

- Note :
- 1) All Questions are compulsory.
 - 2) Figures to the right indicate marks.
 - 3) Statistical tables will be provided on request.

Q. 1. Solve any THREE questions from the following. [5]

a) Fit a straight line $y = a + bx$ to the following data.

Year (x)	1995	1996	1997	1998	1999
Production (y) (000 units)	250	265	280	270	260

b) In a population of 4 units, with values 2, 3, 4, 4 write down all possible simple random samples of size 3 without replacement. [5]

Verify

- (i) $E(\bar{y}) = \bar{y}$
- (ii) $V(\bar{y}) = \frac{N-n}{Nn} S^2$

c) The data relating to a small project consisting of 11 activities is given below. Present these activities in the form of network and determine - [5]

- i) Critical Path
- ii) Earliest and Latest expected time
- iii) Probability of completing the project within scheduled completion of 20 days.

Activity	Optimistic (to)	Most likely (tm)	Pessimistic (tp)
1 - 2	1	2	3
1 - 3	1	2	2
1 - 4	1	2	3
2 - 5	4	9	20
3 - 5	2	5	14
3 - 8	3	6	15
4 - 7	1	2	9
4 - 6	2	3	10
5 - 8	1	2	9
7 - 8	1	4	7
8 - 9	4	4	4

d) Fit a curve of the type $y = a \cdot x^b$ to the following data. [5]

X :	1	2	3	4
Y :	0.5	0.86	0.7	1.05

e) The following table gives the activities in a construction project and other relevant information ; [5]

Activity	1 - 2	1 - 3	2 - 4	3 - 5	4 - 5
Duration	6	4	3	8	7

- i) Draw the network for the project.
- ii) Find critical path.
- iii) Find free, total and independant floats for each activity.

Q. 2. Solve any THREE questions from the following. [5]

- a) A Company has factory at F_1, F_2, F_3 which supply to warehouse W_1, W_2, W_3 and W_4 . Weekly factory capacities are 11, 13, 19 units respectively. Weekly warehouse requirements are 6, 10, 12, 15 units respectively. Unit shipping Cost (in Rs.) are as follows -

Factory	Ware house				Supply
	W_1	W_2	W_3	W_4	
F_1	21	16	25	13	11
F_2	17	18	14	23	13
F_3	32	27	18	41	19
Demand	6	10	12	15	43

Determine the optimal solution for this company to minimize total shipping cost.

- b) Use Simplex Method to solve following LPP. [5]

$$\text{Max } Z = 3x_1 + 2x_2 + 5x_3$$

Subject to,

$$x_1 + 2x_2 + 2x_3 \leq 8.$$

$$3x_1 + 2x_2 + 6x_3 \leq 12$$

$$2x_1 + 3x_2 + 4x_3 \leq 12$$

$$x_1, x_2, x_3 \geq 0$$

- c) A marketing manager have to visit four different territories for sale. Their expected sales in thousand rupees are given. How should the territories be allocated to these sellers to maximize sales. [5]

Sellers	Territories			
	T_1	T_2	T_3	T_4
S_1	28	39	78	22
S_2	45	55	63	40
S_3	38	39	82	53
S_4	73	42	40	45
S_5	58	35	57	56

- d) Solve the following LPP graphically - [5]

$$\text{Minimize } Z = 20x_1 + 40x_2$$

Subject to,

$$18x_1 + 3x_2 \geq 54$$

$$3x_1 + 12x_2 \geq 36$$

$$10x_1 + 5x_2 \geq 50$$

$$x_1, x_2 \geq 0$$

- e) Two sample polls of votes for two candidates A and B for a public office are taken, one from among the residents of rural areas. The results are given in the table. [5]

Votes for area	A	B
Rural	71	42
Urban	49	78

Can we conclude at 5% level of significance that the nature of area is related to voting preference in the election.

