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6 SEM TDC STS M 1 (N/O)

2018 Stat- 601, 602,

(May) Bot- 601, 603, 604, 606
Geo- 601, 603, 605, 607

STATISTICS Math- 601, 602, 603, 604

(Major) Zoo- 601, 603, 604, 606

Course : 601 Che- 601, 603, 605, 607

(Design of Experiments) With - G

Time : 3 hours

The figures in the margin indicate full marks for the questions

(New Course)

Full Marks : 80

Pass Marks : 24

1. Select the correct alternative from the given options : 1×8=8

(a) If $E_{\beta}(\underset{\sim}{C}'\underset{\sim}{Y}) = \underset{\sim}{l}'\underset{\sim}{\beta}$ independent of the parameter $\underset{\sim}{\beta}$, then the function $\underset{\sim}{l}'\underset{\sim}{\beta}$ is called

(i) an estimable parametric function

(ii) a linearly estimable function

(iii) an estimable linear parametric function

(iv) All of the above

(b) The assumption(s) made in the analysis of variance is/are

(i) the observations are independent

(ii) various effects are additive in nature

(iii) errors are normally distributed with zero mean and a constant variance σ^2

(iv) All of the above

(c) If the conclusions are to be drawn for the treatments in general, then the statistical model shall be known as

(i) mixed effect model

(ii) analysis of variance model

(iii) component of variance model

(iv) fixed effect model

(d) Completely randomized designs are suitable in the situation when

(i) all experimental units are homogeneous

(ii) the units are likely to be destroyed during experimentation

(iii) some units are likely to fail to response

(iv) All of the above

(e) The ratio of the number of replications required in CRD and RBD for the same amount of information is

(i) 6 : 4

(ii) 10 : 6

(iii) 10 : 8

(iv) 6 : 10

(f) If two Latin squares are such that one can be obtained by interchanging the rows and columns of the other, then the Latin squares are said to be

(i) conjugate

(ii) self-conjugate

(iii) orthogonal

(iv) asymmetric

(g) The effect, which is confounded in all the blocks in an experimental design

(i) is estimated more precisely

(ii) is estimated less precisely

(iii) cannot be estimated

(iv) None of the above

(h) Split plot design for all sets of comparisons as compared to a randomized block design with the same experimental material is

(i) superior

(ii) inferior

(iii) equally good

(iv) None of the above

2. Answer the following in brief : 2×8=16

(a) What are the different types of statistical model for experimental design?

(b) Write briefly on local control.

(c) What do you understand by the technique of analysis of variance?

(d) How is the principle of randomization used in CRD?

(e) State the situation when the missing plot technique arises.

(f) What are the drawbacks of an RBD?

(g) Distinguish between total confounding and partial confounding.

(h) Mention the demerits of a split plot design.

3. *(a)* State the problem of linear estimation in Markov setup. Obtain the expected value of various SS in ANOVA for a two-way classification. 4+5=9

Or

Define the terms—estimable parametric function, error function and BLUE.

Obtain the expressions for the sums of squares due to linear function and sums of squares due to error. 4½+4½=9

(b) What do you mean by analysis of variance? What are the basic assumptions in ANOVA? What is one-way classification? Obtain the least square estimates of the parameters of one-way classification and prepare the analysis of variance table. 2+2+2+4=10

Or

What do you mean by analysis of covariance? Describe the basis for choosing concomitant variable in analysis of covariance. In what respects do analysis of variance differ from analysis of covariance? 2+2+6=10

4. *(a)* Explain the basic principles of experimental designs. Discuss the importance of these principles with respect to designing the statistical experiments. 6+3=9

Or

Under what situation will you prefer RBD over CRD? Discuss the statistical model for RBD with one observation per experimental unit. 3+6=9

(b) What is the importance of Latin square design? What are the advantages and disadvantages of LSD? Write a note on Graeco-Latin square design. 3+4+3=10

Or

What do you understand by a 'missing plot' in a design of experiment? Derive a formula for estimating single missing plot in $m \times m$ Latin square design. Can the same procedure be followed for estimating more than one missing observation? 3+5+2=10

