

Box and Whiskers Plot Lesson Plan

Teacher: Ramona Gillen

Date(s):

Subject area / course / grade level: Math Grade 8

Materials:

Centimeter graph paper cut in strips
Lesson handouts.

TEKS/SEs:

8.12(A), 8.12(C)

Lesson objective(s):

Students will be introduced to the concept of box and whisker plots. A step-by-step process for creating a box and whisker plot will be provided for the student. The goal of the lesson is that students understand the components of a box and whisker plot and be able to analyze or compare sets of data using box and whisker plots.

Instructional strategies:

Students will use strips of centimeter graph paper to put numbers in order. They then fold the paper to find the minimum, maximum, median, 1st quartile, and 3rd quartile of the data set. They will then use these values to construct a box and whiskers plot for the data set.

See Teacher Instruction Guide for detailed instructions.

Differentiation strategies to meet diverse learner needs:

The lesson provides kinesthetic/tactile experience as the students fold the paper strips into fourths. The lesson progresses as they use the paper strip to create a numerical model. The complexity of the lesson can be varied by offering data sets that are more or less complicated and by moving to other models of box and whiskers such as graphing calculator or Excel spreadsheet.

Evaluation of student learning:

Box and Whiskers Plot Lesson Plan

TEACHER INSTRUCTION GUIDE

Prepare Ahead of Time:

Cut strips of centimeter graph paper so that you have strips that are one square wide and 26 squares long. Each student may want several of these to use as they move through the lesson. You will also need a copy of each of the lesson handouts for each student.

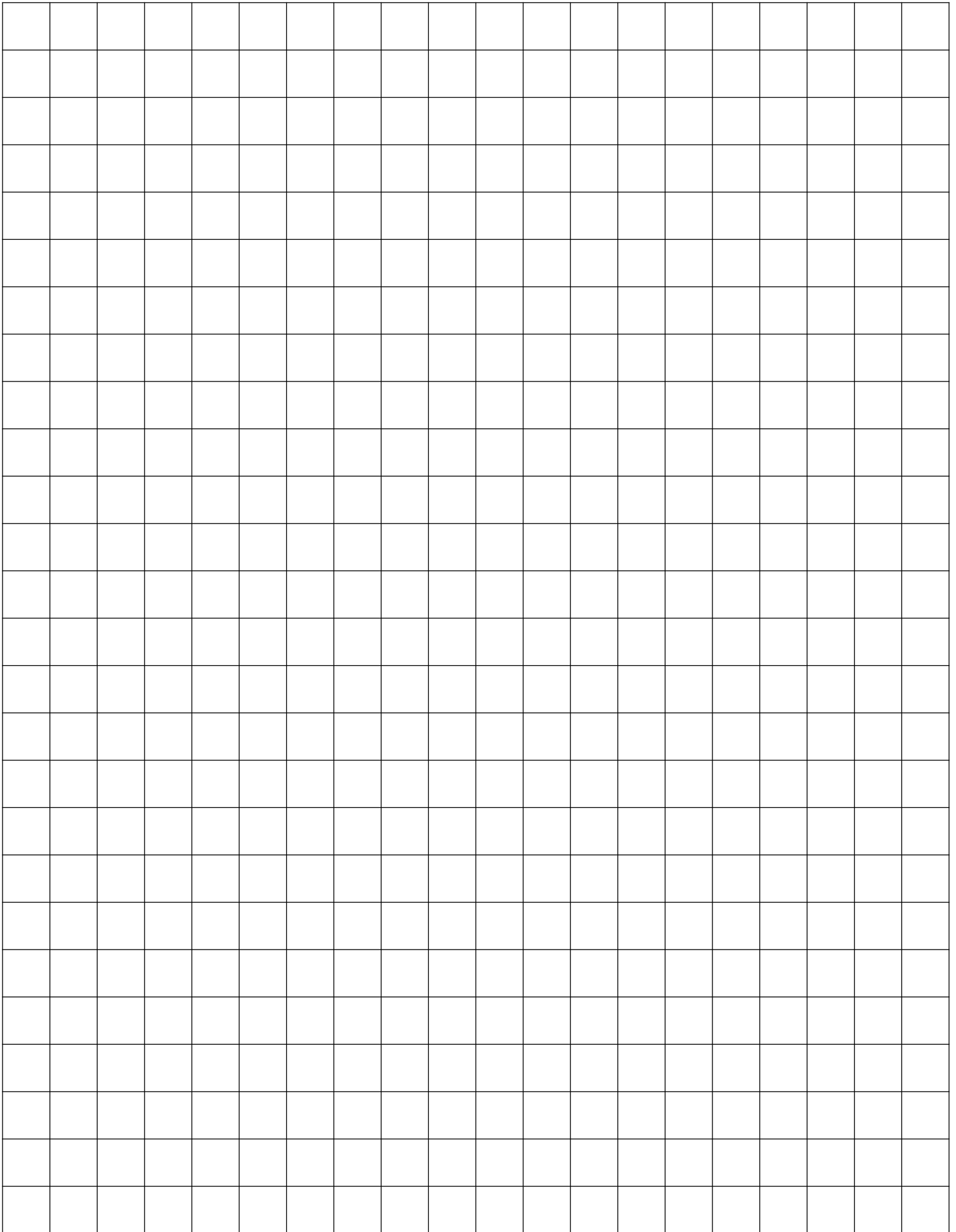
Instructions:

