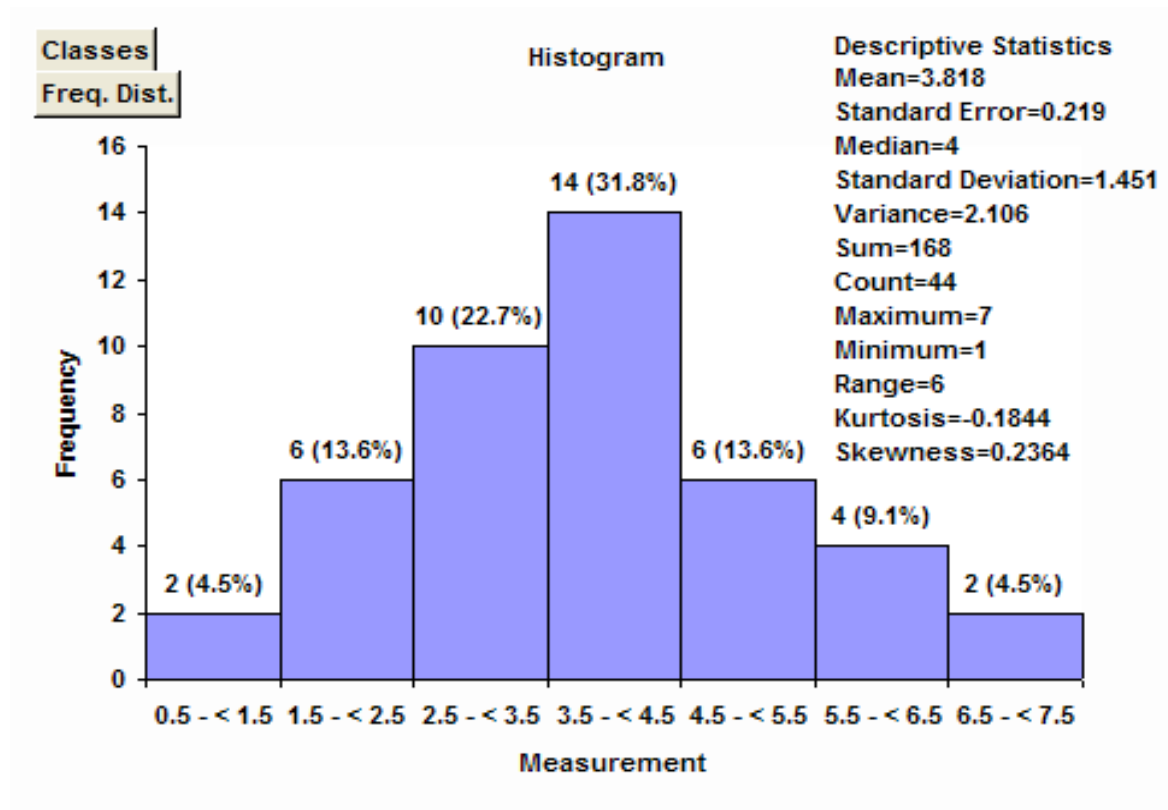# 14.2 Measures of Central Tendancy

A measure of center is a single value used to represent the "average" of the data.

There are 3 types of center:
     Mean   Median   Mode

Mean: (arithmetic average)

COMPUTING THE MEAN If a data set contains n data values, the **mean** $\bar{x}$ of the data set is

$$\bar{x} = \frac{\sum x}{n}.$$

Here we use the Greek letter Σ to represent a sum.

Ex.   Data = { 3, 8, 5, 2 }
$\qquad$ Σx $= 3 + 8 + 5 + 2 = 18$

$\qquad \bar{x} = \text{Σx/x} = 18 / 4 = 6.5$

Sample mean $= \bar{x}$ (x bar)
Population mean $= \mu$ (Greek mu)

Example:
    Sample Data = 2, 7, 5, 3, 4, 8, 1
    Find the mean

Example:
  Sample Data = 2, 7, 5, 3, 4, 8, 1
  Find the mean

$$\frac{2+7+5+3+4+8+1}{7} = 4.286$$

Given a frequency table,
   - find the total number of data points,
      which is the sum of the frequencies
      So find Σf
   - find the sum of all values,
      if freq f occurs x times it contributes xf
      So find Σxf

