

Stat 155 – Probability and Statistics for Science and Engineering
First Mid-Term Examination
April 29, 2019

Multiple Choice Questions (5 points each). Please choose the *SINGLE* best answer and indicate your choice on the scantron.

1. 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. an event
2. In a data set, a characteristic of interest (defined for each subject or unit) is called a
 - a. sample
 - b. data set
 - ☒ c. variable
 - d. none of the above
3. If two groups of numbers have the same sample mean, then
 - a. their sample variances must also be equal.
 - b. their medians must also be equal.
 - c. their ranges must also be equal.
 - ☒ d. none of the above statements is correct.
4. Which of the following statements is true about sample variance and sample standard deviation?
 - ☒ a. Sample standard deviation has the same unit as the original variable, while sample variance does not.
 - b. Sample standard deviation can take negative values.
 - c. Sample variance can take negative values.
 - d. None of the above statements is true.
5. For the data set $\{2, 4, 6\}$, the sample standard deviation is
 - a. 3
 - b. 1.41
 - ☒ c. 2
 - d. 1.63

Exhibit I

A researcher has collected the following sample data: 2, 1, 9, 4.

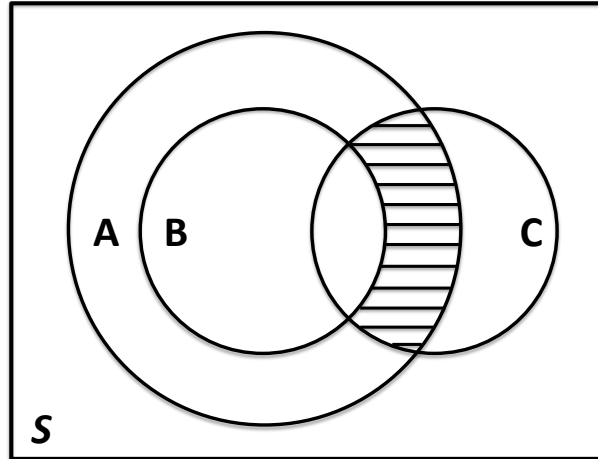
6. Refer to Exhibit I. The mean is
- a. 2
 - b. 3
 - c. 4**
 - d. none of above
7. Refer to Exhibit I. The median is
- a. 2
 - b. 3**
 - c. 4
 - d. none of above
8. Refer to Exhibit I. The range is
- a. 8**
 - b. 9
 - c. 10
 - d. none of above

Exhibit II

Michael's Compute-All, a national computer retailer, has kept a record of daily sales of laptop computers over a period of 200 days. Their sales record is summarized below:

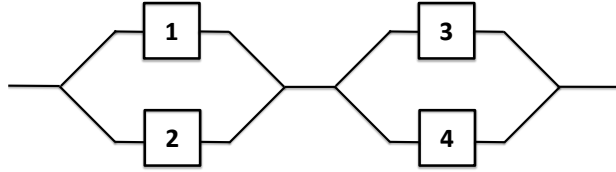
Number of Laptops Sold	Number of Days
0-19	20
20-39	40
40-59	60
60-79	40
80-99	40

9. Refer to Exhibit II. The **number of days** on which the company sold 39 or fewer laptops is
- a. 40
 - b. 60**
 - c. 80
 - d. 100
10. Refer to Exhibit II. The **proportion of days** on which the company sold between 40 and 59 laptops is
- a. 0.2
 - b. 0.3**
 - c. 0.4
 - d. 0.6



11. The above figure is a Venn diagram showing three events (A , B and C) in the sample space S . Event B is a subset of event A , while event C overlaps with both A and B . Which of the following expressions correctly describes the event represented by the shaded area in the Venn diagram? (' denotes complement.)
- $A \cap B \cap C$
 - $A' \cap B \cap C$
 - $A \cap B' \cap C$
 - $A \cap B \cap C'$
12. Continuing the last question, if we know that $P(A) = 0.5$, $P(B) = P(C) = 0.15$, $P(A \cap C) = 0.10$ and $P(B \cap C) = 0.05$, what is the probability of the shaded area in the Venn diagram?
- 0.05
 - 0.10
 - 0.15
 - 0.20
13. Consider events A and B such that $P(A) \neq 0$ and $P(B) \neq 0$. Which of the following statements is **false**?
- If A is any event, then $0 \leq P(A) \leq 1$.
 - $P(A | B) = \frac{P(A \cap B)}{P(B)}$.
 - If A and B are independent, then $P(A | B) = P(A)$ and $P(A \cap B) = P(A)P(B)$.
 - If A and B are mutually exclusive, then A and B are independent.
14. Consider events A , B and C such that $P(A) = 0.8$, $P(B) = 0.3$, $P(C) = 0.7$, and $P(B \cap C) = 0.1$. Which of the following statements is **true**?
- A and B can be mutually exclusive.
 - $P(A') > P(B')$ (' denotes complement).
 - $P(B \cup C) = 0.9$.
 - None of the above statements is true.

15. The commuting route used by a student driving to the campus contains two intersections with traffic signals. The probability that the student must stop at the first signal is 0.6, the probability that the student must stop at the second signal is 0.4, and the probability that the student must stop at one or both of the two signals is 0.8. What is the probability that the student must stop at both signals?
- a. 0.2
 - b. 0.4
 - c. 0.6
 - d. none of the above
16. Continuing the last question, what is the probability that the student must stop at **exactly one** signal?
- a. 0.2
 - b. 0.4
 - c. 0.6
 - d. none of the above
17. There are 2 black balls and 2 white balls in a box. Suppose you close your eyes and randomly draw 2 balls from the box. What is the probability that you get exactly one black and one white balls?
- a. $1/3$
 - b. $2/3$
 - c. $1/2$
 - d. none of the above
18. Apple sells two models of iPhone 7: the 4.7-inch model and the 5.5-inch Plus model. Since last September, 75% of the sold iPhone 7's were the 4.7-inch model and 25% were the 5.5-inch Plus model. Of those customers who bought the 4.7-inch iPhone 7, 45% purchased an AppleCare extended warranty; whereas 65% of all 5.5-inch iPhone 7 Plus buyers purchased an AppleCare extended warranty. What is the probability that the next iPhone 7 buyer will purchase an AppleCare extended warranty? (Hint: use the law of total probability.)
- a. 0.45
 - b. 0.50
 - c. 0.55
 - d. 0.60
19. Continuing the last question, if the next buyer is known to have purchased an AppleCare extended warranty, how likely is it that he or she has bought the 4.7-inch iPhone 7 model? (Hint: use Bayes' Theorem.)
- a. 0.325
 - b. 0.500
 - c. 0.675
 - d. 0.750



20. The above figure shows a system that consists of four components. Because components 1 and 2 are connected in parallel, the subsystem (1-2) works if at least one of the two components works. Similarly, components 3 and 4 are connected in parallel in the subsystem (3-4), whose functioning thus requires that one or both of components 3 and 4 work. The two subsystems, (1-2) and (3-4), are connected in series; therefore, both subsystems must work for the whole system to work. Suppose the components work independently of one another, and each component works with probability 0.8. What is the probability that the whole system works?

- a. 0.4096
- b. 0.9216**
- c. 0.9600
- d. 0.9984