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Sr. No. of Question Paper : 6098

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Your Roll No.....

Unique Paper Code : 234615

Name of the Course : **B.Sc. (Hons.) Computer Science**

Name of the Paper : Statistical Methodology (STC – 402)

Semester : VI

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 **fifteen** questions in all, selecting **five** questions from each section.
3. **All** questions carry equal marks.
4. Use of simple calculator is allowed.

SECTION I

1. Show that the coefficient of correlation r is independent of change of origin and scale. State the limits between which it lies.
2. X and Y are independent variables with mean 5 and 10 and standard deviations 2 and 3 respectively. Obtain the correlation coefficient between U and V where $U = 3X + 4Y$ and $V = 3X - Y$.
3. The marks secured by 10 recruits in the selection test (X) and in the proficiency test (Y) are given below :

X	10	15	12	17	13	16	24	14	22	20
Y	30	42	45	46	33	34	40	35	39	38

Calculate the rank correlation coefficient for this data.

P.T.O.

4. The variables X and Y are connected by the equation $aX + bY + c = 0$. Show that the correlation between them is -1 if the signs of a and b are alike and $+1$ if they are different.
5. Fit a curve of the form $Y = a + bX + cX^2$ to the following data :

X	1	1	2	2	3	3	4	5	6	7
Y	2	7	7	10	8	12	10	14	11	14

6. Explain the concepts of multiple and partial correlation coefficients. If $R_{1,23} = 1$, prove that $r_{13,2}$ is also equal to 1. If $R_{1,23} = 0$, does it necessarily mean that $r_{13,2}$ is also 0.

SECTION II

7. State and prove Markov's inequality.
8. A random sample of size n is drawn from an exponential population :

$$f(x) = (1/\lambda)e^{-x/\lambda} ; \lambda > 0, x \geq 0$$

Obtain the p.d.f. of $X_{(n)}$.

9. A random variable X takes the values $-1, 1, 3, 5$ with associated probabilities $1/6, 1/6, 1/6, 1/2$ respectively. Find by direct computation $P(|X - 3| \geq 1)$. Also find an upper bound to this probability by applying Chebychev's inequality.
10. What is meant by a statistical hypothesis ? What are the two types of errors of decision that arise in testing a hypothesis ? Briefly explain how a statistical hypothesis is tested.
11. Given the discrete uniform population :

$$f(x) = 1/3, x = 2, 4, 6.$$

Find the probability that a random sample of size 54 selected with replacement will yield a sample mean greater than 4.1 but less than 4.4.

12. The average life of a bread making machine is 7 years with a standard deviation of 1 year. Assuming that the lives of these machines follow approximately a normal distribution, find
- The probability that the mean life of a random sample of 9 such machines falls between 6.4 and 7.2 years.
 - The value of X to the right of which 15% of the means computed from random samples of size 9 would fall.

SECTION III

13. The distribution of heights of a certain breed of terrier dogs has a mean height of 72 cms and standard deviation of 10 cms, whereas the distribution of heights of a certain breed of poodles has a mean height of 28 cms with a standard deviation of 5 cms. Find the probability that the sample mean for a random sample of heights of 64 terriers exceeds the sample mean for a random sample of heights of 100 poodles by at most 44.2 cms.
14. A manufacturer of car batteries guarantees that his batteries will last, on the average 3 years with a standard deviation of 1 year. If 5 of these batteries have lifetimes of 1.9, 2.4, 3.0, 3.5 and 4.2 years, is the manufacturer still convinced that his batteries have a standard deviation of 1 year? Assume that the battery lifetime follows a normal distribution.
15. Consider the following measurements of heat producing capacity of the coal produced by two mines (in millions of calories per ton).

Mine 1	82	81	83	80	83	
Mine 2	79	78	79	81	79	78

Can it be concluded that the two population variances are equal?

16. The breaking strength X of a certain rivet used in a machine engine has a mean 5000 psi and standard deviation 400 psi. A random sample of 36 rivets is taken. Consider the distribution of \bar{X} , the sample mean breaking strength.

P.T.O.

- (a) What is the probability that the sample mean falls between 4800 psi and 5200 psi ?
- (b) What sample size n would be necessary in order to have $P(4900 < \bar{X} < 5100) = 0.99$?
17. In 100 tosses of a coin, 63 heads and 37 tails are observed. Is this a unbiased coin ?
18. The following table gives the number of aircraft accidents that occurred during the seven days of the week. Find whether the accidents are uniformly distributed over the week.

Days :	Mon	Tue	Wed	Thu	Fri	Sat	Total
No. of Accidents :	14	18	12	11	15	14	84