Measuring Center

Lecture 15
Sections 5.1 - 5.2

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Outline

1. Introduction
2. Measuring the Center
3. The Mean
   - TI-83 Means
4. The Median
   - TI-83 Medians
5. Assignment

Review Quiz

Example (Review Quiz)

1. We survey 100 adults and find that 45 favor banning Sunday hunting and 55 do not. The variable in this study is
   (a) Qualitative.
   (b) Quantitative discrete.
   (c) Quantitative continuous.

Review Quiz

Example (Review Quiz)

2. We survey 100 households and find that they own an average of 1.6 computers per household. The variable in this study is
   (a) Qualitative.
   (b) Quantitative discrete.
   (c) Quantitative continuous.

Review Quiz

Example (Review Quiz)

3. We measure the weights of 100 individuals and find that 30 of them are obese. The variable in this study is
   (a) Qualitative.
   (b) Quantitative discrete.
   (c) Quantitative continuous.

Review Quiz Answers

Example (Review Quiz Answers)

1. (a) Qualitative. (Whether they favor banning Sunday hunting.)
2. (b) Quantitative discrete. (Number of computers in the household.)
3. (c) Quantitative continuous. (The person's weight.)

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Measuring the Center

- Often, we would like to have one number that that is "representative" of a population or sample.

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- But there is no single "correct" way to do this.

Measuring the Center

- Often, we would like to have one number that that is "representative" of a population or sample.
- It seems reasonable to choose a number that is near the "center" of the distribution rather than in the left or right extremes.
- But there is no single "correct" way to do this.
- Instead, we will have two (or three) ways to measure the center.

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Measuring the Center

Definition (Mean)

The mean is the simple average of a set of numbers.

Definition (Median)

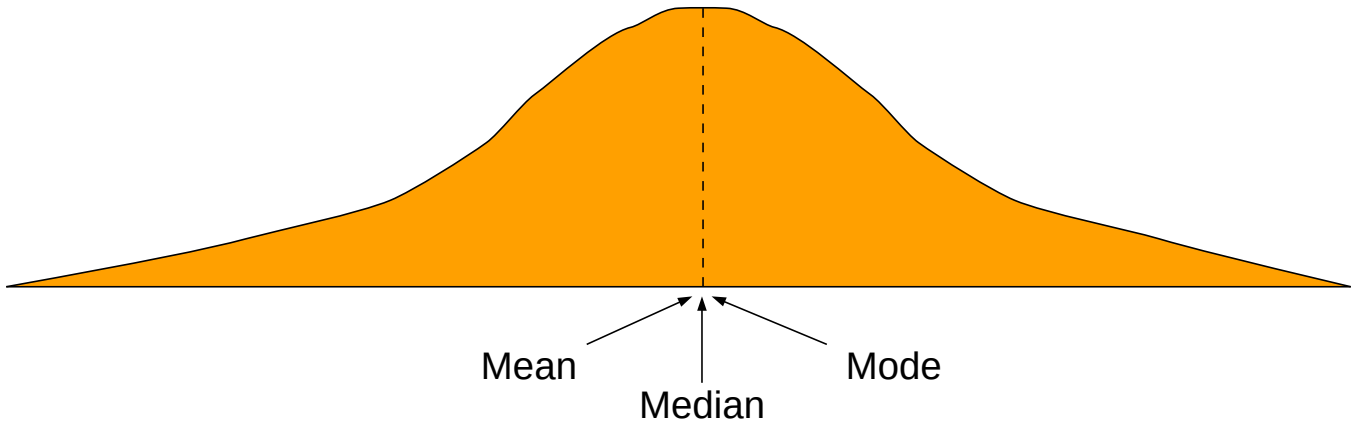
The median is the value that divides the set of numbers into a lower half and an upper half.

Definition (Mode)

The mode is the most frequently occurring value in the set of numbers.

