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PG CBCS M.SC. Semester-III Examination, 2021 DEPARTMENT OF MATHEMATICS PAPER: MTM-306B

(OPERATIONAL RESEARCH MODELLING-I)

Full Marks: 50

Time: 2 Hours

Answer any <u>FOUR</u> questions from the following: $10 \times 4=40$

1. a) A truck business man of second hand trucks used to maintain a stock of trucks every month. The demand of the truck occurs at a relatively constant rate but not in a constant size. The demand follows the following probability distribution:

Demand	0	1	2	3	4	5	6 or more
Probability	0.40	0.24	0.20	0.10	0.05	0.01	0

The holding cost of an old truck in stock for one month is Rs. 100 and the penalty for a truck if not supplied on demand is Rs. 1000. Determine the optimal size of stock for the business man.

b) What is the necessity of supply chain management? 8+2

- 2. a) Write the advantages and limitations of simulation technique.
 - b) With the help of a single server queuing model having inter-arrival and service times constantly 1.4 minutes and 3 minutes respectively, explain discrete simulation technique taking 10 minutes as the simulation period. Find from this average waiting time and percentage of idle time of the facility of a customer. Assume that initially the system is empty and the first customer arrives at time t = 0. 3+7
- 3. With the help of appropriate assumptions, formulate the profit expression of each supply chain partner for the two-echelon supply chain model. Hence,

[P. T. O]

10

explain how to solve the above problem.

- 4. A company has the option of buying one of the two mini computers: MINICOMP and CHIPCOMP. MINICOMP costs Rs 5 lakh, and its running and maintenance costs are Rs 60,000 for each of the first five years, increasing by Rs 20,000 per year in the sixth and subsequent years. CHIPCOMP has the same capacity as MINICOMP, but costs only Rs 2,50,000. However, its running and maintenance costs are Rs 1,20,000 per year in the first five years, and increase by Rs 20,000 per year thereafter. If the money is worth 10 per cent per year, which computer should be purchased? What are the optimal replacement periods for each of the computers? Assume that there is no salvage value for either of the computers. Explain your analysis. 10
- 5. Use dynamic programming method to find the shortest path from the vertex A to the vertex B along the edges joining various vertices lying between A and B shown in the following figure. The length of each edge is given with each edge.



10 [P. T. O]

7. a) Write the basic difference between PERT and CPM.
b) Draw the network diagram for the project given below and find the expected project completion time? Also, calculate the variance of each critical activity. 2+3+3+2

Activities		Days				
i	j	t_0	t_m	t_p		
10	20	5	12	17		
10	30	8	10	13		
10	40	9	11	12		
20	30	5	8	9		
20	50	9	11	13		
40	60	14	18	22		
30	70	21	25	30		
60	70	8	13	17		
60	80	14	17	21		
70	80	6	9	12		

8. Explain the dynamic programming technique to solve the following problem: $\begin{array}{l} Maximize \ z = f_1(y_1)f_2(y_2) \dots f_n(y_n) \\ subject \ to \ a_1y_1 + a_2y_2 + \dots + a_ny_n = b \\ \end{array}$ Hence find y_1, y_2, y_3 such that $y_1y_2y_3$ is maximum and $y_1 + y_2 + y_3 = b$

Hence find y_1, y_2, y_3 such that $y_1y_2y_3$ is maximum and $y_1 + y_2 + y_3 = 24, y_j \ge 0, j = 1, 2, 3.$ 10

[Internal Assessment- 10 Marks]