GURU NANAK INSTITUTE OF TECHNOLOGY
An Autonomous Institute under MAKAUT
2020-2021
OPERATIONS RESEARCH
CS505A

TIME ALLOTTED: 3 Hours **FULL MARKS: 70**

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

GROUP – A
(Multiple Choice Type Questions)

Answer any ***ten*** from the following, choosing the correct alternative of each question: **10×1=10**

			Marks	CO No
1.	(i)	The formula for finding the minimum inventory cost under the purchasing model without shortage is (a) $\sqrt{2RC_3 / C_1}$ (b) $\sqrt{2RC_1 / C_3}$ (c) $\sqrt{2RC_1C_3}$ (d) $\sqrt{C_1 / (2RC_3)}$	1	CO1, CO2
	(ii)	To solve any L.P.P with more than two decision variables we use (a) Graphical Method (b) Simplex method (c) All of the above (d) None of the above	1	CO1
	(iii)	To test optimality of an initial basic feasible solution of a given transportation problem we use (a) North-West Corner method (b) VAM (c) MODI method (d) Least Cost method	1	CO2
	(iv)	In the case of '≥ ' constraints, ______are used to make the equation equality. (a) Surplus variables (b) slack variable (c) all of the above (d) none of the above	1	CO1
	(v)	Artificial variables are introduced in (a) Simplex method (b) Big-M method (c) Graphical Method (d) None of the above	1	CO2
	(vi)	To get initial basic feasible solution of a given transportation problem which one is closest to the optimal solution, we use (a) North-West Corner method (b) VAM (c) MODI method (d) Least Cost method	1	CO3

(vii)	An activity which does not consume any kind of resource but merely serves the purpose of indicating the predecessor or successor relationship clearly is called: (a) Predecessor activity (b) dummy activity (c) All of the above (d) none of the above	1	CO2
(viii)	A competitive situation is known as (a) Pay off matrix (b) game (c) All of the above (d) none of the above	1	CO1
(ix)	Path connecting the first initial node to the very last terminal node, of longest duration in any project network is called (a) Project path (b) dummy path (c) Critical path (d) none of the above	1	CO1
(x)	Any set of non- negative allocations ($x_{ij} > 0$) which satisfies the row and column sum (rim requirements) is called a – (a) Feasible Solution (b) Initial Basic Feasible Solution (c) Non-degenerate basic feasible solution (d) Optimal Solution	1	CO3
(xi)	A saddle point of a payoff matrix is that position in the payoff matrix where- (a) Maximum of row minima coincides with the minimum of the column maxima. (b) Minimum of row maxima coincides with the maximum of the column minima. (c) Maximum of row maxima coincides with the minimum of the column minima. (d) Minimum of row minima coincides with the maximum of the column maxima.	1	CO1
(xii)	To reduce the size of a game we use (a) Dominance Property (b) Dormant Property (c) Inventory Property (d) Complex Property	1	CO2

GROUP – B

(Short Answer Type Questions)

Answer any ***three*** from the following: **3×5=15**

			Marks	**CO No.**
2.	(a)	Find the dual of the following LPP $\text{Max}Z=2x_1+3x_2+4x_3$ Subject to $x_1-5x_2+3x_3 = 7$ $2x_1-3x_2+4x_3 \leq 3$ $x_1, x_2 \geq 0$ and x_3 is unrestricted in sign	5	CO3

3. (a) Determine an initial basic feasible solution to the following transportation problem: 5 CO3

	D_1	D_2	D_3	D_4	Supply
O_1	2	1	3	4	30
O_2	3	2	1	4	50
O_3	5	2	3	8	20
Demand	20	40	30	10	

4. (a) A person wants to decide the constituents of a diet, which will fulfil his daily requirements of proteins, carbohydrates at the minimum cost. The choice is to be made from four different types of foods. The yields per unit of these foods are given in the Table1 below: 5 CO2

Food	Yield per unit			Cost per units (Rs.)
	Proteins	Fats	Carbohydrates	
1	3	2	6	45
2	4	2	4	40
3	8	7	7	85
4	6	5	4	65
Minimum requirement	800	200	700	

5. (a) Solve the following L.P.P graphically: 5 CO1

Minimize z = -3x + y

Subject to $-x + 3y \leq 9$, $x + y \leq 6$, $x - y \leq 2$ and $x, y \geq 0$

6. (a) Solve the following payoff matrix 5 CO3

	Player B		
Player A		B1	B2
	A1	3	5
	A2	4	1

GROUP – C

(Long Answer Type Questions)

Answer any ***three*** from the following: **3×15=45**

			Marks	CO No
7.	(a)	What do you mean by degeneracy in transportation problem?	3	CO1
	(b)	Consider the following data for the activities of a project-	10	CO2

Activity	A	B	C	D	E	F
Immediate Predecessors	–	A	A	B, C	–	E
Duration days)	2	3	4	6	2	8

Draw the network and find the critical path and various floats.

	(c)	Define payoff matrix and saddle point.	2	CO1
8.	(a)	Solve the following 2*5 graphically-	9	CO2

	Player B					
Player A		B1	B2	B3	B4	B5
	A1	2	-1	5	-2	6
	A2	-2	4	-3	1	0

(b) Solve the following assignment problem: 6 CO1

Profit matrix

	I	II	III	IV	V
A	45	40	65	25	55
B	50	30	25	60	30
C	25	20	10	20	40
D	35	25	30	25	20
E	80	60	50	70	50

9. (a) Define EOQ. 3 CO2

(b) An aircraft company uses rivets at an approximate customer rate of 2,500 kg per year. Each unit costs Rs. 30 per kg and the company personnel estimate that it costs Rs. 130 to place an order, and that the carrying cost of inventory is 10 percent per year. How frequently should orders for rivets be placed? Also determine the optimum size of each order. 12 CO2

10. (a) Find out the optimal solution of the transportation problem: 15 CO2

	D_1	D_2	D_3	D_4	D_5	Supply
O_1	2	1	7	4	3	5
O_2	2	1	4	5	3	9
O_3	5	2	9	3	1	9
Demand	5	2	6	7	3	

11. (a) Solve the following L.P.P using Charnes' Big M-Method: 9 CO2

Max Z= -2x –y

Subject to,

$3x + y = 3$

$4x + 3y \geq 6$

$x + 2y \leq 4$

$x, y \geq 0$

(b) Determine the optimal sequence of jobs which minimizes a total elapsed time based on the following information. Processing time on the machines is given in hours and passing is not allowed. 6 CO3

Job	A	B	C	D	E	F	G
M1	3	8	7	4	9	8	7
M2	4	3	2	5	1	4	3
M3	6	7	5	11	5	6	12