M. Sc. (Statistics) Examination

Sem.III Nov 2014

Paper – X : Linear Models & Design of Experiments

Code- 3575

Time : 2.30 hours

Marks: 70

Q1	a)	Define Best Linear Unbaised Estimator (B.L.U.E.) State and prove Gauss- Markoff's theorem.	10
	b)	Explain following terms in Designs: i) Estimable Parametric Function, ii) Estimable Parametric Function, iii) Unbiased Estimator, And iv) Incidence Matrix,	4
		OR	
Q1	a)	In usual notation prove that *(i)* $V(Q) = \sigma^2 C$ *(ii)* $V(P) = \sigma^2 D$ *(iii)* $Cov(P,Q) = -\sigma^2 D$	8
	b)	Let y_i, i = 1, 2,3. are three observations for which, $E(y_1) = \theta_1 + \theta_2$, $E(y_2) = \theta_1 + \theta_3$, $E(y_3) = \theta_1 + \theta_4$ are given, i) Show that $\underline{b}'\theta$ is estimable if $b_1 = b_2 + b_3 + b_4$.	6
Q2	a)	State and prove necessary and sufficient condition for a block design to be orthogonal.	8
	b)	Explain the following terms: i) Connectedness, ii) Orthogonality, & iii) Balancing in Block designs.	6
		OR	
Q2	a)	Check whether the block design with incidence matrix $N = E_{vv} - I_v$ is connected, balanced and orthogonal.	8
	b)	Prove that necessary and sufficient condition for a block design to be balanced is that all the non zero eigen roots are equal.	6
Q3	a)	Define Balanced Incomplete Block Design. With usual parameters of B.I.B.D, prove that- i) $bk = vr$, ii) $r(k-1) = \lambda(v-1)$, and iii) $b \geq v$.	6
	b)	Given that the primitive element for GF (7) is 2. Hence construct a Balanced Incomplete Block Designs with parameters- $v = b = 7$, $r = k = 3$, $\lambda = 1$ using odd powers of primitive elements.	8
		OR	
Q3	a)	Derive the Intra-block analysis of a BIBD.	8
	b)	Define RBIBD, For a Resolvable BIBD, prove that- $b \geq v + r - 1$.	6
Q4	a)	Define Two Associated class of Partially Balanced Incomplete Blocks Design (P.B.I.B.D).	8

		With usual notations, prove that for a P.B.I.B.D,- i) $\sum_{i=1}^{n} n_i$ = v – 1, ii) $\sum_{i=1}^{2} n_i \lambda_i = r(k-1)$ iii) $n_i p_{jk}^{i} = n_j p_{ik}^{j} = n_{ki} p_{ij}^{ik}$, (I = j = k = 1,2)	
	b)	Discuss various type of BIBD.	6
		OR	
Q4	a)	For BIBD (v, b, r, k, λ), show that $(i)\ NN' = (r-\lambda)\mathrm{I_v} + \lambda \mathrm{E_{vv}}$ i) $(ii)\ C = (\lambda v/_k)\,[I - \mathrm{E_{vv}}/_v]$	8
	c)	Given below the blocks of an block design- (1 3 5 8), (2 3 4 7), (3 6 7 8), (1 2 6 9), (1 5 6 9), (3 4 5 9), (2 4 6 8), (1 4 8 9), (2 5 7 9) i) Identify the above design. ii) Obtain its all parameters.iii) Incidence Matric &C-matric.	6
Q5	a)	Define the concept of confounding. Give critical comparison of total and partial confounding with an example.	8
	b)	Describe the Yates procedure to analyse the 2^n factorial design.	6
		OR	
Q5	a)	Construct a 2^3 factorial design in a block of 3^2 plots each by confounding the suitable interaction. Write its generalized confounded interaction. Discuss how remaining blocks can be obtained.	8
	b)	Explain main effect and interaction effects in 2^n & 3^n factorial experiments. Discuss how to estimate the main effect and interaction effects in 3^n factorial experiments.	6
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