

Answer all questions using complete sentences.

1. Consider the mode, median, and mean. Which average represents the middle value of the data distribution? Which average represents the most frequent value of a distribution? Which average takes all the specific values into account?

Median - middle value of the data.

Mode - most frequent value

Mean - average of ALL values

2. What symbol is used for the arithmetic mean when it is a sample statistic? What symbol is used when the arithmetic mean is a population parameter?

\bar{x} - for samples

μ - for populations

3. In order to find the median of a data set, what do we do first with the data?

Place data in order from least to greatest.

4. Consider a data set with at least three data values. Suppose the highest value is increased by 10 and the lowest value is decreased by 10.

- a. Does the mean change? Explain.

No, because the sum of the data does not change.

- b. Does the median change? Explain.

No, changing the extreme values does not change the median

- c. Is it possible for the mode to change? Explain.

Yes, depending on which value(s) occur most frequently after the data is changed.

5. When a distribution is mound-shaped symmetrical, what is the general relationship among the values of the mean, median, and mode?

The mean, median, and mode are all approximately equal.

6. Consider the numbers: 2 3 4 5 5

a. Compute the mode, median, and mean.

mode: 5

median: 4

mean: $\bar{x} = 3.8$

b. If the numbers represent codes for the colors of T-shirts ordered from a catalog, which average(s) would make sense?

mode

c. If the numbers represent one-way mileages for trails to different lakes, which average(s) would make sense?

ALL 3 could make sense.

d. Suppose the numbers represent survey responses from 1 to 5 with 1 = disagree strongly, 2 = disagree, 3 = agree, 4 = agree strongly, and 5 = agree very strongly. Which averages make sense?

mode, median

7. A job-performance evaluation form has these categories:

1 = excellent; 2 = good; 3 = satisfactory; 4 = poor; 5 = unacceptable

Based on 15 client reviews, one employee had

median rating of 4; mode rating of 1

The employee was pleased that most clients had rated her as excellent. The supervisor said improvement was needed because at least half of the clients had rated the employee at the poor or unacceptable level. Comment on the different perspectives.

The supervisor has a valid concern because at least half the clients rated the employee below satisfactory.

Based on the provided information, the employee seems very inconsistent in her performance.

8. In this problem we explore the effect on mean, median, and mode of adding the same number to each data value (a – c) and the effect of multiplying each data value by the same number (d – e). Consider the data set: 2 2 3 6 10

a. Compute the mode, median, and mean.

mode: 2

median: 3

$\bar{x} = 4.6$

b. Add 5 to each of the data values. Compute the mode, median, and mean.

mode: 7

median: 8

$\bar{x} = 9.6$

c. Compare the results of part (a) and (b). In general, how do you think the mode, median, and mean are affected when the same constant is added to each data value in a set?

Corresponding values are 5 more than the original.

In general, adding/subtracting a constant to each data value will increase the \bar{x} , median, and mode by that constant.

d. Multiply each data value by 5. Compute the mode, median, and mean.

mode: 10

median: 15

$\bar{x} = 23$

e. Compare the results of part (a) and (d). In general, how do you think the mode, median, and mean are affected when each data value in a set is multiplied by the same constant?

Corresponding values are 5 times greater than the original.

In general, multiplying/dividing by a constant to each data value will increase the \bar{x} , median, mode by that constant

f. Suppose you have information about average heights of a random sample of airplane passengers. The mode is 70 inches, the median is 68 inches, and the mean is 71 inches. To convert the data into centimeters, multiply each data value by 2.54. What are the mode, median, and mean in centimeters?

mode: 177.8 cm

median: 172.72 cm

$\bar{x} = 180.34$ cm

9. The Grand Canyon and the Colorado River are beautiful, rugged, and sometimes dangerous. Thomas Myers is a physician at the park clinic in Grand Canyon Village. Dr. Myers has recorded (for a 5-year period) the number of visitor injuries at different landing points for commercial boat trips down the Colorado River in both the Upper and Lower Grand Canyon.

Upper Canyon: Number of Injuries per Landing Point Between North Canyon and Phantom Ranch

~~2~~ ~~2~~ ~~1~~ ~~1~~ ~~2~~ ~~2~~ ~~3~~ ~~3~~ ~~3~~ ~~4~~ ~~6~~ ~~9~~
 1 1 1 2 3 3 3 3 4 6 9

Lower Canyon: Number of Injuries per Landing Point Between Bright Angel and Lava Falls

~~0~~ ~~1~~ ~~1~~ ~~1~~ ~~1~~ ~~1~~ ~~2~~ ~~2~~ ~~3~~ ~~6~~ ~~7~~ ~~8~~ ~~13~~ ~~14~~
 0 0 1 1 1 1 2 2 3 6 7 8 13 14

- a. Compute the mean, median, and mode for injuries per landing point in the Upper Canyon.

$$\bar{x} = 3.27$$

median: 3

mode: 3

- b. Compute the mean, median, and mode for injuries per landing point in the Lower Canyon.

$$\bar{x} = 4.21$$

median: 2

mode: 1

- c. Compare the results of parts (a) and (b).

lower canyon \bar{x} is much greater

lower canyon median, mode are much lower

- d. The Lower Canyon stretch had some extreme data values. Compute a 5% trimmed mean for this region, and compare this result to the mean for the Upper Canyon computed in part (a).

$$5\% \times 14 = 0.7 = 1; \text{ cut } 0 \text{ and } 14 \text{ from the data}$$

$$\bar{x}_{5\%} = 3.75$$

$\bar{x}_{5\%}$ is closer to the Upper Canyon \bar{x}

10. Find the weighted average of a data set where

10 has a weight of 5; 20 has a weight of 3; 30 has a weight of 2

$$\frac{10(5) + 20(3) + 30(2)}{5 + 3 + 2} = \frac{170}{10} = 17$$

11. In your biology class, your final grade is based on several things: a lab score, scores on two major tests, and your score on the final exam. There are 100 points available for each score. However, the lab score is worth 25% of your total grade, each major test is worth 22.5%, and the final exam is worth 30%. Compute the weighted average for the following scores: 92 on the lab, 81 on the first major test, 93 on the second major test, and 85 on the final exam.

$$\frac{92(.25) + 81(.225) + 93(.225) + 85(.3)}{.25 + 2(.225) + .3} = 87.65$$

= 88%

12. Where does all the water go? According to the Environmental Protection Agency (EPA), in a typical wetland environment, 38% of the water is outflow, 47% is seepage, 7% evaporates, and 8% remains as water volume in the ecosystem. Chloride compounds as residuals from residential areas are a problem for wetlands. Suppose that in a particular wetland environment the following concentrations (mg/L) of chloride compounds were found: outflow, 64.1; seepage, 75.8; remaining due to evaporation, 23.9; in the water volume, 68.2.

- a. Compute the weighted average of chlorine compound concentration (mg/L) for this ecological system.

$$\frac{64.1(.38) + 75.8(.47) + 23.9(.07) + 68.2(.08)}{.38 + .47 + .07 + .08}$$

64.113 mg/L

- b. Suppose the EPA has established an average chlorine compound concentration target of no more than 58 mg/L. Comment on whether this wetlands system meets the target standard for chlorine compound concentration.

This wetlands system does not meet the target standards.