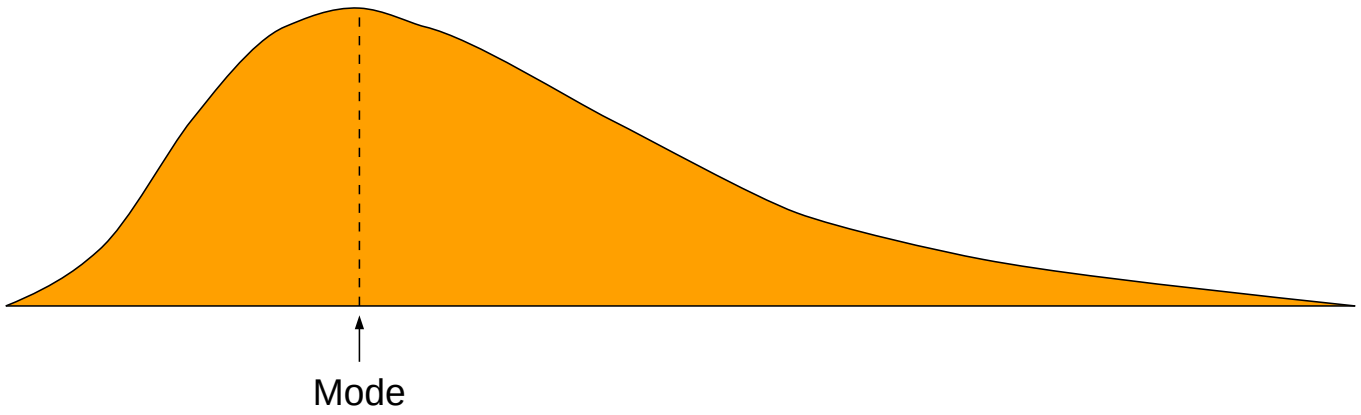
Mean, Median, and Mode

- If a distribution is symmetric and unimodal, then the mean, median, and mode are all the same and are all at the center of the distribution.



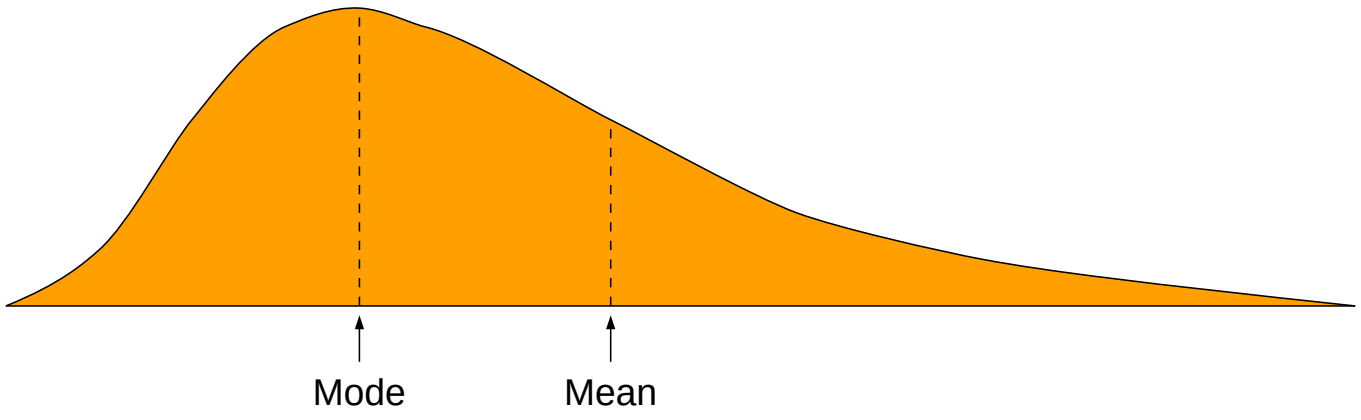
Mean, Median, and Mode

- However, if the distribution is skewed, then the mean, median, and mode are all different.
- The mode is at the peak.