The purpose of using the strips is to help the students understand what is happening to the data set as they are constructing the box and whiskers plot. They will be actually folding the strip into fourths which is the same thing that happens to the data set (it is divided into four parts). Students should begin with a graph paper strip and follow the instructions on Handout 1. Put the numbers in order. Write one number in each square on the strip moving from left to right, least to greatest. When all numbers have been written in a square tear off any extra squares.

To find the median of the data set fold the strip in half. If the data set has an even amount of numbers (as in the first example) the fold will fall between two squares. If there is an odd amount of numbers the fold will fall on a number. To find the 1st and 3rd quartiles students will fold the ends of the paper strip to the center. In the first example the ends will be folded to the middle since it is between two numbers. If there is an odd number in the data set and the original fold falls on a number, the ends will be folded to the square that contains that number. You are folding the ends to the middle of the data whether it falls between two numbers or on a number. The students have now “folded” the data into four parts. The Handout 1 explains how they should draw vertical bars to mark the 1st quartile (first fold), median (middle fold), and 3rd quartile (third fold) and dots to mark the minimum and maximum numbers (ends of the strip). Teacher should monitor to insure they understand the instructions.

After the class has constructed the box and whiskers plot from the paper strip they should move to Handout 2 and Handout 3 which will help them formalize the vocabulary and process for constructing a box and whiskers plot. Teacher should provide guidance as needed as students fill in the correct values in the spaces below the box and whiskers model. A copy of the completed model is provided for your reference. Emphasis should be given to the vocabulary which will likely be new to the students.

Handout 4 is a check for understanding. Additional activities have been included to build student knowledge of box and whiskers, their purpose, and their usefulness.



Box and Whiskers Plot

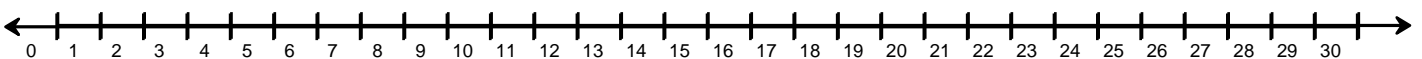
PART I

Instructions:

1. Using the following set of data put the numbers in order from least to greatest. Write each number in one square of the graph paper strip that is provided. Tear off the empty squares from the strip.

15, 18, 21, 7, 29, 20, 9, 23, 25, 25, 29, 14, 8, 18, 26, 28, 27, 19, 7, 26

2. Find the median of the data by folding the paper strip in the middle. Fold the ends of the paper strip to the center. These folds mark the median (middle) of the lower half of the data and the median (middle) of the upper half of the data. By folding the paper strip in this way you have divided the data into four equal parts.
3. You are now ready construct the box and whiskers plot which will be drawn above the number line below.
 - A. Draw a vertical bar above the number line to mark the median of the data set.
 - B. Draw two more vertical bars above the number line to show where the lower median (1^{st} quartile) and upper median (3^{rd} quartile) are on the number line.
 - C. Connect the tops of these bars with a horizontal line. Connect the bottom of the bars with a horizontal line. This should form a "box"
 - D. Place dots above the number line to show where the smallest (minimum) and the largest (maximum) numbers are on the number line. Connect these dots to the "box" on each side with horizontal lines. These are the "whiskers".



