Chapter 9 Section 3 MA1020 Quantitative Literacy

Sidney Butler

Michigan Technological University

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# Measures of Central Tendency

- Mean
- Median
- Mode

If the N numbers in a data set are denoted by  $x_1, x_2, \ldots, x_N$ , the mean of the data set is

$$\frac{x_1+x_2+\cdots+x_N}{N}.$$

Sample Mean

Population Mean

To find the median, arrange the data points of a data set in order from smallest to largest.

- 1 If the number of data points is *odd*, the data point in the middle of the list is the median of the data set.
- 2 If the number of data points is *even*, the mean of the two data points in the middle is the median of the data set.



A distribution is skewed left if the mean is less than the median.

#### Definition

A distribution is skewed right if the mean is greater than the median.

In a data set, the number that occurs most frequently is called the mode. A data set can have more than one mode if more than one number occurs most frequently. If every number in a data set appears equally often, then we say the distribution has no mode.

In stratified sampling, the population is subdivided into two ore more nonoverlapping subsets, each of which is called a stratum. A stratified random sample is obtained by selecting a simple random sample from each stratum.

### Example

The team roster for the WNBA Los Angeles Sparks basketball team (2003-2004 season) and the players' heights and weights are given in the following table.

| Player               | Height (in) | Weight (Ibs) |
|----------------------|-------------|--------------|
| Tamecka Dixon        | 69          | 148          |
| Isabelle Fijalkowski | 77          | 200          |
| Jennifer Gillom      | 75          | 180          |
| Chandra Johnson      | 75          | 185          |
| Lisa Leslie          | 77          | 170          |
| Mwadi Mabika         | 71          | 165          |
| DeLisha Milton-Jones | 73          | 172          |
| Vanessa Nygaard      | 73          | 175          |
| Lynn Pride           | 74          | 180          |
| Nikki Teasley        | 72          | 169          |
| Teresa Weatherspoon  | 68          | 161          |
| Shaquala Williams    | 66          | 135          |
| Sophia Witherspoon   | 70          | 145          |

**1** Find the mean, median, and mode for the players' heights.

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If the numbers in a data wet are  $x_1, x_2, \ldots, x_N$  and these numbers have weights of  $w_1, w_2, \ldots, w_N$ , respectively, then the weighted mean of the data is

$$w_1x_1+w_2x_2+\cdots+w_Nx_N$$

 $w_1 + w_2 + \cdots + w_N$ 

# Measures of Variability (Spread)

### Range

### Quartiles

- Five Number Summary
- Box-and-Whisker Plot
- Variance
- Standard Deviation



If the numbers in a data set  $x_1, x_2, \ldots, x_N$  are arranged in increasing order from smallest to largest, then the range of the data set is  $x_N - x_1$ .

#### Example

Compute the range for the data set 0, 8, 9, 6, 0, 1, 5, 3, 0, 9, 8, 0, 5, 6, 9, 5, 0.

The definition is much easier to explain than write out. See the text if you would like a formal explanation.

#### Example

Compute the first quartile, third quartile and interquartile range of the data set 0, 8, 9, 6, 0, 1, 5, 3, 0, 9, 8, 0, 5, 6, 9, 5, 0.

# **Five-Number Summary**

### Definition

The five-number summary of a data set is the list,  $s, q_1, m, q_3, L$ , where

- s = the smallest value in the data set
- $q_1$  = the first quartile
- m = the median of the data set
- $q_3$  = the third quartile, and
- L = the largest value in the data set

#### Example

Give a five-number summary of the data set 0, 8, 9, 6, 0, 1, 5, 3, 0, 9, 8, 0, 5, 6, 9, 5, 0.

#### Example

Create a box-and-whisker plot for the data set 0, 8, 9, 6, 0, 1, 5, 3, 0, 9, 8, 0, 5, 6, 9, 5, 0.

The difference between a data point x and the mean  $\overline{x}$ , namely  $x - \overline{x}$ , is called the deviation from the mean of a data point.

### Sample Variance and Standard Deviation

$$s^{2} = \frac{(x_{1} - \overline{x})^{2} + (x_{2} - \overline{x})^{2} + \dots + (x_{n} - \overline{x})^{2}}{n - 1}$$
$$s = \sqrt{s^{2}} = \sqrt{\frac{(x_{1} - \overline{x})^{2} + (x_{2} - \overline{x})^{2} + \dots + (x_{n} - \overline{x})^{2}}{n - 1}}$$

# Population v. Sample

# $\sigma$ or s