

Mercer University
MBA Program
Statistical Skills Examination (SSE)

On the paper provided, please answer each of the following questions.

Section I: Statistics and Data

1. In a short, lucid paragraph, explain how, by way of statistical inferencing, sample statistics and population parameters are related.
2. For each of the following sample plans, indicate why the target population and the sampled population are not the same:
 - a.) To determine the opinions and attitudes of customers who regularly shop at a particular mall, a surveyor stands outside of a large department store in the mall and randomly selects people to participate in the survey.
 - b.) A library wants to estimate the proportion of its books that have been damaged. The librarians decide to select one book per shelf by measuring 12 inches from the left edge of each shelf and selecting the book in that location.
 - c.) Political surveyors visit 200 residences during one afternoon and ask eligible voters present in the house at the time whom they intend to vote for.
3. After the graduation ceremonies at a university, six graduates were asked whether they were in favor of (identified by 1) or against (identified by 0) abortion. Some information about these graduates is shown below.

<u>Graduate</u>	<u>Sex</u>	<u>Age</u>	<u>Abortion Issue</u>	<u>Class Rank</u>
Nancy	F	22	1	3
Michael	M	21	1	2
Tammy	F	33	0	1
John	M	38	0	20
Marlene	F	25	1	4
David	M	19	0	8

- a. How many elements are in the data set?
- b. How many variables are in the data set?
- c. How many observations are in the data set?
- d. Name the scale of measurement for each of the above (Sex, Age, Abortion Issue, Class rank)

- e. Which of the above (Sex, Age, Abortion Issue, Class rank) are qualitative and which are quantitative variables?
 - f. Are arithmetic operations appropriate for the variable "abortion issue"?
4. Which of the following variables use the interval scale of measurement?
- a. name of stock exchange
 - b. time
 - c. SAT scores
 - d. Social Security number
5. Which of the following variables use the ratio scale of measurement?
- a. name of stock exchange
 - b. time
 - c. SAT scores
 - d. Social Security number

Section II: Numerical Descriptive Techniques

1. The following data provide information on the height (in inches) and salary (in thousands of dollars) for each of nine employees of a hypothetical firm.

height	salary
64	45
63	40
68	39
65	38
67	42
66	45
65	43
64	35
66	33

- a. What are the mean height and salary, respectively, of these nine employees?
- b. What are the median height and salary, respectively, of these nine employees?
- c. What is the standard deviation of height? What is the standard deviation of salary?
- d. Compare the coefficient of variation for height to the coefficient of variation of salary? Are the results of this comparison sensible?
- e. Develop a "scattergram" of height versus salary. Do they at least appear to be linearly related?

2. Since the population size is always larger than the sample size, then the sample statistic
 - a. can never be larger than the population parameter
 - b. can never be equal to the population parameter
 - c. can never be zero
 - d. None of the other answers are correct.

3. μ is an example of a
 - a. population parameter
 - b. sample statistic
 - c. population variance
 - d. mode

4. Since the population is always larger than the sample, the value of the sample mean
 - a. is always smaller than the true value of the population mean
 - b. is always larger than the true value of the population mean
 - c. is always equal to the true value of the population mean
 - d. could be larger, equal to, or smaller than the true value of the population mean

5. If a data set has an even number of observations, the median
 - a. can not be determined
 - b. is the average value of the two middle items
 - c. must be equal to the mean
 - d. is the average value of the two middle items when all items are arranged in ascending order

6. Since the median is the middle value of a data set, it must always be
 - a. smaller than the mode
 - b. larger than the mode
 - c. smaller than the mean
 - d. None of the other answers are correct.

7. The 75th percentile is also the
 - a. first quartile
 - b. second quartile
 - c. third quartile
 - d. fourth quartile

8. The measure of location that is the most likely to be influenced by extreme values in the data set is the
 - a. range
 - b. median
 - c. mode
 - d. mean

ANSWER: d

Exhibit 3-1

A researcher has collected the following sample data.

5	12	6	8	5
6	7	5	12	4

9. Refer to Exhibit 3-1. The 75th percentile is
 - a. 5
 - b. 6
 - c. 7
 - d. 8
10. Refer to Exhibit 3-1. The range is
 - a. 5
 - b. 6
 - c. 7
 - d. 8
11. During a cold winter, the temperature stayed below zero for ten days (ranging from -20 to -5). The variance of the temperatures of the ten day period
 - a. is negative since all the numbers are negative
 - b. must be at least zero
 - c. can not be computed since all the numbers are negative
 - d. can be either negative or positive

Section III: Elements of Probability

1. A sample point refers to a(n)
 - a. numerical measure of the likelihood of the occurrence of an event
 - b. set of all possible experimental outcomes
 - c. individual outcome of an experiment
 - d. All of these answers are correct.
2. The sample space refers to
 - a. any particular experimental outcome
 - b. the sample size minus one
 - c. the set of all possible experimental outcomes
 - d. both any particular experimental outcome and the set of all possible experimental outcomes are correct

3. A small town has 5,600 residents. The residents in the town were asked whether or not they favored building a new bridge across the river. You are given the following information on the residents' responses, broken down by gender.

