Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

MCA - SEMESTER–IV • EXAMINATION – SUMMER - 2017

Subject Code: 3640009 Date:06/06/2017

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)** Use graphical method to solve following LPP: **07**

$$\begin{aligned} &\textit{Minimize} \quad Z = 6x_1 + 14x_2 \\ &\textit{Sub. to} \quad 5x_1 + 4x_2 \geq 60; \\ &\qquad\quad 3x_1 + 7x_2 \leq 84; \\ &\qquad\quad x_1 + 2x_2 \geq 18 \\ &\& \quad x_1, x_2 \geq 0 \end{aligned}$$

(b) **(1)** Construct dual of the following problem **03**

$$\begin{aligned} &\textit{Maximize} \quad Z = 3x_1 + 5x_2 - 7x_3 \\ &\textit{Subject to} \quad 3x_1 - 5x_2 + 7x_3 \geq 60 \\ &\qquad\quad x_1 + 6x_3 = 40 \\ &\& \quad x_1, x_2, x_3 \geq 0 \end{aligned}$$

(2) In context of game theory define (i) Pure and mixed strategies (ii) Saddle Point. **04**

Q.2 **(a)** Solve the following LPP using Big-M method **07**

$$\begin{aligned} &\textit{Maximize} \quad Z = 2x_1 + 3x_2 + 4x_3 \\ &\textit{Subject to} \quad 3x_1 + x_2 + 4x_3 \leq 600 \\ &\qquad\quad 2x_1 + 4x_2 + 2x_3 \geq 480 \\ &\qquad\quad 2x_1 + 3x_2 + 3x_3 = 540 \\ &\& \quad x_1, x_2, x_3 \geq 0 \end{aligned}$$

(b) **(1)** What is Simulation? What are the advantages and disadvantages of Simulation? **04**

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

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

Determine the best strategies for players A and B and the value of the game. Is this game (i) fair? (ii) strictly determinable?

OR

(b) Define Operation Research. Explain the features and application areas of operations research. **07**

Q.3 **(a)** Solve the following Transportation Problem using VAM and obtain an optimal solution to minimize the cost: **07**

Factory	Warehouse				
	A	**B**	**C**	**D**	**Capacity**
1	6	3	5	4	22
2	5	9	2	7	15
3	5	7	8	6	8
Requirement	7	12	17	9	

(b) Solve the following Assignment problem. **07**

Operators	Machines			
	A	B	C	D
1	10	5	7	8
2	11	4	9	10
3	8	4	9	7
4	7	5	6	4
5	8	9	7	5

OR

Q.3 **(a)** Explain what are looping, dangling, burst events, merge events, and dummy activities. Why do we need dummy activities? **07**

(b) Five men are available to do 5 different jobs from past records. The time (in hours) that each man takes to do each job is known and given in the following table. **07**

Men	Jobs				
	1	2	3	4	5
A	2	9	2	7	1
B	6	8	7	6	1
C	4	6	5	3	1
D	4	2	7	3	1
E	5	3	9	5	1

Find the assignment of men to jobs to minimize the total time taken.

Q.4 **(a)** The data collected in running a machine, the cost of which is Rs. 50,000 are given below: **07**

Year	1	2	3	4	5	6
Operating cost (Rs.)	7500	8000	8500	9000	10000	12250
Resale value (Rs)	45000	40500	37500	36000	34500	33250

Determine the optimum period of replacement of the machine.

(b) A purchase manager places order each time for a lot of 500 units of a particular item. From the data, the following results are obtained: **07**

Inventory carrying cost = 40%, Ordering cost per order = Rs. 600

Cost per unit = Rs. 50, Annual demand = 1000 units

Find out the loss to the organization due to his ordering policy.

OR

Q.4 **(a)** An electric generator costs Rs. 60,000, operating and maintenance costs are Rs. 10,000 per year for the first five years. In the sixth year and subsequent yeas these costs increase by Rs. 3000 per year. Assuming 10% cost of money per year, find the optimum length of time to keep the machine before replacing it. **07**

(b) Describe the major cost categories used in inventory analysis and their functional relationship to each other. **07**

Q.5 **(a)** Briefly explain the structure of Queuing system. **07**

(b) Find the sequence for the following eight jobs, that will minimize the total elapsed time for the completion of all the jobs. Each job is processed in the same order CAB. Entries give the time in hours on the machines. **07**

Machines	Jobs							
	1	2	3	4	5	6	7	8
A	4	6	7	4	5	3	6	2
B	8	10	7	8	11	8	9	13
C	5	6	2	3	4	9	15	11

OR

Q.5 **(a)** Arrivals at a telephone booth are considered to be Poisson, with an average time of 10 minutes between one arrival and the next. The length of a phone call is assumed to be distributed exponentially, with mean 3 minutes. Find: **07**

1. The probability that an arrival finds that four persons are waiting for their turn.
2. The average number of persons waiting and making telephone calls.
3. The average length of the queue that is formed time to time.
4. The probability that a waiting time of a person in queue shall be more than 2 minutes?

(b) The precedence relationships of the activities, and activity time estimates (in weeks) of a project is as follows: **07**

Task	A	B	C	D	E	F	G	H	I	J	K
Precedence	--	A	B	C	B	E	D, F	E	H	G, I	J
Time	13	8	10	9	11	10	8	6	7	14	18

1. Draw the network of the project.
2. Find Critical path and critical activities and expected completion time.

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