SL No of QP :3565

Unique paper code: 6202451203

Name of the Paper: Mathematics for Computing – II

Name of the course: B.Voc Software Development

Semester: II

Duration: 3 Hours

Maximum marks: 90

Instructions for candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any six questions.
3. Part of the questions to be attempted together.

Q1. (i) State and prove Chebyshev's inequality. (7)

(ii) Two digits are selected at random from the digits 1 through 9. If the sum is odd, find the probability that both digits are odd. (4)

(iii) What is the difference between pairwise and mutually independent events. Explain with help of an example. (4)

Q2. (i) Define and prove Bayes Theorem. (5)

(ii) An urn contains α Blue and β Green balls. A second urn contains δ Blue and γ Green balls. One ball is transferred from first urn to the second and then one ball is drawn. Find the probability that it's a Blue ball. (5)

(iii) The probability of employees $M_1, M_2, and\ M_3$ becoming Senior Manager is $(4/9)$, $(2/9)$, $(1/3)$ respectively. The probabilities that bonus scheme will be introduced if $M_1, M_2, and\ M_3$ becomes senior manager are $(3/10)$, $(2/4)$, $(4/5)$ respectively. If the bonus is introduced what is probability that the senior manager appointed was M_2.

(5)

Q3. (i) Calculate $E[X]$ and $E[X^2]) - \{E[X]\}^2$ for a Poisson distribution with parameter λ.
(8)

(ii) A box contains three different types of torches. The probability that type-1 gives hundred hours of usage is 0.70, while for type-2 and type-3 it is 0.40 and 0.30 respectively. If 20% of the torches in the box are of type-1, 30% are of type-2, and 50% are of typre-3, then find the following:

1. Probability that randomly chosen torch gives more than 100 hours of usage.
2. If the torch lasts over 100 hours, what is the conditional probability that it was of type-2.

(7)

Q4. (i) Determine the mean and variance of exponential distribution with parameter λ (7)

(ii) Suppose that the chance of rain tomorrow depends on previous weather conditions only through whether or not it is raining today and not on past weather conditions. If it rains today, then it will rain tomorrow with probability $A = 0.70$; and if it does not rain today, then it will rain tomorrow with probability $B = 0.40$. The weather is considered to be a two state Markov chain, calculate the probability that it will rain four days from today given that it is raining today.

(8)

Q5. (i) Illustrate the m step transition probabilities of a Markov chain using Chapman-Kolmogorov equation. (7)

(ii) If X is uniformly distributed with mean unity and variance 4/3. Determine $P(X < 0)$.(8)

Q6. (i) The joint distribution of X and Y is given as follows:

$$p(x,y) = \frac{x+y}{21} \;;x = 1,2,3 \; and \; y = 1,2$$

Then find the marginal distribution of random variables X and Y. Also, find the conditional distribution of Y given $X = 3$. (7)

(ii) If X and Y are two independent random variables and $Z = X + Y$ is the sum of these random variables, then determine probability density function of $[Z]$. (8)

Q7. (i) The joint density function of random variable X and Y is given as follows:

$$f(x,y) = \begin{cases} kxy & ; \quad 0 < x < 1, \; 0 < y < 1, \; x + y \leq 1 \\ 0 & ; elsewhere \end{cases}$$

Find the following:

(i) Value of k

(ii) Marginal density function of X and Y

(iii) determine whether X and Y are independent

(iv) $P(X + Y \leq 1)$ (7)

(ii) (i) What is the difference between covariance and correlation? (3)

(ii) Prove the following:

(i) $Cov(X, \alpha) = 0.$; where X is a random variable and α is constant

(ii) $Cov(X + Y, Z) = Cov(X, Z) + Cov(Y, Z)$; where $X, Y, and \; Z$ are random variables (5)

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