Measures of Dispersion *9*

The following numbers represent the number of employees absent from work over a nine day period: 2, 6, 5, 4, 7, 1, 0, 5, 2.

Order the data: $0, 1, 2, 2, 4, 5, 5, 6, 7$

Identify the median: 4

Percentiles
A very large sample may be split into 100 parts called *percentiles*, or ten parts called *decile*. Essentially the 3rd decile is equivalent to the 30th percentile. To score in the 90th percentile indicates 90% of scores were less than or equal to your score.

Quartiles are descriptive measures that separate large *ordered* data sets. Quartiles are the data items that are one quarter and three quarters of the way through a list.

The **lower or first quartile (Q1)** is the 25th percentile. The first quartile divides ordered data such that 25% of observations are at or below this value.

The **upper or third quartile (Q3)** is the 75th percentile.

The **inter-quartile range** is the difference between Q3 and Q1. The inter-quartile range measures the spread of the middle 50% of the data.
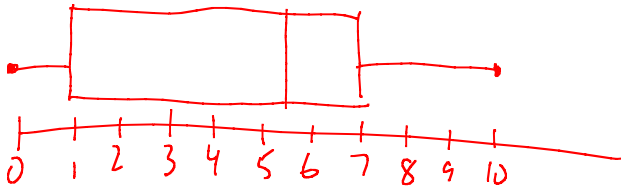
Example: Given the following data calculate the median, Q1, the upper boundary and the inter-quartile range.

8, 10, 6, 5, 6, 2, 0, 2, 9, 1, 9, 7

$0, 0, 1, 2, 5, 6, 6, 7 / 8, 9, 10$

median 5.5 $Q3 - Q1 = 7 - 1 = 6$

$Q1 = 1$

$Q3 = 7$

A **Box and Whisker Plot** is a useful way to represent ~~an ogive,~~ *data* and quickly shows the median, quartiles and spread of data.
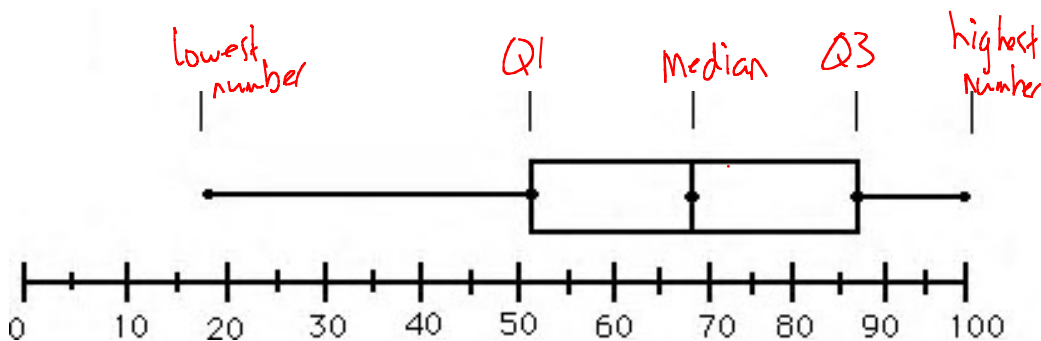
Make a Box and Whisker plot of the data from the previous page.

Compare these two sets of data.

         2, 3, 4, 5, 6   -3, 2, 3, 5, 13

Mean?   4   4

Range?   4   16

Range is a measure of dispersion easy to calculate but not as useful as others.

Deviation is the difference of the value x and the mean value $\bar{x}$. $x - \bar{x}$

Variance, σ^2, is the mean of the deviations squared. $\sigma^2 = \dfrac{\sum (x - \bar{x})^2}{n}$

Standard Deviation, σ, is the square root of the variance. $\sigma = \sqrt{\dfrac{\sum\limits_{i=1}^{k} f_i(x_i - \mu)^2}{n}}$

Example: Calculate the standard deviation of the heights of the following trees:
          30, 17, 32, 25, 31, 28, 35, 26

By hand: $\dfrac{30+17+32+25+31+28+35+26}{8} = 28$

$$\sqrt{\dfrac{(30-28)^2 + (17-28)^2 + \ldots + (26-28)^2}{8}}$$

By calculator: