Reflect and Turn in!

	Assignment Effort Grade (Circle One)	Comments (What was interesting or challenging?)
Monday Date: 4/09 Topic: 10A: Types of Data	0 1 2	
Tuesday Date: 4/10 Topic: 10B: Stem plots, discrete data	0 1 2	
Wednesday Date: 4/11 Topic: 10C: Histograms, continuous data	0 1 2	
Thursday Date: 4/12 Topic: 10D: Measures of center	0 1 2	
Friday Date: 4/13 Topic: 10E: Cumulative Data	0 1 2	

Warm-up: Two groups of students were asked how many cousins they have.

State the similarities and differences of the two data sets.

1, 4, 5, 5, 6, 7, 8, 9, 9 and 4, 4, 5, 6, 6, 7, 7, 7, 8

$\bar{x} = 6$ min = 1
$n = 9$ Range = 8
mode = 5, 9
Median = 6
max = 9

$\bar{x} = 6$ min = 4
$n = 9$ Range = 4
mode = 7 max = 8
med = 6

Class Plan

1. Warm-up

2. Practice

3. Respect Retreat

F MEASURING THE SPREAD OF A DATA SET

1) The Range - Difference between the maximum (largest data value) and minimum (smallest data value).

$$\text{range} = \text{maximum} - \text{minimum}$$

Textbook...

THE RANGE

The **range** is the difference between the **maximum** or largest data value, and the **minimum** or smallest data value.

range = maximum data value − minimum data value

F MEASURING THE SPREAD OF A DATA SET

2) The Interquartile Range - The range of the middle half (50%) of the data.

$$IQR = Q_3 - Q_1$$

Min

Lower Quartile(Q_1) - middle value of the lower half. 25% of data is less than or equal to Q_1.

Median (Q_2)

Upper Quartile(Q_3) - middle value of the upper half. 25% of data is greater than or equal to Q_3.

Max

Textbook...

THE INTERQUARTILE RANGE

We have already seen how the median divides an ordered data set into two halves. These halves are divided in half again by the **quartiles**.

The middle value of the *lower* half is called the **lower quartile** or $\mathbf{Q_1}$. One quarter or 25% of the data have values less than or equal to the lower quartile. 75% of the data have values greater than or equal to the lower quartile.

The middle value of the *upper* half is called the **upper quartile** or $\mathbf{Q_3}$. One quarter or 25% of the data have values greater than or equal to the upper quartile. 75% of the data have values less than or equal to the upper quartile.

The data set is thus divided into quarters by the lower quartile $\mathbf{Q_1}$, the median $\mathbf{Q_2}$, and the upper quartile $\mathbf{Q_3}$.

The **interquartile range** is the range of the middle half of the data.

$$\textbf{interquartile range} = \textbf{upper quartile} - \textbf{lower quartile}$$

$$\text{or} \quad \mathbf{IQR = Q_3 - Q_1}$$

Technology: TI - 83/84

Finding mean, 5 # Summary

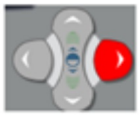
1. 

2. 

3. 

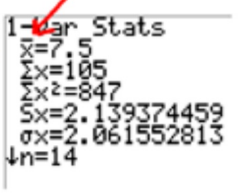
4. #,enter (repeat)

5. 

6. 

7. 

8. 

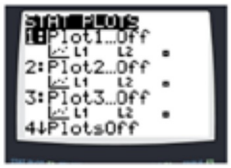
9. 

mean

10. Scroll down 5# Summary

Box Plot

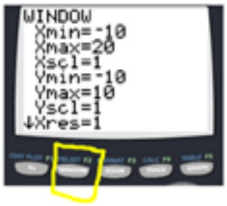
1. 

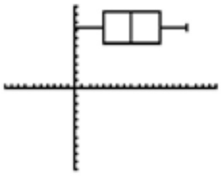
2. 

3. 

4. 

5. 

6. 

7. 

yay!

Example 12 Self Tutor

For the data set 7, 3, 4, 2, 5, 6, 7, 5, 5, 9, 3, 8, 3, 5, 6, find the:

a median b lower and upper quartiles c interquartile range.

2, 3, 3, 3, 4, 5, 5, (5), 5, 6, 6, (7), 7, 8, 9

{2, 3 5, 7, 9}

$IQR = Q_3 - Q_1 = 7 - 3 = 4$

Example 12 Self Tutor

For the data set 7, 3, 4, 2, 5, 6, 7, 5, 5, 9, 3, 8, 3, 5, 6, find the:

a median **b** lower and upper quartiles **c** interquartile range.