PART II

1. Your paper strip is divided into four parts with five numbers listed on each part. Using the attached box and whiskers plot model write the five numbers in the lower quartile of the strip in the left “whisker”. Write the five numbers from the second quartile in the left “box” section. Repeat this process for the other two sections of the strip. You should have five numbers written in each whisker and box section.
2. Write the lowest number (7) in the first quartile in the first line at the bottom of the page (Min of Q1) and the highest number (14) on the second line at the bottom of the page (Max of Q1). Repeat this process across for the Min and Max of Q2, Q3, and Q4.
3. Fill in the values for the Minimum, First Quartile, Median, Third Quartile, and Maximum.
 - A. The value for First Quartile is the mean of Max of Q1 and Min of Q2.
 - B. The value for the Median is the mean of Max of Q2 and Min of Q3.
 - C. The Third Quartile value is the mean of Max of Q3 and Min of Q4.

PART III

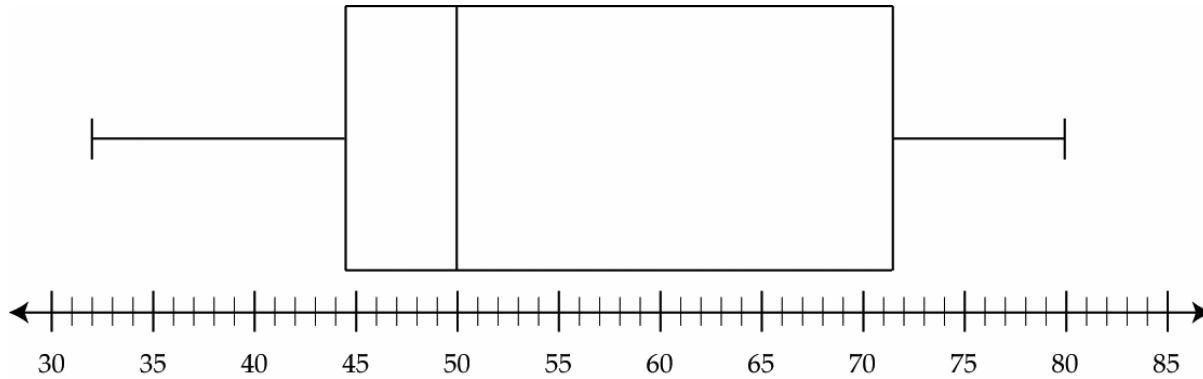
Now that you know how a box and whiskers is formed use the following set of data to build another one. You may use a paper graph strip to organize your numbers if you like.

20, 15, 45, 33, 19, 30, 31, 32, 31, 30, 27, 34, 50, 22, 29, 30, 16, 19



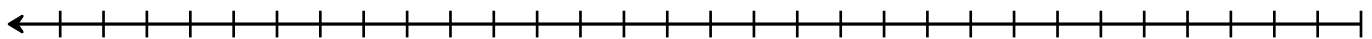
Post-Assessment

1. Read, identify and interpret the key components of the box-and whisker plot below. (Use back of page to record any interpretations of the box-and-whisker plot).

