M.sc 3rd Semester Examination,2021

Applied Mathematics With Oceanology And Computer Programming

Paper: MTM - 306 (Operation Research Modelling-I)

(Calculator may be used)

Full Marks:50 **Time:2 hour**

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.
Illustrate the answers wherever necessary

1. Answer any ***four*** questions: 2x4=8

   (a) State Bellman's principle of optimality.

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

   (c) What do you mean by time-cost trade-off? Define cost slope.

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

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

   (f) Write brief notes on setup cost and lead time, in connection with inventory control.

   (g) What are the critical paths and critical activities in network analysis?

   (h) What is PERT and CPM?

2. Answer any ***four*** questions: 4x4=16

   (a) Discuss the common errors in network construction. What are the main features of it?

   (b) Let us consider the following problem:

   Maximize $z = f_1(y_1) + f_2(y_2) + \cdots + f_n(y_n)$

   Subject to $y_1 y_2 \cdots y_n \geq p, p > 0, y_j > 0$for all$j$.

   Define the state variables and decision functions to solve this problem by the dynamic programming method. Also, give an outline to solve this type of problem.

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

   (d) How do you calculate the earliest starting time and earliest finish time?

   (e) A machine owner finds from his past records that the cost per year of maintaining a machine whose purchase price is Rs. 6000 are as given below:

$Year$	1	2	3	4	5	6	7	8
$Maintenance\ cost\ (Rs)$	1000	1200	1400	1800	2300	2800	3400	4000
$Resale\ price$	3000	1500	750	375	200	200	200	200

   Determine at what age a replacement is due?

   (f) Explain a method for the generation of random numbers.

   (g) A pipeline is due for repairs. It will cost Rs. 10000 and last for 3 years. Alternatively, a new pipeline can be laid at a cost of Rs 30000 and last for 10 years. Assuming cost of capital to be 10% and ignoring salvage value, which alternative should be chosen.

(h) Write down the common errors in drawing networks. Draw the network for the following data:

$Activity$	A	B	C	D	E	F	G	H	I
$Preceeding\ Activity$	$-$	A	A	B	A	B,E	C	D,F	G

3. Answer any ***two*** questions: 8x2=16

(a) Solve the following LP problem by dynamic programming method.

$$Maximize\ z = 8x_1 + 7x_2$$

$$Subject\ to\ \ 2x_1 + x_2 \leq 9$$

$$5x_1 + 2x_2 \leq 17$$

$$x_1, x_2 \geq 0$$ 8

(b) 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. 8

(c) A project consists of eight activities with the following relevant information.

Activity	Time estimates (days)			Predecessor
	t_0	t_m	t_p	
A	1	1	7	None
B	2	4	7	None
C	2	2	8	None
D	1	1	1	A
E	2	5	14	B
F	2	5	8	C
G	3	6	15	D, E
H	1	2	3	F, G

(i) Draw the network and find the expected project completion time.

(ii) If the duration for activity F increases to 14 days what will be its effect on this expected project. 8

(d) Formulate and solve single period discrete probabilistic inventory model with continuous demand, zero lead time, no replenishment cost, costs are independent of time. 8

[Internal Assessment : 10 Marks]