2019

(October)

STATISTICS

(Honours)

[STH-52 (TH)]

(Linear Models, Regression and Operations Research, Design of Experiments)

Marks : 56

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer **five** questions, taking **one** from each Unit

UNIT—I

1. *(a)* Explain the terms 'estimable parametric function', 'error function' and 'best linear unbiased estimator' in connection with the problem of linear estimation. 6

   (b) Stating all the assumptions, write down the Gauss-Markov linear model. 4+2=6

2. *(a)* Prove the necessary and sufficient conditions for linear function $l'\beta$ of the parameters to be linearly estimable is

$$\text{rank}(A) = \text{rank}\begin{pmatrix} A \\ l' \end{pmatrix}$$

where $\begin{pmatrix} A \\ l' \end{pmatrix}$ is the matrix obtained from A by adjoining the row vector l'. 6

(b) Consider three independent random variables Y_1, Y_2 and Y_3 having variance σ^2 and expectations $E(Y_1) = \mu_1 + \mu_3$, $E(Y_2) = \mu_1 + \mu_2$ and $E(Y_3) = \mu_1 + \mu_3$. Determine the condition of estimability of the parametric function

$$l'\mu = l_1\mu_1 + l_2\mu_2 + l_3\mu_3$$ 4

(c) Based on the values of a_{ij}'s in the Gauss-Markov linear model, explain the analysis of variance model and regression model. 2

UNIT—II

3. Obtain the formula to express the multiple correlation coefficient in terms of the total correlation coefficient between the pairs of variable, i.e.,

$$R^2_{1\cdot 23} = 1 - \frac{w}{w_{11}} = \frac{r_{12}^2 + r_{13}^2 - 2r_{12}r_{13}r_{23}}{1 - r_{23}^2}$$ 11

(Continued)

4. Write notes on the following : 5½×2=11

(a) Correlation index

(b) Correlation ratio

UNIT—III

5. Give the complete analysis of two-way classified data with m observations per cell under fixed effect model stating clearly assumptions used, hypothesis to be tested, test statistic to be used along with ANOVA table. 11

6. *(a)* What is a factorial experiment? In what respects is it different from a single-factor experiment? Define the terms 'main effects' and 'interaction effects' in relation to a 2^3-experiment. 1+2+3=6

(b) Write notes on partial confounding and complete confounding in a 2^3-experiment. 5

UNIT—IV

7. What do you understand by linear programming problem? What are the conditions that need to be satisfied to solve linear programming problems for optimisation? Write the assumptions of linear programming problem and the different steps for the formulation of LPP. 2+3+4+2=11

(Turn Over)

8. *(a)* Write short notes on the following : 2×2=4

(i) Slack variable

(ii) Surplus variable

(b) Write a note on graphical method of solution of LPP. 3

(c) Define—

(i) feasible solution;

(ii) optimum feasible solution. 2+2=4

UNIT—V

9. *(a)* Write a short note on 'transportation problem'. Also give its mathematical formulation. 5

(b) Describe any one method to obtain initial basic feasible solution for a transportation problem. 6

10. *(a)* Write a note on assignment problem. 5

(b) Describe a method (Hungarian) for solving an assignment problem. 6

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