5. *(a)* What is a treatment contrast? When are two such contrasts said to be orthogonal? Show that in an RBD, every block contrast is orthogonal to every treatment contrast. Show that in a 2^3-experiment, the main effects and interaction effects are mutually orthogonal. 2+1+3+3=9

Or

What are the main considerations in the use of confounded factorial designs? Describe the layout of a 2^3-experiment where all the interactions are partially confounded. In such a case, indicate d.f.'s and s.s's for all the components of the treatment sum of squares. 2+7=9

(b) Explain the concept of confounding and balanced confounding. Construct a balanced confounding scheme for 2^4-factorial experiment. 4+5=9

Or

Discuss the nature of the experimental error in split plot design. Explain the special features of a split plot design. Mention some applications of split plot design. 3+4+2=9

(Old Course)

Full Marks : 80
Pass Marks : 32

1. Select the correct alternative from the given options : 1×8=8

(a) A statistical model is categorized into

(i) one type

(ii) two types

(iii) three types

(iv) four types

(b) For the validity of *F*-test in ANOVA, one of the assumptions made is

(i) parent population from which observations are taken is normal

(ii) the observations are dependent

(iii) various treatment effects are multiplicative in nature

(iv) None of the above

(c) Replication in an experiment means

(i) the number of blocks repeated

(ii) the number of times a treatment occurs in an experiment

(iii) the total number of treatments repeated

(iv) None of the above

(d) Completely randomized designs are suitable in the situation when
   (i) all the experimental units are homogeneous
   (ii) the units are likely to be destroyed during experimentation
   (iii) some units are likely to fail to response
   (iv) All of the above

(e) A Latin square design controls
   (i) two-way variation
   (ii) three-way variation
   (iii) multiway variation
   (iv) None of the above

(f) The formula for obtaining a missing value in randomized block design by minimizing the error mean square was given by
   (i) W. G. Cochran
   (ii) T. Wishart
   (iii) J. W. Tukey
   (iv) F. Yates

(g) If the same factorial effect is confounded in all the replications, it is known as
   (i) partial confounding
   (ii) complete confounding
   (iii) conservative confounding
   (iv) balanced confounding

(h) In a split plot design, more error degrees of freedom is obtained for

(i) main plots

(ii) sub-plots

(iii) interaction of main plot and sub-plot

(iv) None of the above

2. Answer the following in brief : 2×8=16

(a) Define a treatment with reference to an experiment.

(b) What are the assumptions of ANOVA?

(c) What factors are responsible for determining the number of replications?

(d) Point out the advantages of RBD over CRD.

(e) Under what conditions can Latin square design be used?

(f) What do you understand by a 'missing plot' in a design of experiment?

(g) What are the limitations of confounding?

(h) Give the statistical model for a split plot design.

3. Answer any *two* questions : 9×2=18

(a) State the different types of models associated with the analysis of variance technique. Estimate the parameters of the fixed effects model of analysis of variance for one-way classified data with one observation per cell and write down the analysis of variance table.

(b) What do you mean by analysis of variance? Work out the analysis of variance for a two-way classification (one observation per cell). State the assumptions necessary for it.

(c) What do you mean by analysis of covariance? Work out the analysis of covariance (one-way layout).

4. Answer any *two* questions : 10×2=20

(a) Give the layout of a completely randomized block design and explain the situations when it is used. Give the complete statistical analysis of CRD.

(b) Define a Latin square design and show how you split up the total sum of squares into components for this design. Give the analysis of variance table. Give the expression for the relative efficiency of an LSD of order K over a CRD.

(c) What are the usual assumptions made in the analysis of an RBD? Give the procedure for estimating a missing value in an RBD. Show the ANOVA table in this case.

5. Answer any *two* questions : 9×2=18

(a) What is a factorial experiment? State the advantages of a factorial experiment over a simple experiment. Give an outline of analysis of a 2^3-experiment conducted in RBD.

(b) Explain the principle of confounding in design of experiments. Suppose we have a 2^3-experiment with three factors each at two levels. Suppose there are three replicates each divided into 2 blocks, each block of 4 units. Show how you will confound *ABC*, in the first replication, *AC* in the second replication and *BC* in the third replication. Show how the results of confounded factorial design can be analyzed.

(c) Give the expected mean squares for various component factors in ANOVA table of a split plot design with two factors. Write the merits of a split plot design.

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