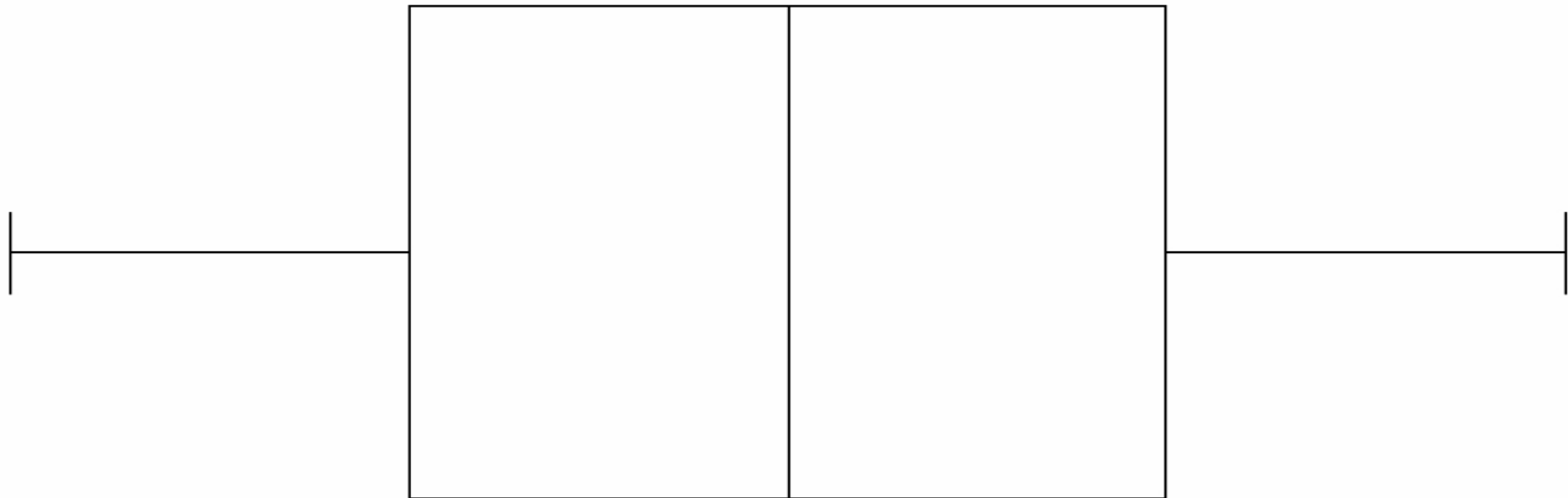


- A. Minimum _____
 - B. Maximum _____
 - C. 1st Quartile _____
 - D. Median _____
 - E. 3rd Quartile _____
2. Identify a set of data containing 12 numbers that would create the box-and-whisker plot in question 1.
3. Create a box-and-whisker plot for the following set of data.

20, 15, 45, 33, 19, 30, 31, 32, 31, 30, 27, 34, 45, 22, 29, 30



BOX-AND-WHISKER PLOT WORKSHEET



Min. of Q1

Max. of Q1 Min. of Q2

Max. of Q2 Min. of Q3

Max. of Q3 Min. of Q4

Max. of Q4

Minimum

**First
Quartile**

Median

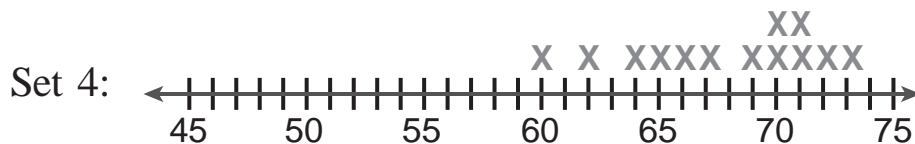
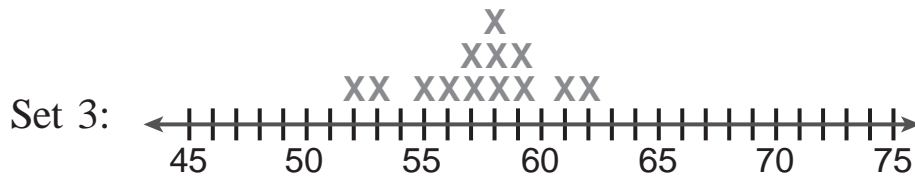
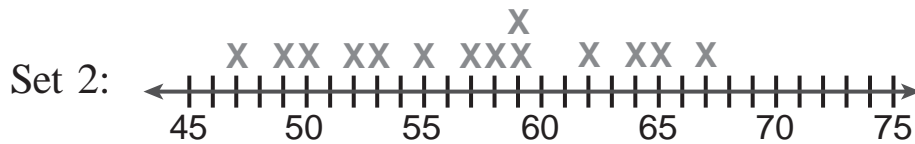
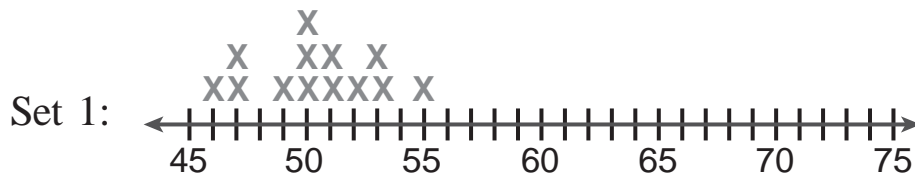
**Third
Quartile**

Maximum

Variability

When placed on a number line, values in a data set can be spread out or clustered together.

