

M.Sc. Semester-II Examination 2017

Statistics (Old)

Course : MSC-24

(Design of Experiments and Regression Analysis)

Time : 3 Hours

Full Marks : 40

Questions are of value as indicated in the margin

Answer **any four** questions

1. Give two definitions of connectedness of a block design. Prove that these definitions are equivalent. 3+7=10
 2. Define Q , the adjusted treatment totals. Show that (i) $Q'1_u = 0$ (ii) $E(Q) = C_\tau$ and (iii) $D(Q) = \sigma^2 C$ where 1_u is a vector of ones and C is the C -matrix of the design. 1+2+3+4=10
 3. (a) For a connected block design d , show that the covariance between Q and P is zero if and only if $N = rk^T / n$, where the notations have their usual meaning.
(b) For a connected block design d , discuss in brief the testing of the null hypothesis $H_0 : \tau_1 = \tau_2 = \dots = \tau_v$. 5+5=10
 4. (a) Show that for a connected block design d with v treatments, the matrix $C+aJ$, where $a \neq 0$ is any scalar, is non-singular and $(C+aJ)^{-1}$ is the g -inverse of C .
(b) let c be a vector such that $Cc = p$, where C is the C -matrix of a connected block design d . Show that the BLUE of $p'\tau$ is $c'Q$ and the variance of this estimator is $\sigma^2 p'c$. 5+5=10
 5. (a) Let $0 = \lambda_0 < \lambda_1 \leq \dots \leq \lambda_{v-1}$ be the eigenvalues of C , the C -matrix of a connected block design d . Show that the variance of the BLUE of an elementary contrast of treatment effects is bounded below by σ^2 / λ_{v-1} and bounded above by σ^2 / λ_1 .
(b) Give an example of an orthogonal block design whose incidence matrix is not a multiple of J_{vb} , where v is the number of treatments and b , the number of blocks. 6+4=10
 6. (a) Let N be the incidence matrix of a symmetric BIB design d . By taking the inverse of NN' , show that any two blocks of d intersect in λ treatments.
(b) Prove that for a BID design (v, b, r, k, λ) , the Fisher's inequality is equivalent to the inequality $b \geq v + r - k$. 5+5=10
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