Types of averages:
- Mean ← Most common
- Median
- Mode

The <u>mean</u> of $n$ numbers $x_1, x_2, \ldots, x_n$ is given by

$$\mu = \frac{x_1 + x_2 + \cdots + x_n}{n}$$

Example: The mean of $2, 3, 5, 7, 9$ is

$$\frac{2+3+5+7+9}{5} = \frac{26}{5} = 5.2$$

Example: Scores on golf hole in tournament

| Score | Frequencies | Rel Freq |
|-------|-------------|----------|
| 2 | 1 | $1/50 = 0.02$ |
| 3 | 15 | $15/50 = 0.3$ |
| 4 | 21 | $21/50 = 0.42$ |
| 5 | 11 | $11/50 = 0.22$ |
| 6 | 2 | $2/50 = 0.04$ |

$$\text{Mean Score} = \frac{1(2) + 15(3) + 21(4) + 11(5) + 2(6)}{50} = \frac{198}{50} = 3.96$$

$$= 0.02(2) + 0.3(3) + 0.42(4) + 0.22(5) + 0.04(6)$$

Example: Test Score

| Scores | Frequency |
|--------|-----------|
| 50-59 | 1 |
| 60-69 | 2 |
| 70-79 | 3 |
| 80-89 | 5 |
| 90-100 | 4 |

Can't compute the mean **exactly**, but can approximate

Midpoint of 50-59

Midpoint of 60-69

$$\text{Mean Score} = \frac{1(54.5) + 2(64.5) + 3(74.5) + 5(84.5) + 4(95)}{15}$$

$$= 80.63$$

Example: Class w/ 3 juniors, 2 seniors

On exam, juniors averaged 80% and seniors averaged 90%

$\dfrac{x_1 + x_2 + x_3}{3} = 80$

What is the class average?

$\dfrac{y_1 + y_2}{2} = 90$

$$\text{Mean} = \frac{x_1 + x_2 + x_3 + y_1 + y_2}{5} = \frac{x_1 + x_2 + x_3}{5} + \frac{y_1 + y_2}{5}$$

$$= \frac{x_1 + x_2 + x_3}{3}\left(\frac{3}{5}\right) + \frac{y_1 + y_2}{2}\left(\frac{2}{5}\right)$$

$$= 80\left(\frac{3}{5}\right) + 90\left(\frac{2}{5}\right) = \frac{80(3) + 90(2)}{5}$$

Example: Salaries at company

| Position | # people in pos | Salary |
|---|---|---|
| Pres | 1 | 300,000 |
| VP | 1 | 40,000 |
| Production Workers | 15 | 25,000 |

$$\text{Mean Salary} = \frac{300000 + 40000 + 15(25000)}{17} \approx 42,060$$

Higher then all but one person's salary!

Problem: Extreme values can throw off mean

The **median** is the middle number after the numbers have been arranged in order

Example: ~~57~~, ~~64~~, ~~68~~, 71, ~~73~~, ~~79~~, ~~80~~

Median = 71

Example: ~~57~~, ~~64~~, 68, 71, ~~73~~, ~~79~~

$$Median = \frac{68+71}{2} = \frac{139}{2} = 69.5$$

Intuition: Median essentially divides the data points in half

Example:

| Position | # people in pos | Salary |
|---|---|---|
| Pres | 1 | 300,000 |
| VP | 1 | 40,000 |
| Production Workers | 15 | 25,000 |

Median = 25000

The __mode(s)__ of a data set is the value
that occurs the most often (can be more then
one value)

Example: 1,1,1, 2,3, 4,4, 5,5,5 ,6,7, 8,8

   Mode = 1,5

Example : Mode Salary = 25,000

# Which average is best? It depends

**Mean:**
- No extreme values
- Equal distances between scores mean equal distances between things being measured

**Median:**
- Extreme values
- Rankings

**Mode:**
- Things like clothing sizes (need to know values occurring most often)