Enrollment No: _____ Exam Seat No: _____

C.U.SHAH UNIVERSITY

Summer Examination-2018

Subject Name: Operations Research

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

Semester: 6 **Date:07/05/2018** **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) One of the properties of Linear Programming Model is (01)

(1) It will not have constraints
(2) It should be easy to solve
(3) It must be able to adopt to solve any type of problem
(4) The relationship between problem variables and constraints must be linear

b) The key column indicates (01)

(1) Outgoing variable (2) Incoming variable
(3) Independent variable (4) Dependent variable

c) The solution of the Linear programming problem in graphical solution lies in (01)

(1) First quadrant (2) Second quadrant
(3) Third quadrant (4) Fourth quadrant

d) When all the elements of replacement ratio column are equal, the situation is known as (01)

(1) Tie (2) Degeneracy
(3) Break (4) None of the above

e) The cost coefficient of slack variable is (01)

(1) Zero (2) One
(3) $>$ than one (4) $<$ than one

f) In a transportation problem where the demand or requirement is equal to the available resource is known as (01)

(1) Balanced transportation problem
(2) Regular transportation problem
(3) Resource allocation transportation problem
(4) Simple transportation problem

g) In Northwest corner method the allocations are made (01)

(1) Starting from the left hand side top corner
(2) Starting from the right hand side top corner
(3) Starting from the lowest cost cell
(4) Starting from the lowest requirement and satisfying first

h) MODI stands for (01)

(1) Modern distribution (2) Mendel's distribution method

(3) Modified distribution method (4) Model index method

i) If the losses of player *A* are the gins of the player *B*, then the game is known as: (01)

(1) Fair game (2) Unfair game

(3) Nonzero sum game (4) Zero sum game

j) A game involving '*n*' persons is known as: (01)

(1) Multimember game (2) Multiplayer game

(3) *n*-person game (4) Not a game

k) Critical path method is an activity oriented and Program evaluation and review technique is an event oriented. Determine whether the statement is True or False. (01)

l) Saddle point means the value of the game. Determine whether the statement is True or False. (01)

m) Every LP problem can be solved graphically. Determine whether the statement is True or False. (01)

n) Least cost method when applied in comparison with Vogel's approximation method gives a better optimal solution. 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) Obtain the initial basic feasible solution by Vogel's approximation method and optimal solution by MODI method. (07)

Destinations

Source	**1**	**2**	**3**	**4**	a_i
1	21	16	25	13	**11**
2	17	18	14	23	**13**
3	32	27	18	41	**19**
b_j	**6**	**10**	**12**	**15**	

b) 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 $x_1, x_2 \geq 0$

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

a) Explain various steps of the simplex method involved in the computation of an optimum solution to a linear programming problem. (07)

b) Explain basic difference between CPM and PERT. (07)

Q-4 **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	D_5	D_6	Supply
S_1	9	12	9	8	4	3	5
S_2	7	3	6	8	9	4	8
S_3	4	5	6	8	10	14	6
S_4	7	3	5	7	10	9	7
S_5	2	3	8	10	2	4	3
Demand	3	4	5	7	6	4	

b) 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. (04)

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.

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

a) What is linear programming problem? How can formulate a given problem into linear programming problem? (05)

b) Solve the following LP Problem by Graphical Method (05)

Minimize $z = 3x_1 + 2x_2$

Subject to

$$5x_1 + x_2 \geq 10$$
$$x_1 + x_2 \geq 6$$
$$x_1 + 4x_2 \geq 12$$

and $x_1, x_2 \geq 0$

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

a) Determine an initial basic feasible solution to the following transportation problem by using matrix minima method. (05)

From \ To	D_1	D_2	D_3	D_4	D_5	Availability
O_1	40	20	30	20	60	**8**
O_2	50	40	50	20	10	**12**
O_3	60	50	40	70	30	**14**
Demand	**4**	**4**	**6**	**8**	**8**	

b) Solve the following LP Problem by Simplex method (04)

Maximize $z = 3x_1 + 2x_2$

Subject to

$$-2x_1 + 3x_2 \leq 9$$
$$x_1 - 5x_2 \geq -20$$

and $x_1, x_2 \geq 0$

c) Solve the following LP Problem by Graphical Method (03)

Maximize $z = 3x_1 - 2x_2$

Subject to

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

and $x_1, x_2 \geq 0$

d) Write 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 unrestricted in sign.

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

a) Use the penalty (Big-M) Method to solve the following LP Problem (05)

Maximize $z = 3x_1 + 2x_2$

Subject to

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

and $x_1, x_2 \geq 0$

b) Find all basic solution for the system of equation (04)

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

c) Using the following predecessor relationship, draw a network diagram (03)

Activity	A	B	C	D	E	F	G	H	I	J	K	L
Predecessor	$-$	$-$	$-$	A	A	B	C	C	D, E, F, G	I	H	H

d) Define:Optimum basic feasible solution, Unbounded solution. (02)

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

a) Describe the transportation problem with its general mathematical formulation. (05)

b) 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. (04)

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

		Player B				
		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

d) Write matrix form of linear programming problem. (02)