

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Backlog), May-2019

B. Tech (All Branches),

Roll No.....

COURSE CODE: MA 403

Time: 3 hours

Max. Marks: 100

COURSE NAME: Engineering Optimization

Instructions to students:

1. Do not write anything other than your roll number on question paper. Assume suitable data wherever required and mention it clearly. Be neat!! Be clean!! All the best!!!!

- Q.1 Suggest the suitable model (whether iconic, analogue or symbolic) for the following: (a) microfilmed documents, (b) flow process chart in an organization, (c) monogram and (d) motion film 04
- Q.2 Supporters arrive at an administrator counter at an average inter-arrival rate of 2 minutes. The administrator in duty takes an average of one minute per supporter. What is average waiting time of a Supporter? 04
- Q.3A Derive pure birth and death model. 08
- Q.3B Explain steps involving in simulation. 05
- Q.4 A food company is developing a low-calorie high-protein diet supplement called Hi-pro. The specifications for Hi-pro have been established by a panel of medical experts. These specifications along with the calorie, protein and vitamin content of three basic foods, are given in the following table: 08

Nutritional Elements	Units Of Nutritional Elements			Basic Foods Hi-pro specifications
	1	2	3	
Calories	50	250	100	300
Proteins	50	100	250	200
Vitamin A	00	190	85	100
Vitamin C	5	195	150	100
Cost per serving (Rs.)	1.50	2.00	1.20	

What quantities of foods 1, 2, and 3 should be used?

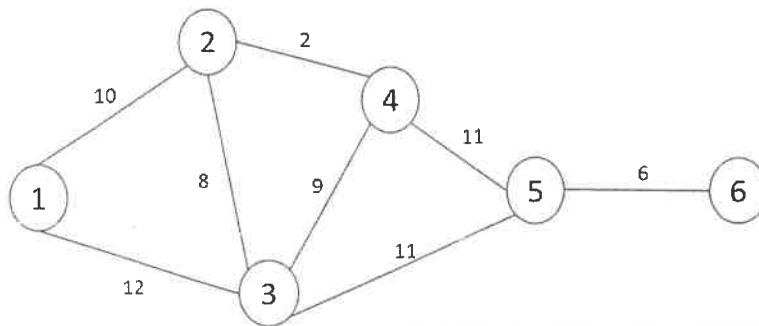
Formulate this problem as an LPP to minimize cost of serving.

- Q.5A Reduce the following game by dominances and find the value of the game 07

		Player B			
		I	II	III	IV
Player A	I	3	2	4	0
	II	3	4	2	4
	III	4	2	4	0
	IV	0	4	0	8

Q.5B Find minimal spanning tree in the following graph

07



Q.6 A project has a following time estimates

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Activity	Estimated durations (days)		
	Optimistic (to)	Most Likely (tm)	Pessimistic (tp)
(1,2)	3	6	15
(1,6)	2	5	14
(2,3)	6	12	30
(2,4)	2	5	8
(3,5)	5	11	17
(4,5)	3	6	15
(5,8)	1	4	7
(6,7)	3	9	27
(7,8)	4	19	28

(a) Draw the project network.

(b) Find the critical path.

Q.7 Write down the Kuhn-Tucker conditions to get an optimal solution of the following Non-linear programming problem:

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$$\text{Minimize } Z = x_1 + 3x_2 - x_1^2 - 2x_2^2$$

Subject to: $x_1 + x_2 \leq 6$, $5x_1 - 2x_2 \leq 10$ and $x_1, x_2 \geq 0$

Q. 8A Solve the following assignment problem to get minimize cost:

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	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

Q.8B Find the optimal solution for the following transportation problem given as:

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	D1	D2	D3	D4	D5	Available
O1	68	35	4	74	15	18
O2	57	88	91	3	8	17
O3	91	60	75	45	60	19
O4	52	53	24	7	82	13
O5	51	18	82	13	7	15
	16	18	20	14	14	

OR

Q.8B Solve the following using dual simplex method:

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$$\begin{aligned}
 &\text{Minimize } Z = 2x_1 + 2x_2 + 4x_3 \\
 &\text{s. to. } 2x_1 + 23 + 5x_3 \geq 2 \\
 &\quad 3x_1 + x_2 + 7x_3 \leq 3 \\
 &\quad x_1 + 4x_2 + 6x_3 \leq 5 \\
 &\text{and } x_1, x_2, x_3 \geq 0
 \end{aligned}$$

Q.9A Use dynamic programming to solve

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$$\begin{aligned}
 &\text{Min. } Z = u_1 u_2 \dots u_n \\
 &\text{s. to } u_1 + u_2 + \dots + u_n = c \\
 &\text{and } u_i \geq 0, i = 1, 2, \dots, n
 \end{aligned}$$

Q.9B Lovely and Co. manufacture two types of products A and B. According to past experience, production of either A or B requires an average of one hour in the plant. The plant has normal production capacity of 400 hours a month. The marketing department of the firm reports that because of limited market, the maximum number of A or B that can be sold in a month are \$ 800 and \$ 400 respectively. Formulate this as a linear programming problem and solve it.

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OR

Q.9B Use graphical method to minimize the time needed to process the following jobs on the machines shown below. Also, calculate the total elapsed time needed to complete both the jobs. 10

Job 1	Sequence of machines time	A	B	C	D	E
		3	4	2	6	2
Job 2	Sequence of machines time	B	C	A	D	E
		5	4	3	2	6