

2021

STATISTICS — HONOURS

Sixth Paper

(Group - B)

Full Marks : 50

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

Unit - I

(Time Series Analysis)

[Marks : 25]

Answer *any two* questions from *question nos. 1 to 4*
and *any one* question from *question nos. 5 and 6.*

1. Give real-life examples of time-series having its possible components. 5
2. Discuss how you will fit an exponential trend model to time-series data. 5
3. Explain when a moving-average technique can eliminate an oscillatory movement of a time-series. 5
4. Describe the exponential smoothing technique for forecasting. 5
5. (a) What are the different models used in the analysis of time-series data? Specify the measuring units of the components of time-series in each case.
(b) Suppose $\{u_t, t = 1, 2, \dots, n\}$ represents a set of monthly time-series data. If a multiplicative model is used where cyclical fluctuation is absent and the trend be known to be quadratic in time, discuss the computation of fixed-pattern seasonal indices. 5+10
6. Write short notes on the following :
 - (i) Preliminary adjustment of time-series data
 - (ii) Use a quadratic curve to choose the weights of a 5-point moving average
 - (iii) Stationarity of a time-series. 5+5+5

Please Turn Over

Unit - II
(Sample Survey)

[Marks : 25]

Answer **any two** questions from **question nos. 7 to 10**
and **any one** question from **question nos. 11 and 12**.

7. If a population is divided into L strata, and n_h units are selected by SRSWOR from the h^{th} stratum of size N_h , show that the estimator, given by

$$\hat{P} = \sum_{h=1}^L W_h p_h$$

is unbiased for the population proportion P ,

and that
$$V(\hat{P}) = \sum_{h=1}^L W_h^2 \frac{1 - f_h}{n_h} \frac{N_h P_h (1 - P_h)}{N_h - 1},$$

where $W_h = \frac{N_h}{N}$, $f_h = \frac{n_h}{N_h}$ and p_h and P_h are, respectively, the sample proportion and the population proportion in the h^{th} stratum. 2+3

8. Show that for a hypothetical population where the values of the population units are linearly related with the unit numbers, systematic sampling is more efficient than simple random sampling. 5
9. Explain the statement, 'Partial complete enumeration is adopted in cluster sampling'. If a cluster is selected by simple random sampling, find the variance of the total of the values of a study variable y of the selected cluster. 5
10. Describe one method using the information on an auxiliary variable x correlated with the study variable y to improve the simple unbiased estimate of the total of y -values in simple random sampling without replacement. 5
11. Suppose a population is stratified into L strata.
- (a) Suggest an unbiased estimator of the population mean of a variable y and derive its variance.
 - (b) Using a simple cost function, obtain the optimum allocation of sample sizes to the strata.
 - (c) In case of estimating the population mean of a study variable y , obtain an estimator of the gain (defined by sampling variance of an estimator minus that of the other) due to stratification over simple random sampling, on the basis of random data on a study variable y . 5+5+5

12. (a) In case of two-stage sampling using simple random without replacement sampling at both the stages, obtain an unbiased estimator of the population total where the first-stage units are of equal size. Show that the variance of the estimator depends on both the between-mean-square and the within-mean-square of the first-stage values of the study variable.
- (b) Consider an urn containing 12 identical balls, of which 5 are red and 7 black. Treating drawing of a ball from the urn to be a randomizing trial, describe Warner's method of estimating a proportion π in a finite population. (5+5)+5
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