April - 2015

M. Sc. (Statistics) (Semester - III) Examination
Paper – X : Linear Models & Design of Experiments

TIME: 2.5 HOURS MARKS: 70

Notes:- (i) Attempt All FIVE questions.
(ii) Each question carries equal marks.

1(a) Define main effect and interaction effect for 2^n factorial experiment. Discuss Yates procedure method to estimate all the main effect and interaction effect for 2^3 factorial experiments. Write its ANOVA table.

(b) Given three independent stochastic variables y1, y2 , and y3 having common variance σ2 such that E(y1) = θ1 + θ2+ θ3, E(y2) = θ1 + θ3 +θ4 , E(y3) = θ1 + θ2 +θ4 and E(y4) = θ2 + θ3 + θ4. Find the condition for linear parametric function b'θ to be estimable. Further show that b'θ is unique

OR

1 (a) In usual notations, prove that-

i) $V(Q) = \sigma_C^2$, ii) $V(P) = \sigma_D^2$, and iii) $Cov(P, Q) = -\sigma_D^2$

(b) Let Y_i, i=1,2, 3 are independent observation with common variance $\sigma^2$and expected values

$$E(Y_1)=\theta_1 + \theta_3$$

$$E(Y_2)=\theta_2 + \theta_3$$

$$E(Y_3)=\theta_1 + \theta_2$$

then prove that $\theta_1 + \theta_2 + 2\theta_3$ is estimable and obtain BLUE of it and variance of BLUE.

2 (a) Derive the intra block analysis of BIBD.

(b) Define Symmetric BIBD. Prove that for a symmetric BIBD number of common treatments between any two block is λ.

OR

2 (a) Given C-matrix of a block design explain how you will identify that whether the design is (i) connected, and (ii) balanced. Identify the below given design.
(1,2,4); (2,3,5); (3,4,6) ; (4,5,7) ; (5,6,1) ; (6,7,2) ; (7,1,3). Write its all parameters, its C-matrix and then verify that block design is balanced. Give the reasons. Also obtain Eigen value of C matrix of the block design.

(b)) For BIBD (v, b, r, k, λ), show that

(i) NN'=$(r-\lambda)I_v + \lambda E_{vv}$

(ii)$C=\left(\lambda_v/_K\right)[I - E_{vv}/v]$

3 (a) Check whether the block design with incidence matrix

$$N = \begin{bmatrix} 2 & 1 & 1 & 1 \\ 1 & 2 & 1 & 1 \\ 1 & 1 & 2 & 1 \\ 1 & 1 & 1 & 2 \end{bmatrix}$$ is connected, balanced and orthogonal.

(b). Construct a2^4 confounded factorial experiment by confounding ACD and ABCD .. Write its all generalized confounded interactions. Give its ANOVA table.

OR

3 (a) State and prove Gauss- Markov theorem. Show that BLUE of estimable linear parametric function b'θ is unique even though the equation A'y = A'Aθ have no unique solution.

(b)
Prove that necessary and sufficient condition for a block design to be balanced is that all the n zero eigen roots are equal.

4(a) Define the concept of confounding. Give critical comparison of total and partial confounding with an example.

(b). Explain the method of confounding 2 independent interaction in2^m design.

OR

4(a) Construct a BIBD with parameters v = 11, b= 11, r = 5, k = 5, λ = 2.

(b) Define BIBD. Prove that (i) b ≥ v and (ii) λ(v-1) = r(k-1)

5 (a) Explain construction of BIBD using mutual orthogonal latin square.

(b) Construct a BIBD with parameters:-
V = b = 7, r = k = 3, λ = 1, using elements of GF (7)

OR

5. (a) Explain various type of BIBD
(b) Discuss Association scheme and hence define PBIB design of m associate classes.

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