

2008
STATISTICS
Paper 2

Time : 3 Hours]

[Maximum Marks : 300

INSTRUCTIONS

*Candidates should attempt **all** the questions in Parts A, B & C
However, they have to choose only **three** questions in Part D.*

*Answers must be written in the medium opted (i.e. English or
Kannada).*

This paper has four parts :

A	20 marks
B	100 marks
C	90 marks
D	90 marks

Marks allotted to each question are indicated in each part.

*Assume suitable data if considered necessary and indicate the
same clearly.*

Notations and symbols used are as usual.

SEAL

PART A

4×5=20

Each question carries 5 marks.

1. (a) Describe ratio method of estimation. When is this method more precise than simple random sampling ?
- (b) Explain 'reliability' and 'hazard rate' and establish a relation between them.
- (c) Explain duality in linear programming and give its economic interpretation.
- (d) Describe the logistic model of population growth.

PART B

10×10=100

Each question carries 10 marks.

2. Explain PPS sampling. Give an unbiased estimator for the population total under PPSWR and derive its variance. How do you estimate this variance ?
3. Explain a method of analyzing the data obtained from a randomized block design.
4. Explain the basis and construction of control charts for 'defectives' and 'defects'.
5. Derive the reliability of a system with n independent components having exponential life length when the components are connected in series.
6. Derive the probability distribution of number of customers in the $M|M|1$:FIFO queueing system in steady state conditions. Hence determine the mean queue length.
7. Find an initial solution by the least cost method for the following transportation problem: and then solve :

	D_1	D_2	D_3	Availability
O_1	2	3	4	30
O_2	6	2	5	50
O_3	3	2	7	35
Requirement	45	25	45	

8. Describe the method of constructing an abridged life table.
9. What is multicollinearity ? What are its consequences ? How do you overcome the problem of multicollinearity ?
10. Write a program in FORTRAN to fit a straight line $y = \alpha + \beta x$ to the given data $\{(x_i, y_i), i = 1, 2, \dots, n\}$ using the method of least squares.
11. Explain the need for scaling techniques in psychological studies. Explain any two scaling techniques.

[Turn over

PART C

6×15=90

Each question carries 15 marks.

12. Describe two-stage sampling. Explain its advantages. Outline a method of determining the optimum sampling and sub-sampling fractions.
13. Describe the Yate's technique of analyzing 2^3 factorial experiment. Explain the meaning of confounding in factorial experiments.
14. Outline the basis and construction of \bar{X} and R charts. Derive the OC of R-chart.
15. Explain the components of a time-series. Outline the 'ratio to trend' and 'link relative' methods to measure seasonal fluctuations.
16. Solve the following linear programming problem :

$$\text{Maximize } Z = 5x_1 + 3x_2$$

$$\text{subject to } 2x_1 + x_2 \leq 1$$

$$x_1 + 4x_2 \geq 6$$

$$x_1, x_2 \geq 0.$$

17. (a) What is an index number ? Explain the construction of Paasche's and Fisher's price index numbers and compare them.
- (b) Explain 'stable population' and 'stationary population'.

PART D

3×30=90

Answer any *three* of the following questions. Each question carries 30 marks.

18. (a) Explain (i) cluster sampling, (ii) two-phase sampling.
- (b) Define recurrent and transient states. Show that a state j is recurrent iff $\sum_{n=0}^{\infty} p_{jj}^{(n)}$ is divergent.
19. (a) Explain the analysis of data in a balanced incomplete block design.
- (b) Compare Shewhart control charts and CUSUM control charts. Outline the V-mask procedure.
20. (a) Explain the truncated life testing for exponential model.
- (b) Describe the lot-by-lot double sampling plan for attributes. Derive its expressions for OC, ASN and AOQ.
21. (a) Stating the assumptions, derive the optimum inventory policy when the demand is probabilistic.
- (b) Outline the Leontief's method of fitting demand curve from time series data.
22. (a) What is the problem of identification in a simultaneous equation model? Establish a necessary condition for identifiability.
- (b) Explain
- (i) infant mortality rate
 - (ii) general fertility rate
 - (iii) net reproduction rate.