TIME : 2 Hrs.

MARKS : 50

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

Q. 1. a) Explain various steps involved in solving transportation problem using -
i) least cost method   ii) Vogel's approximation method.
[6]

b) Determine an initial basic feasible solution to the following transportation problem using -
i) North west corner method   [6]
ii) Vogel's approximation method.

Destination

Source	D_1	D_2	D_3	D_4	Supply
A	11	13	17	14	250
B	16	18	14	10	300
C	21	24	13	10	400
Demand	200	225	275	250	

OR

Q. 1. p) What is an assignment problem ? Give the mathematical formulation of an assignment problem.
[6]

q) A certain equipment needs five repair jobs which have to be assigned to five machines. The estimated time (in hours) that each machine requires to complete the repair job is given in the following table -
[6]

Job

Machine	J_1	J_2	J_3	J_4	J_5
M_1	7	5	9	8	11
M_2	9	12	7	11	10
M_3	8	5	4	6	9
M_4	7	3	6	9	5
M_5	4	6	7	5	11

Assuming that each machine can be assigned to only one job, determine the minimum time assignment.
[6]

Q. 2. a) Explain the graphical method of solving an L. P. problem.
[6]

b) The vitamins A and B are found in two different foods F_1 and F_2. One unit of food F_1 contains 2 units of vitamin A and 5 units of vitamin B. One unit of food F_2 contains 4 units of vitamin A and 2 units of vitamin B. One unit of

food F_1 and F_2 cost Rs. 3 and Rs. 2.50 respectively. The minimum daily requirement for a person of vitamin A and B is 40 and 50 units respectively. Find the optimum mix of food F_1 and F_2 at the minimum cost which meets the daily minimum requirement of vitamin A and B. Assume that anything in excess of daily minimum requirement of vitamin A and B is not harmful. Formulate the given problem as a linear programming problem. [6]

OR

[6]

Q. 2. p) Solve the following LPP graphically.

Maximize $Z = 25x + 20y$

Subject to the constrainnts,

$$16x + 12y \leq 100$$
$$8x + 16y \leq 80$$
$$x, y \geq 0$$

q) Solve the following L.P. problem using simplex method –

Maximize $Z = 5x_1 + 3x_2$

Subject to,

$$x_1 + x_2 \leq 2$$
$$5x_1 + 2x_2 \leq 10$$
$$3x_1 + 8x_2 \leq 12$$
$$x_1, x_2 \geq 0$$

[6]

Q. 3. a) 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. [6]

b) Four coins were tossed 100 times with the following results- [6]

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. [6]

OR

Q. 3. p) 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, $N = a + b + c + d$

[7]

q) Test for independence between health and working capacity from the
following data - [7]

		Health		
		Very Good	Good	Fair
Working	Good	20	25	15
Capacity	Bad	10	15	15

Q. 4. a) A marketing manager has five salesman and five sales districts. Considering
the capabilities of the salesman and the nature of districts, the marketing
manager estimates that sales per month (in hundred rupees) for each
salesman in each district would be as follow - .

		Districts				
		A	B	C	D	E
Salesman	1	32	38	40	28	40
	2	40	24	28	21	36
	3	41	27	33	30	37
	4	22	38	41	36	36
	5	29	33	40	35	39

Find the assignment of salesman to districts that will result in maximum
sales. [7]

b) Solve the following LPP graphically -

Minimize $Z = 3x_1 + 2x_2$

Subject to,

$$5x_1 + x_2 \geq 10$$
$$x_1 + x_2 \geq 6$$
$$x_1 + 4x_2 \geq 12$$
$$x_1, x_2 \geq 0$$

[7]

OR

Q. 4. p) Write the dual of the following LP problem -

Minimize $Z = 3x_1 - 2x_2 + 4x_3$

Subject to,

$$3x_1 + 5x_2 + 4x_3 \geq 7$$
$$6x_1 + x_2 + 3x_3 \geq 4$$
$$7x_1 - 2x_2 - x_3 \leq 10$$
$$x_1 - 2x_2 + 5x_3 \geq 3$$
$$4x_1 + 7x_2 - 2x_3 \geq 2$$
$$x_1, x_2, x_3 \geq 0$$

q) In an experiment on immunization of cattle from tuberculosis the following
results were obtained - [7]

	Affected	unaffected
Inocculated	11	31
Not inocculated	14	4

Examine the effect of vaccine in controlling the incidence of the disease
at 1% level of significance. [7]