UE19CS203 – STATISTICS FOR DATA SCIENCE

Unit-1 - Introduction to Data Science

QUESTION BANK

Probability

Exercises for Section 2.1 **[Text Book Exercise– Pg. No. [60 – 62]]**

1. The probability that a bearing fails during the first month of use is 0.12. What is the probability that it does not fail during the first month?

2. A die (six faces) has the number 1 painted on three of its faces, the number 2 painted on two of its faces, and the number 3 painted on one face. Assume that each face is equally likely to come up.
a. Find a sample space for this experiment.
b. Find P(odd number).
c. If the die were loaded so that the face with the 3 on it were twice as likely to come up as each of the other five faces, would this change the sample space? Explain.
d. If the die were loaded so that the face with the 3 on it were twice as likely to come up as each of the other five faces, would this change the value of P(odd number)? Explain.

3. A section of an exam contains four True-False questions.
A completed exam paper is selected at random,and the four answers are recorded.
a. List all 16 outcomes in the sample space.
b. Assuming the outcomes to be equally likely, find the probability that all the answers are the same.
c. Assuming the outcomes to be equally likely, find the probability that exactly one of the four answers is "True."
d. Assuming the outcomes to be equally likely, find the probability that at most one of the four answers is "True."

4. Three times each day, a quality engineer samples a component from a recently manufactured batch and tests it. Each part is classified as conforming (suitable for its intended use), downgraded (unsuitable for the intended purpose but usable for another purpose), or scrap (not usable). An experiment consists of recording the categories of the three parts tested in a particular
day.
a. List the 27 outcomes in the sample space.
b. Let A be the event that all the parts fall into the same category. List the outcomes in A.

c. Let B be the event that there is one part in each category. List the outcomes in B.
d. Let C be the event that at least two parts are conforming.List the outcomes in C.
e. List the outcomes in $A \cap C$.
f. List the outcomes in $A \cup B$.
g. List the outcomes in $A \cap Cc$.
h. List the outcomes in $Ac \cap C$.
i. Are events A and C mutually exclusive? Explain.
j. Are events B and C mutually exclusive? Explain.

5. Four candidates are to be interviewed for a job. Two of them, numbered 1 and 2, are qualified, and the other two, numbered 3 and 4, are not. The candidates are interviewed at random, and the first qualified candidate interviewed will be hired. The outcomes are the sequences of candidates that are interviewed. So one outcome is 2, and another is 431.
a. List all the possible outcomes.
b. Let A be the event that only one candidate is interviewed.List the outcomes in A.
c. Let B be the event that three candidates are interviewed.List the outcomes in B.
d. Let C be the event that candidate 3 is interviewed.List the outcomes in C.
e. Let D be the event that candidate 2 is not interviewed.List the outcomes in D.
f. Let E be the event that candidate 4 is interviewed.Are A and E mutually exclusive? How about B and E, C and E, D and E?

6. Refer to Exercise 5. Two candidates are randomly selected.
a. List the equally likely outcomes.
b. What is the probability that both are qualified?
c. What is the probability that exactly one is qualified?

7. In a survey of households with television sets, the proportion of television sets in various types of rooms was

Proportion	Room of TV Sets
Bedroom	0.37
Living Room	0.26
Den	0.22
Basement	0.12
Kitchen	0.02
Bathroom	0.01

a. What is the probability that a TV set is located in a living room or den?
b. What is the probability that a TV set is not located in a bedroom?

8. An automobile insurance company divides customers into three categories, good risks, medium risks, and poor risks. Assume that 70% of the customers are good risks, 20% are medium risks, and 10% are poor risks.As part of an audit, one customer is chosen at random.
a. What is the probability that the customer is a good risk?
b. What is the probability that the customer is not a poor risk?

9. Among the cast aluminum parts manufactured on a certain day, 80% were flawless, 15% had only minor flaws, and 5% had major flaws. Find the probability that a randomly chosen part
a. has a flaw (major or minor).
b. has no major flaw.

