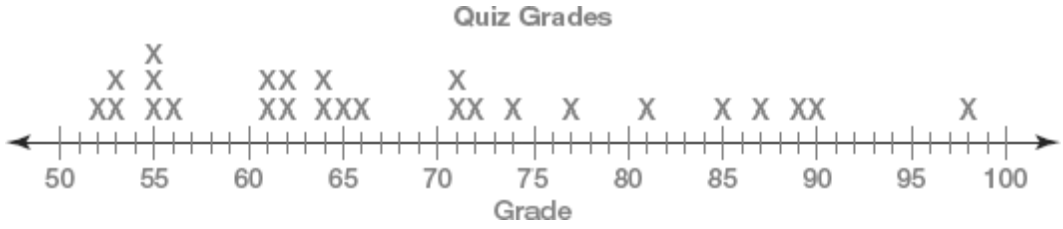
6. During the Summer Olympic Games, Karen keeps track of the number of gold medals won by the various countries participating.

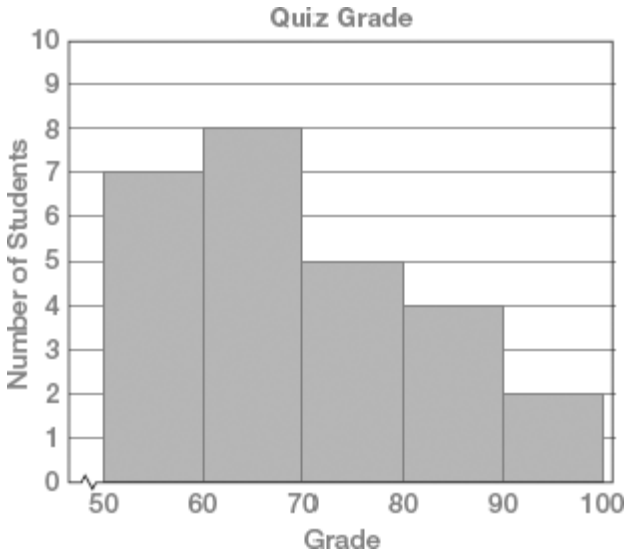
Box-and-Whisker Plots
Answer Section

1. ANS:

a. Answers will vary.

b.

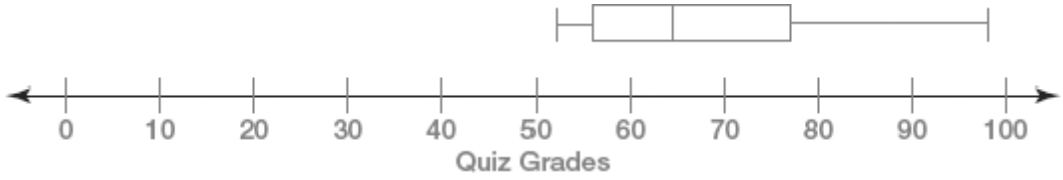




c. Both graphs are skewed to the right.

d. The dot plot shows individual student grades. The histogram only shows the number of students whose grades fall within a 10 point range.

e. Minimum = 52, Q1 = 56, Median = 64.5, Q3 = 77, Maximum = 98

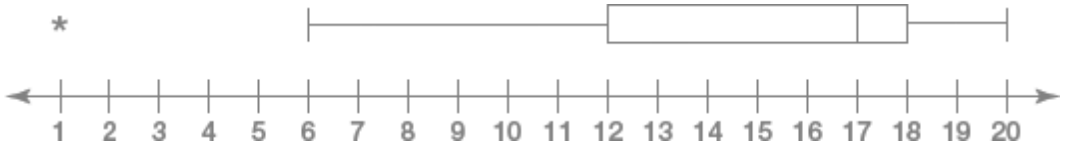


f. The box-and-whisker plot is skewed to the right. This means that the majority of the students had low scores.

g. The students are incorrect. The value of Q1 is 56, and this means that 25% of the students scored less than 56. So, 75% of the students scored 56 or more and thus, passed the quiz.

PTS: 1 REF: 8.1 NAT: S.ID.1 | S.ID.3
TOP: Assignment
KEY: dot plot | discrete data | data distribution | symmetric distribution | skewed right distribution | skewed left distribution | box-and-whisker plot | five number summary | histogram | bin | frequency | continuous data

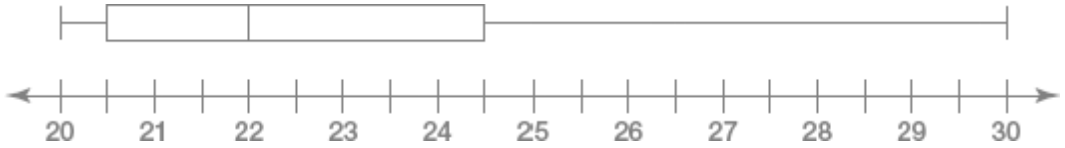
2. ANS:



The most appropriate measure of center is the median, and the most appropriate measure of spread is the IQR because the data are skewed left.
The median is 17 and the IQR is 6.

PTS: 1 REF: 8.5 NAT: S.ID.1 | S.ID.2 | S.ID.3
TOP: Skills Practice KEY: stem-and-leaf plot | side-by-side stem-and-leaf plot

3. ANS:



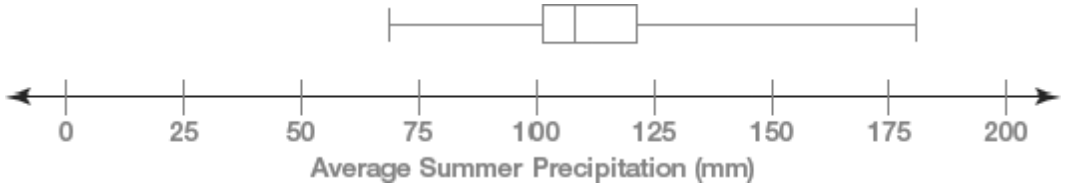
The most appropriate measure of center is the median, and the most appropriate measure of spread is the IQR because the data are skewed right.
The median is 22 and the IQR is 4.

