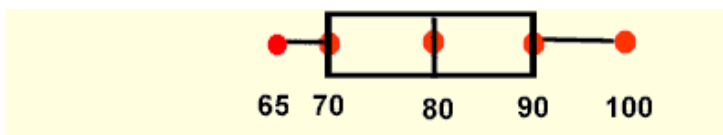


Notes on Box-and-Whisker Plots, Quartiles, and Percentiles

Box-and-whisker plots are helpful in interpreting the distribution of data.



minimum	first quartile	second quartile (median)	third quartile	maximum
65	70	80	90	100

Quartiles and Box and Whisker Plots

Quartiles:

<p>Q₁ 1st Quartile</p> <p>25th percentile “Lower Quartile”</p>	<p>Q₂ 2nd Quartile (median) 50th Percentile</p>	<p>Q₃ 3rd Quartile</p> <p>75th Percentile “Upper Quartile”</p>
25% of the data lies at or below the first quartile and three-fourths lies above.	Median of data set = second quartile of data set.	75% of the data lies at or below the third quartile.

Constructing a Box-and-Whisker Plot

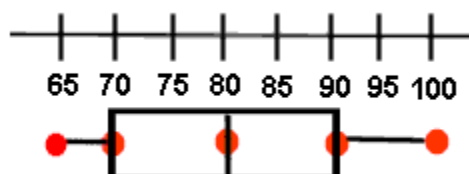
Steps to Make a Box-and-Whisker Plot:

1st Use your Graphing Calculator to find the **5 statistical summary values**:

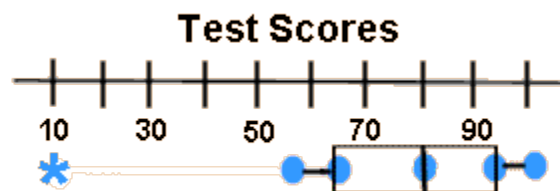
1. Q₁
2. median (Q₂)
3. Q₃
4. Max
5. Min

Example: According to the box-and-whisker plot shown below, what are the five statistical summary values?

- the median = 80
- the first quartile = 70
- the third quartile = 90
- the minimum value = 65
- the maximum value = 100



Special Case: You may see a box-and-whisker plot, like the one below, which contains an asterisk.



Sometimes there is **ONE** piece of data that falls well outside the range of the other values. This single piece of data is called an **outlier**. If the outlier is included in the whisker, readers may think that there are grades dispersed throughout the whole range from the first quartile to the

outlier, which is not true. To avoid this misconception, an * is used to mark this "out of the ordinary" value.

Percentiles show us what percent of the data is equal to or less than a specific data point.

Example 1: Find the percentile rank for a score of 84 on a test when the scores were:

50, 65, 70, 72, 72, 78, 80, 82, 84, 84, 85, 86, 88, 88, 90, 94, 96, 98, 98, 99.

To find the percentile rank of a score, x , out of a set of n scores:

$$\frac{\text{number of scores equal to or less than score}}{\text{total number of scores}} \times 100\% = \text{percentile}$$

Example 3: The math test scores were:

50, 65, 70, 72, 72, 78, 80, 82, 84, 84, 85, 86, 88, 88, 90, 94, 96, 98, 98, 99.

Find the percentile rank for a score of 86 on this test.

Sometimes, instead of the exact scores, you are given a frequency table with intervals.

Example: 1) The following data are exam grades of 10 students in a math class.

Interval	Frequency
69 - 76	1
77 - 84	4
85 - 92	4
93 - 100	1

a) Which interval contains the first (lower) quartile?

b) Which interval contains the third (upper) quartile?

c) If students who received at least an 85% on this exam received a "math star" pencil, what percent of the students received a pencil?

d) Which interval contains the 90th percentile?

e) Which interval contains the median?

Summary:

To find the interval containing specific information, such as the median, lower quartile, or a percentile, you need:

1. To find the total number using the frequency
2. For Q1 multiply the total by .25
For Median (Q2) multiply the total by .5
For Q3 multiply the total by .75
3. Find the interval containing that piece of data.