COMPUTING THE MEAN OF A FREQUENCY DISTRIBUTION We use a frequency table to compute the mean of a data set as follows:

1. Write all products $x \cdot f$ of the scores times their frequencies in a new column of the table.

2. Represent the sum of the products you calculated in step 1 by $\Sigma(x \cdot f)$.

3. Denote the sum of the frequencies by Σf.

4. The mean is then $\dfrac{\Sigma(x \cdot f)}{\Sigma f}$.

Example: What is the mean temperature?

Temperature (°F), x	Frequency, f
52	4
53	6
54	3
55	8
56	4
57	5
Total	30

Example: What is the mean temperature?

Temperature (°F), x	Frequency, f	Product, $x \cdot f$
52	4	$52 \cdot 4 = 208$
53	6	$53 \cdot 6 = 318$
54	3	$54 \cdot 3 = 162$
55	8	$55 \cdot 8 = 440$
56	4	$56 \cdot 4 = 224$
57	5	$57 \cdot 5 = 285$
Totals	$\Sigma f = 30$	$\Sigma(x \cdot f) = 1{,}637$

sum of frequencies ⎯⎯⎯⎯⎯⎯⎯⎯⎯⎦   ⎣⎯ sum of products

The mean is:

$$\frac{\Sigma(x \cdot f)}{\Sigma f} = \frac{\text{sum of scores}}{\text{number of scores}} = \frac{1{,}637}{30} \approx 54.6°\text{F}.$$

The **median** of a set of data is the number in the middle of the list when the numbers are ordered.

If there is no single middle number, average the two middle numbers.

Example:
    3 5 3 4 1 3 2 5 4

Example:
    2 4 1 3 5 3 2 4 5 3

Example:
    3 5 3 4 1 3 2 5 4

Ordered: 1 2 3 3 **3** 4 4 5 5
       Mean 3

Example:
    2 4 1 3 5 3 2 4 5 3

Ordered: 1 2 2 3 **3 3** 4 4 5 5
      Mean = (3+3)/2 = 3

The **mode** is the data value which occurs most frequently.

Example:

2 4 1 3 5 3 2 4 5 3

Weirdness:
   If more than one value occurs most
   frequently, each is a mode.

Ex   2 4 5 3 4 3

   If no value is repeated, there is no mode.

Ex   8 6 3 4 7

Two ways of representing data by more than just a single number:

Five Number Summary

Box and Whisker Plot
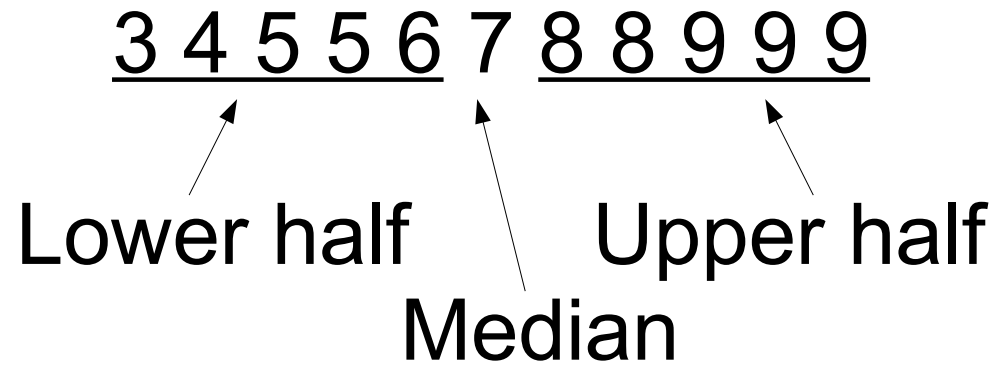
Five Number Summary

