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1205E569

Candidate's Seat No: _____

IMBA (IIS) Sem.6 Examination
Operation Research & Control Methods

Time : 2-00 Hours]

May-2025

[Max. Marks : 70

Instructions:

1. The figures on right-hand side indicate marks.
2. Use of calculators is **allowed**.

Q#1. Define Operations Research. Explain its nature and key characteristics. [14 Marks]

OR

Q#1. What is a Linear Programming Problem (LPP)? Discuss the fundamental assumptions associated with linear programming. [14 Marks]

Q#2. Solve the following problems using the simplex method.

$$\begin{array}{ll} \text{Maximise} & Z = 45x_1 + 80x_2 \\ \text{Subject to} & 5x_1 + 20x_2 \leq 400 \\ & 10x_1 + 15x_2 \leq 450 \\ & x_1, x_2 \geq 0 \end{array}$$

[14 Marks]

OR

Q#2. Solve the following problems using Big M method.

$$\begin{array}{ll} \text{Minimise} & Z = 40x_1 + 24x_2 \\ \text{Subject to} & 20x_1 + 50x_2 \geq 4800 \\ & 80x_1 + 50x_2 \geq 7200 \\ & x_1, x_2 \geq 0 \end{array}$$

Total Cost

Phosphate requirement

Nitrogen requirement

[14 Marks]

Q#3. The Perfect Manufacturing Company has a current transportation schedule which is being questioned by the top management as to whether or not it is optimal. The firm has three factories and five warehouses. The necessary data in terms of unit transportation cost (in Rs.), factory capacities, and warehouse requirements are given below. Find an initial solution using North-West Corner method and least cost method. [14 marks]

Warehouse	Factories			Warehouse requirements
	A	B	C	
1	50	40	80	400
2	80	70	40	400
3	60	70	60	500

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4	60	60	60	400
5	30	50	40	800
Factory Availability	800	600	1100	2500

OR

Q#3. The table below records transportation costs per unit of a product from origins O1, O2, O3 and O4 to destinations D1, D2, D3, D4 and D5. The capacities of the four origins are, respectively, 55, 45, 30 and 50 while the requirements of the five destinations are, respectively, 40, 20, 50, 30 and 40. Employing Vogel's Approximation method, or otherwise, make the initial allocations to the origins to satisfy the requirements of the destinations and test the optimality of these allocations. Use Modified Distribution method (MODI) for obtaining an optimal solution that would minimise the total cost of transportation. Find the total cost implied by the solution. [14 Marks]

Origin	Destination					Capacity
	D1	D2	D3	D4	D5	
O1	12	4	9	5	9	55
O2	8	1	6	6	7	45
O3	1	12	4	7	7	30
O4	10	15	6	9	1	50
Requirement	40	20	50	30	40	

Q#4. A production supervisor is considering how he should assign the four jobs that are to be performed by four of the workers. He wants to assign the jobs to the workers such that the aggregate time to perform the jobs is least. Based on previous experience, he has the information on the time taken by the four workers in performing these jobs, as given in Table. Solve the problem using HAM method. [14 Marks]

Worker	JOB			
	A	B	C	D
1	45	40	51	67
2	57	42	63	55
3	49	52	48	64
4	41	45	60	55

OR

Q#4. Solve the following transportation problem taking initial solution by VAM. Use Modified Distribution method (MODI) for obtaining an optimal solution that would minimise the total cost of transportation. Find the total cost implied by the solution. [14 Marks]

Plant	M ₁	M ₂	M ₃	M ₄	Supply
P ₁	10	5	7	8	150
P ₂	6	4	8	5	125
P ₃	9	12	10	7	185
Demand	110	80	150	120	460

Q#5 Answer the following MCQs (attempt any 7 out of 12)

[14 Marks]

- What is the objective of a linear programming problem?
 - To maximize or minimize a linear objective function
 - To find the root of a nonlinear equation
 - To minimize the number of constraints
 - To graph a set of inequalities
- Which of the following is *not* a requirement for a linear programming model?
 - Linear objective function
 - Linear constraints
 - Integer decision variables
 - Non-negativity restrictions
- In LP, the feasible region is:
 - The area that maximizes the objective function
 - The region containing all optimal points
 - The set of all points satisfying the constraints
 - The region outside the constraint boundaries
- A transportation problem is balanced if:
 - Supply exceeds demand
 - Demand exceeds supply
 - Total supply equals total demand
 - Total cost is minimized
- The MODI (Modified Distribution) method is used to:
 - Find an initial feasible solution
 - Test the optimality of the current solution
 - Convert the problem to LP
 - Balance an unbalanced transportation problem
- Which of the following methods is *not* used for finding an initial basic feasible solution in transportation problems?
 - Northwest Corner Rule
 - Least Cost Method
 - Vogel's Approximation Method
 - Big M Method

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7. The assignment problem is a special case of:
 - A) Transportation problem
 - B) Integer programming
 - C) Non-linear programming
 - D) Game theory
8. In an assignment problem with n agents and n tasks, the total number of assignments is:
 - A) n^2
 - B) 2^n
 - C) $n!$
 - D) $n+n$
9. The Hungarian Method is used to solve:
 - A) Linear equations
 - B) Transportation problems
 - C) Assignment problems
 - D) Game theory models
10. In the simplex method, a basic feasible solution corresponds to:
 - A) A point inside the feasible region
 - B) An intersection of constraint boundaries
 - C) A non-optimal solution
 - D) The last row of the simplex tableau
11. In the simplex method, which variable enters the basis?
 - A) The one with the most negative coefficient in the objective row
 - B) The one with the most positive coefficient in the constraint row
 - C) Any variable
 - D) The one with the smallest absolute value
12. What does an unbounded solution in the simplex method indicate?
 - A) Multiple optimal solutions
 - B) No feasible solution
 - C) The objective function can increase indefinitely
 - D) A tie in the entering variable

*****END OF PAPER*****