BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BE **SEMESTER : VII**
BRANCH: PRODUCTION **SESSION : MO/17**

SUBJECT: PE7019 ADVANCED OPERATION RESEARCH

TIME: 3 HOURS **FULL MARKS: 60**

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1 Use revised simplex method to the find the optimal solution following problem: [12]

$Maximize\ Z = 10x_1 + 4x_2$ (Objective function)

Subject to

$20x_1 + 10x_2 \leq 1200$

$40x_1 + 10x_2 \leq 1600$

Where, $x_1, x_2 \geq 0$

Q.2(a) The initial cost of a vehicle is Rs. 3,800.00 and the trade in value drops as time passes until it reaches Rs. 600.00. The maintenance costs are as shown below. Find when the replacement is due? [6]

Year of service:	1	2	3	4	5
Year-end trade-in value	2000	1200	800	700	600
Annual operating cost in Rs	1600	1900	2200	2500	2800
Annual Maintenance cost in Rs	400	500	700	900	1100

Q.2(b) A machine costs Rs.500/-. Operation and maintenance costs are zero for the first year and increase by Rs. 100/-every year. If money is worth 5 % every year, determine the best age at which the machine should be replaced. The resale value of the machine is negligibly small. What is the weighted average cost of owning and operating the machine? [6]

Q.3 A departmental store purchases Christmas trees which can be ordered only in lots of 100. Each tree costs Rs 25 and sells at Rs 40 each. Unsold trees, however, have no salvage value. The probability distribution obtained from analysis of past sales data is given below: [12]

Trees sold	Probability
100	0.2
200	0.35
300	0.25
400	0.15
500	0.05
Total	1

How many units of trees should the store order? Also find the expected value of perfect information.

Q.4 Suppose in a medical clinic, patients arrive in random order. The inter arrival time and their probability is given in the table below. The patients are required to first report to a nurse measurement of BP, Weight etc. and then to the doctor. These factors are felt to be independent of each other. The service time required to serve a patient is same for the doctor and the nurse and their probability is given in the table below. Simulate by Monte Carlo method for 20 customers. Determine the average time spent by the patients in the system. [12]

Time between arrivals [min]	Probability
5	0.5
10	0.3
15	0.2

Nurse/Doctor's service time [min]	Probability
4	0.3
8	0.5
12	0.2

Use the following random numbers for arrivals: 4,86, 42, 86, 86, 3, 28, 73, 64, 49, 61, 14, 86, 3, 47, 97, 16, 52, 68, 56

Use the following random numbers for Nurse/Doctor's service time: 34, 56, 27, 14, 28, 84, 82, 43, 92, 84, 79, 39, 11, 97, 30, 8, 42, 6, 55, 51

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Q.5(a) Determine the optimal strategies and the value of the game for the payoff matrix for a competitive situation is as under: [6]

		B		
	Strategies	I	II	III
A	1	6	5	2
	II	-1	1	-2
	III	4	9	6

Q.5(b) Use graphical method for solving the following game and find the value of the game. [6]

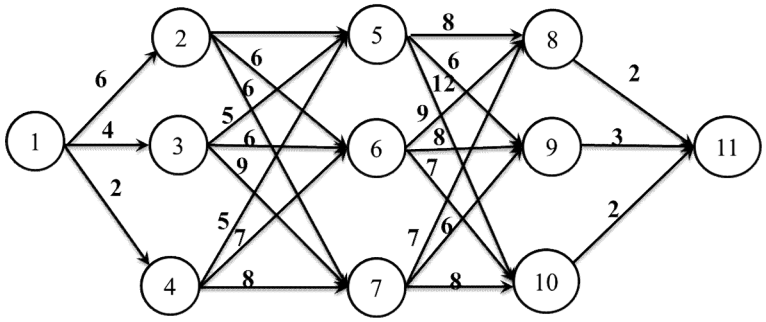
		B		
	Strategies	I	II	III
A	I	2	4	10
	II	9	6	3

Q.6(a) Customers arrive at the first-class ticket counter of a theater at the rate of 12 per hour. There is one clerk serving the customers at the rate of 30 per hour. [6]

(i) What is the probability that there is no customer at the counter?
(ii) What is the probability that there are more than 2 customers at the counter?
(iii) What is the probability that a customer is being served and nobody is waiting?

Q.6(b) A railway station only one train is handled at a time. The railway yard is sufficient for two trains to wait while other is given signal to leave the station. Trains arrive at a station at an average rate of 6 per hour and the railway station can handle them on an average rate of 12 per hour. Assuming Poisson arrivals and exponential service distribution, find the steady state probabilities of the various number of trains in the system. Also find the average number of trains in the system and the average waiting time of a new train coming into the yard. [6]

Q.7(a) Mr. Khanna, the sales executive is planning a business tour from Mumbai to Delhi. He intends to cover one town from each of the company's different marketing precincts on route. [12]
The network shows clearly the three intermediate stages and three possible choices of route at all but the last cities. The travel time between two cities inclusive of the working time is given above the arrow between the cities. Which intermediate cities should he visit to minimize the time required to get from 1 to 11?



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