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[This question paper contains 8 printed pages]

Your Roll No. :

Sl. No. of Q. Paper : **7613** **HC**

Unique Paper Code : 32375201

Name of the Course : **Generic Elective :**
Statistics

Name of the Paper : Introductory
Probability

Semester : II

Time : 3 Hours **Maximum Marks : 75**

Instructions for Candidates :.

- (a) Write your Roll No. on the top immediately on receipt of this question paper.
- (b) **Section A** is compulsory.
- (c) Attempt any **five** questions, selecting at least **two** questions from each of the **Sections B** and **C**.
- (d) Use of simple Calculator is allowed.

P.T.O.

Section - A

1. Answer the following :

(i) Let $f(x) = c\left(\frac{1}{4}\right)^x$ for $x = 1, 2, 3, \dots$ then the value of c for which $f(x)$ can serve as a probability mass function is 1

(ii) Let A and B be two independent events with $P(A) = 0.70$ and $P(B) = 0.35$. Then the value of $P(\bar{A} | \bar{B}) = \dots\dots\dots$ 1

(iii) If $X \sim N(4, 9)$ and $Y \sim N(2, 16)$ and X and Y are independent, then the distribution of $Z = 3X - 4Y$ is 1

(iv) If X follows exponential distribution with parameter 3, then $\text{Var}(X)$ is 1

(v) State Lindeberg - Levy Central limit theorem. 1

(vi) If $\frac{1+3p}{3}, \frac{1-p}{4}$ and $\frac{1-2p}{2}$ are probabilities of three mutually exclusive and exhaustive events then the value of p is 2

2

(vii) If $M_{X(t)} = (0.6 + 0.4e^t)^8$ then $P(X \leq 2) = \dots\dots\dots$

2

(viii) If $E(X) = 4$, $E(Y) = 12$ and $\text{COV}(X, Y) = 10$ then the value of $E[(X + 1)(Y + 2)]$ is 2

(ix) If $X \sim P(4)$ and $Y = X - 4$, then $M_{Y(t)} = \dots\dots\dots$ 2

(x) Name a discrete distribution and a continuous distribution for which variance $>$ mean. 2

Section - B

2. (a) The probabilities of X , Y and Z becoming managers are $4/9$, $2/9$ and $1/3$ respectively. The probabilities that the Bonus scheme will be introduced if X , Y and Z becomes managers are $3/10$, $1/2$ and $4/5$ respectively : 7.5

(i) What is the probability that Bonus scheme will not be introduced ?

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P.T.O.

(ii) If the Bonus scheme has been introduced, what is the probability that the manager appointed was X ?

(b) For married couples living in a certain suburb, the probability that the husband will vote in a school board election is 0.21, the probability that the wife will vote in the election is 0.28, the probability that they will both vote is 0.15 : 7.5

(i) What is the probability that at least one of them will vote ?

(ii) What is the probability that none of them will vote ?

3. (a) Let X be a continuous random variable with p.d.f. given by : 7.5

$$f(x) = \begin{cases} kx & ; 0 \leq x < 1 \\ -kx + 3k & ; 1 \leq x < 2 \\ k & ; 2 \leq x < 3 \\ 0 & ; \text{elsewhere} \end{cases}$$

(i) Find the value of the constant k.

(ii) Determine F(x), the c.d.f.

(iii) Compute $P[1.5 \leq X \leq 2.0]$.

(b) If X has the distribution function : 7.5

$$F(x) = \begin{cases} 0 & \text{for } x < -2 \\ 1/4 & \text{for } -2 \leq x < 2 \\ 1/2 & \text{for } 2 \leq x < 4 \\ 3/4 & \text{for } 4 \leq x < 6 \\ 1 & \text{for } x \geq 6 \end{cases}$$

(i) Obtain the p.m.f. of X.

(ii) Obtain mean and variance of X.

(iii) Compute $P[-2.5 < X < 4.5]$ and $P[X \geq 5]$

4. (a) A random variable X has p.m.f.

$$p(x) = \left(\frac{1}{2}\right)^x ; x = 1, 2, 3, \dots \text{Find the m.g.f.}$$

of X and hence obtain the mean. 7.5

- (b) IF the probability density function of X is given by :

$$f(x) = \begin{cases} \frac{x}{2} & \text{for } 0 < x \leq 1 \\ \frac{1}{2} & \text{for } 1 < x \leq 2 \\ \frac{3-x}{2} & \text{for } 2 < x < 3 \\ 0 & \text{elsewhere} \end{cases}$$

- (i) Obtain $E(X^2 - 5X + 3)$.

- (ii) Obtain $V\left(\frac{4}{9}X - \frac{9}{10}\right)$. 7.5

Section - C

5. (a) State Chebyshev's inequality and prove it when X is a continuous random variable.
 (b) Use Chebyshev's inequality to determine how many times a fair coin must be tossed in order that the probability will be at least 0.90 that the ratio of the observed number of heads to the number of tosses will lie between 0.4 and 0.6. 7.5

6. (a) Find the mean and variance of the Binomial distribution. 7.5
 (b) A car hire firm has two cars, which it hires out day by day. The number of demands for a car on each day is distributed as a Poisson variate with mean 1.5. Calculate the proportion of days on which (i) neither car is used, and (ii) the proportion of days on which some demand is refused. (Use value of $e^{1.5} = 4.48$). 7.5
7. (a) Prove that a linear combination of independent normal variates is also a normal variate. 7.5
 (b) The random variables X_i , $i = 1, 2, 3, \dots$ are independent and all of them have the same distribution defined by : 7.5

$$f(x) = \frac{1}{\sqrt{18\pi}} \exp\left\{-\frac{(x-1)^2}{18}\right\}; -\infty < x < \infty$$

Find the distribution of (i) $\frac{1}{5} \sum_{i=1}^5 X_i$

(ii) $3X_1 - X_2 + 2X_3$

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8. (a) If the probability is 0.40 that a child exposed to a certain contagious disease will catch it, what is the probability that the tenth child exposed to the disease will be the third to catch it ? Also name the distribution used.
- (b) Define Gamma distribution and obtain its Moment Generating Function.
- (c) If $X \sim B(6, p)$ and $9P(X = 4) = P(X = 2)$ find the value of p . (5,5,5)

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Your Roll No.....

Sr. No. of Question Paper : 6757

HC

Unique Paper Code : 72182801

Name of the Paper : Environmental Science

Name of the Course : Ability Enhancement Compulsory
Course (AECC-1)

Semester : II

Duration : 3 Hours

Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **five** questions.
3. **All** questions carry equal marks.
4. Answers may be written either in English or Hindi, but the same medium should be used throughout the paper.

छात्रों के लिए निर्देश

1. इस प्रश्न-पत्र के मिलते ही ऊपर दिए गए निर्धारित स्थान पर अपना अनुक्रमांक लिखिए।
2. किन्हीं पाँच प्रश्नों के उत्तर दीजिए।
3. सभी प्रश्नों के अंक समान हैं।
4. इस प्रश्न-पत्र का उत्तर अंग्रेजी या हिंदी किसी एक भाषा में दीजिए, लेकिन सभी उत्तरों का माध्यम एक ही होना चाहिए।

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