The ordered data set is: ~~2 3 3 3 4 5 5~~ 5 ~~5 6 6 7 7 8 9~~ {15 data values}

a Since $n = 15$, $\frac{n+1}{2} = 8$ $\therefore$ the median is the 8th score, which is 5.

b As the median is a data value, we now ignore it and split the remaining data into two halves:

lower upper

2 3 3 3 4 5 5 5 5 6 6 7 7 8 9

Q_1 Q_3

Q_1 = median of lower half = 3

Q_3 = median of upper half = 7

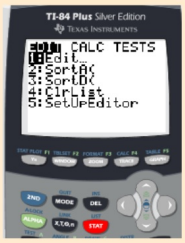
c IQR $= Q_3 - Q_1 = 7 - 3 = 4$

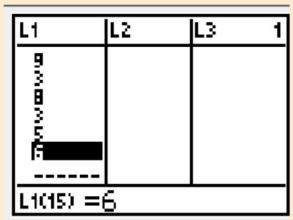
TI-84 Calculator

Example 12 — Self Tutor

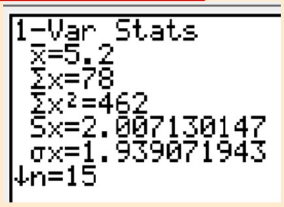
For the data set 7, 3, 4, 2, 5, 6, 7, 5, 5, 9, 3, 8, 3, 5, 6, find the:

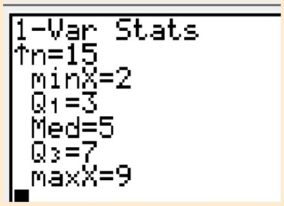
a median b lower and upper quartiles c interquartile range.





note: L_1 may need to be changed if your data is in a different list.





Example 13 Self Tutor

For the data set 6, 10, 7, 8, 13, 7, 10, 8, 1, 7, 5, 4, 9, 4, 2, 5, 9, 6, 3, 2, find the:

a median **b** lower and upper quartiles **c** interquartile range.

Example 13 **Self Tutor**

For the data set 6, 10, 7, 8, 13, 7, 10, 8, 1, 7, 5, 4, 9, 4, 2, 5, 9, 6, 3, 2, find the:

a median **b** lower and upper quartiles **c** interquartile range.

The ordered data set is:

1 2 2 3 4 4 5 5 6 6 7 7 7 8 8 9 9 10 10 13 {20 data values}

a Since $n = 20$, $\frac{n+1}{2} = \frac{21}{2} = 10.5$

$\therefore$ the median $= \frac{\text{10th value} + \text{11th value}}{2} = \frac{6+7}{2} = 6.5$

b As the median is not a data value, we split the data into two halves:

lower upper

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

$Q_1 = 4$ $Q_3 = 8.5$

Q_1 = median of lower half = 4

Q_3 = median of upper half = 8.5

c IQR $= Q_3 - Q_1$
$= 8.5 - 4$
$= 4.5$

Some computer packages (for example, **MS Excel**) calculate quartiles in a different way from this example.

G BOX-AND-WHISKER PLOTS

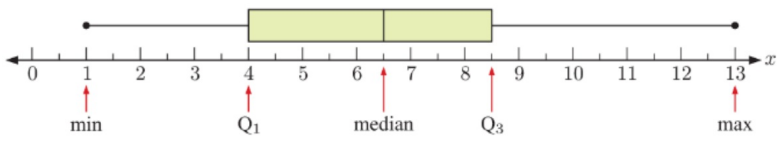
A **box-and-whisker plot** is a visual display of some of the descriptive statistics of a data set. It shows:

- the minimum value (min)
- the lower quartile (Q_1)
- the median (Q_2)
- the upper quartile (Q_3)
- the maximum value (max)

These five numbers form the **five-number summary** of a data set.

For **Example 13**, the five-number summary and corresponding box-and-whisker plot are:

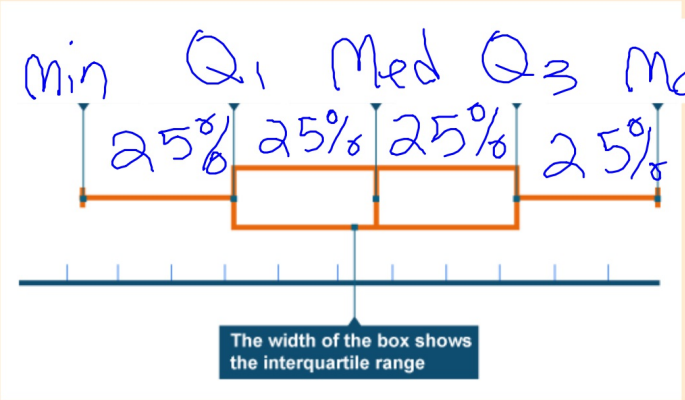
minimum = 1
$Q_1 = 4$
median = 6.5
$Q_3 = 8.5$
maximum = 13

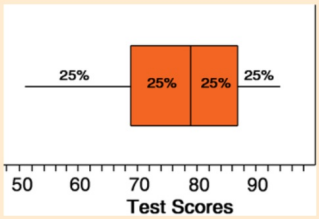


Notice that:

- the rectangular box represents the 'middle' half of the data set
- the lower whisker represents the 25% of the data with smallest values
- the upper whisker represents the 25% of the data with greatest values.

