

BIOM 559 Biostatistics In-Class Exercises

July 20, 2020

Name: \_\_\_\_\_

Part I Multiple Choice Quiz

1. The sample mean is
  - a. usually considered as a random variable
  - b. always equal to mean of the population from which the sample was drawn
  - c. considered a parameter of the population from which the sample was drawn
  - d. None of the above answers is correct

Answer: \_\_a\_\_\_\_\_

2. Since the mode is the most frequently occurring data value, it
  - a. must have a value of at least two
  - b. can never be larger than mean
  - c. is always larger than median
  - d. is always larger than median and smaller than mean
  - e. None of the above answers is correct

Answer: \_\_\_\_e\_\_\_\_\_

3. The median may be larger than mean if
  - a. the distribution is skewed to the right
  - b. the distribution is skewed to the left
  - c. the score of skewness  $> 0$
  - d. the score of skewness  $< 0$
  - e. None of the above answers is correct

Answer: \_\_\_\_b\_\_\_\_d\_\_\_\_\_

4. Which of the following descriptive statistics are invariant of the measurement unit
  - a. Mean
  - b. Median
  - c. Variance
  - d. Standard Deviation
  - e. Coefficient of variance
  - f. None of the above answers is correct

Answer: \_\_\_\_e\_\_\_\_\_

5. Suppose events  $A$  and  $B$  are mutually exclusive and collectively exhaustive, then
  - a. The union of the two events,  $A \cup B$ , is a sure event
  - b. The union of the two events,  $A \cup B$ , is an impossible event
  - c. The intersection of the two events,  $A \cap B$ , is a sure event

- d. The intersection of the two events,  $A \cap B$ , is an impossible event
- e. None of the above answers is correct

Answer:   a     d  

6.  $P(A \cup B) = P(A) + P(B)$  holds if
- a.  $A$  and  $B$  are independent
  - b. One of  $A$  and  $B$  must occur
  - c.  $A$  and  $B$  cannot occur simultaneously
  - d.  $A \cup B$ , is a sure event
  - e.  $A \cap B = \emptyset$
  - f. None of the above answers is correct

Answer:       c             e      

7. Suppose  $P(A) > 0$  and  $P(B) > 0$ . Then  $A$  and  $B$  are independent if and only if
- a.  $A$  and  $B$  cannot occur at the same time
  - b.  $P(A|B) = P(A)$
  - c.  $P(B|A) = P(B)$
  - d.  $P(A \cup B) = P(A) + P(B)$
  - e.  $P(A \cap B) = P(A) \cdot P(B)$
  - f. None of the above answers is correct

Answer:       b             c             e      

8.  $P(A) = P(A \cap B) + P(A \cap C)$  if
- a.  $B$  and  $C$  are mutually exclusive
  - b.  $B$  and  $C$  are independent
  - c.  $B$  and  $C$  are collectively exhaustive
  - d.  $B$  and  $C$  are mutually exclusive and  $B \cup C$  is a sure event
  - e. None of the above answers is correct

Answer:   d  

9. The prevalence of obesity in adults is 40% in an area, while the probability that an obese adult suffers hypertension is 70%. (1) What is the chance that a randomly selected adult from this area is obese and also has hypertension? (2) Suppose the prevalence of hypertension in the adults in the area is 35%. What is the chance that an adult with hypertension is also obese?
- a. (1) = 0.28, (2) = 0.8
  - b. (1) = 0.28, (2) = 0.098
  - c. (1) = 0.28, (2) = 0.35
  - d. (1) = 0.7, (2) = 0.245
  - e. None of the above answers is correct

Answer:   a

Part II Give a couple of examples for each of the following concepts

1. Random variable

Solution: (1) The number of visit to a clinic in one day; (2) The time from diagnosis to death of a subject randomly selected from the patients with ovarian cancer.

2. Nominal measurement scale

Solution: (1) Gender; (2) Race.

3. Ordinal measurement scale

Solution: (1) Stage of breast cancer, (2) frequency of occurrence labeled as very often, often, not often, and not at all.

4. Interval measurement scale

Solution: (1) temperature measured in Celsius; (2) elevation measured in feet

5. Ratio measurement

Solution: (1) weight of a patient (2) intake of calories

Part III Answer the following questions

1. Why would we say that nominal and ratio scales are the lowest and highest scales, respectively?

Solution: (You may answer this question differently.) We say that the nominal scale is the lowest measurement scale because compared to the other three measurement scales, it does not have an order. It does not make sense to perform any arithmetic operations on the measurements of this kind of measurement scale. We say that the ratio scale is the highest measurement scale because compared to the other three measurement scales, not only is it possible to order the measurements, but also you can perform all four arithmetic operations on the measurements.

2. The arithmetic mean is commonly used in biostatistics, but in what cases does it become undesirable as a measure of central tendency? What measure would be better used in such cases? Try to explain with one or two examples.

Solution: The mean is sensitive to extreme values. It becomes undesirable as a measure of central tendency when there are some extreme values (such as outliers), or the distribution of the data is substantially skewed with a long tail extends to one side. In this case, the median would be better used. For example, in a region where the distribution of wealth is much skewed, with half of the total net wealth belonging to the top 1%, the mean is not a good measure of average wealth. In this case, median wealth will be a better measure for the average wealth.