2019

(October)

STATISTICS

(Elective/Honours)

[STEH-3 (TH)]

(Categorical Data, Survey Sampling and Design of Experiments)

Marks : 56

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer **five** questions, taking **one** from each Unit

UNIT—I

1. *(a)* What do you understand by consistency of data? How do you check it? 2+2=4

(b) Show that—

(i) if all A's are B's and all B's are C's, then all A's are C's;

(ii) if all A's are B's and no B's are C's, then no A's are C's. 4

(Turn Over)

(c) If $\delta = (AB) - (AB)$, then with usual notations prove that—

(i) $[(A)-(\alpha)][(B)-(\beta)] + 2N\delta$
$= (AB)^2 + (\alpha\beta)^2 - (A\beta)^2 - (\alpha B)^2$

(ii) $\delta = \frac{(B)(\beta)}{N}\left\{\frac{(AB)}{(B)} - \frac{(A\beta)}{\beta}\right\}$ 4

2. (a) What is association of attributes? When are two attributes said to be positively associated and negatively associated? Does association between two attributes imply a causal relationship? Explain. 1+2+3=6

(b) Define Yule's coefficient of association and the coefficient of colligation. Establish the following relation between coefficient of association Q and coefficient of colligation Y:

$$Q = \frac{2Y}{1+Y^2}$$

What is the range of values for Q? 2+3+1=6

UNIT—II

3. (a) What is a sample survey? Discuss the basic principles of a sample survey. 2+3=5

(Continued)

(b) How does sampling with replacement differ from that of without replacement? Which of them provides a more efficient estimator of the population mean? 2+1=3

(c) Describe the method of determining the sample size in case of simple random sampling with given margin of error d and confidence coefficient $(1-\alpha)$. 3

4. (a) Obtain the expression for the variance of the estimate of the population mean for SRSWOR. 6

(b) Prove that systematic sampling is more efficient than SRSWOR if the variability in a particular systematic sample is more than the variability in the populataion as a whole. 5

UNIT—III

5. (a) Describe the procedure of stratified random sampling. Discuss its advantages. 3+3=6

(b) Obtain the estimator of the population mean by the method of stratified random sampling and also obtain the variance of the estimator. 5

(Turn Over)

6. *(a)* Prove that $V(\bar{y}_{st})$ is minimum for fixed total size of the sample (n), if $n_h \propto N_h S_h$. 5

(b) Show that

$$V(\bar{y}_{sys}) = \frac{k-1}{nk} S^2_{wst}\{1+(n+1)\rho_{wst}\}$$ 6

(Notations have their usual meanings)

UNIT—IV

7. *(a)* What is analysis of variance? Discuss the analysis of variance of a two-way classified data with one observation per cell. 2+4=6

(b) State the mathematical model used in analysis of variance in a one-way classification. Explain the hypothesis to be used. Discuss the advantages of two-way over one-way classification. 1+2+2=5

8. *(a)* Explain the principles of replication, randomization and local control in experimental designs pointing out the role each one plays in the valid and precise interpretation of the data. 6

(b) Define experimental error. What are its main sources? What methods are needed to increase the precision of an experiment? 1+2+2=5

(Continued)

UNIT—V

9. *(a)* What is meant by RBD? Give the analysis of variance for the design stating clearly the mathematical model and the underlying assumptions. 2+4=6

(b) What do you understand by missing plot technique? Explain how missing plot technique can be used to estimate the missing observation in RBD. 2+3=5

10. *(a)* What is a factorial experiment? Define the terms 'main effects' and 'interaction effects' in relation to a 2^3-experiment. 2+3=5

(b) What is a treatment contrast? When are two such contrasts said to be orthogonal? Show that in a 2^3-experiment, the main effects and interaction effects are mutually orthogonal. 1+1+4=6

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