PTS: 1 REF: 8.5 NAT: S.ID.1 | S.ID.2 | S.ID.3
TOP: Skills Practice KEY: stem-and-leaf plot | side-by-side stem-and-leaf plot

4. ANS:

a. Minimum: 69 Q1: 101 Median: 108 Q3: 121 Maximum: 181

Average Summer Precipitation in the Southern States



b. The box-and-whisker plot is slightly skewed to the right. So, the median is the best measure of center for this data.

c. $IQR = Q3 - Q1$

$= 121 - 101$

$= 20$

Lower Fence:

$Q1 - (1QR \cdot 1.5) = 101 - (20 \cdot 1.5)$

$= 101 - 30$

$= 71$

Upper Fence:

$Q3 + (1QR \cdot 1.5) = 121 + (20 \cdot 1.5)$

$= 121 + 30$

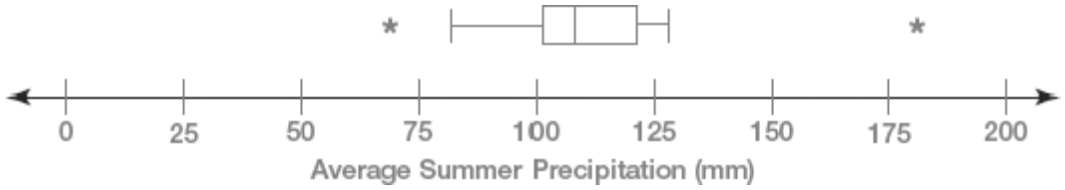
$= 151$

Because the data value for Texas is 69, it is less than the lower fence. So, Texas is an outlier.

Because the data value for Florida is 181, it is greater than the upper fence. So, Florida is an outlier.

d.

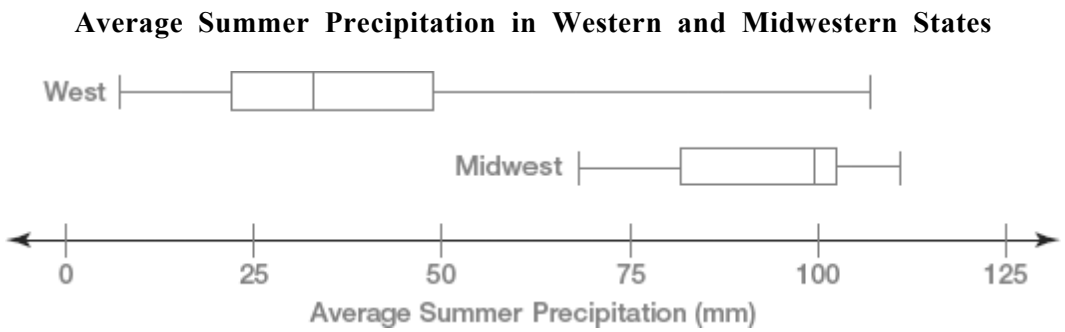
Average Summer Precipitation in the Southern States



PTS: 1 REF: 8.3 NAT: S.ID.1 | S.ID.2 | S.ID.3
TOP: Assignment KEY: interquartile range (IQR) | outlier | lower fence | upper fence

5. ANS:

a.



b. The box-and-whisker plot for the West is skewed to the right. This means that most of the Western states on average have a lower amount of precipitation in the summer. The box-and-whisker plot for the Midwest is slightly skewed to the left. This means that most of the Midwestern states on average have a higher amount of precipitation in the summer.

c. West

$IQR = 49 - 22 = 27$

Lower Fence:

$$Q1 - (1QR + 1.5) = 22 - (27 \cdot 1.5)$$
$$= 22 - 40.5$$
$$= -18.5$$

Upper Fence:

$$Q3 + (1QR \cdot 1.5) = 49 + (27 \cdot 1.5)$$
$$= 49 + 40.5$$
$$= 89.5$$

Midwest

$IQR = 102.5 - 81.5 = 21$

Lower Fence:

$$Q1 - (1QR \cdot 1.5) = 81.5 - (21 \cdot 1.5)$$
$$= 81.5 - 31.5$$
$$= 50$$

Upper Fence:

$$Q3 + (1QR \cdot 1.5) = 102.5 + (21 \cdot 1.5)$$
$$= 102.5 + 31.5$$
$$= 134$$

In the Western states, the maximum is 107, which is greater than the upper fence. So, it is an outlier. There may be more outliers, but without the data values there is no way of knowing. The lower fence is less than the minimum, so there are no lower outliers in this data set. In the Midwestern states, the upper and lower fences are less than and greater than the minimum and maximum values, respectively. So, there are no outliers in this data set.

d. Answers may vary.

Students will likely recommend that Chen camp in the Western states, because overall, they seem to have less precipitation in the summer months.

PTS: 1 REF: 8.3 NAT: S.ID.1 | S.ID.2 | S.ID.3
TOP: Assignment KEY: interquartile range (IQR) | outlier | lower fence | upper fence

6. ANS:
For this situation, it would be best to use a stem-and-leaf plot because Karen is only ordering one set of numerical data.

PTS: 1 REF: 8.5 NAT: S.ID.1 | S.ID.2 | S.ID.3
TOP: Skills Practice KEY: stem-and-leaf plot | side-by-side stem-and-leaf plot