1 (Sem–3/FYUGP) STA41MJ

2025

STATISTICS

(Major)

Paper : STA4300104 MJ

(Survey Sampling and Design of Experiments–I)

Full Marks : 45

Time : 2 hours

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

1. Answer the following questions as directed : 1×5=5

   (a) Sampling errors are not present in ____. *(Fill in the blank)*

   (b) When sample size increases, sampling error also increases. *(State True* ***or*** *False)*

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

(d) The error d.f. in an RBD with 5 blocks and 4 treatments is ____. *(Fill in the blank)*

(e) A complete list of sampling units which represent the population to be covered is called the _____. *(Fill in the blank)*

2. Answer ***any five*** questions from the following : 2×5=10

(a) Explain the term "sampling error".

(b) How errors can be controlled by Local Control ?

(c) What is judgement sampling ?

(d) When do we go for stratification in a sample survey ?

(e) In what situation will you prefer RBD over CRD ?

(f) Define uniformity trials.

(g) What is mixed sampling ?

(h) What are the different types of statistical models for experimental design ?

(i) Define the term treatment in the design of experiments.

(j) Write advantages and disadvantages of CRD.

3. Answer ***any four*** questions from the following : 5×4=20

(a) What are the advantages of sample survey over complete enumeration ?

(b) Obtain the variance of the sample mean in case of SRSWOR. What is the variance in case of SRSWR ?

(c) What is Pilot survey ? In what situation Pilot survey is to be conducted ? Give *one* example.

(d) What is a linear model ? Write a note on the assumptions made in a linear model in the AOV.

(e) Define linear and circular systematic sampling. Give the condition under which a systematic sampling is more precise than a SRSWOR sampling.

(f) Prove that in stratified random sampling, the sample mean is an unbiased estimate of the population mean. Also find its sampling variance.

(g) Describe the basic principles of Design of Experiments that are used in the construction of CRD and RBD.

(h) Explain the principal steps involved in the planning and execution of sample survey.

4. Answer ***any one*** question from the following : 10×1=10

(a) (i) An experiment was conducted to test 4 treatments *A*, *B*, *C* and *D* in 5 randomized blocks. Under the above set-up answer the following :

1. Write the null hypothesis.

2. Construct the AOV table.

3. Draw conclusion.

(ii) The following random sample has been drawn from a population of size 200 :

35, 15, 55, 50, 41, 25, 30, 35, 47, 40.

Estimate the population mean and its standard error.

(b) Considering the linear cost function

$$C = a_0 + \sum_{i=1}^{n} c_i n_i$$

a_0 being the overhead cost and c_i the cost per unit for the i-th stratum, obtain the optimum value of n_i, $(i = 1, 2, \cdots, n)$.

(c) Find the unbiased estimate of the population mean in linear systematic sampling. If ρ is the interclass correlation co-efficient between the units of the same systematic sample, show that

$$Var(\bar{y}_{sys}) = \frac{nk-1}{nk}\{1+(n-1)\rho\}\frac{S^2}{n}$$

What is the minimum values of ρ ?

(d) (i) Write a note on non-sampling biases

(ii) Give complete analysis of an AOV one-way classified data.
