

Total No. of Questions : 8]

SEAT No. :

P6674

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B.E. (Mechanical)

OPERATIONS RESEARCH

(2019 Pattern) (Semester - VII) (402045 D) (Elective - IV)

Time : 2 ½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.
- 2) Figures to the right indicate full marks.
- 3) Assume suitable data, if necessary.

Q1) a) Give the correspondence between entities in primal and dual in LPP. [5]

b) Use the simplex method to solve the following LP problem. [12]

$$\text{Maximize } Z = 3x_1 + 5x_2 + 4x_3$$

subject to the constraints

i) $2x_1 + 3x_2 \leq 8,$

ii) $2x_2 + 5x_3 \leq 10$

iii) $3x_1 + 2x_2 + 4x_3 \leq 15$

and $x_1, x_2, x_3 \geq 0$

OR

Q2) a) Discuss the general mathematical model of linear programming problem. [7]

b) Use the graphical method to solve the following LP problem. [10]

$$\text{Maximize } Z = 15x_1 + 10x_2$$

subject to the constraints

i) $4x_1 + 6x_2 \leq 360.$

ii) $3x_1 + 0x_2 \leq 180,$

iii) $0x_1 + 5x_2 \leq 200$

and $x_1, x_2 \geq 0$

P.T.O.

Q3) a) Discuss the Hungarian method with the help of flow chart for assignment problem. [8]

b) A department of a company has five employees with five jobs to be performed. The time (in hours) that each man takes to perform each job is given in the effectiveness matrix. [10]

		Employees				
		I	II	III	IV	V
Jobs	A	10	5	13	15	16
	B	3	9	18	13	6
	C	10	7	2	2	2
	D	7	11	9	7	12
	E	7	9	10	4	12

OR

Q4) a) Explain the generalized syntax of assignment and transportation problems. [8]

b) Find the initial basic feasible solution by using Vogel's Approximation Method. [10]

W →					
F ↓	W ₁	W ₂	W ₃	W ₄	Factory Capacity
F ₁	19	30	50	10	7
F ₂	70	30	40	60	9
F ₃	40	8	70	20	18
Warehouse Requirement	5	8	7	14	34

Q5) a) Explain the different types of floats involved in CPM analysis of network and how it is calculated? [6]

- b) An insurance company has decided to modernize and refit one of its branch offices. Some of the existing office equipment will be disposed of but the remaining will be returned to the branch after the completion of the renovation work. Tenders are invited from a number of selected contractors. The contractors would be responsible for all the activities in connection with the renovation work excepting the prior removal of the old equipment and its subsequent replacement. The major elements of the project have been identified, as follows, along with their durations and immediately preceding elements. [12]

<i>Activity</i>	<i>Description</i>	<i>Duration (weeks)</i>	<i>Immediate Predecessors</i>
A	Design new premises	14	-
B	Obtain tenders from the contractors	4	A
C	Select the contractor	2	B
D	Arrange details with selected contractor	1	C
E	Decide which equipment is to be used	2	A
F	Arrange storage of equipment	3	E
G	Arrange disposal of other equipment	2	E
H	Order new equipment	4	E
I	Take delivery of new equipment	3	H, L
J	Renovations take place	12	K
K	Remove old equipment for storage or disposal	4	D, F, G
L	Cleaning after the contractor has finished	2	J
M	Return old equipment for storage	2	H, L

- i) Draw the network diagram showing the interrelations between the various activities of the project.
- ii) Calculate the minimum time that the renovation can take from the design stage.
- iii) Find the effect on the overall duration of the project if the estimates or tenders can be obtained in two weeks from the contractors by reducing their numbers.
- iv) Calculate the 'independent float' that is associated with the non-critical activities in the network diagram.

OR

- Q6) a)** Describe the problem of replacement of items whose maintenance cost increase with time. Assume that the value of money remains constant. [6]
- b) A firm is considering the replacement of a machine, whose cost price is Rs. 12,200, and its scrap value is Rs 200. From experience the running (maintenance and operating) costs are found to be as follows : [12]

Year :	1	2	3	4	5	6	7	8
Running cost (Rs) :	200	500	800	1,200	1,800	2,500	3,200	4,000

When should the machine be replaced?

- Q7) a)** Explain Monte Carlo Simulation. [5]
- b) A dentist schedules all his patients for 30-minute appointments. Some of the patients take more 30 minutes some less, depending on the type of dental work to be done. The following summary shows the various categories of work, their probabilities and time actually needed to complete the work: [12]

<i>Caregon of Service</i>	<i>Time Required (minutes)</i>	<i>Probability of Category</i>
Filling	45	0.40
Crown	60	0.15
Cleaning	15	0.15
Extraction	45	0.10
Checknp	15	0.20

Simulate the dentist's clinic for four hours and determine the average waiting time for the patients as well as the idleness of the doctor. Assume that all the patients show up at the clinic at exactly their scheduled arrival time starting at 8.00 a.m. Use the following random numbers for handling the above problem: 40 82 11 34 25 66 17 79.

OR

- Q8) a)** Explain the various steps involved in simulation process. [5]
- b) A salesman located in a city A decided to travel to city B. He knew the distances of alternative routes from city A to city B. He then drew a highway network map as shown in the Fig. The city of origin A, is city 1. The destination city B, is city 10. Other cities through which the salesman will have to pass through are numbered 2 to 9. The arrow representing routes between cities and distances in kilometers are indicated on each route. The salesman's problem is to find the shortest route that covers all the selected cities from A to B. [12]

