

# ✦ Measures of Central Tendency ✦

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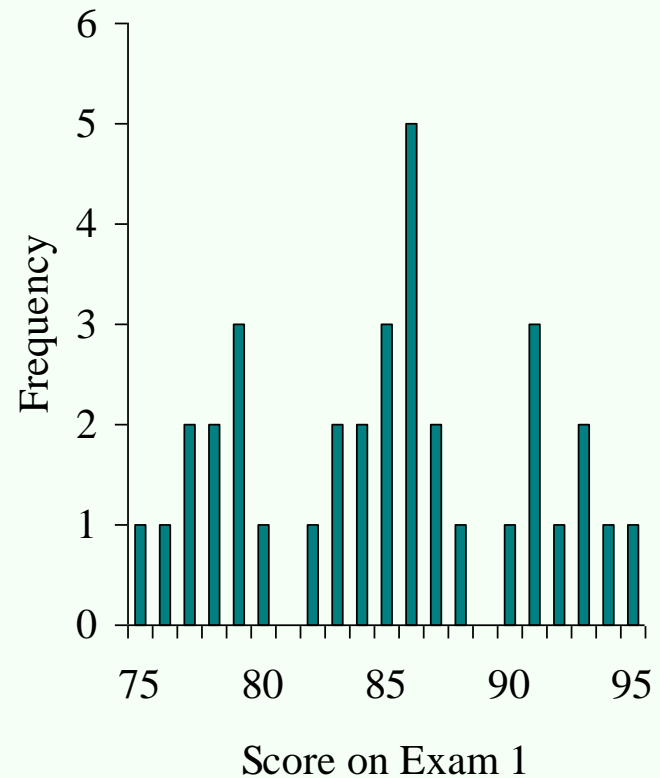
# Measures of Central Tendency

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- ✧ A *measure of central tendency* is a descriptive statistic that describes the average, or typical value of a set of scores
- ✧ There are three common measures of central tendency:
  - ✧ the mode
  - ✧ the median
  - ✧ the mean

