

Duration: 3 Hrs

Total Marks: 80

N.B : (1) Question 1 is compulsory.

- (2) Attempt any Three out of remaining five questions.
- (3) Assume any additional data, if required but justify the same.
- (4) Figure to the right indicate full marks for that question.
- (5) Use of calculator is allowed.

Q.1) a) A farmer is engaged in breeding pigs. The pigs are fed on various products grown on the farm. Because of the need to ensure nutrient constituents, it is necessary to buy additional one or two products, which we shall call A and B. The nutrients constituents (vitamins and proteins) in each of the product are given below:

Nutrient Constituents	Nutrient in the Product		Minimum Requirement of Nutrient constituents
	A	B	
X	36	06	108
Y	3	12	036
Z	20	10	100

Product A costs Rs. 20 per unit and product B costs Rs. 40 per unit. Determine how much of products A and B must be purchased so as to provide the pigs nutrients not less than minimum required, at the lowest possible cost. Solve graphically. (10)

b) A company has three factories N1, N2, N3 with production capacities of 11,13,19 units (in thousands). It has four warehouses G1, G2, G3 and G4 with demands of 6, 10, 12 and 15 units (in thousands). Unit cost (Cost in Rs.) of transportation is given from each factory to each warehouse. (10)

From\To	G1	G2	G3	G4
N1	42	32	50	26
N2	34	36	28	46
N3	64	54	36	82

Based on the above information,

- (1) Construct a Transportation table.
- (2) Find Initial Feasible Solution by:
  - (a) North-West Corner Method (NWCM)
  - (b) Least Cost Method (LCM)
  - (c) Vogel's Approximation Method (VAM)

Q.2) a) A company has 4 sales Executive which need to be appointed on one to one basis in 3 sales Territories Profit potential for each Executive Territory combination is given in Rs. thousands. Find optimal Assignment of Executives and Territories to maximize total profit. Which sales executive will remain idle? (10)

Executive\Territ	T1	T2	T3
E1	60	67	90
E2	80	83	95
E3	70	72	82
E4	85	95	110

Profit (in Rs.'000)

- b) Max.  $Z = 100X_1 + 80X_2$  (10)  
 Subject to constraints:  
 $6X_1 + 4X_2 \leq 7200$   
 $2X_1 + 4X_2 \leq 4000$   
 $X_1, X_2 \geq 0$   
 Find optimal solution by simplex method.

Q.3) a) A company has four plants with capacities of 5000, 10000, 7000, 3000 units. It has three warehouses with demands of 5000, 8000 & 10000 units.

Transportation cost per unit (in Rs.)

Plant\WH	P	Q	R
A	14	6	12
B	8	12	16
C	10	16	8
D	16	8	6

Find optimal transportation schedule & optimal cost. (10)

b) For the following Project:

- (1) Draw network diagram.
- (2) Find critical path and project completion time.
- (3) Find earliest and latest starting and finishing times of each activity.
- (4) Find total float, free float, independent float and interfering float for each activity. (10)

Activity	Time (days)
A(1-2)	3
B(1-3)	4
C(1-4)	6
D(2-5)	5
E(3-6)	6
F(4-7)	5
G(5-8)	4
H(6-8)	7
I(7-8)	4

Q.4) a) Solve by Artificial variable method. (10)

Min.  $Z = 4X_1 + 3X_2$

Subject to :

$200X_1 + 100X_2 \geq 4000$

$1X_1 + 2X_2 \geq 50$

$40X_1 + 40X_2 \geq 1400$

- b) i) Write the difference between an Event and an Activity.
- ii) What is operations research? What are the characteristics of operation research? (10)

Q.5) a) A small project consist of seven activities. Optimistic, most likely and pessimistic time estimates are given for each activity. (10)

Activity	Preceding Activity	Time(days)		
		Optimistic	Most likely	Pessimistic
A	-	2	5	8
B	-	2	5	14
C	A	4	6	14
D	A	5	7	15

E	B,C	2	3	10
F	D	3	3	3
G	E	1	2	3

- (1) Draw the PERT network and find expected completion time of project.
- (2) What is the probability that project will be completed in?
  - (a) 18 days
  - (b) 21 days
  - (c) 16 days
- (3) If the project manager wants an assurance of 95% that the project is completed on time, how many days before the scheduled date he should start the project.

b) Find the optimum solution of the following transportation problem using Least Cost/Matrix Minima Method and MODI method, where cells shows the transportation costs in rupees. (10)

	W1	W2	W3	W4
O1	6	4	1	14
O2	8	9	2	16
O3	4	3	6	5
Demand	6	10	15	

Q.6) a) In a factory there are 5 employees and 5 jobs are to be done on a one to one basis. Time required (in Minutes) is given for each Employee-Job combination. Find optimal assignment of employees & Jobs to minimize total time. (10)

Time (in minutes)

Employees\Job	A	B	C	D	E
I	160	130	175	190	200
II	135	120	130	160	175
III	140	110	155	170	185
IV	50	50	80	80	110
V	55	35	70	80	105

b) Solve the following game using Principle of Dominance: (10)

		Player B					
		I	II	III	IV	V	VI
Player A	1	4	2	0	2	1	1
	2	4	3	1	3	2	2
	3	4	3	7	-5	1	2
	4	4	3	4	-1	2	2
	5	4	3	3	-2	2	2

\*\*\*\*\*