10. The article "High Cumulative Risk of Lung Cancer Death among Smokers and Nonsmokers" (P. Brennan,et al. *American Journal of Epidemiology*, 2006:1233–1241) states that the probability is 0.24 that a man who is a heavy smoker will contract lung cancer. True or false:
a. In a sample of 100 men who are heavy smokers, exactly 24 of them will contract lung cancer.
b. In a sample of 100 men who are heavy smokers,the number who will contract lung cancer is likely to be close to 24, but not exactly equal to 24.
c. As more and more heavy-smoking men are sampled,the proportion who contract lung cancer will approach 0.24.

11. Let *V* be the event that a computer contains a virus,and let *W* be the event that a computer contains a worm. Suppose $P(V) = 0.15$, $P(W) = 0.05$, and $P(V \cup W) = 0.17$.
a. Find the probability that the computer contains both a virus and a worm.
b. Find the probability that the computer contains neither a virus nor a worm.
c. Find the probability that the computer contains a virus but not a worm.

12. Let *S* be the event that a randomly selected college student has taken a statistics course, and let *C* be the event that the same student has taken a chemistry course. Suppose $P(S) = 0.4$, $P(C) = 0.3$, and $P(S \cap C) = 0.2$.
a. Find the probability that a student has taken statistics,chemistry, or both.
b. Find the probability that a student has taken neither statistics nor chemistry.
c. Find the probability that a student has taken statistics but not chemistry.

13. Six hundred paving stones were examined for cracks,and 15 were found to be cracked. The same 600 stones were then examined for discoloration, and 27 were found to be discolored. A total of 562 stones were neither cracked nor discolored. One of the 600 stones is selected at random.
a. Find the probability that it is cracked, discolored,or both.
b. Find the probability that it is both cracked and discolored.
c. Find the probability that it is cracked but not discolored.

14. All the fourth-graders in a certain elementary school took a standardized test. A total of 85% of the students were found to be proficient in reading,78%were found to be proficient in mathematics, and 65% were found to be proficient in both reading and mathematics. A student is chosen at random.
a. What is the probability that the student is proficient in mathematics but not in reading?
b. What is the probability that the student is proficient in reading but not in mathematics?
c. What is the probability that the student is proficient in neither reading nor mathematics?

15. Asystem contains two components,Aand B. The system will function so long as either A or B functions.The probability that A functions is 0.95, the probability that B functions is 0.90, and the probability that both function is 0.88. What is the probability that the system functions?

16. A system contains two components, A and B. The system will function only if both components function.The probability that A functions is 0.98, the probability that B functions is 0.95, and the probability that either A or B functions is 0.99. What is the probability that the system functions?

17. Human blood may contain either or both of two antigens,A and B. Blood that contains only the A antigen is called type A, blood that contains only the B antigen is called type B, blood that contains both antigens is called type AB, and blood that contains neither antigen is called type O. At a certain blood bank, 35% of the blood donors have type A blood, 10% have type B, and 5% have type AB.
a. What is the probability that a randomly chosen blood donor is type O?
b. A recipient with type A blood may safely receive blood from a donor whose blood does not contain the B antigen. What is the probability that a randomly chosen blood donor may donate to a recipient with type A blood?

18. True or false: If A and B are mutually exclusive,
a. $P(A \cup B) = 0$
b. $P(A \cap B) = 0$
c. $P(A \cup B) = P(A \cap B)$
d. $P(A \cup B) = P(A) + P(B)$

19. A flywheel is attached to a crankshaft by 12 bolts,numbered 1 through 12. Each bolt is checked to determine whether it is torqued correctly. Let A be the event that all the bolts are torqued correctly, let B be the event that the #3 bolt is not torqued correctly, let C be the event that exactly one bolt is not torqued correctly,and let D be the event that bolts #5 and #8 are torqued correctly. State whether each of the following pairs of events is mutually exclusive.
a. A and B
b. B and D
c. C and D
d. B and C