

A-103

IJ3AGO

SYBN
Stat III19/4/18
MARKS :50

TIME : 2 hrs

- N. B. :**
- All questions are compulsory.
 - Figures to the right indicate marks.
 - Graph papers will be provided on request.

Q.1 a. Explain various steps involved in solving transportation problem using - (1) least cost method. (2) Vogel's approximation method. (6)

b. Solve the following transportation problem to maximize profit, using vogel's method. (6)

| Origin | Profit (Rs.) Unit | | | | Supply |
|--------|-------------------|----|----|----|--------|
| | Destination | | | | |
| | 1 | 2 | 3 | 4 | |
| A | 40 | 25 | 22 | 33 | 100 |
| B | 44 | 35 | 30 | 30 | 30 |
| C | 38 | 38 | 28 | 33 | 70 |
| Demand | 40 | 20 | 60 | 30 | |

OR

Q.1 p. What is an assignment problem? How would you deal with the assignment problem where the objective function is to be maximized? (6)

q. A departmental head has four subordinates and four tasks to be performed. The subordinates differ in efficiency and the tasks differ in their intrinsic difficulty. His estimates of the times that each man would take to perform each task is given below -

| Subordinates | Tasks | | | |
|--------------|-------|----|-----|----|
| | I | II | III | IV |
| A | 8 | 26 | 17 | 11 |
| B | 13 | 28 | 4 | 26 |
| C | 38 | 19 | 18 | 15 |
| D | 19 | 26 | 24 | 10 |

How should the tasks be allocated to subordinates so as to minimize the total man hours? (6)

Q.2 a. Explain the meaning of basic feasible solution and degenerate solution in a linear programming problem. (5)

b. Solve the following LPP graphically -

$$\text{Minimize } Z = 6x_1 + 7x_2$$

Subject to,

$$3x_1 + 9x_2 \geq 36$$

$$6x_1 + 2x_2 \geq 24$$

$$2x_1 + 2x_2 \geq 16$$

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

(7)

OR

- Q.2 p.** Vitamins A and B are found in foods F1 and F2. One unit of Food F1 contains 3 units of vitamin A and 4 units of vitamin B. One unit of Food F2 contains 6 units of vitamin A and 3 units of vitamin B. One unit of food F1 and F2 cost Rs. 4 and Rs. 5 respectively. The minimum daily requirement to vitamin A and B is 80 and 100 units respectively. Assuming that anything in excess of daily minimum requirement of vitamin A and B is not harmful, find out the optimum mixture of Food F1 and F2 at the minimum cost which meets the daily minimum requirement of vitamins A and B. Formulate this as a linear programming problem. (5)

- q.** Solve the following L.P. problem using simplex method - (7)
- Maximize $Z = 5x_1 + 3x_2$
 Subject to,
- $$x_1 + x_2 \leq 2$$
- $$5x_1 + 2x_2 \leq 10$$
- $$3x_1 + 8x_2 \leq 12$$
- $$x_1 \geq 0, x_2 \geq 0$$

- Q.3 a.** Show that for a 2 x 2 contingency table with cell frequencies

| | |
|---|---|
| a | b |
| c | d |

 the chi-square test of independence gives.

$$\chi^2 = \frac{N (ad - bc)^2}{(a + b)(a + c)(b + d)(c + d)}$$

Where $N = a + b + c + d$ (6)

- b.** The eyesight of 1000 randomly selected people from a town were tested with the following results:

| | Poor eyesight | Good eyesight |
|--------|---------------|---------------|
| Male | 200 | 350 |
| Female | 200 | 250 |

Can we conclude at 5% level of significance that sex has no bearing on the quality of eyesight? (6)

OR

- Q.3 p.** Define a chi-square variable with n degrees of freedom and state its probability density functions. State any three important properties of a chi-square variate. (5)
- q.** Four coins were tossed 100 times with the following results.
- | | | | | | |
|-----------------|---|----|----|----|----|
| No. of heads : | 0 | 1 | 2 | 3 | 4 |
| No. of trials : | 5 | 20 | 35 | 30 | 10 |
- Test whether they can be regarded to be unbiased. (7)

- Q.4 a.** Determine an initial basic feasible solution to the following transportation problem by using (i) North West corner method (ii) Vogel's approximation method (7)

| | Destination | | | | Supply |
|----------|----------------|----------------|----------------|----------------|--------|
| | D ₁ | D ₂ | D ₃ | D ₄ | |
| Source A | 11 | 13 | 17 | 14 | 250 |
| B | 16 | 18 | 14 | 10 | 300 |
| C | 21 | 24 | 13 | 10 | 400 |
| Demand | 200 | 225 | 275 | 250 | |

- b.** Solve the following LPP graphically - (7)
 Maximize $Z = 20x_1 + 30x_2$
 Subject to,

$$3x_1 + 3x_2 \leq 36$$

$$5x_1 + 2x_2 \leq 50$$

$$2x_1 + 6x_2 \leq 60$$

$$x_1, x_2 \geq 0$$

OR

- Q.4 p.** Write the dual of the following primal LP problem
 Maximize $Z = 2x_1 + 5x_2 + 6x_3$
 Subject to,

$$5x_1 + 6x_2 - x_3 \leq 3$$

$$-2x_1 + x_2 + 4x_3 \leq 4$$

$$x_1 - 5x_2 + 3x_3 \leq -1$$

$$-3x_1 - 3x_2 + 7x_3 \leq 6$$

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

- q.** A socio - economic survey conducted in 1981 in Mumbai revealed the following results : (7)

| | Monthly family income | | |
|----------------------|-----------------------|----------------------|--------------------|
| | Below Rs. 1200 | Rs. 1200 to Rs. 1800 | Rs. 1800 and above |
| No Child | 18 | 15 | 12 |
| One Child | 31 | 34 | 25 |
| Two or More Children | 81 | 51 | 63 |

- Can we regard (at 1% level of significance) that the number of children in the family has no association with monthly income ? (7)
