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V Semester B.Sc. Degree Examination, March/April - 2023

STATISTICS

Sampling Theory and Statistical Quality Control

(CBCS Scheme Freshers 2020)

Paper : V



Time : 3 Hours

Maximum Marks : 70

Instructions to Candidates:

1. Answer five questions from Section A and five questions from Section B.
2. Scientific calculators are allowed.

SECTION - A (25 Marks)

- I. Answer any **Five** questions from the following. (5×5=25)
1. What is sampling? What are the advantages of sampling over census? Explain.
 2. What is Simple Random Sampling? Distinguish between SRSWOR and SRSWR. Explain the method of drawing random samples using random number tables.
 3. What is Stratified Random Sampling? Explain proportional and Optimum allocation.
 4. Explain Systematic Sampling. Prove that the Systematic sample mean is more precise than the mean of SRSWOR if $S^2_{wsy} > S^2$.
 5. What is SQC? State its benefits.
 6. Describe the steps involved in the construction of charts for Mean and Range.
 7. What are rational subgroups? Describe a general approach used in the formulation of rational subgroups.
 8. Define consumer's risk and producer's risk and obtain its expression for Single sampling plan.

SECTION - B (45 Marks)

- II. Answer any **Five** questions from the following. (5×9=45)
9. a. What is a questionnaire? What are the precautions necessary in drafting a good questionnaires?
 - b. Distinguish between :
 - i. Probability and Non - Probability sampling.
 - ii. Sampling and Non - sampling errors. (5+4)

[P.T.O.]



10. a. Under SRSWOR, with usual notations, obtain an expression for the variance of sample mean.
- b. With usual notations under SRSWR, prove that $E(s^2) = \sigma^2$. (5+4)
11. a. Explain SRS for proportions. With usual notations obtain expression for the estimate of the variance of the estimate of the total number of units possessing the given attribute in the population, under SRSWOR.
- b. Derive an expression for sample size in case of SRSWOR while estimating population proportion. (4+5)
12. Obtain an unbiased estimator of the population mean in the case of Stratified Random sampling and derive its variance. Also, deduce variance under proportional and Neyman allocations. (9)
13. a. In Stratified Random Sampling, Show that the variance of the estimate of the population mean is minimum if n_h is proportional to $N_h S_h / \sqrt{C_h}$ for $h = 1, 2, \dots, L$.
- b. Prove that Systematic sample mean is an unbiased estimator of the population mean when $N = nk$. (6+3)
14. a. Explain the terms :
- i. Warning limits.
- ii. $3 - \sigma$ control limits.
- iii. Tolerance limits.
- b. What is U chart? Explain basis, construction and interpretation of U chart. (3+6)
15. a. Define AOQ and AOQL. Derive an expression for AOQ of a single sampling plan.
- b. Explain Double sampling plan. (6+3)
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V Semester B.Sc. Degree Examination, March/April - 2023**STATISTICS****Design and Analysis of Experiments****(CBCS Scheme Freshers 2020)****Paper : VI****Time : 3 Hours****Maximum Marks : 70****Instructions to Candidates:**

1. Answer any **five** questions from Section A and **five** questions from Section B.
2. Scientific calculations are allowed.

SECTION - A**I. Answer any Five questions from the following.****(5×5=25)**

1. What is analysis of variance (ANOVA)? State its need. Mention the assumptions involved.
2. Obtain the expectation of error sum of square (ESS) in ANOVA for one way classified data.
3. Explain three basic principles of experimental design.
4. Explain how randomization is carried out in a completely randomized design (CRD). Mention the advantages of RBD over CRD.
5. Obtain the expression for relative efficiency of a LSD over RBD.
6. What is factorial experiment (FE)? Write down the various treatment combinations under 2^2 and 2^3 F.E.
7. Define contrast and orthogonal contrasts in a 2^3 F.E. Show that the main effects A and B are orthogonal contrasts.
8. What is meant by confounding? Distinguish between partial and complete confounding.

[P.T.O.]

**SECTION - B**

- II. Answer any Five questions. (5×9=45)**
9. Describe ANOVA for a one - way classified data. (9)
 10. Explain ANOVA for two - way classified data with interaction effect, (9)
 11. What is randomized block design (RBD)? Discuss the role of basic principles of experimental design in RBD. Write the lay out of a RBD with five treatment and five blocks. Also write down the corresponding ANOVA table. (9)
 12. Describe the analysis of Latin square design (LSD). (9)
 13. a. Obtain the expression for relative efficiency of a RBD over CRD.
b. Obtain the expression for estimating missing observation in RBD. (4+5)
 14. a. Explain the Yates method of obtaining factorial effect totals in a 2^3 factorial experiment using treatment total from all the given replications.
b. For a 2^3 factorial experiment derive an expression for interaction effects AB and ABC. (4+5)
 15. Describe the procedure of analysing a 2^3 factorial experiment with three replications where in AC is confounded in replication I, AB is confounded in replication II and BC is confounded in replication III. Write the ANOVA table by giving the relevant layout. (9)
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