1. Order the data sets from the ones you think are the least spread out to the most spread out.



2. Use a paper strip to put the numbers in order for data Set 1. Remember, the number appears one time in the data set for each "X" stacked over it. After you have put the numbers in order, fold the paper to find the median, 1st quartile, and 3rd quartile. Construct a Box and Whiskers plot above the line plot. Repeat this process for data Sets 2-4. Compare the four box and whiskers plots to answer these questions.

- A. Which box and whiskers plots have quartiles that seem equal?

- B. Which box and whiskers plots have quartiles that are not even? What makes this true?

- C. How does the median change from one box and whiskers plot to another?

- D. Which box and whiskers plot has the greatest range? The least range?

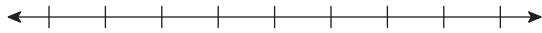
- E. Describe how the spread of the data would change in Set 1 if the value 72 were added.

Write the correct answer.

1. Find the median of the data.

2. Find the first and third quartiles of the data.

3. Make a box-and-whisker plot of the data.



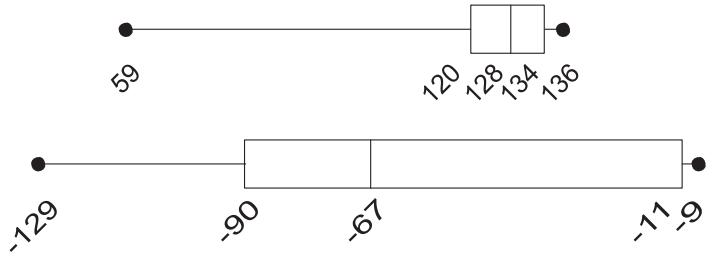
Super Bowl Point Differences

Year	Point Difference
2001	27
2000	7
1999	15
1998	7
1997	14
1996	10
1995	23
1994	17
1993	35
1992	13

The box-and-whisker plots compare the highest recorded Fahrenheit temperatures on the seven continents with the lowest recorded temperatures. Choose the letter for the best answer.

4. Which statement is true?

- A The median of the high temperatures is less than the median of the low temperatures.
- B The range of low temperatures is greater than the range of high temperatures.
- C The range of the middle half of the data is greater for the high temperatures.
- D The median of the high temperatures is 49 F.



5. What is the median of the high temperatures?

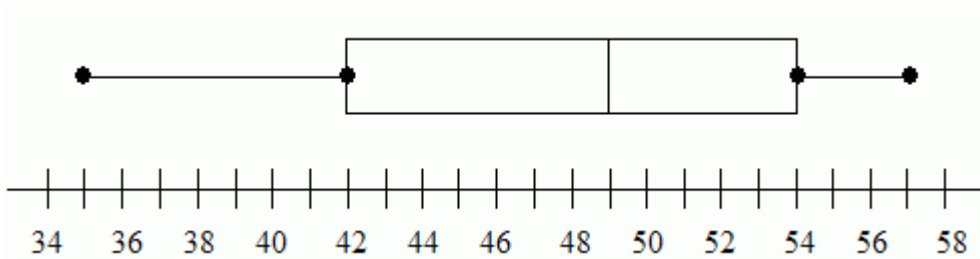
- F 128 F
- G 120 F
- H 67 F
- J 90 F

6. What is the range of the low temperatures?

- A 77 F
- B 79 F
- C 120 F
- D 129 F

Box-and-Whisker Plots 1

1. A boxplot was made from some data. Find the median, the 1st quartile, the 3rd quartile, the minimum, the maximum, and the range of the data.



