Measures of Center
Section 2-4

Definitions
Mean
(Arithmetic Mean)
AVERAGE
the number obtained by adding the values and dividing the total by the number of values

Mean as a Balance Point
Notation

\[ \sum \] denotes the addition of a set of values

\[ x \] is the variable usually used to represent the individual data values

\( n \) represents the number of data values in a sample

\( N \) represents the number of data values in a population

Notation

\( \bar{x} \) is pronounced ‘x-bar’ and denotes the mean of a set of sample values

\[ \bar{x} = \frac{\sum x}{n} \]

\( \mu \) is pronounced ‘mu’ and denotes the mean of all values in a population

\[ \mu = \frac{\sum x}{N} \]

Calculators can calculate the mean of data

Definitions

- **Median**
  - the middle value when the original data values are arranged in order of increasing (or decreasing) magnitude
  - often denoted by \( \bar{x} \) (pronounced ‘x-tilde’)
  - is not affected by an extreme value
Definitions

Mode

the score that occurs most frequently

Bimodal

Multimodal

No Mode
denoted by $M$

the only measure of central tendency that can be used with nominal data

Examples

a. 5 5 5 1 5 1 4 3 5

$\Rightarrow$ Mode is 5

b. 1 2 2 2 3 4 5 6 6 7 9

$\Rightarrow$ Bimodal - 2 and 6

c. 1 2 3 6 7 8 9 10

$\Rightarrow$ No Mode
Definitions

Midrange

the value midway between the highest and lowest values in the original data set

\[ \text{Midrange} = \frac{\text{highest score} + \text{lowest score}}{2} \]

Round-off Rule for Measures of Center

Carry one more decimal place than is present in the original set of values

\[ \bar{x} = 8.166... = 8.2 \]
\[ \bar{x} = 5.025 = 5.03 \]

Measures of Center

Mean
Median
Mode
Midrange
**Mean from a Frequency Distribution**

Use class midpoint of classes for variable $x$

\[
\bar{x} = \frac{\sum (f \cdot x)}{\sum f}
\]

- $x$ = class midpoint
- $f$ = frequency
- $\sum f = n$

**Weighted Mean**

\[
\bar{x} = \frac{\sum (w \cdot x)}{\sum w}
\]

**Mean for a Frequency Distribution**

<table>
<thead>
<tr>
<th>Quiz Scores</th>
<th>Midpoints</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>5-9</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>10-14</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>15-19</td>
<td>17</td>
<td>11</td>
</tr>
<tr>
<td>20-24</td>
<td>22</td>
<td>7</td>
</tr>
</tbody>
</table>

\[
\bar{x} = \frac{\sum (f \cdot x)}{\sum f}
\]
Calculator Basics for Statistical Data

1. Put calculator into statistical mode
2. Clear previous data
3. Enter data (and frequency)
4. Select key(s) that calculate $\bar{x}$

Mean for a Frequency Table

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$\bar{x} = 14.4$ (rounded to one more decimal place than data)

Quiz Scores

![Quiz Scores Graph]

$\bar{x} = 14.4$
**Definitions**

- **Symmetric**
  Data is symmetric if the left half of its histogram is roughly a mirror of its right half.

- **Skewed**
  Data is skewed if it is not symmetric and if it extends more to one side than the other.

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**Skewness**

![Skewness Diagram](image)

- **Symmetric**
  Mean = Mode = Median

- **Skewed Left**
  Skewed negatively
  Mean < Mode < Median

- **Skewed Right**
  Skewed positively
  Mode < Median < Mean

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**Important Distributions**

- Normal
- Uniform
- Skewed Right
- Skewed Left