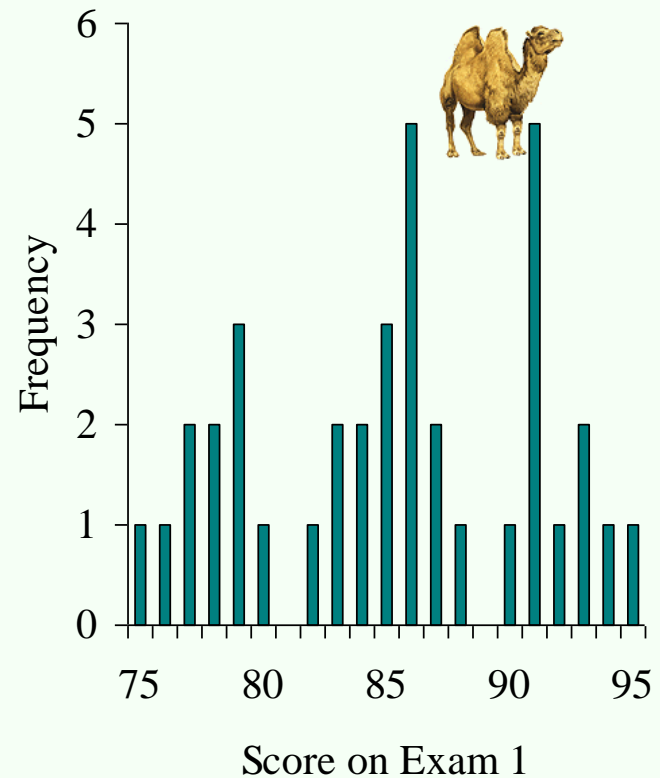
# The Mode

- ✚ The *mode* is the score that occurs most frequently in a set of data



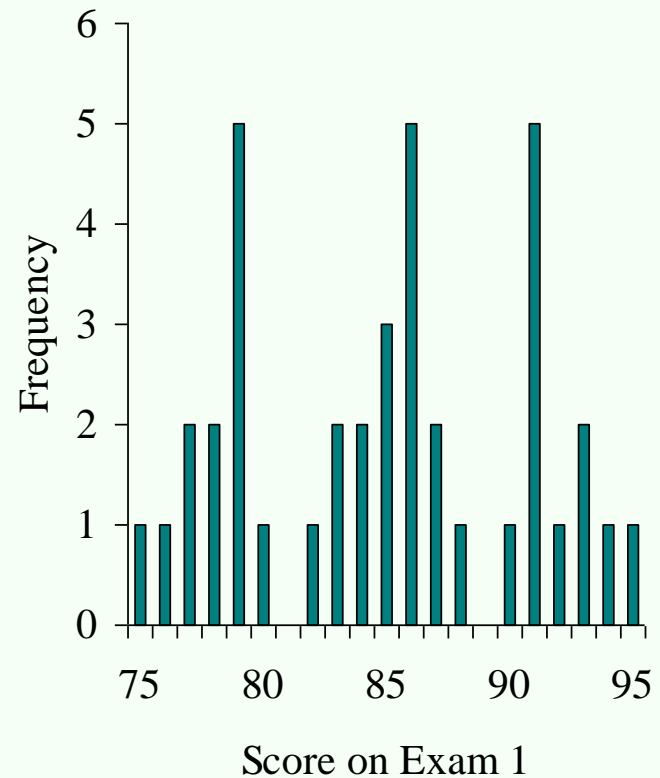
# Bimodal Distributions

- ✚ When a distribution has two “modes,” it is called *bimodal*



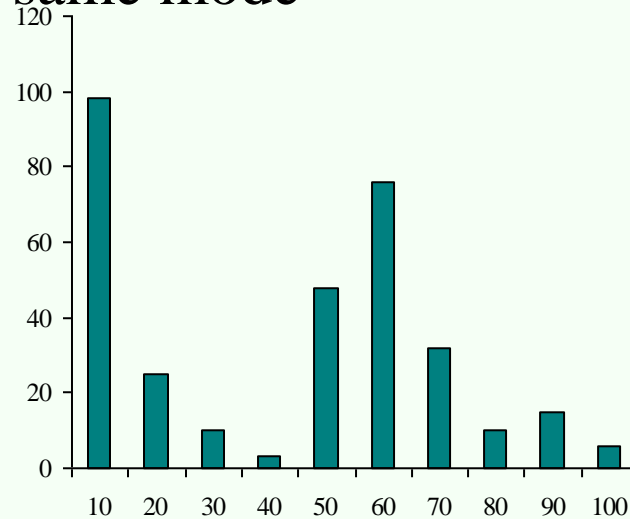
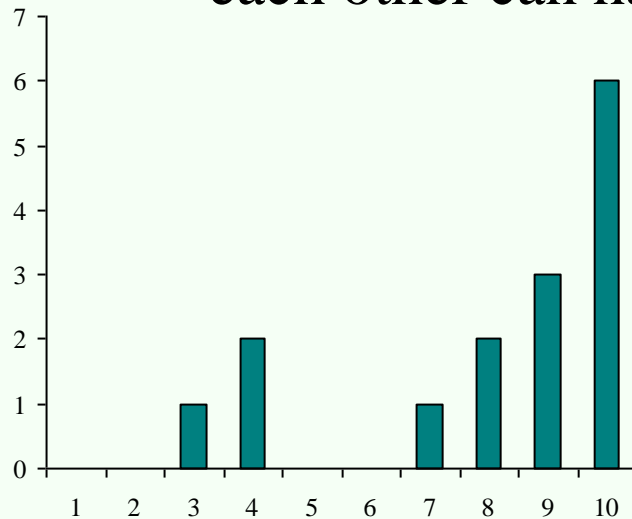
# Multimodal Distributions

- ✚ If a distribution has more than 2 “modes,” it is called *multimodal*



# When To Use the Mode

- ✚ The mode is not a very useful measure of central tendency
  - ✚ It is insensitive to large changes in the data set
    - ✚ That is, two data sets that are very different from each other can have the same mode



# When To Use the Mode

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- ✚ The mode is primarily used with nominally scaled data
  - ✚ It is the only measure of central tendency that is appropriate for nominally scaled data

# The Median

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- ✚ The *median* is simply another name for the 50<sup>th</sup> percentile
  - ✚ It is the score in the middle; half of the scores are larger than the median and half of the scores are smaller than the median



# How To Calculate the Median

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- ✧ Conceptually, it is easy to calculate the median
  - ✧ There are many minor problems that can occur; it is best to let a computer do it
- ✧ Sort the data from highest to lowest
- ✧ Find the score in the middle
  - ✧  $\text{middle} = (N + 1) / 2$
  - ✧ If N, the number of scores, is even the median is the average of the middle two scores

# Median Example

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✚ What is the median of the following scores:

10 8 14 15 7 3 3 8 12 10 9

✚ Sort the scores:

15 14 12 10 10 9 8 8 7 3 3

✚ Determine the middle score:

$$\text{middle} = (N + 1) / 2 = (11 + 1) / 2 = 6$$

✚ Middle score = median = 9

# Median Example

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✚ What is the median of the following scores:

24 18 19 42 16 12

✚ Sort the scores:

42 24 19 18 16 12

✚ Determine the middle score:

$$\text{middle} = (N + 1) / 2 = (6 + 1) / 2 = 3.5$$

✚ Median = average of 3<sup>rd</sup> and 4<sup>th</sup> scores:

$$(19 + 18) / 2 = 18.5$$

# When To Use the Median

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- ✚ The median is often used when the distribution of scores is either positively or negatively skewed
  - ✚ The few really large scores (positively skewed) or really small scores (negatively skewed) will not overly influence the median

# The Mean

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✧ The *mean* is:

✧ the arithmetic average of all the scores

$$(\Sigma X)/N$$

✧ the number,  $m$ , that makes  $\Sigma(X - m)$  equal to 0

✧ the number,  $m$ , that makes  $\Sigma(X - m)^2$  a minimum

✧ The mean of a population is represented by the Greek letter  $\mu$ ; the mean of a sample is represented by  $\bar{X}$

# Calculating the Mean

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✚ Calculate the mean of the following data:

1 5 4 3 2

✚ Sum the scores ( $\Sigma X$ ):

$$1 + 5 + 4 + 3 + 2 = 15$$

✚ Divide the sum ( $\Sigma X = 15$ ) by the number of scores ( $N = 5$ ):

$$15 / 5 = \underline{3}$$

✚ Mean =  $\bar{X} = 3$

# When To Use the Mean

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- ✧ You should use the mean when
  - ✧ the data are interval or ratio scaled
    - ✧ Many people will use the mean with ordinally scaled data too
  - ✧ and the data are not skewed
- ✧ The mean is preferred because it is sensitive to every score
  - ✧ If you change one score in the data set, the mean will change

# Relations Between the Measures of Central Tendency

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- ✚ In symmetrical distributions, the median and mean are equal
  - ✚ For normal distributions,  $\text{mean} = \text{median} = \text{mode}$
- ✚ In positively skewed distributions, the mean is greater than the median
- ✚ In negatively skewed distributions, the mean is smaller than the median

