

STATISTICS

(Paper II)

Time Allowed : Three Hours
Maximum Marks : 300

QUESTION PAPER SPECIFIC INSTRUCTIONS

(Please read each of the following instructions carefully before attempting questions)

There are EIGHT questions divided in two Sections.

Candidate has to attempt FIVE questions in all.

Question Nos. 1 and 5 are compulsory and out of the remaining, any THREE are to be attempted choosing at least ONE question from each Section.

The number of marks carried by a question/part is indicated against it.

Wherever any assumptions are made for answering a question, they must be clearly indicated.

Word limit in questions, wherever specified, should be adhered to.

SECTION 'A'

1. Answer any five sub-parts of the following:
 - (a) Distinguish between (i) chance causes and assignable causes and (ii) specification limits and control limits. 12
 - (b) What is a CUSUM chart and where is it used? How does it differ from a Shewhart control chart? 12
 - (c) Explain renewal density and renewal function. 12
 - (d) Show that the set of feasible solutions to a linear programming problem is convex. 12
 - (e) State the chief characteristics of a queuing process. For the queuing process (M/M/1 FCFS/ ∞), derive its steady state solution. 12
 - (f) For the Markov chain with transition probability matrix $P = \begin{bmatrix} 1-a & a \\ b & 1-b \end{bmatrix}$, $0 < a < b < 1$ obtain p^n . 12
2. (a) Describe a double sampling plan for attributes. Derive the expressions for OC, ASN & ATI of this plan. 20
 - (b) Describe and illustrate the concepts of (i) reliability and (ii) maintainability. 15
 - (c) Given the hazard function $h(t) = \lambda t$ ($\lambda > 0$), compute the reliability function & the mean time to failure. 25
3. (a) Explain what you understand by an assignment problem. Solve the following assignment problem for minimizing total time. 20

Job	Machine A	Machine B	Machine C	Machine D
I	10	14	7	11
II	12	16	10	9
III	14	9	6	10
IV	11	6	7	5

 - (b) Discuss the inventory problem when the demand is stochastic having a discrete probability distribution. 15
 - (c) Show that in an irreducible Markov chain, all the states are of the same type – these are all transient or all persistent null or all persistent non-null. 25
4. (a) Explain clearly the basis and working of control chart for mean and range. Give interpretation of $\bar{X}$ and R charts. 15
 - (b) What are survival models? Explain (i) bath-tub and (ii) Weibull survival models. 15

- (c) For the queuing model M/M/s: FCFS/ ∞ obtain (i) the mean queue length and (ii) the average number of units in the system. 15
- (d) Describe the use of SPSS software packages with an illustration. 15

SECTION 'B'

5. Attempt any five sub-parts of the following
- (a) What is a time series? Explain briefly the various components of a time series. Also explain the additive and multiplicative models. 12
- (b) What are index numbers? Explain their uses. Discuss the difference between fixed-base and chained-base index numbers. 12
- (c) What are the principal publications relating to data on (i) agricultural statistics, (ii) trades statistics and (iii) Joint-stock companies? 12
- (d) Distinguish clearly between stable and stationary populations. 12
- (e) Define (i) total fertility rate, (ii) age-specific death rate and (iii) expectation of life. 12
- (f) Define T-scores. Explain the method of computing T-scores from raw test scores. 12
6. (a) State the different methods for determining the seasonal variation in a time series. Describe the Link-Relative method. 20
- (b) Describe the essential steps for the construction of a cost of living index number. 20
- (c) Describe the method of two-stage least squares to estimate the parameters of a given equation in a system of simultaneous equation; and show that these estimators are consistent. 20
7. (a) Define gross and net reproduction rates. Explain the computation of net reproduction rates. Interpret its value being less than, equal to or greater than unity. 20
- (b) State the basic assumptions while constructing a life table. In the usual notations, show that $q_x = 2m_x / (2 + m_x)$ What is an abridged life table? 20
- (c) State the main features of a logistic curve and explain its suitability as a growth model. How is this curve fitted to observed data? 20
8. (a) Describe the present official statistical system in India relating to information about population. 15
- (b) Describe the official method adopted for collection and publication of economic data and indices in our country. 15
- (c) What is meant by intelligence quotient (IQ)? Describe the procedure and tests for measuring IQ. 15
- (d) Describe the following methods of determining the reliability of test scores: (i) Split-half technique (ii) Rational equivalence 15