Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

MCA Integrated- SEMESTER– IV EXAMINATION – WINTER 2019

Subject Code: 4440602 Date:28/11/2019

Subject Name: Operations Research

Time: 02:30 PM TO 05:00 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 its features. **07**

(b) A person requires 10 , 12 and 12 units of chemicals A , B and C respectively for his garden. A typical liquid product contains 5 , 2 and 1 units of A, B and C respectively per jar. on the other hand a typical dry product contains 1 , 2 and 4 units of A,B and C per unit. If the liquid product sells for Rs. 3 per jar and the dry product for Rs. 2 per carton, how many of each should be purchased in order to minimize the cost and meet the requirement? Formulate this Problem and Solve using Graphical Method. **07**

Q.2(a) Solve the following LPP using Simplex Method. **07**

Max $Z = 20x_1 + 6x_2 + 8x_3$

Subject to the Constraint $8x_1 + 2x_2 + 3x_3 \leq 250$

$4x_1 + 3x_2 \leq 150$

$2x_1 + x_3 \leq 50$

and $x_1 , x_2 , x_3 \geq 0.$

(b) Use Penalty (BIG-M) method to solve the following LP Problem. **07**

Min $Z = 2x_1 + x_2$

Subject to the Constraint $3x_1 + x_2 = 3$

$4x_1 + 3x_2 \geq 6$

$x_1 + 2x_2 \leq 4$

and $x_1 , x_2 \geq 0.$

OR

(b) Describe the characteristics of calling population (input source) of a queuing system. What do you understand by Queue discipline? **07**

Q.3(a) Determine an initial Basic feasible solution to the following Transportation problem by using (a) Least Cost Method (b)Vogel Approximation Method. **07**

		Distribution Centre				
		D1	D2	D3	D4	Supply
Source	S1	21	16	15	3	11
	S2	17	18	14	23	13
	S3	32	27	18	41	19
	Demand	6	10	12	15	

(b) A research and development department is developing a new power supply for a console television set. It has broken job down into the following : **07**

Job	Description	Immediate predecessors	Time (Day)
A	Determine output voltages	-	5
B	Determine whether to use solid state rectifiers	A	7
C	Choose rectifier	B	2
D	Choose filters	B	3
E	Choose transformer	C	1
F	Choose chassis	D	2
G	Choose rectifier mounting	C	1
H	Layout Chassis	E,F	3
I	Built and test	G,H	10

(a) Draw the network diagram of activities involved in the project and indicate the critical path.
(b) What is the minimum completion time for the project?

OR

Q.3 **(a)** A television repairman finds that the time spent on his jobs has an exponential distribution with a mean of 30 minutes. If he repairs the sets in the order in which they came in, and if the arrival of sets follows a Poisson distribution with an approximate average rate of 10 per 8-hour day, what is the repairman's expected idle time each day? How many jobs are ahead of the average set just brought in? **07**

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

		JOBS				
		I	II	III	IV	V
MEN	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 out how men should be assigned the jobs in way that will minimize the total time taken.

Q.4 **(a)** (i) Solve the following game by maximin (minimax) principle, whose payoff matrix are given below: Include in your answer: (1) strategy selection for each player (2) the value of the game to each player. Does the game has a saddle point? **03**

	Player B				
Player A	B1	B2	B3	B4	B5
A1	-2	0	0	5	3
A2	3	2	1	2	2
A3	-4	-3	0	-2	6
A4	5	3	-4	2	6

(a) (ii) Obtain the Dual problem of the following Primal LP problem: **04**

$$\text{Minimum } z = x_1 - 3x_2 - 2x_3$$

Subject to the constraints $3x_1 - x_2 + 2x_3 \leq 7$

$$2x_1 - 4x_2 \geq 12$$

$$-4x_1 + 3x_2 + 8x_3 = 10$$

and $x_1, x_2 \geq 0$; x_3 unrestricted in sign

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

OR

Q.4 **(a)** The data on the operating cost per year and resale price of equipment A whose purchase price is Rs.10,000 are given below: **07**

Year	1	2	3	4	5	6	7
Operating cost (Rs)	1,500	1,990	2,300	2,900	3,600	4,500	5,500
Resale Value(Rs.)	5,000	2,500	1,250	600	400	400	400

What is the optimum period for replacement?

When equipment A is 2 years old, equipment B, which is new model for the same usage, is available. The optimal period for replacement is 4 years with an average cost of Rs. 3,600. Should we replace equipment A with equipment B? If so, when?

(b) A small project consists of seven activities, the detail of which are given below: **07**

Activity	Duration (Days)			Immediate
	Most likely	Optimistic	Pessimistic	Predecessors
A	3	1	7	-
B	6	2	14	A
C	3	3	3	A
D	10	4	22	B,C
E	7	3	15	B
F	5	2	14	B,E
G	4	4	4	D

(a) Draw the network diagram.

(b) Find expected time and variance for each activity also find critical path.

(c) Find expected project completion time.

Q.5 **(a)** Define simulation. Explain various stages involved in simulation process. **07**

(b) A company that operates for 50 weeks in a year is concerned about its stocks of copper cable. This costs Rs. 240 a meter and there is a demand for 8,000 meters a week. Each replenishment costs Rs. 1050 for administration and Rs. 1650 for delivery, while holding costs are estimated at 25% of value held a year. Assuming no shortage are allowed, what is the optimal inventory policy for the company? How would this analysis differ if the company wanted to maximize its profit rather than minimized cost? What is the gross profit if the company sells cable for Rs. 360 a meter? **07**

OR

Q.5 **(a)** Determine the optimal sequence of jobs that minimized elapsed time, based on the following information. Processing time on machines is given in hours and passing is not allowed. **07**

Job	A	B	C	D	E	F	G
Machine M1	3	8	7	4	9	8	7
Machine M2	4	3	2	5	1	4	3
Machine M3	6	7	5	11	5	6	12

(b) The following failure rates have been observed for certain light bulbs **07**

End of week	1	2	3	4	5
End of failure to date	0.10	0.25	0.50	0.70	1.00

The cost of replacing an individual bulb is Rs. 3, the decision is made to replace all bulbs simultaneously at fixed interval, and also to replace individual bulb as they fail in service. If the cost of group replacement is Rs. 1 per bulb and the total number of bulb is 1,000, What is the best interval of group replacement?

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