| Reg. No. | | | | | | | | | | | | |
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| Question Paper Code | 11997 |
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# M.E. / M.Tech. - DEGREE EXAMINATIONS, APRIL/MAY 2023

First Semester

## Computer Science and Engineering and Networking

## 20PCSMA104 – APPLIED PROBABILITY AND STATISTICS

(Regulations 2020)

Duration: 3 Hours  Max. Marks: 100

### PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

*Marks, K-Level,CO*

1. A random variable X has the following probability distribution  2,K2,CO1

| x | -2 | -1 | 0 | 1 | 2 | 3 |
|---|---|---|---|---|---|---|
| P(x) | 0.1 | K | 0.2 | 2k | 0.3 | 3k |

Find the value of 'k' and mean value of X.

2. State the memoryless property of geometric distribution.  2,K1,CO1
3. Find the marginal density functions of $X \, and \, Y$ if $f(x,y)=\frac{2}{5}(2x+5y), 0\le x\le 1, 0\le y\le 1$ .  2,K2,CO2
4. Write the properties of coefficient of correlation.  2,K2,CO2
5. Can $y = 5 + 2.8x$ and $x = 3 - 0.5y$ be the regression lines of Y on X and X on Y respectively. Give suitable arguments.  2,K2,CO3
6. Give the normal equations to fit the parabola $y = a + bx + cx^2$.  2,K2,CO3
7. Define Type I and Type II errors.  2,K1,CO4
8. Give the main use chi-square test.  2,K1,CO4
9. If $\sum = \begin{pmatrix} 4 & 1 & 2 \\ 1 & 9 & -3 \\ 2 & -3 & 25 \end{pmatrix}$ Find the standard deviation matrix $V^{1/2}$.  2,K2,CO5
10. Define multivariate analysis.  2,K1,CO5

### PART - B (5 × 16 = 80 Marks)

Answer ALL Questions

11. a) A random variable X has the following probability function :  16,K3,CO1

| Value of $x$ | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| P(x) | 0 | k | 2k | 2k | 3k | $k^2$ | $2k^2$ | $7k^2+k$ |

(i) Find $k$

(ii) Evaluate $P(X<6), P(X\ge 6) \; and \; P(0<X<5)$

(iii) Find the minimum value of a such that $P(X\le a)>\frac{1}{2}$,

(iv) Determine the distribution function of $X$ .

*K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create*  **11997**

**OR**

b) (i) The diameter of an electric cable, say X, is assumed to be a continuous random variable with probability density function $f(x) = 6x(1-x), 0 \le x \le 1$. 8,K3,CO1

(a) Check that the above is a p.d.f.

(b) Determine $b$ such that $P(X < b) = P(X > b)$

(c) Find the distribution function of $X$.

(ii) The mileage which car owners get with certain kind of radial tyre is a random variable having an exponential distribution with mean 4000 km. Find the probabilities that one of these tyres will last (a) at least 2000 km (b) at most 3000km. 8,K3,CO1

12. a) Find the correlation coefficient for the following data 16,K3,CO2

| | | | | | | |
|---|---|---|---|---|---|---|
| X | 10 | 14 | 18 | 22 | 26 | 30 |
| Y | 18 | 12 | 24 | 6 | 30 | 36 |

**OR**

b) (i) The joint probability mass function of $(X, Y)$ is given by $p(x, y) = k(2x + 3y)$, $x = 0, 1, 2$, $y = 1, 2, 3$. Find all the marginal and conditional probability distributions. Also find the probability distribution of $X + Y$. 8,K3,CO2

(ii) If the joint probability density function of $(X, Y)$ is given by $f_{XY}(x, y) = e^{-(x+y)}$; $x \ge 0$, $y \ge 0$, find the probability density function of $U = \dfrac{X+Y}{2}$. 8,K3,CO2

13. a) (i) Fit a straight line y = a + bx for the following data by the principle of least squares. 8,K3,CO3

X : 0 1 2 3 4

Y : 1 1.8 3.3 4.5 6.3

Also find the value of y when x = 1.5.

(ii) Find the maximum likelihood estimate for the parameter λ of a poisson distribution on the basis of a sample of size n. Also find its variance. Show that the sample mean x is sufficient for estimating the parameter λ of the poisson distribution. 8,K3,CO3

**OR**

b) The following data relate to the marks of 10 students in the internal test and the university examination for the maximum of 50 in each. 16,K3,CO3

Internal Marks : 25 28 30 32 35 36 38 39 42 45

University Marks : 20 26 29 30 25 18 26 35 35 46

a) Obtain the equations of the lines of regression

b) The most likely internal mark for the university mark of 25

c) The most likely university mark for the internal mark of 30.

14. a) The time taken by workers in performing a job by method I and method II is given below: *16,K3,CO4*

Do the data show that the variances of time distribution from

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Method I | 20 | 16 | 26 | 27 | 23 | 22 | |
| Method II | 27 | 33 | 42 | 35 | 32 | 34 | 38 |

population from which these samples are drawn do not differ significantly?

**OR**

b) (i) The theory predicts that the proportion of beans in four given group should be $9:3:3:1$ . In an examination with 1600 beans, the numbers in the four groups were 882, 313, 287 and 118. Does the experimental result support the theory? *8,K3,CO4*

(ii) The means of two large samples of 1000 and 2000 members are 67.5 inches and 68.0 inches respectively. Can the samples be regarded as drawn from the same populations of standard deviation 2.5 inches? *8,K3,CO4*

15. a) For the covariance matrix $\Sigma = \begin{pmatrix} 1 & 4 \\ 4 & 100 \end{pmatrix}$ the derived correlation matrix $P = \begin{pmatrix} 1 & 0.4 \\ 0.4 & 1 \end{pmatrix}$, Show that the principal components obtained from covariance and correlation matrices are different. *16,K3,CO5*

**OR**

b) (i)Explain principal component population. *6,K3,CO5*

(ii) Let X be distributed as *10,K3,CO5*

$$N_3(\mu, \Sigma) \text{ where } \mu' = (1,-1,2) \text{ and } \Sigma = \begin{pmatrix} 4 & 0 & -1 \\ 0 & 5 & 0 \\ -1 & 0 & 2 \end{pmatrix}$$

Which of the following random variables are independent ? Explain.

(i) $X_1$ and $X_2$

(ii) $X_1$ and $X_3$

(iii) $X_2$ and $X_3$

(iv) $(X_1, X_3)$ and $X_2$