

C. U. SHAH UNIVERSITY

Summer Examination-2022

Subject Name: Operations Research

Subject Code: 4SC06OPR1

Branch: B.Sc. (Mathematics)

Semester: 6

Date: 09/05/2022

Time: 02:30 To 05:30

Marks: 70

Instructions:

- (1) Use of Programmable calculator & any other electronic instrument is prohibited.
- (2) Instructions written on main answer book are strictly to be obeyed.
- (3) Draw neat diagrams and figures (if necessary) at right places.
- (4) Assume suitable data if needed.

- Q-1 Attempt the following questions: (14)**
- | | | |
|-----------|--|----|
| a) | Define: Basic feasible solution. | 01 |
| b) | Discuss degeneracy in LPP | 02 |
| c) | Define: Convex Set. | 01 |
| d) | Write general mathematical formulation of LPP | 02 |
| e) | Define: Artificial variable. | 01 |
| f) | Write general mathematical formulation of transportation problem. | 02 |
| g) | True/False. Every linear programming problem can be solved by graphical methods. | 01 |
| h) | Is it possible zero value of key element in simplex method? | 01 |
| i) | Define: Saddle point. | 01 |
| j) | How many methods are there for finding initial basic feasible solution to transportation problem. List all of them | 02 |

Attempt any four questions from Q-2 to Q-8

- Q-2 Attempt all questions (14)**
- | | | |
|-----------|--|-----------|
| a) | A paper mill produces two grades of paper namely X and Y. Because of raw material restrictions, it cannot produce more than 400 tons of grade X and 300 tons of grade Y in a week. There are 160 production hours in a week. It requires 0.2 and 0.4 hours to produce a ton of products X and Y respectively with corresponding profits of Rs.200 and Rs.500 per ton. Formulate the above as a LPP to maximize profit. | 05 |
| b) | Solve the Linear programming problem by using graphical method. | 05 |
- $$Max Z = 6x_1 + 4x_2$$
- Subject to
- $$-2x_1 + x_2 \leq 2$$
- $$x_1 - x_2 \leq 2$$
- $$3x_1 + 2x_2 \leq 9$$
- $$\text{and } x_1, x_2 \geq 0$$
- | | | |
|-----------|--|-----------|
| c) | Solve the following system of equation | 04 |
|-----------|--|-----------|
- $$2x_1 + 3x_2 + 4x_3 = 5$$



$$3x_1 + 4x_2 + 5x_3 = 6$$

Q-3 **Attempt all questions** **(14)**

a) Solve the linear programming problem using Big – M method **07**

$$\text{Min } Z = 5x_1 + 8x_2$$

Subject to

$$3x_1 + 2x_2 \geq 3$$

$$x_1 + 4x_2 \geq 4$$

$$x_1 + x_2 \leq 5$$

$$\text{and } x_1, x_2 \geq 0$$

b) Write steps of graphical method to solve linear programming problem. **04**

c) Write standard form of following Linear programming problem **03**

$$\text{Min } Z = x_1 - 2x_2 + x_3$$

Subject to

$$2x_1 + 3x_2 + 4x_3 \geq -7$$

$$3x_1 + 5x_2 + 2x_3 \geq 7$$

$$\text{and } x_1, x_2 \geq 0, x_3 \text{ is unrestricted.}$$

Q-4 **Attempt all questions** **(14)**

a) Write difference between CPM and PERT. **06**

b) For what value of λ , is the game with the following matrix strictly determinable? *Player B* **05**

$$\text{Player A} \begin{matrix} A_1 \\ A_2 \\ A_3 \end{matrix} \begin{bmatrix} \lambda & 6 & 2 \\ -1 & \lambda & -7 \\ -2 & 4 & \lambda \end{bmatrix} \begin{matrix} B_1 \\ B_2 \\ B_3 \end{matrix}$$

c) Write four limitation of linear programming problem. **03**

Q-5 **Attempt all questions** **(14)**

a) Write note on MODI method. **07**

b) Define: (i) zero – sum game (ii) strategy **03**

c) Draw the network diagram from the given activity and it's preceding relationship. **04**

Activity	A	B	C	D	E	F	G	H	I
Preceding Activity	-	-	-	A	A	B, D	C	B	F,G

Q-6 **Attempt all questions** **(14)**

a) Solve by using simplex method. **07**

$$\text{Max } Z = x_1 + 4x_2 + 5x_3$$

Subject to



$$3x_1 + 6x_2 + 3x_3 \leq 22$$

$$x_1 + x_2 + 3x_3 \leq 14$$

$$3x_1 + 2x_2 \leq 14$$

$$\text{and } x_1, x_2, x_3 \geq 0$$

- b) Find an optimal solution to given transportation table

07

	D_1	D_2	D_3	D_4	Supply
01	6	1	9	3	70
02	11	5	2	8	35
03	10	12	4	7	70
Demand	85	35	50	45	

Q-7

Attempt all questions

(14)

- a) A newly developed dairy has started producing cheese, butter, and milk candy. There are three departments: one is the manufacturing department and the other two are pasteurization and packing departments respectively. The following table shows the labor hours spent by one unit (kg) in each department.

05

Time/kg.			
Department	Cheese	Butter	Milk Candy
I Manufacturing	10	1	2
II Pasteurization	7	2	3
III Packing	2/5	4/5	2/5

The minimum working capacity of each plant is 100, 75, and 80 hours respectively. The profit on sale of one (kg) of cheese, butter, and milk candy is Rs. 12, Rs. 10 and Rs. 8 respectively. You have to plan the schedule that maximizes the total profit.

- b) Find Initial Basic Feasible solution by using Vogel's approximation method

05

	D_1	D_2	D_3	D_4	Supply
F_1	3	3	4	1	100
F_2	4	2	4	2	125
F_3	1	5	3	2	75
Demand	120	80	75	25	

- c) Write down steps of Least corner method.

04

Q-8

Attempt all questions

(14)

- a) Find Initial Basic Feasible solution by using North west corner method

05

	A	B	C	D	Supply
P	5	3	6	4	30
Q	3	4	7	8	15
R	9	6	5	8	15
Demand	10	25	18	7	

- b) Solve by using Graphically

05

$$\text{Max } Z = 5x + 8y$$

Subject to

$$3x + 2y \leq 36$$

$$x + 2y \leq 20$$

$$3x + 4y \leq 42$$



and $x, y \geq 0$

c) Find the value of game and saddle point for the given pay-off matrix

04

		Player B				
		B_1	B_2	B_3	B_4	B_5
Player A	A_1	-2	0	0	5	3
	A_2	3	2	1	2	2
	A_3	-4	-3	0	-2	6
	A_4	5	3	-4	2	-6

