BACHELOR OF TECHNOLOGY (CBCS - 2023)
B. Tech. Sem-II Computer Science & Business Systems : WINTER: 2025
SUBJECT: STATISTICAL METHODS & MODELLING

Day : Monday
Date : 24/11/2025

W-27708-2025

Time : 10:00 AM-01:00 PM
Max. Marks : 60

N.B.:
1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Use of non-programmable **CALCULATOR** is allowed.
4) Assume suitable data if necessary.

**Q.1** A population consists of four numbers 3, 7, 11, 15. Consider all possible distinct samples of size two with replacement. Find **a)** mean of population **b)** the population standard deviation **c)** show that population mean is same as mean of sampling distribution of mean. **[10]**

**OR**

**Q.1** Write a short notes on: **[10]**
**a)** Simple random sampling
**b)** Cluster sampling

**Q.2** If $r_{12} = 0.82$, $r_{13} = 0.77$ and $r_{23} = 0.80$, determine $r_{23.1}$ and $R_{1.23}$. **[10]**

**OR**

**Q.2** The three samples below have been obtained from normal populations with equal variances. Test the hypothesis at 5% LOS that the population means are equal. **[10]**

| | | |
|---|---|---|
| 8 | 7 | 12 |
| 10 | 5 | 9 |
| 7 | 10 | 13 |
| 14 | 9 | 12 |
| 11 | 9 | 14 |

(Where $F_{0.05}(2, 12) = 3.85$)

**Q.3** Find the unbiased estimate of the mean and standard deviation of the population and also estimate of standard error of sample mean from the random sample drawn from an unknown population 35, 44, 43, 37, 41, 48. **[10]**

**OR**

**Q.3** Find the maximum likelihood estimator of p in binomial distribution **[10]**
$f(x,p) = p^x(1-p)^{n-x}\ x \in \{0,1\}$.
Find MLE for p.

**Q.4** Write a note on : **[10]**
**a)** Null Hypothesis and Alternative Hypothesis
**b)** Type-I error and Type-II error

**OR**

**P.T.O.**

Q.4 A tyre company claims that the lives of tyres have mean 42,000 kms with S.D. of 4,000 km. A change in the production process is believed to result in better product. A test sample of 81 new tyres has a mean life of 42,500 kms. Test at 5% level of significance that the new product is significantly better than the old one. [10]

Q.5 In the past suspects of drink driving were required to walk on a white line. Ten volunteers were asked to walk a white line before and after drinking two pints of a Manchester ale. The distances travelled before wobbling off were measured to the nearest metre, and the following results were obtained: [10]

| Volunteer | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Before ale | 10 | 9 | 11 | 4 | 8 | 12 | 6 | 7 | 8 | 8 |
| After ale | 8 | 6 | 11 | 5 | 6 | 13 | 3 | 1 | 9 | 4 |

Test at the 5% significance level whether getting drunk on Manchester ale makes a difference to your ability to walk straight.

**OR**

Q.5 In 30 tosses of a coin the following sequences of heads (H) and tails (T) is obtained [10]

H T T H T H H H T H H T T H T H T H H T H T T H T H H T H T

a) Determine the number of runs, V.
b) Test at the 0.05 significance level whether the sequence is random.

Q.6 What are the different components of time series analysis? Describe briefly each of these components. [10]

**OR**

Q.6 Estimate the trend values using the data given by taking a 3 yearly moving average for the years from 1980 to 1989. Also draw a graph to represent the moving averages. [10]

| Years | Sales (millions of rupees) |
|---|---|
| 1980 | 3 |
| 1981 | 4 |
| 1982 | 8 |
| 1983 | 6 |
| 1984 | 7 |
| 1985 | 11 |
| 1986 | 9 |
| 1987 | 10 |
| 1988 | 14 |
| 1989 | 12 |

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