BRAINWARE UNIVERSITY

Term End Examination 2023
Programme – M.Sc.(MATH)-2021
Course Name – Operations Research
Course Code - MSCMC401
(Semester IV)

Full Marks : 60 **Time : 2:30 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question) 1 x 15=15

1. *Choose the correct alternative from the following :*

(i) Write the minimum number of lines covering all zeroes in a reduced cost matrix of order

a) at the most n
b) at the least n
c) n-1
d) n 1

(ii) Illustrate the purpose of a dummy row or column in an Assignment Problem is to

a) obtain balance among all the activities and all the resources
b) prevent a solution from degenerate
c) provide an unbalanced problem
d) obtain multiple optimum solutions.

(iii) An assignment problem can be solved by

a) Simplex method
b) Transportation Problem
c) Branch & Bound method
d) All of these

(iv) Consider the LP

Maximize $9X_1 + 3X_2$
subject to $4X_1 + X_2 \leq 12$
$2X_1 + 4X_2 \leq 22$
$X_1, X_2 \geq 0.$

Estimate the primal using the graphical method. Is a dual solution $Y_1 = 15/7$, $Y_2 = 3/14$ optimum?

a) It is not optimum to the dual because it is not feasible to the dual
b) The dual solution is feasible but not optimum because the objective function value is different from that of the primal
c) It is optimum using the optimality criterion theorem
d) Weak duality theorem is violated.

(v) The graphical approach to an LPP is useful because------select the correct one

a) it provides general way to solve linear programming problems
b) it does not provide unbounded solution
c) it gives geometric insight into the given LPP and the meaning of optimality
d) none of these

(vi) An iso-profit line defined as

a) an infinite number of solutions all of which yield same profit.
b) an infinite number of optimum solutions
c) An infinite number of solutions all of which yield the same cost.
d) a boundary line of the feasible region.

(vii) While solving a LPP graphically, the region bounded by the constraints is defined as

a) feasible region
b) infeasible region
c) unbounded solution
d) solution space and feasible region

(viii) Consider the LP

Maximize $2X_1 + 3X_2 + 4X_3 + X_4$
subject to $X_1 + 2X_2 + 5X_3 + X_4 \leq 12$.
$X_j \geq 0$.
Solve the dual and find the optimum solution to the primal.
Select the correct option.

a) A single constrained LP can have more than one variable taking non zero value at the optimum
b) The variable with the largest coefficient in the objective function is the only variable with a non-zero value in the optimum solution.
c) The variable with the smallest coefficient in the constraint is the only variable with a non-zero value in the optimum solution.
d) The variable with the largest ratio of the objective function coefficient to constraint coefficient is the only variable with a non-zero value in the optimum solution.

(ix) Consider the LP
Maximize $2X_1 + 3X_2 + 4X_3 + X_4$
subject to $X_1 + 2X_2 + 5X_3 + X_4 \leq 12$.
$X_j \geq 0$.
Only 11 units of the resource is available. Calculate the value of the objective function at optimum is _____

a) 18
b) 20
c) 22
d) 24

(x) At any iteration of the usual simplex method of maximization LPP, if there is at least one basic variable in the basis at zero level and all $z_j - c_j \geq 0$, the current solution is------select the correct one.

a) Infeasible
b) unbounded
c) non-degenerate
d) degenerate

(xi) Consider the LP problem:
Maximize $5X_1 + 12X_2$
subject to $2X_1 + 5X_2 \leq 13$
$7X_1 + 11X_2 \leq 31$
$X_1, X_2 \geq 0$. Solve this problem using Simplex algorithm and answer the following:
Deduce the objective function value after first iteration.

a) 28.8
b) 30.0
c) 31.2
d) 32.2

(xii) The point of intersection of pure strategies in a game is distinguished as

a) Value of the game
b) Saddle point
c) Mixed strategy
d) Optimal strategy

(xiii) In game theory, a choice that is optimal for a firm no matter what its competitors do is identified to as

a) the dominant strategy.
b) the game-winning choice.
c) super optimal.
d) a gonzo selection.

(xiv) In game theory, a situation in which one firm can gain only what another firm loses is illustrated a

a) nonzero-sum game.
b) prisoners' dilemma.
c) zero-sum game.
d) cartel temptation.

(xv) If the primal (maximization) is unbounded then distinguish the corresponding dual is _____

a) bounded
b) unbounded
c) infeasible
d) none of these

Group-B

(Short Answer Type Questions) 3 x 5=15

2. Identify the following game is strictly determinable and fair. (3)

	Player B		
Player A		B_1	B_2
	A_1	5	0
	A_2	0	2

3. The demand for a purchased item is 1000 units/ month, and shortages are allowed. If the unit cost is Rs. 1.50 per unit, the cost of making one purchase is Rs. 600, the holding cost for one unit is Rs. 2 per year, and the cost of one shortage is Rs. 10 per year, evaluate the number of orders per year. (3)

4. Analyze the following terms: (3)

(i) Basic solution

(ii) Basic feasible solution

5. Write the initial B.F.S of the transportation problem by North West corner method also find the cost (3)

	D1	D2	D3	D4	Availability
O1	5	3	6	2	19
O2	4	7	9	1	37
O3	3	7	4	5	34
Demand	16	18	31	25	

6. State short note on queue discipline. (3)

OR

State short note on customer behaviour in Queuing Theory (3)

Group-C

(Long Answer Type Questions) 5 x 6=30

7. For the game with pay off matrix: (5)

	Player B	
Player A	B1	B2
A1	1	-3
A2	3	5
A3	-1	6
A4	4	1
A5	2	2
A6	-5	0

Identify the Optimal strategies for player A and B using graphical method. Also identify the values of the game.

8. Evaluate the following Transportation problem. (5)

	To			
From	A	B	C	Availability
I	6	9	4	14
II	4	9	8	12
III	1	2	6	5
Requirement	6	10	15	

9. Justify what is meant by linear programming problem. (5)

10. A maintenance service facility has Poisson arrival rates, negative exponential service times, and operates on a FCFS queue discipline. Breakdowns occur on an average of three per day with a range of zero to eight. The maintenance crew can service on an average six machines per day with a range from zero to seven. Then estimate mean number in the system in breakdown or repair. (5)

11. Determine the optimum basic feasible solution to the following transportation problem: (5)

	A	B	C	Available
I	50	30	220	1
II	90	45	170	3
III	250	200	50	4
Required	4	2	2	

12. Reframe the following LPP to its standard form. (5)

$$Max\ z = x_1 - 3x_2$$

Subject to the constraints

$$-x_1 + 2x_2 \leq 15$$
$$x_1 + 3x_2 = 10$$

x_1 and x_2 are unrestricted in sign.

OR

Evaluate the following LPP into the form where all the constraints are of equality type. (5)

$$Max\ z = 2x_1 + x_2 - 6x_3 - 4x_4$$

Subject to the constraints

$$3x_1 + x_4 \leq 25$$
$$x_1 + x_2 + x_3 + x_4 = 20$$
$$4x_1 + 6x_3 \geq 5$$
$$2 \leq x_1 + 3x_3 + 2x_4 \leq 30$$

$x_j \geq 0$(j=1,2,3,4)

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