SEAT No. :

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[5927]-424

B.E. (Mechanical)
OPERATIONS RESEARCH

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

Time : 2½ 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) *Answers in one answer books.*

3) *Figures to the right indicate full marks.*

4) *Assume suitable data, if necessary.*

Q1) a) Use Graphical method to solve the following LPP **[10]**

Minimize $Z = 10 X_1 + 4 X_2$

Subject to Constraints

$3X_1 + 2X_2 \geq 60$

$7X_1 + 2X_2 \geq 84$

$3X_1 + 6X_2 \geq 72$

$X_1, X_2 \geq 0$

b) Write the generalised syntax of LPP and discuss the following terms related to LPP **[7]**

i) Objective function.

ii) Constraint surface.

iii) Feasible and infeasible points.

iv) Optimum solution.

OR

P.T.O.

Q2) a) Use Simplex method to solve the following LPP **[10]**

Maximize $Z = 80 X_1 + 55 X_2$

Subject to Constraints

$4X_1 + 2X_2 \leq 40$

$2X_1 + 4X_2 \leq 32$

$X_1, X_2 \geq 0$

b) i) Limitations of graphical method. **[3]**

ii) Explain with the help of example conversion of Primal to Dual LPP problem. **[4]**

Q3) a) Discuss with the help of flow chart Hungarian method to solve the assignment problems. **[8]**

b) Find out the initial feasible solution by **Vogel's Approximation Method (VAM).** **[10]**

	W_1	W_2	W_3	W_4	Availability
F_1	19	30	50	10	7
F_2	70	30	40	60	9
F_3	40	8	70	20	18
Requirement	5	8	7	14	

OR

Q4) a) An airline company has drawn up a new flight schedule that involves five flights. To assist in allocating five pilot to the five flights, it has asked them to state their preference scores by giving each flight a number out of 10. The higher the number, the greater is the preference. A few of these flights are unsuitable to some pilots, owing to domestic reasons.

These have been marked wit "X".

		I	II	III	IV	V
	A	8	2	X	5	4
Pilot	B	10	9	2	8	4
	C	5	4	9	6	X
	D	3	6	2	8	7
	E	5	6	10	4	3

What should be the allocation of the pilots in order to meet **maximum preference**? **[12]**

b) Explain the generalised syntax of assignment and transportation problem. **[6]**

Q5) a) A small project involves 7 activities and their times estimates are listed in the following table. Activities are identified by their beginning (i) and ending (j) node numbers. **[12]**

Activities (i-j)	Estimated Duration (Weeks)		
	Optimistic	Most likely	Pessimistic
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

i) Draw the network diagram of the activities in the projects.

ii) Find expected duration and variance for each activity. What is the expected project length?

iii) Calculate the variance and standard deviation of the project length. What is the probability that the project will be completed :

1) At least 4 weeks earlier than expected time.

2) No more than 4 weeks later than expected time.

Given

Z (0-Z)	1.33
Probability	0.4082

b) Explain with example what is looping and Dangling errors in the network.

[6]

OR

Q6) a) A taxi owner estimates from his past records that the costs per year for operating a taxi whose purchase price when new is Rs. 60,000 are as given below :

Year	1	2	3	4	5
Operating Cost (Rs)	10,000	12,000	15,000	18,000	20,000

After 5 years, the operating cost is Rs. 6000 *K where K = 6, 7, 8, 9 and 10 (K denotes the age of in years) If the resale value decreases by 10% of purchase price each year, what is the best replacement policy? Cost on money is zero. **[12]**

b) Explain different types of floats involved in the in CPM analysis of network and how it is calculated during the analysis. **[6]**

Q7) a) A dentist scheduled all his patients for 30 minute appointments. Some of the patients take more or less than 30 minutes depending on the type of dental work to be done. The following summary shows the various categories of work, their probability and time actually needed to complete the work :

| Category of service	Time required in Minute	Probability
Filling	45	0.40
Crown	60	0.15
Cleaning	15	0.15
Extraction	45	0.10
Check tip	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 sequence of random numbers to stimulate the above problem.

Random Numbers : 40, 82, 11, 34, 25, 66, 17, 79. **[12]**

b) Write short note on Monto Carlo Simulation. **[5]**

OR

Q8) a) 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 following figure. 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 kilometres are located on each route. The salesman problem is to find the shortest route that covers all the selected cities from A to B. The time for each activity is given in the table. (Solve by using Dynamic programming) **[12]**
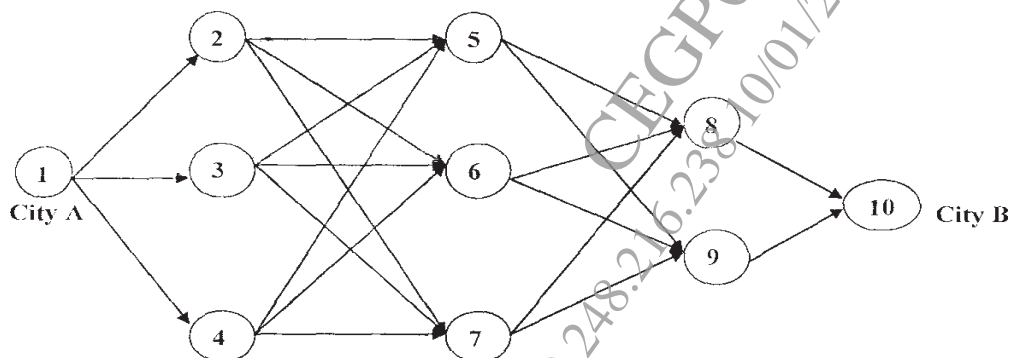
Activity	Duration	Activity	Duration
1-2	4	4-5	6
1-3	6	4-6	10
1-4	3	4-7	5
2-5	7	5-8	4
2-6	10	5-9	8
2-7	5	6-8	3
3-5	3	6-9	7
3-6	8	7-8	8
3-7	4	7-9	4
		8-10	7
		9-10	9

b)   Explain in brief various steps involved in the simulation.   **[5]**