Enrollment No: _____ Exam Seat No:_____

C.U.SHAH UNIVERSITY

Summer Examination-2017

Subject Name: Operations Research

Subject Code: 4SC06ORE1 Branch: B.Sc. (Mathematics)

Semester: 6 Date: 25/04/2017 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) Write the Standard form of the following LP problem. **(02)**

Minimize $z = x_1 - 2x_2 + x_3$

Subject to

$$2x_1 + 3x_2 + 4x_3 \geq -4$$
$$3x_1 + 5x_2 + 2x_3 \geq 7$$

and$x_1, x_2 \geq 0$ and x_3 is unrestrictedin sign.

b) Which type of solution exist for the given LP problem **(02)**

Maximize $Z = 3x_1 + 4x_2$

Subject to

$$x_1 - x_2 = -1$$
$$-x_1 + x_2 \leq 0$$

and $x_1, x_2 \geq 0$

c) Write general mathematical model of an LP problem. **(02)**

d) If the optimal simplex table, $c_j - z_j = 0$ value indicates_____. **(01)**

e) Define: Convex Set. **(01)**

f) Define: Slack variable. **(01)**

g) Define: Dummy activity. **(01)**

h) Define: Network. **(01)**

i) Define: Saddle point. **(01)**

j) Define: Zero-sum game. **(01)**

k) The right hand side of the constraint in simplex method must be non-negative. **(01)**
Determine whether statement is true or false.

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

Q-2 **Attempt all questions** **(14)**

a) Explain the graphical method of solving an LP problem. Also solve the following LP problem using graphical method. **(07)**

Maximize $z = 3x_1 - 2x_2$

Subject to

$$x_1 + x_2 \leq 1$$
$$2x_1 + 2x_2 \geq 4$$

and $x_1, x_2 \geq 0$

b) What is linear programming problem? How can formulate a given problem into LP problem? **(04)**

c) Solve the game whose pay off matrix is given by **(03)**

Player A	Player B		
	B_1	B_2	B_3
A_1	1	3	1
A_2	0	-4	-3
A_3	1	5	-1

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

a) Use the simplex method to solve the following LP problem. **(07)**

Maximize $z = 3x_1 + 5x_2 + 4x_3$

Subject to

$$2x_1 + 3x_2 \leq 8$$
$$2x_2 + 5x_3 \leq 10$$
$$3x_1 + 2x_2 + 4x_3 \leq 15$$

and $x_1, x_2, x_3 \geq 0$

b) A company manufactures two products A and B. These products are processed in the same machine. It takes 10 minutes to process one unit of product A and 2 minutes for each unit of product B and the machine operates for a maximum of 35 hours in a week. Product A requires 1 kg. and B requires 0.5 kg. of raw material per unit the supply of which is 600 kg. per week. Market constraint on product B is known to be 800 unit every week. Product A costs Rs.5 per unit and sold at Rs.10. Product B costs Rs.6 per unit and can be sold in the market at a unit price of Rs.8. Determine the number of units of A and B per week to maximize the profit. Formulation the problem as a linear programming problem. **(04)**

c) Find all basic solutions of the following system of equations **(03)**

$2x_1 + 3x_2 + 4x_3 = 5, 3x_1 + 4x_2 + 5x_3 = 6.$

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

a) Use the penalty (Big-M) method to solve the following LP Problem. **(07)**

Maximize $z = -2x_1 - x_2$

Subject to

$$3x_1 + x_2 = 3$$
$$4x_1 + 3x_2 \geq 6$$
$$x_1 + 2x_2 \leq 4$$

and $x_1, x_2 \geq 0$

b) Obtain initial basic feasible solution for the following transportation problem using the matrix minima method. **(04)**

	A	B	C	D	Supply
P	05	03	06	04	30
Q	03	04	07	08	15
R	09	06	05	08	15
Demand	10	25	18	07	60

c) Define: Basic solution, Basic feasible solution, Optimum basic feasible solution. **(03)**

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

a) Using simplex method to solve the following LP problem **(07)**

Maximize $z = 3x_1 + 9x_2$

Subject to

$$x_1 + 4x_2 \leq 8$$
$$x_1 + 2x_2 \leq 4$$

and $x_1, x_2 \geq 0$

b) Explain the North-West corner method for obtaining an initial basic solution of a transportation problem. **(04)**

c) 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 LP problem to maximize profit. **(03)**

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

a) Determine an initial basic feasible solution using (a) North-West corner method, (b) Vogel's approximation method, by considering the following transportation problem: **(08)**

	D_1	D_2	D_3	D_4	D_5	Supply
A	02	11	10	03	07	04
B	01	04	07	02	01	08
C	03	09	04	08	12	09
Demand	03	03	04	05	06	21

b) Solve the following LP problem graphically **(03)**

Maximize $z = 2x_1 + 3x_2$

Subject to

$$x_1 + x_2 \leq 4$$
$$2x_1 + 3x_2 \leq 6$$

and $x_1, x_2 \geq 0$

c) Explain: Errors in a network. **(03)**

Q-7 **Attempt all questions** **(14)**

a) Solve the following transportation problem using MODI Method. **(08)**

	D_1	D_2	D_3	Supply
O_1	04	03	02	10
O_2	02	05	00	13
O_3	03	08	06	12
Demand	08	05	04	

b) For the game with payoff matrix: **(03)**

Player A	Player B		
	B_1	B_2	B_3
A_1	-1	2	-2
A_2	6	4	-6

Determine the value of game. Is this game (i)fair ?(ii)strictly determinable?

c) Draw a network diagram for the following data: **(03)**

Activity	A	B	C	D	E	F	G	H	I	J
Immediate Predecessors	-	A	B	B	B	C	C	F,G	D, E, H	I

Q-8 **Attempt all questions** **(14)**

a) Obtain initial basic feasible solution of the following transportation problem. Is this solution an optimal solution? If not, obtain the optimal solution. **(08)**

	I	*II*	*III*	*IV*	*V*	Available
A	5	8	6	6	3	800
B	4	7	7	6	5	500
C	8	4	6	6	4	900
Demand	400	400	500	400	800	

b) Draw a network diagram for the following data: **(03)**

Activity	A	B	C	D	E	F	G	H	I	J
Immediate Predecessors	-	-	A	A	B, C	B, C	E	E	D, G	F, H, I

c) Explain: Minimax and maximin principle used in the theory of games. **(03)**