2024
SRMUJ
3rd Semester Examination
M. Sc.
Mathematics
MTM-306B
Special Paper-OR: Operational Research-I

Full Marks: 40 **Time: 2 Hours**

The figures in the margin indicate full marks. Candidates are required to give their answers as far as practicable. Notations used here have their usual meaning.

1. Answer any four of the following questions: **2 × 4**

(a) State Bellman's Principle of optimality. Also, write the corresponding mathematical equation.
(b) What are the critical paths and critical activities in network analysis?
(c) As a corporate manager, in which situation you decide to use Monte Carlo Simulation technique?
(d) What are the new components in supply chain management over inventory control?
(e) What is replacement? Discuss some key replacement situations that arise in operations management.
(f) How do 'Resource leveling' and 'Resource smoothing' contribute to better project management? Explain briefly.

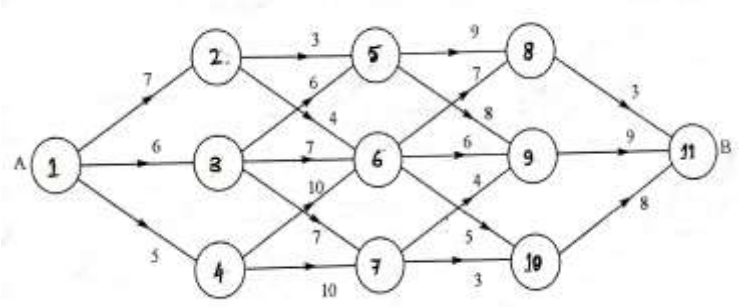
2. Answer any four of the following questions: **8 × 4**

(a) (i) Solve the following problem using dynamic programming

$$\text{Max } z = y_1^2 + y_2^2 + y_3^2$$
$$\text{subj. to } y_1 y_2 y_3 \le 4$$
$$y_1, y_2, y_3 \ge 0$$

(ii) Explain the primary distinctions between PERT and CPM techniques in managing projects. 5 + 3

(b) (i) The following figure shows the route map of various branch offices of a company. The marketing executive of the company should like to start from Head office at A and reach the branch office at B by traveling shortest path and visiting as many as branch offices. Help him to plan his journey by using dynamic programming technique.



(ii) Define *critical path* and *critical activities* in the context of project management. 6 + 2

(c) A project consists of eight activities with the following relevant information. 8

Activities	Time Estimates (week)			Predecessor
	t_O	t_L	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 for the given project and indicate the critical path.
(ii) Find the expected project completion time.
(iii) Calculate the expected variances and standard deviation for each.
(iv) What is the probability of completing the project 4 weeks before the expected completion time?

(d) (i) Describe the steps involved in solving problems using the Monte Carlo Simulation technique and represent them in a flowchart.
(ii) Describe a suitable method for generating random numbers. 4 + 4

(e) A newspaper boy buys papers for Rs. 1.40 each and sells them for Rs. 2.00. He cannot return the unsold news papers. Daily demand has the following distribution

No. Of Customers	23	24	25	26	27	28	29	30	31	32
Probability	0.01	0.03	0.06	0.10	0.20	0.25	0.15	0.10	0.05	0.05

In each day's demand is independent of previous day's demand, how many papers should he ordered each day? 8

(f) The following mortality rates have been observed for a certain type of fuse:

Week	1	2	3	4	5
% failing at the end of week	5	15	35	75	100

There are 100 fuses in use and it costs Rs. 5 to replace an individual fuse. If all fuses were replaced simultaneously it would cost Rs. 1.25 per fuse. It is proposed to replace all fuses at fixed intervals of time, whether or not they have burnt out, and to continue replacing burnt out fuses as they fail. At what intervals the group replacement should be made? Also, prove this optimal policy is superior to the straight forward policy of replacing each fuse only when it fails. 8