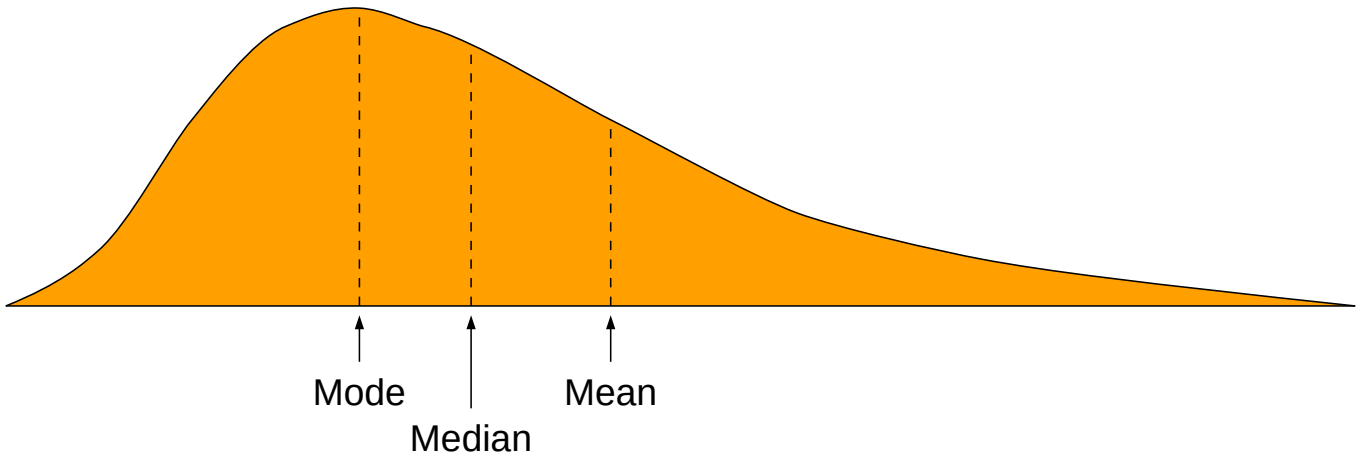
Mean, Median, and Mode

- However, if the distribution is skewed, then the mean, median, and mode are all different.
- The mean is shifted in the direction of skewing.



Mean, Median, and Mode

- However, if the distribution is skewed, then the mean, median, and mode are all different.
- The median is between the mode and the mean.



The Median vs. The Mean

- If the data are strongly skewed, then the median generally gives a more representative value.
- If the data are not skewed, then the mean is usually preferred.

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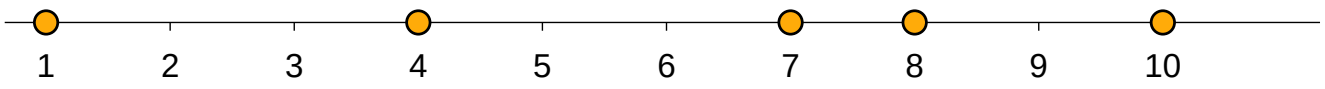
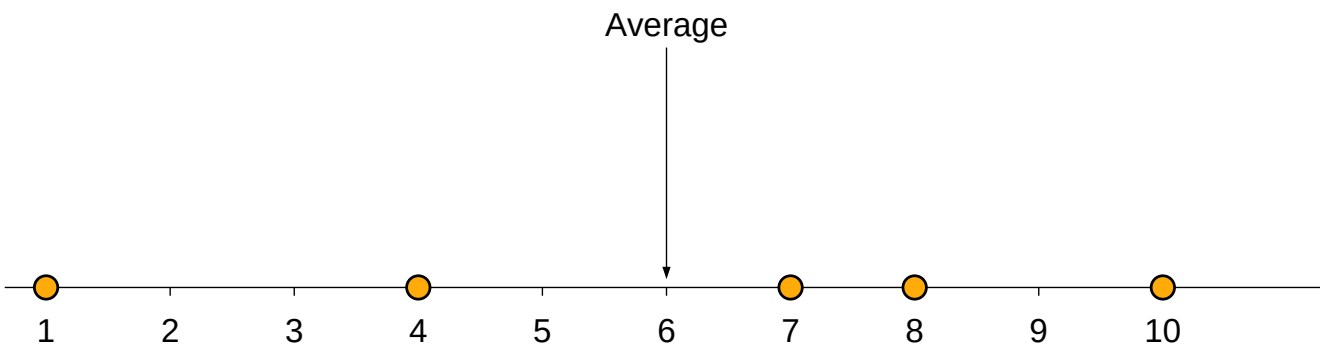
The Mean

- Why is the average usually a good measure of the center?
- If we have only two numbers, the average is half way between them.
- What if we have more than two numbers?
- The mean balances the “deviations” on the left with the “deviations” on the right.

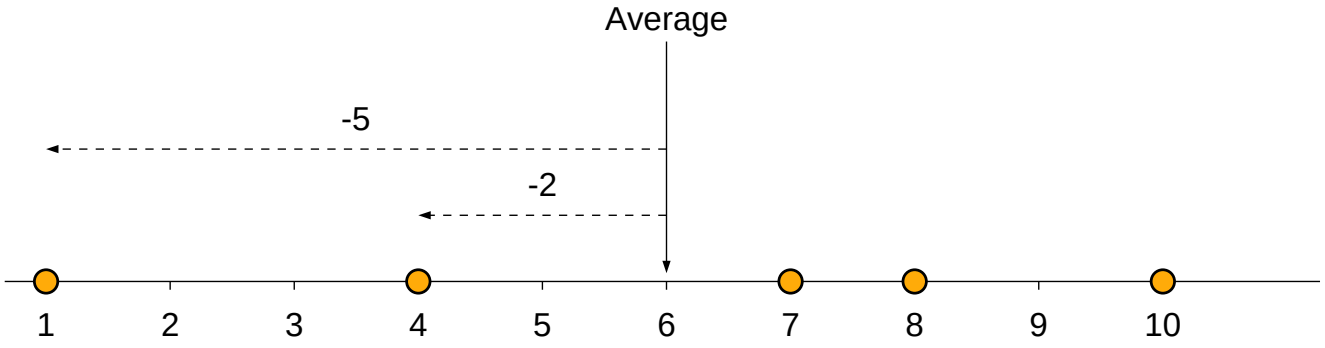
The Mean



