Enrollment No: _____ Exam Seat No: _____

C.U.SHAH UNIVERSITY

Summer Examination-2016

Subject Name: Operations Research

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

Semester: 6 **Date: 17/05/2016** **Time: 2:30 To 5:30** **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) What is degeneracy problems? **(02)**

b) What is linear programming problem? **(02)**

c) Define: Payoff matrix. **(02)**

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

e) Define: Unbounded solution. **(01)**

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

g) Define: Basic solution. **(01)**

h) All the three methods of finding IBFS to a transportation problem work on different working principles.Determine whether the statement is true or false? **(01)**

i) The game has no saddle point means the maximin value equal to minimax value. Determine whether the statement is true or false? **(01)**

j) In a standard LP problem (ready to write in simplex table), the number of basic variables equals the number of equality constraints. Determine whether the statement is true or false? **(01)**

k) Every problem of real life situation when formulated in mathematical model assumes a linear form. Determine whether the statement is true or false? **(01)**

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

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

a) A manufacturer produces two types of models M_1 and M_2. Each model of the type M_1 requires 4 hours of grinding and 2 hours of polishing; whereas each model of the type M_2 requires 2 hours of grinding and 5 hours of polishing. The manufacturer has 2 grinders and 3 polishers. Each grinder works for 40 hours a week and each polisher works for 60 hours a week. Profit on M_1 model is Rs.3.00 and on M_2 model is Rs.4.00. Whatever is produced in a week is sold in the market. How should the manufacturer allocate his production capacity to the two types of models, so that he may make the maximum profit in a week? **(05)**

Formulate the problem as a linear programming problem.

b) Find the graphical solution of the following LP Problem. **(05)**

Maximize $z = x_1 + x_2$

Subject to

$$x_1 - x_2 \geq 0$$
$$-3x_1 + x_2 \geq 3$$

and $x_1, x_2 \geq 0$

c) Write the Standard form of the following LP problem. **(04)**

i) Maximize$z = 4x_1 + 10x_2$

Subject to

$$2x_1 + x_2 \leq 50$$
$$2x_1 + 5x_2 \leq 100$$
$$2x_1 + 3x_2 \leq 90$$

and $x_1, x_2 \geq 0$

ii) Maximize $z = 3x_1 + 2x_2$

Subject to

$$2x_1 + x_2 \leq 2$$
$$3x_1 + 4x_2 \geq 12$$

and $x_1, x_2 \geq 0$

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

a) Use the 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) Obtain initial basic feasible solution of the following transportation problem by using matrix minima method. **(04)**

	D_1	D_2	D_3	D_4	Supply
S_1	23	27	16	18	30
S_2	12	17	20	51	40
S_3	22	28	12	32	53
Demand	22	35	25	41	

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

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

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

a) Use the penalty (Big-M) Method to solve the following LP Problem. **(06)**

Minimize $z = 4x_1 + 2x_2$

Subject to

$$3x_1 + x_2 \geq 27$$
$$x_1 + x_2 \geq 21$$

and $x_1, x_2 \geq 0$

b) A dietician plans diet menu for a group of students. She concentrates on three components-fat, carbohydrate, and protein. She has two main foods A and B. Each 100 gram of A has 2 units of fat, 1 unit of carbohydrate and 5 units protein. Each 100 gram of food B has 3 units of fat, 2 units of carbohydrate and 3 units of protein. She wants that the diet must contain at least 18 units of fat, 20 units of **(05)**

carbohydrate, and 24 units of protein. The basic cost of 100 gram of food A is Rs, 10 and Rs. 12 for that of food B. Her problem is to make the proportionate combination of these types of food that satisfies the basic needs of the diet and minimizes the total cost of food. Formulation the problem as a linear programming problem.

c) Solve the following game to find the saddle point. **(03)**

		Player B				
	Strategy	b_1	b_2	b_3	b_4	b_5
Player A	a_1	4	0	1	7	-1
	a_2	0	-3	-5	-6	5
	a_3	3	2	2	4	3
	a_4	-6	1	-2	0	-5

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

a) Solve the following transportation problem using MODI Method. **(07)**

	D_1	D_2	D_3	Availability
O_1	2	7	4	5
O_2	3	3	7	8
O_3	5	4	1	7
O_4	1	6	2	14
Requirement	7	9	18	34

b) Find the graphical solution of the following LP Problem. **(04)**

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

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

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

a) What are the limitations of linear programming problem? **(06)**

b) Determine all basic feasible solutions of the system of equations **(04)**
$2x_1 + x_2 + 4x_3 = 11, 3x_1 + x_2 + 5x_3 = 14.$

c) A company management and the labour union are negotiating a new three year settlement. Each of these has 4 strategies: **(04)**

I : Hard and aggressive bargaining

II : Reasoning and logical approach

III : Legalistic strategy

IV : Conciliatory approach

The costs to the company are given for every pair of strategy choice.

Union Strategies	Company Strategies I	II	III	IV
I	20	15	12	35
II	25	14	8	10
III	40	2	10	5
IV	-5	4	11	0

What strategy will the two sides adopt? Also determine the value of the game.

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

a) Solve the following transportation problem using MODI Method. **(07)**

	D_1	D_2	D_3	D_4	Supply
S_1	21	16	25	13	11
S_2	17	18	14	23	13
S_3	32	27	18	41	19
Demand	06	10	12	15	

b) Solve the LP Problem by Simplex method. **(07)**

Maximize $z = 2x_1 + x_2$

Subject to

$$4x_1 + 3x_2 \leq 12$$
$$4x_1 + x_2 \leq 8$$
$$4x_1 - x_2 \leq 8$$

and $x_1, x_2 \geq 0$

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

a) Explain North-West corner method. Find the initial basic feasible solution of the following transportation problem by using North-West corner method. **(07)**

	D_1	D_2	D_3	D_4	Supply
S_1	19	30	50	10	7
S_2	70	30	40	60	9
S_3	40	8	70	20	18
Demand	5	8	7	14	34

b) Explain differences between CPM and PERT in detail. **(07)**