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10ME74

Seventh Semester B.E. Degree Examination, June/July 2019
Operations Research

Time: 3 hrs.

Max. Marks:100

- Note:1. Answer FIVE full questions, selecting at least TWO questions from each part.**
2. Areas under the standard normal distribution (statistical table).

PART - A

- 1 a. A Farmer has 100 acre farm. He can sell all tomatoes, lettuce or radishes he can raise. The price he can obtain is Rs. 1.00 per kg tomatoes, Rs. 0.75 a head for lettuce and Rs. 2.00 per kg for radishes. The average yield per acre is 2,000 kg of tomatoes, 3,000 heads of lettuce, and 1000 kgs of radishes. Fertilizer is available at Re.0.50 per kg and the amount required per acre is 100 kgs each for tomatoes and lettuce and 50 kgs for radishes. Labour required for sowing, cultivating and harvesting per acre is 5-man-days for tomatoes and radishes and 6 man-days for lettuce. A total of 400 man-days are available at Rs.20 per man-day. Formulate this problem as a linear programming model to maximize the farmer's total profit. (10 Marks)
- b. Solve the following LP problem graphically:
 Max $z = 8000x_1 + 7000x_2$
 Subject to $3x_1 + x_2 \leq 66$
 $x_1 + x_2 \leq 45$
 $x_1 \leq 20, x_2 \leq 40$
 and $x_1, x_2 \geq 0$. (10 Marks)
- 2 a. Use BIG-M method to maximize $Z = 3x_1 - x_2$
 Subject to $2x_1 + x_2 \leq 2$
 $x_1 + 3x_2 \geq 3$
 $x_2 \leq 4$
 $x_1, x_2 \geq 0$. (10 Marks)
- b. Obtain the dual of the following primal problem:
 Minimize $z = 3x_1 - 2x_2 + x_3$
 Subject to $2x_1 - 3x_2 + x_3 \leq 5$
 $4x_1 - 2x_2 \geq 9$
 $-8x_1 + 4x_2 + 3x_3 = 8$
 $x_1, x_2 \geq 0, x_3$ is unrestricted. (10 Marks)
- 3 a. Find the optimal solution to the following:
 Transportation problem shown in Table Q3 (a) in which the calls contain the transportation. Cost in Rupees. (10 Marks)

		To Ware houses					Available
		W ₁	W ₂	W ₃	W ₄	W ₅	
From	F ₁	7	6	4	5	9	40
	F ₂	8	5	6	7	8	30
	F ₃	6	8	9	6	5	20
	F ₄	5	7	7	8	6	10
Required		30	30	15	20	5	

Table Q3 (a)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
 2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

- 3 b. Solve the following Assignment problem shown in Table Q3 (b).

	I	II	III	IV	V
1	11	17	8	16	20
2	9	7	12	6	15
3	13	16	15	12	16
4	21	24	17	28	26
5	14	10	12	11	13

Table Q3 (b)

- 4 a. What is integer programming problem, and methods adopted to solve them? (05 Marks)
 b. Solve the following integer programming problem, using Gomary's fractional cutting plane method.

$$\text{Maximize } z = x_1 + 2x_2$$

$$\text{Subject to Constraints } 2x_2 \leq 7$$

$$x_1 + x_2 \leq 7$$

$$2x_1 \leq 11$$

$$x_1, x_2 \geq 0 \text{ and are integers.}$$

(15 Marks)

PART - B

- 5 a. A project has the following time schedule, shown in Table Q5 (a).

Activity	1-2	1-3	1-4	2-5	3-6	3-7	4-6	5-8	6-9	7-8	8-9
Duration (in months)	2	2	1	4	8	5	3	1	5	4	3

Table Q5 (a)

- (i) Construct PERT network.
 (ii) Compute Total float, Free float and Independent float for each activity.
 (iii) Critical path and its duration. (10 Marks)
- b. A small project is composed of seven activities whose time estimates are listed in Table Q5 (b).
 (i) Draw the project network.
 (ii) Find the critical path.
 (iii) Find the probability of the project being completed within 19 weeks. (10 Marks)

Activity	Estimated Direction in Weeks		
	Optimistic most likely		Pessimistic
	a	m	b
1-2	1	1	7
1-3	1	4	7
1-4	2	2	8
2-5	1	1	1
3-5	2	5	14
4-6	2	5	8
5-6	3	6	15

Table Q5 (b)

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- 6 a. What are the elements of a queuing system (structure of queuing system)? (05 Marks)
 b. A self service stores employs one cashier at its counter. Nine customers arrive on an average every 5 minutes, while the cashier can serve 10 customers in 5 minutes. Assuming poisson's distribution for arrival rate and exponential distribution for service time. Find :
 (i) Arrival and service rate per minute.
 (ii) Average number of customer in the system.
 (iii) Average number of customers in the queue or Average queue length.
 (iv) Average time a customer spends in the system.
 (v) Average time a customer waits before being served. (15 Marks)

- 7 a. Explain, what is theory of Games, and based on what principle Neumann forward it also state characteristics of games. (10 Marks)
- b. Solve the following 2×5 game by graphical method, refer Table Q7 (b). (10 Marks)

Player B

		1	2	3	4	5	
Player A	x_1	1	-5	5	0	-1	8
	$x_2 = 1 - x_1$	2	8	-4	-1	6	-5

Table Q7 (b)

- 8 a. What are the assumptions in sequencing problems? (05 Marks)
- b. There are 5 jobs, each of which is to be processed through three machines A, B and C in the order ABC. Determine the optimum sequence for the 5-jobs and the minimum elapsed time. Also find the idle time for the three machines refer the Table Q8 (b) for machining time in hours. (15 Marks)

Job	A	B	C
1	3	4	7
2	8	5	9
3	7	1	5
4	5	2	6
5	4	3	10

Table Q8 (b)
