Roll No												

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF INFORMATION SCIENCE

MIDTERM EXAMINATION

Winter Semester: 2021-22
Course Code: MAT1008
Course Name: Probability and Inferential Statistics
Program & Sem: BSc Data Science & II Sem

Date: 10th/May/2022
Time: 01:30PM – 03:00PM
Max Marks: 50
Weightage: 25%

Instructions:

(i) Read all questions carefully and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and Non-programmable calculators are permitted.

Part A [Memory Recall Questions]

Answer all the questions. Each question carries ONE mark. (10Q x 1M = 10M)

1. The set of possible outcomes of a random experiment is called _____. (C.O.No.1) [Knowledge]

2. The value of probability of an event lies between _____. (C.O.No.1) [Knowledge]

3. Probability of a sure event is _____. (C.O.No.1) [Knowledge]

4. According to the addition rule for probability, $P(A \cup B)$ = _____. (C.O.No.1) [Knowledge]

5. According to the definition of conditional probability, $P(A \mid B)$ = _____. (C.O.No.1) [Knowledge]

6. If the events *A* and *B* are independent, then the conditional probability $P(B \mid A)$ = _____. (C.O.No.1) [Knowledge]

7. If the events *A* and *B* are independent, then $P(A \cap B)$ = _____. (C.O.No.1) [Knowledge]

8. A random variable is called a discrete random variable if its set of possible values is _____. (C.O.No.2) [Knowledge]

9. If *X* is a continuous random variable, then $P(a < X < b)$ = _____. (C.O.No.2) [Knowledge]

10. The mean (expected value) of a continuous random variable *X* is calculated using the formula $E(X)$ = _____. (C.O.No.2) [Knowledge]

Part B [Thought Provoking Questions]

Answer all the questions. Each question carries FIVE marks. (4Q x 5M = 20M)

11. What is the probability of getting a total of 7 or 11 when a pair of fair dice is rolled?
(C.O.No.1) [Comprehension]

12. For married couples living in a certain suburb, the probability that the husband will vote on a bond referendum is 0.21, the probability that the wife will vote on the referendum is 0.28, and the probability that both will vote is 0.15. What is the probability that (a) at least one member of a married couple will vote? (b) a wife will vote, given that her husband will vote?
(C.O.No.1) [Comprehension]

13. A continuous random variable *X* has the probability density function

$$f(x)=\begin{cases}\dfrac{x^2}{3}, & -1<x<2\\ 0, & \text{elsewhere.}\end{cases}$$

(a) Verify that $f(x)$ is a probability density function (b) Find $P(0<X\leq 1)$.
(C.O.No.2) [Comprehension]

14. Following is the probability distribution of a discrete random variable *X*

x	0	1	2	3	4
$f(x)$	0.41	0.37	0.16	0.05	0.01

Calculate mean, standard deviation and variance of *X*. (C.O.No.2) [Comprehension]

Part C [Problem Solving Questions]

Answer all the questions. Each question carries TEN marks. (2Q x 10M = 20M)

15. A consulting firm rents cars from three agencies such that 20% from agency X, 30% from agency Y and 50% from agency Z. If 90% of the cars from X, 80% of the cars from Y and 95% of the cars from Z are in good condition, (i) what is the probability that the firm will get a car in good condition? (ii) if a car is in good condition, what is the probability that it has come from agency Y? (C.O.No.1) [Comprehension]

16. A shipment of 20 similar laptop computers to a retail outlet contains 3 that are defective. If a school makes a random purchase of 2 of these computers, find the probability distribution and the cumulative distribution function for the number of defectives.
(C.O.No.2) [Comprehension]

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END TERM EXAMINATION

Winter Semester: 2021-22
Course Code: MAT 1008
Course Name: Probability and Inferential Statistics
Program & Sem: BSc Data Science & II Sem

Date: 28th June 2022
Time: 01:00 PM to 04:00 PM
Max Marks: 100
Weightage: 50%

Instructions:

(i) Read all questions carefully and answer accordingly.
(ii) Question paper consists of 3 parts.P
(iii) Scientific calculator and distribution tables are permitted.