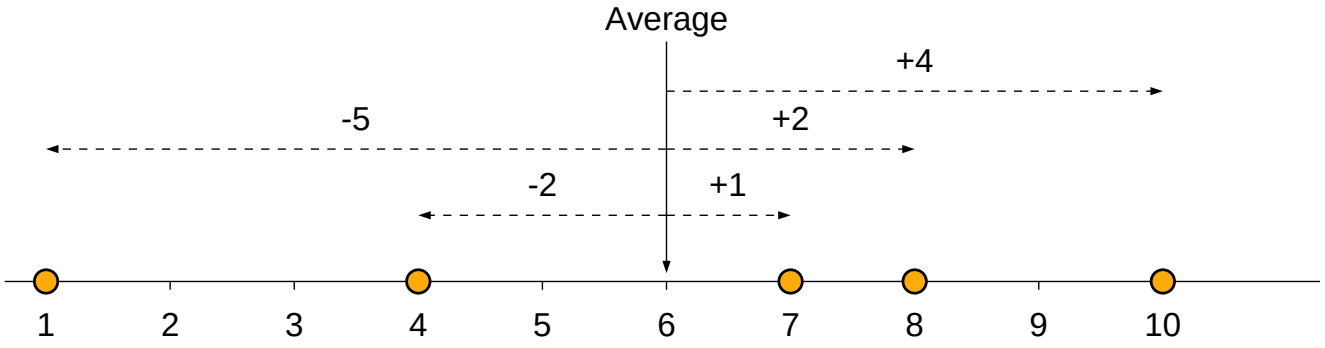
The Mean



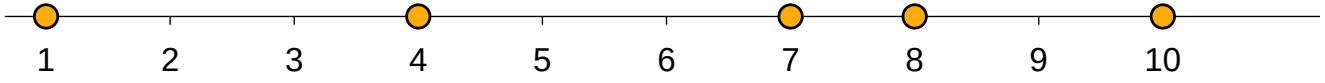
The Mean



The Mean



The Median



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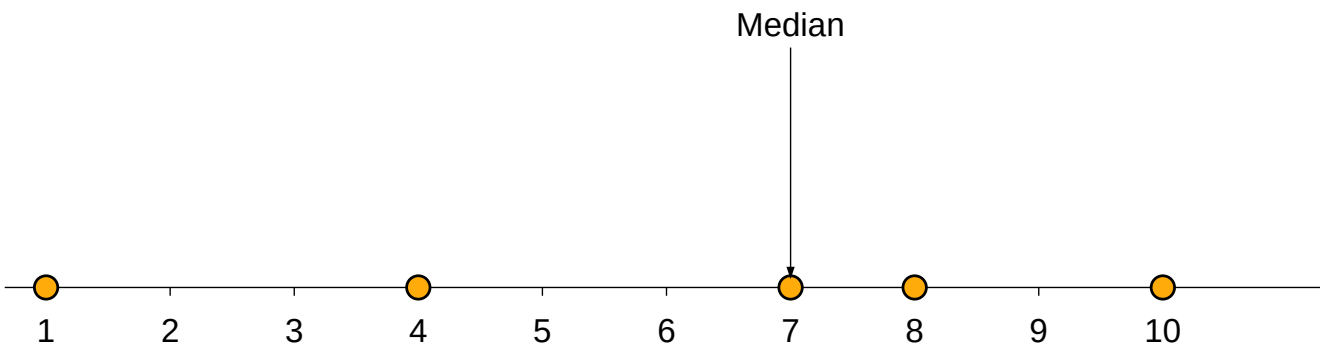

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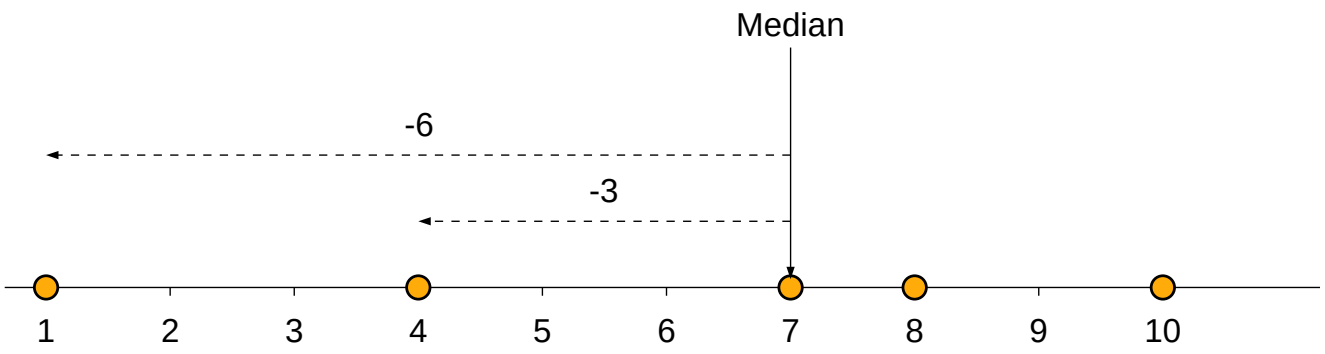