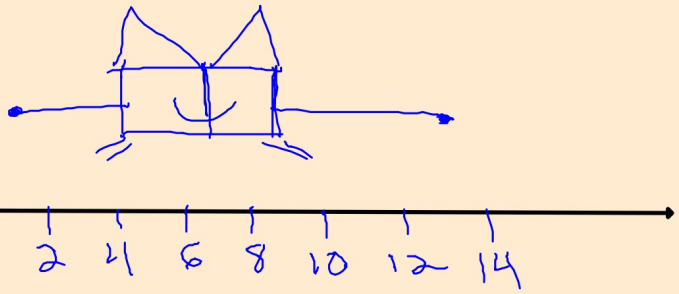
How does the box & whisker plot divide the data?





Example 13: Box and Whisker Plot

minimum $= 1$
$Q_1 = 4$
median $= 6.5$
$Q_3 = 8.5$
maximum $= 13$



$\{1, 4, 6.5, 8.5, 13\}$

Example 14

Consider the data set: 5 6 7 6 2 8 9 8 4 6 7 4 5 4 3 6 6

a Construct the five-number summary for the data.

b Draw a box-and-whisker plot to display the data.

c Find the: **i** range **ii** interquartile range of the data.

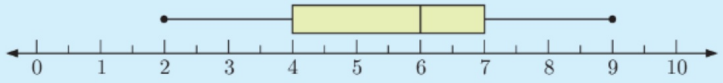
a The ordered data set is:

2 3 4 4 4 5 5 6 6 6 6 7 7 8 8 9 {17 data values}

$Q_1 = 4$ median $= 6$ $Q_3 = 7$

So, the 5-number summary is: min $= 2$, $Q_1 = 4$, median $= 6$, $Q_3 = 7$, max $= 9$

b



c **i** range $=$ max $-$ min $= 9 - 2 = 7$ **ii** IQR $= Q_3 - Q_1 = 7 - 4 = 3$

Exercises: 10F #4, #5, 10G #5

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4 The following amounts of money were withdrawn from an ATM on a particular day:

$100	$60	$120	$90	$130	$150	$200	$120	$180
$70	$140	$100	$50	$200	$120	$80	$100	$150

Find the:

a median

b lower quartile

c upper quartile

d interquartile range of the data.

4 The following amounts of money were withdrawn from an ATM on a particular day

$100	$60	$120	$90	$130	$150	$200	$120	$180
$70	$140	$100	$50	$200	$120	$80	$100	$150

Find the:

a median **b** lower quartile

c upper quartile **d** interquartile range of the data.

1.3 1.8 1.2 3.4 1.6 2.8 0.8 2.6

a Find the:

i median **ii** lower quartile

iii upper quartile of the data.

b Find the range and interquartile range of the waiting times.

c Copy and complete the following statements:

i "50% of the waiting times were greater than ..... minutes."

ii "75% of the waiting times were less than ..... minutes."

iii "The minimum waiting time was ..... minutes and the maximum waiting time was ..... minutes. The waiting times were spread over ..... minutes."

Exercises...

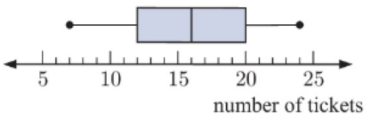
5 The data below shows the number of parking tickets handed out by an inspector each day for a month.

21	18	27	25	16	22	23	19	22	24
15	21	22	26	14	18	17	19	21	14
13	19	24	28	23	25	16	15	20	25

a Construct the five-number summary for the data.

b Draw a box-and-whisker plot to display the data.

c The box-and-whisker plot alongside shows the number of parking tickets handed out by the inspector in the previous month. Did the inspector hand out more tickets this month or last month? Explain your answer.



Solutions

4 **a** \$120 **b** $Q_1 = \$90$ **c** $Q_3 = \$150$ **d** IQR = \$60

5 **a** **i** 1.7 min **ii** 1.1 min **iii** 2.4 min

b range = 2.7 min, IQR = 1.3 min

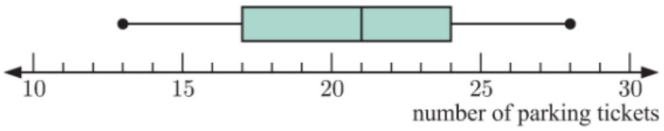
c **i** "50% of the waiting times were greater than 1.7 minutes."

ii "75% of the waiting times were less than 2.4 minutes."

iii "The minimum waiting time was 0.7 minutes and the maximum waiting time was 3.4 minutes. The waiting times were spread over 2.7 minutes."

5 **a** min = 13 tickets, $Q_1 = 17$ tickets, med = 21 tickets, $Q_3 = 24$ tickets, max = 28 tickets

b



c The inspector handed out more tickets this month. The minimum, Q_1, median, Q_3, and maximum have all increased from last month.