1. Order the data

2. Find the smallest, largest and median.

3. Find the median of the lower half, Q_1

4. Find the median of the upper half, Q_3

5. The Five Number Summary is:
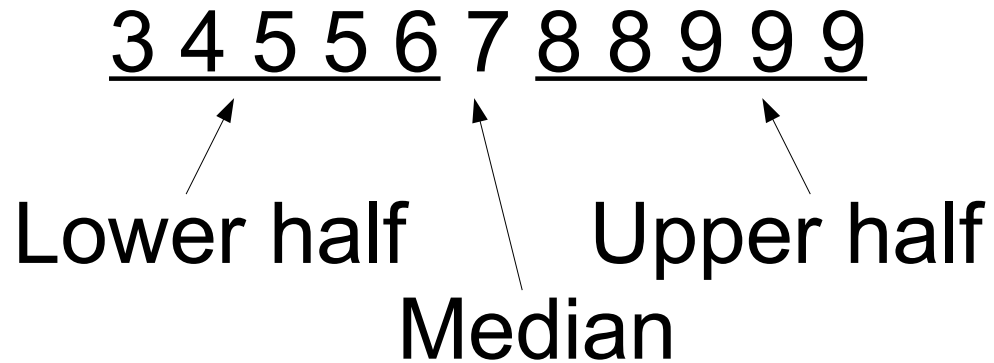
    smallest, Q_1, median, Q_3, largest

Example:

3 4 5 5 6 7 8 8 9 9 9

Example:

$$\underline{3\ 4\ 5\ 5\ 6}\ 7\ \underline{8\ 8\ 9\ 9\ 9}$$

Lower half   Upper half

Median

Example:

$$\underline{3\ 4\ 5\ 5\ 6}\ 7\ \underline{8\ 8\ 9\ 9\ 9}$$

Lower half   Upper half

Median

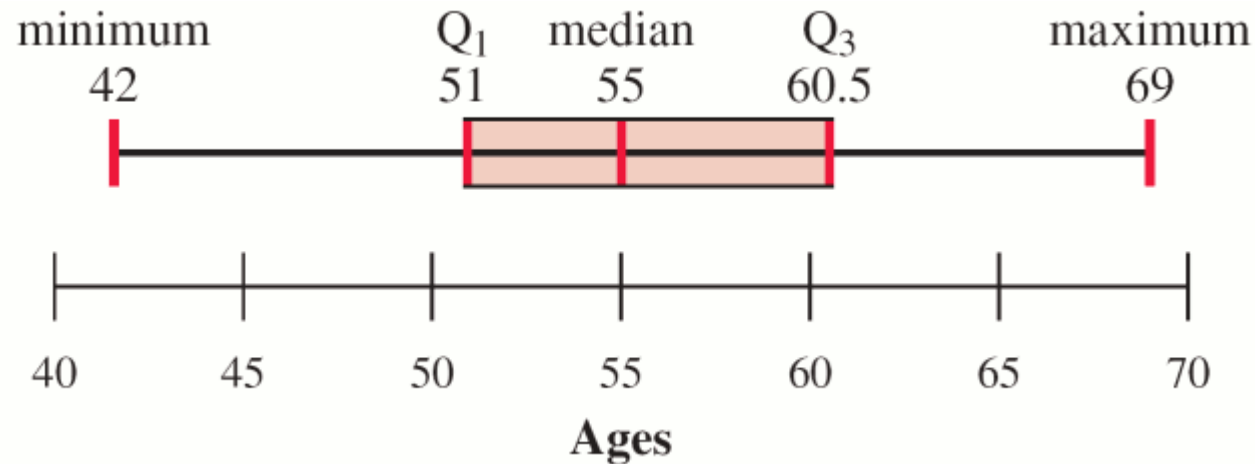Smallest = 3
Q_1 = 5
Median = 7
Q_3 = 9
Largest = 9

Summary: 3, 5, 7, 9, 9

The Box and Whiskers Plot is a visual representation of the Five Number Summary

Example: Summary = 42, 51, 55, 60.5 69

Full example:
38 38 52 40 48 48 31 37 40 36 37 37 49 39 47

Full example:
38 38 52 40 48 48 31 37 40 36 37 37 49 39 47

Ordered:
31 36 37 37 37 38 38 39 40 40 47 48 48 49 52

Smallest = 31
Q_1 = 37
Median = 39
Q_3 = 48
Largest = 52