Part A [Memory Recall Questions]

Answer all the questions. Each question carries FIVE marks. (6Qx5M=30M)

1. A bag contains 5 white balls and 7 black balls. Three balls are drawn at random. Find the probability that (a) all are white (b) one is white and two are black. (C.O.No.1) [Knowledge]
2. The probability that an American industry will locate in Shanghai, China, is 0.7, the probability that it will locate in Beijing, China is 0.4, and the probability that it will locate in either Shanghai or Beijing or both is 0.8. What is the probability that the industry will locate in both cities? (C.O.No.1) [Knowledge]
3. The probability that a regularly scheduled flight departs on time is P(D) = 0.83; the probability that it arrives on time is P(A) = 0.82; and the probability that it departs and arrives on time is P(D∩A) = 0.78. Find the probability that a plane (a) arrives on time given that it departed on time, and (b) departed on time given that it has arrived on time. (C.O.No.1) [Knowledge]
4. State any five properties of the standard normal probability distribution. (C.O.No.3) [Knowledge]
5. Distinguish between (a) population and sample (b) parameters and statistics. (C.O.No.4) [Knowledge]
6. Briefly explain the terms (a) critical region (b) level of significance. (C.O.No.4) [Knowledge]

Part B [Thought Provoking Questions]

Answer all the questions. Each question carries EIGHT marks. (5Qx8M=40M)

7. The probability that a married man watches a certain television show is 0.4 and the probability that a married woman watches the show is 0.5. The probability that a man watches the show, given that his wife does, is 0.7. Find the probability that (a) a married couple watches the show

(b) a wife watches the show, given that her husband does (c) at least one member of a married couple will watch the show. (C.O.No.1) [Comprehension]

8. A bin contains 3 different types of disposable flashlights. Suppose that 20% of the flashlights in the bin are of type 1, 30% are of type 2 and 50% are of type 3. The probability that type 1 flashlight will give over 100 hours of use is 0.7, while the corresponding probabilities for type 2 and type 3 flashlights being 0.4 and 0.3 respectively. (a) Find the probability that a randomly chosen flashlight will give more than 100 hours of use (b) Given the flashlight lasting over 100 hours, what is the probability that it is of type 2 flashlight? (C.O.No.1) [Comprehension]

9. Find the probability distribution and the cumulative distribution function for the "number of 3's obtained" when 2 dice are thrown at a time. (C.O.No.2 [Comprehension]

10. The probability that a patient recovers from a rare blood disease is 0.4. If 15 people are known to have contracted the disease, what is the probability that (a) at least 10 survive (b) from 3 to 8 survive and (c) exactly 5 survive? (C.O.No.3) [Comprehension]

11. (a) The probability that a student pilot passes the written test for a private pilot's license is 0.7. Find the probability that a given student will pass the test on the third try.

(b) The smiling times (in seconds) of an eight-week-old baby follows a continuous uniform distribution between zero and 23 seconds. What is the probability that a randomly chosen eight-week-old baby smiles between 2 and 18 seconds? (C.O.No.3) [Comprehension]

Part C [Problem Solving Questions]

Answer both the questions. Each question carries FIFTEEN marks. (2Qx15M=20M)

12. (a) The probability density function of a continuous random variable X is given by

$$f(x)=\begin{cases} k\left(1-x^2\right) & \text{for } 0\le x\le 1 \\ 0, & \text{otherwise} \end{cases}$$

Find (i) the value of k (ii) $P\left(0.1\le X\le 0.2\right)$ (iii) $P\left(X\ge 0.5\right)$.

(b) Following is the probability distribution of a discrete random variable X :

X	0	1	2	3
$f(x)$	0.51	0.38	0.10	0.01

Calculate mean, variance and standard deviation of X. (C.O.No.2) [Comprehension]

13. (a) An automobile manufacturer is concerned about a fault in the braking mechanism of a particular model. The fault can, on rare occasions, cause a catastrophe at high speed. The distribution of the number of cars per year that will experience the catastrophe is a Poisson random variable with mean $\lambda=5$. What is the probability that (i) at most 3 cars per year will experience a catastrophe? (b) more than 1 car per year will experience a catastrophe?

(b) In a test on 2000 electric bulbs, it was found that the life of a particular make, was normally distributed with an average life of 2040 hours and a standard deviation of 60 hours. Estimate the number of bulbs likely to burn for (i) more than 2150 hours (ii) less than 1950 hours (iii) more than 1920 hours and less than 2160 hours. (C.O.No.3) [Comprehension]