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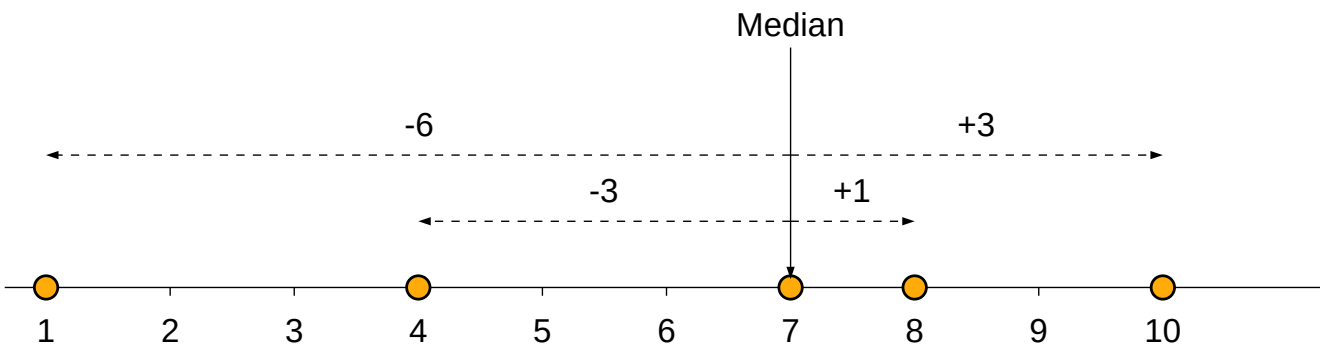

The Mean

- We use the letter x to denote a value from the sample or population.
- The symbol Σ means "add them all up."
- So,
$$\sum x$$
means add up all the values in the population or sample (depending on the context).
- Then the sample mean is
$$\frac{\sum x}{n}.$$

The Mean

- We denote the mean of a sample by the symbol $\overline{x}$, pronounced "x bar."
- We denote the mean of a population by μ, spelled "mu" and pronounced "myoo".
- Therefore,

$$\overline{x} = \frac{\sum x}{n}$$

$$\mu = \frac{\sum x}{N}.$$

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TI-83 - The Mean

TI-83 Means

- Enter the data into a list, say L_1.
- Press `STAT > CALC > 1-Var Stats`.
- Press `ENTER`. "`1-Var-Stats`" appears in the display.
- Type L_1 and press `ENTER`.
- A list of statistics appears. The first one is the mean.

Practice

Practice

- The coin-tossing data from the previous lecture.

67	69	80	96	91
67	65	73	94	82
69	87	76	66	90

- Find the mean of the data.

Practice

Practice

- The coin-tossing data from the previous lecture.

67	69	80	96	91
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- Find the mean of the data.
- Change the last 4 to 100. How does that affect the mean?

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The Median

Definition (Median)

The median is the value that divides the set of numbers into a lower half and an upper half.

- The median, by definition, is the 50th percentile.
- It separates the lower 50% of the sample from the upper 50%.

The Median

- To find the position of the median, compute $\frac{n+1}{2}$.
- If it is a whole number, then that is the position of the median.
- if it falls halfway between whole numbers, then the median is the average of the values in the two nearest positions.

The Median

- Find the median of

$$3 \quad 5 \quad 8 \quad 9 \quad 13 \quad 14 \quad 20$$

- Find the median of

$$3 \quad 5 \quad 8 \quad 9 \quad 13 \quad 14 \quad 20 \quad 22$$

Practice

Practice

- The coin-tossing data again.

67	69	80	96	91
67	65	73	94	82
69	87	76	66	90

- Find the median of the data.
- How do the mean and the median compare?

Practice

Practice

- The coin-tossing data again.

67	69	80	96	91
67	65	73	94	82
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- Find the median of the data.
- How do the mean and the median compare?
- Change the last 4 to 100. How does that affect the median?

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TI-83 - The Median

TI-83 Medians

- Follow the same procedure that was used to find the mean.
- When the list of statistics appears, scroll down to the one labeled "`Med`." It is the median.

TI-83 - The Median

Practice

- Use the TI-83 to find the median of the coin-tossing data.

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Assignment

Homework

- Read Sections 5.1 - 5.2, pages 299 - 311.
- Let's Do It! 5.1, 5.2, 5.3, 5.4, 5.5, 5.6.
- Page 311, exercises 1 - 8.