	<u>Men</u>	<u>Women</u>	<u>Total</u>
In Favor	1,400	280	1,680
Opposed	<u>840</u>	<u>3,080</u>	<u>3,920</u>
Total	2,240	3,360	5,600

Let: M be the event a resident is a man
W be the event a resident is a woman
F be the event a resident is in favor
P be the event a resident is opposed

- a. Find the joint probability table.
 - b. Find the marginal probabilities.
 - c. What is the probability that a randomly selected resident is a man and is in favor of building the bridge?
 - d. What is the probability that a randomly selected resident is a man?
 - e. What is the probability that a randomly selected resident is in favor of building the bridge?
 - f. What is the probability that a randomly selected resident is a man or in favor of building the bridge or both?
4. Assume two events A and B are mutually exclusive and, furthermore, $P(A) = 0.2$ and $P(B) = 0.4$.
- a. Find $P(A \cap B)$.
 - b. Find $P(A \cup B)$.
 - b. Find $P(A | B)$.
5. Make use of a probability tree to show all possible outcomes of 3 successive tosses of a fair quarter. What will be the probability of getting 3 "heads" outcomes? What will be the probability of getting 1 "tails" outcome?
6. Bad gums may mean a bad heart. Researchers discovered that 85 percent of people who have suffered a heart attack had periodontal disease, an inflammation of the gums. Only 29 percent of healthy people have this disease. Suppose that in a certain community heart attacks are quite rare, occurring with only 10 percent probability. If someone has periodontal disease, what is the probability that he or she will have a heart attack? (Hint: Apply Bayes' Rule.)

Section IV: Random Variables and Discrete Probability Distributions

1. A numerical description of the outcome of an experiment is called a
 - a. descriptive statistic
 - b. probability function
 - c. variance
 - d. random variable

2. Which of the following is not a required condition for a discrete probability function?
 - a. $f(x) \geq 0$ for all values of x
 - b. $\Sigma f(x) = 1$
 - c. $\Sigma f(x) = 0$
 - d. All of these answers are correct.

3. X is a random variable with the probability function:
$$f(x) = x/6 \text{ for } x = 1, 2 \text{ or } 3$$

The expected value of x is

 - a. 0.333
 - b. 0.500
 - c. 2.000
 - d. 2.333

Exhibit 5-2

The probability distribution for the daily sales at Michael's Co. is given below.

<u>Daily Sales</u> <u>(In \$1,000s)</u>	<u>Probability</u>
40	0.1
50	0.4
60	0.3
70	0.2

4. Refer to Exhibit 5-2. The expected daily sales are
 - a. \$55,000
 - b. \$56,000
 - c. \$50,000
 - d. \$70,000

5. Refer to Exhibit 5-2. The probability of having sales of at least \$50,000 is
 - a. 0.5
 - b. 0.10
 - c. 0.30
 - d. 0.90

6. The number of customers that enter a store during one day is an example of
- a continuous random variable
 - a discrete random variable
 - either a continuous or a discrete random variable, depending on the number of the customers
 - either a continuous or a discrete random variable, depending on the gender of the customers
7. An experiment consists of measuring the speed of automobiles on a highway by the use of radar equipment. The random variable in this experiment is speed, measured in miles per hour. This random variable is a
- discrete random variable
 - continuous random variable
 - complex random variable
 - None of these alternatives is correct.

7. The random variable x has the following probability distribution:

x	$f(x)$
0	.25
1	.20
2	.15
3	.30
4	.10

- Is this probability distribution valid? Explain and list the requirements for a valid probability distribution.
- Calculate the expected value of x .
- Calculate the variance of x .
- Calculate the standard deviation of x .

Section V: Continuous Probability Distributions

- A continuous random variable may assume
 - all values in an interval or collection of intervals
 - only integer values in an interval or collection of intervals
 - only fractional values in an interval or collection of intervals
 - all the positive integer values in an interval
- For a continuous random variable x , the probability density function $f(x)$ represents
 - the probability at a given value of x
 - the area under the curve at x
 - Both the probability at a given value of x and the area under the curve at x are correct answers.
 - the height of the function at x

3. For any continuous random variable, the probability that the random variable takes on exactly a specific value is
 - a. 1.00
 - b. 0.50
 - c. any value between 0 to 1
 - d. zero

4. The random variable x is known to be uniformly distributed between 70 and 90. The probability of x having a value between 80 to 95 is
 - a. 0.75
 - b. 0.5
 - c. 0.05
 - d. 1

5. Which of the following is **not** a characteristic of the normal probability distribution?
 - a. The mean, median, and the mode are equal
 - b. The mean of the distribution can be negative, zero, or positive
 - c. The distribution is symmetrical
 - d. The standard deviation must be 1

6. Larger values of the standard deviation result in a normal curve that is
 - a. shifted to the right
 - b. shifted to the left
 - c. narrower and more peaked
 - d. wider and flatter

7. A standard normal distribution is a normal distribution with
 - a. a mean of 1 and a standard deviation of 0
 - b. a mean of 0 and a standard deviation of 1
 - c. any mean and a standard deviation of 1
 - d. any mean and any standard deviation

Exhibit 6-4

The starting salaries of individuals with an MBA degree are normally distributed with a mean of \$40,000 and a standard deviation of \$5,000. (Fear not MBA students! These are old data!)

8. Refer to Exhibit 6-4. What is the random variable in this experiment?
 - a. the starting salaries
 - b. the normal distribution
 - c. \$40,000
 - d. \$5,000

9. Refer to Exhibit 6-4. What is the probability that a randomly selected individual with an MBA degree will get a starting salary of at least \$30,000?
 - a. 0.4772
 - b. 0.9772
 - c. 0.0228
 - d. 0.5000

10. Refer to Exhibit 6-4. What is the probability that a randomly selected individual with an MBA degree will get a starting salary of at least \$47,500?
 - a. 0.4332
 - b. 0.9332
 - c. 0.0668
 - d. 0.5000

11. Refer to Exhibit 6-4. What percentage of MBA's will have starting salaries of \$34,000 to \$46,000?
 - a. 38.49%
 - b. 38.59%
 - c. 50%
 - d. 76.98%