M.Sc 3rd Semester Examination, 2019

Applied Mathematics With Oceanology And Computer Programming

Paper: MTM – 306 (Operation Research Modeling -I)

(Calculator may be used)

Full Marks: 50 Time : 2 hours

The figures in the right hand margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

1. Answer any **four** questions: $2 \times 4 = 8$

   (a) Define pseudo random number. State the difference between pseudo numbers with random number.

   (b) State Bellman's principle of optimality.

   (c) Write the rules to draw a network.

   (d) Discuss 'gradual failure' and 'sudden failure' of items with example.

   (e) What is simulation? Describe its advantages in solving the problems.

   (f) What do you mean by 'waiting time' and 'average waiting time' in a queue?

   (g) Write a brief note on individual replacement and group replacement.

   (h) Write the basic concept of supply chain model.

2. Answer any **four** questions: $4 \times 4 = 16$

   (a) Explain Monte–Carlo simulation. State different mathematical steps in Monte-Carlo method.

   (b) Describe a method for generating random numbers.

   (c) Write down the rules to construct a network. Also, describe the process to numbering the events in network analysis.

   (d) Solve the problem by dynamic programming method.

   $Min\ Z = x_1^2 + x_2^2 + x_3^2$

   Sub to, $x_1 + x_2 + x_3 \geq 10$ and $x_1, x_2, x_3 \geq 0$

   (e) The cost of a machine is Rs.6100/- and its scrap value is Rs.100/- .The maintenance costs found from experience are as follows:

Year:	1	2	3	4	5	6	7	8
Maintenance cost(Rs.):	100	250	400	600	900	1200	1600	2000

   When should the machine be replaced?

   (f) Find the optimal replacement policy(s) for items whose running cost increases with time (Continuous variable) and value of money remains constant during the period. After the present machine has done 5 years service, an offer is made of second hand equivalent machine costing Rs. 7500/-. This alternative equipment is expected to need Rs. 400/- as spare cost in first year, which is likely to rise by Rs.500 per year. Scrap value is expected to be zero. Should the offer be taken?

(g) Let $F(x)$ be the probability density function of the demand x in the prescribed scheduling period T weeks. The demand is assumed to occur with a uniform pattern and the probability distribution is continuous. The unit carrying cost and the storage cost are respectively C_1 money units and C_2 money units both per unit per week. There is no set up cost for the system. Obtain the expression for optimal control.

3. Answer any **two** questions: $8 \times 2 = 16$

(a) Formulate and solve a single period discrete stochastic inventory model for a single product with instantaneous discrete demand, zero lead time and no replenishment cost. The storage cost is independent of time.

(b) A man is engaged in buying and selling identical items. He operates from a warehouse that can hold 500 items. Each month he can sell any quantity that he chooses upto the stock at the beginning of the month. Each month, he can buy as much as he wishes for delivery at the end of the month so long as his stock does not exceed 500 items. For the next four months, he has the following error-free forecasts of cost sales prices:

Month	i	4	3	2	1
Cost	c_i	26	22	25	27
Sale Price	p_i	30	28	28	29

If he currently has a stock of 200 units, what quantities should he sell and buy in next four months? Find the solution using dynamic programming.

(c) A small project consist of seven activities, the details of which are given below:

Activity	Time estimates			Predecssor
	t_0	t_m	t_p	
A	3	6	9	None
B	2	5	8	None
C	2	4	6	A
D	2	3	10	B
E	1	3	11	B
F	4	6	8	C,D
G	1	5	15	E

Find the critical path. What is the probability that the project will be completely by 18 weeks?

(d) What is replacement? Deduce the optimal replacement policy(s) for items whose running cost increases with time in discrete units and value of money remains constant during a period.

[Internal Assessment : 10 Marks]