3 (Sem–6/CBCS) STA HC 1

2023

STATISTICS

(Honours Core)

Paper : STA–HC–6016

(Design of Experiments)

Full Marks : 60

Time : Three hours

The figures in the margin indicate full marks for the questions.

1. Answer the following as directed : 1×7=7

   (a) What do you mean by size of a block ?

   (b) Replication provides a valid estimate of _____ . *(Fill in the blank)*

Contd.

(c) Name a design where principle of local control is not used.

(d) With four treatments A, B, C and D what would be degrees of freedom for total sums of square in a Latin square design ?

(e) In completely randomised design, you want to compare 5 treatments with 4 observations per treatment. What will be the error degrees of freedom (d.f.) for it, if there is one missing observation ?

(f) What will be the total number of factorial effects in a 2^n factorial design ?

(g) Write all possible treatment combinations for a 3^2 factorial experiment with factors mentioned by you.

2. Answer the questions from the following : 2×4=8

(a) Define the term 'uniformity trials'.

(b) In an RBD, the yield of the plot for 1st treatment and 1st block is 50 *kg*. Mean of the first treatment is 25 *kg*, mean of the first block is 12 *kg*, grand mean is 10 *kg*. Find the estimate of error component for the corresponding plot.

(c) State why a particular block in each replication of confounded factorial experiment is known as the 'key block' or 'principal block'.

(d) Explain why there can not be a 2×2 L.S.D.

3. Answer ***any three*** questions from the following : 5×3=15

(a) An agricultural field experiment was laid out in a Latin square design (LSD) for comparing varieties of paddy. Due to negligence of the caretaker, the crop in one of the border-lying plots was damaged by cattle long before harvesting. Describe the procedure you would adopt to analyse the resulting yield data, briefly indicating the basic theory involved therein.

(b) Show that in a 2^3 experiment the main effects and interaction effects are mutually orthogonal contrast.

(c) Write lucid notes on Graeco-Latin square and their use in comparative experiments.

(d) What is a split-plot design? Describe the situations in which a split-plot confounding rather than the general type of confounding would be more suitable.

(e) What is the principle of allocating treatments in the blocks of an RBD? Give the layout of an RBD with 5 blocks and 4 treatments *A*, *B*, *C* and *D*.

4. Answer the following questions : 10×3=30

(a) Describe how basic principles of design of experiments are employed in constructing the layouts of

(i) CRD;

(ii) RBD;

(iii) LSD.

Also discuss relative advantages and disadvantages of these designs.

Or

(b) What do you mean by efficiency of a design? Discuss how efficiency of a design can be increased. Obtain an expression for efficiency of LSD compared to CRD.

(c) Discuss the necessity of confounding in a factorial design. How does partial confounding differ from complete confounding? Give your answer with suitable illustrations.

Or

(d) A 2^4 experiment is conducted in 5 replications of 4 blocks each; the factor used being A, B, C, D. For each replication, the elements one of the blocks are a, bc, acd, bd.

Identify the confounding subgroup and indicate the analysis of the experiment.

(e) What is balanced incomplete block design (BIBD) with parameters v, b, r, k, λ ?

(i) When is a BIBD called symmetric ?

(ii) Show that in a symmetric BIBD, any two blocks have same number λ of treatments in common.

Or

(f) Find the standard error of difference between two treatment means one of which has a missing observation in RBD.

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