2. Make a box-and-whisker plot from the following data sets.

a. Initial weights (February) of 14 women in a weight loss study (in pounds):

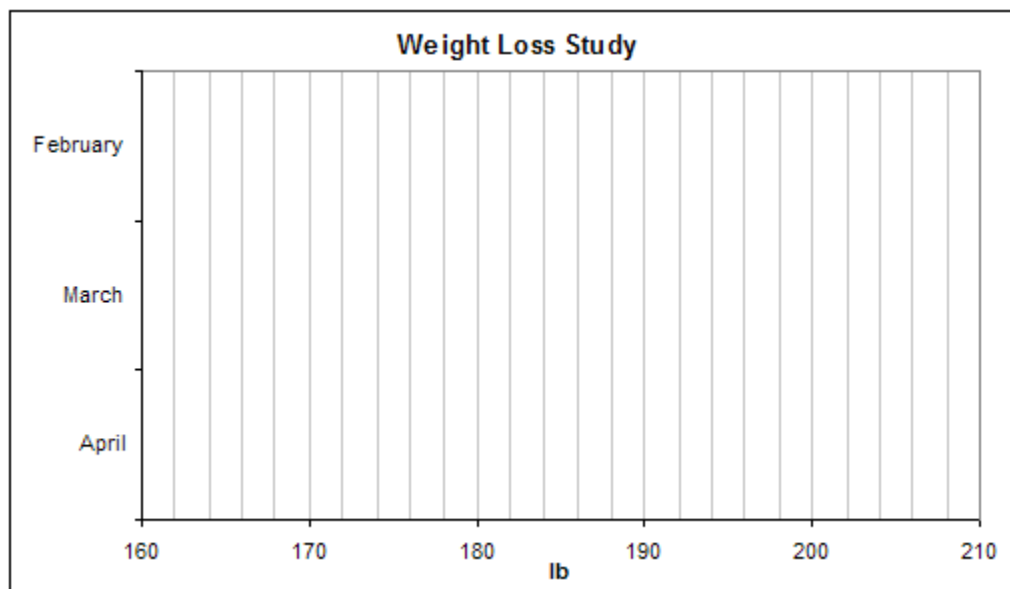
189 176 186 200 204 188 175 179 188 190 199 194 187 195

b. Weights of the same women one month later (March):

186 172 180 190 195 179 173 177 180 187 187 190 184 190

c. Weights of the same women two months later (April):

180 166 175 183 189 177 170 171 170 184 188 182 180 185



d. Compare the data in a and c.

How did the median change?

How did the maximum weight change?

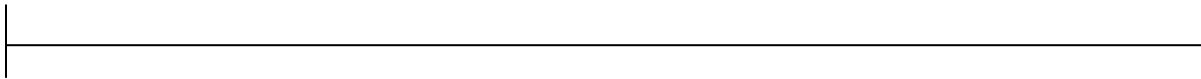
How did the minimum weight change?

How did the range change?

How would you judge the effectiveness of the weight loss method used in the study?

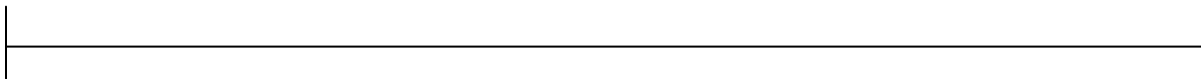
3. Find the minimum, lower quartile, median, upper quartile, and maximum for the heights of the players you listed in Question 1. Construct a box and whisker plot.

Minimum: _____
Lower Quartile: _____
Median: _____
Upper Quartile: _____
Maximum: _____



4. Find the minimum, lower quartile, median, upper quartile, and maximum for the heights of all the players you listed in Question 1 **except** for Yao Ming. Construct a box and whisker plot.

Minimum: _____
Lower Quartile: _____
Median: _____
Upper Quartile: _____
Maximum: _____



5. Compare the box and whisker plots from Questions 3 and 4. How has the plot changed?
6. Did the minimum or the maximum change? Why or why not? Be sure to relate your reasons to the data you used to construct your plot.
7. Did the median change? Why or why not? Be sure to relate your reasons to the data you used to construct your plot.
8. Did the upper or lower quartile change? Why or why not? Be sure to relate your reasons to the data you used to construct your plot.

