

GUJARAT TECHNOLOGICAL UNIVERSITY
MCA - SEMESTER-V EXAMINATION WINTER-2019

Subject Code:4659310**Date: 16/11/2019****Subject Name: Operations Research****Time:10.30 am to 01.00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1 (a)** What is Operations Research? Explain the features of it. **07**
(b) Write the dual of the following LPP **07**

$$\text{Maximize } Z = 4x_1 + 2x_2$$

Subject to

$$x_1 - 2x_2 \geq 2$$

$$x_1 - 2x_2 = 8$$

$$x_1 - x_2 \leq 10$$

 $x_1 \geq 0$, x_2 is unrestricted in sign

- Q.2 (a)** A person wants to decide the constituents of a diet which will fulfill his daily requirements of proteins, carbohydrates at the minimum cost. The choice is to made from four different types of foods. The yield per unit of these foods is given in the table. **07**

Food type	Yield per unit			
	Proteins	Fats	Carbohydrates	Cost per unit(rs)
1	3	2	6	45
2	4	2	4	40
3	8	7	7	85
4	6	5	4	65
Minimum requirement	800	200	700	

Formulate the linear programming model for the problem.

- (b)** Apply graphical method to solve the LPP **07**
 Maximize $z = 40x_1 + 80x_2$
 Subject to $2x_1 + 3x_2 \leq 48$
 $x_1 + 0x_2 \leq 15$
 $0x_1 + x_2 \leq 10$
 and $x_1, x_2 \geq 0$

OR

- (b)** Use Simplex method to solve the LPP **07**
 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 $x_1, x_2, \geq 0$

- Q.3 (a)** Determine the basic physical solution to the following transportation problem using NWCM and LCM **07**

Source	Distribution Centers				Supply
	D1	D2	D3	D4	
S1	2	3	11	7	6
S2	1	0	6	1	1
S3	5	8	15	9	10

Requirements	7	5	3	2	
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- (b) State and discuss the methods of solving an assignment problem. How is the Hungarian method better than other methods for solving an assignment problem **07**

OR

- Q.3 (a)** The assignment cost of assigning any one operator to any one machine is given below. **07**

		Operators			
		I	II	III	IV
Machine	A	10	5	13	15
	B	3	9	18	3
	C	10	7	3	2
	D	5	11	9	7

Find the optimal assignment.

- (b) What do you understand by (i) Queue discipline (ii) arrival process (iii) service process? **07**

- Q.4 (a)** Solve the following games whose pay-off matrix is given by **07**

		Player B			
		B1	B2	B3	B4
Player A	A1	3	-5	0	6
	A2	-4	-2	1	2
	A3	5	4	2	3

What strategies will the two sides adopts? Also determine the value of the game. Is the game (i) fair? (ii) Strictly determinable?

- (b) What is simulation? Explain the advantages and disadvantages of simulation. **07**

OR

- Q.4 (a)** In a health clinic, the average rate of arrival of patients is 12 patients per hour. On an average, a doctor can serve patients at the rate of one patient every four minutes. Assume, the arrival of patients follows a Poisson distribution and service to patients follows an exponential distribution. **07**

- Find the average number of patients in the waiting line and in the clinic.
- Find the average waiting time in the waiting line or in the queue and also the average waiting time in the clinic.

- (b) Discuss the various costs involved in an inventory model. **07**

- Q.5 (a)** A computer contains 10,000 resistors. When any resistor fails, it is replaced. The cost of replacing any resistor individually is Re. 1 only. If all the resistors are replaced at the same time, the cost per resistor would be reduced to 35 paise. The percentage of surviving resistors say $S(t)$ at the end of month t and the probability of failure $P(t)$ during the month t are as follow: **07**

t	0	1	2	3	4	5	6
S(t)	100	97	90	70	30	15	0
P(t)	-	0.03	0.07	0.20	0.40	0.15	0.15

What is the optimal replacement plan?

- (b) Explain errors and dummies in network diagram. **07**

OR

- Q.5 (a)** Consider the following data for the activities of a project. **07**

Activity	A	B	C	D	E	F
Predecessors	-	A	A	B,C	-	E
Duration(days)	2	3	4	6	2	8

- Draw network diagram of activities for the project.
- Indicate the critical path.
- Calculate total, free and independent float.

- (b) There are five jobs, each of which is to be processed through two machines M1,M2 in the order M1,M2,processing hours are as follows: **07**

Jobs	1	2	3	4	5
Machine A	3	8	5	7	4
Machine B	4	10	6	5	8

Determine the optimal sequence for five jobs, and minimum elapsed time. also, find the idle time of machines A and B.

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