2007–08 Rockets Roster

2007-08 Roster							
NUM	PLAYER	POS	HT	WT	DOB	FROM	YRS
12	Rafer Alston	G	6-2	175	07/24/1976	Fresno State	8
31	Shane Battier	F	6-8	220	09/09/1978	Duke	6
	Aaron Brooks	G	6-0	160	01/14/1985	Oregon	R
	Jackie Butler	C	6-10	260	03/10/1985	Coastal Christian Academy (VA)	3
3	Steve Francis	G	6-3	210	02/21/1977	Maryland	8
	Mike Harris	F	6-6	240	06/15/1983	Rice	R
44	Chuck Hayes	F	6-6	238	06/11/1983	Kentucky	2
2	Luther Head	G	6-3	185	11/26/1982	Illinois	2
7	Mike James	G	6-2	195	06/23/1975	Duquesne	6
	Carl Landry **	F	6-7	245	09/19/1983	Purdue	R
15	John Lucas III	G	5-11	165	11/21/1982	Oklahoma State	2
1	Tracy McGrady	F-G	6-8	223	05/24/1979	Mount Zion Christian Acad. HS (NC)	10
55	Dikembe Mutombo	C	7-2	260	06/25/1966	Georgetown	16
	Brad Newley **	G	6-6	195	02/18/1985	Australia	R
20	Steve Novak	F	6-10	220	06/13/1984	Marquette	1
9	Justin Reed	F	6-9	238	01/16/1982	Mississippi	3
	Luis Scola	F	6-9	230	04/30/1980	Argentina	R
13	Kirk Snyder	G	6-6	225	06/05/1983	Nevada-Reno	3
3	Bob Sura	G	6-5	200	03/25/1973	Florida State	10
25	Jake Tsakalidis (FA)	C	7-2	290	06/10/1979	Greece	7
6	Bonzi Wells	G-F	6-5	210	09/28/1976	Ball State	9
11	Yao Ming	C	7-6	310	09/12/1980	China	5

Adopted from: http://www.nba.com/rockets/index_main.html on 10/2/07

Rockets Roster (Numbered Players Only)

NUM	PLAYER	HT	WT
12	Rafer Alston	6-2	175
31	Shane Battier	6-8	220
3	Steve Francis	6-3	210
44	Chuck Hayes	6-6	238
2	Luther Head	6-3	185
7	Mike James	6-2	195
15	John Lucas III	5-11	165
1	Tracy McGrady	6-8	223
55	Dikembe Mutombo	7-2	260
20	Steve Novak	6-10	220
9	Justin Reed	6-9	238
13	Kirk Snyder	6-6	225
3	Bob Sura	6-5	200
25	Jake Tsakalidis (FA)	7-2	290
6	Bonzi Wells	6-5	210
11	Yao Ming	7-6	310

Adopted from: http://www.nba.com/rockets/index_main.html on 10/2/07

2007–08 Nuggets Roster

2007-08 Roster

NUM	PLAYER	POS	HT	WT	DOB	FROM	YRS
15	Carmelo Anthony	F	6-8	230	05/29/1984	Syracuse	4
12	Chucky Atkins	G	5-11	185	08/14/1974	South Florida	8
23	Marcus Camby	C-F	6-11	235	03/22/1974	Massachusetts	11
25	Anthony Carter	G	6-2	195	06/16/1975	Hawaii	8
5	Yakhouba Diawara	F	6-7	225	08/29/1982	Pepperdine	1
	Steven Hunter	C-F	7-0	240	10/31/1981	DePaul	6
3	Allen Iverson	G	6-0	165	06/07/1975	Georgetown	11
	Alvin Jones	C	6-11	265	09/09/1978	Georgia Tech	1
	Bobby Jones	F	6-7	215	01/09/1984	Washington	1
43	Linus Kleiza	F	6-8	245	01/03/1985	Missouri	2
4	Kenyon Martin	F	6-9	240	12/30/1977	Cincinnati	7
	Jelani McCoy	F-C	6-10	245	12/06/1977	UCLA	7
21	Eduardo Najera	F	6-8	235	07/11/1976	Oklahoma	7
31	Nenê	F-C	6-11	268	09/13/1982	Brazil	5
	Anthony Roberson	G	6-2	180	02/14/1983	Florida	2
1	J.R. Smith	G	6-6	220	09/09/1985	St. Benedict's Prep (Newark, NJ)	3
22	Von Wafer	G	6-5	210	07/21/1985	Florida State	2

Adopted From: <http://www.nba.com/nuggets/roster> on 10/2/07