Roll No. …….

Exam Code
2592

MMS/M11 6801

Management Science
Paper: CP-201

Time: Three Hours] **[Maximum Marks: 70**

Note:- Non programmable calculators are allowed. Attempt any **FIVE** questions. All questions carry equal marks.

1. (a) What is a role of models in scientific decision making? Name different OR models and their applications.

   (b) Use Sensitivity Analysis to determine the range of change in objective function so that the solution remains optimal.

   Maximize $Z = 5x_1 + 4x_2$

   s.t.c. $6x_1 + 4x_2 \leq 24$

   $x_1 + 2x_2 \leq 6$

   $- x_1 + x_2 \leq 1$

   $x_2 \leq 2$

   $x_1 , x_2 \geq 0$

2. Solve the following integer programming problem using the branch and bound methods.

   Maximize $Z = 3x_1 + 5x_2$

   Subject to the constraints

   $2x_1 + 4x_2 \leq 25$

   $x_1 \leq 8$

   $2x_2 \leq 10$

   and $x_1 , x_2 \geq 0$ and integers

3. A steel company has three open hearth furnaces and five rolling mills. Transportation costs (rupees per quintal) for shipping steel from furnaces to rolling mills are shown in the following table:

		M1	M2	M3	M4	M5	Capacities (in quintal)
Furnaces	F1	4	2	3	2	6	8
	F2	5	4	5	2	1	12
	F3	6	5	4	7	3	14
Requirement (in quintal)		4	4	6	8	8	

What is an optimal shipping schedule?

4. A marketing manager has five salesman and five sales districts. Considering the capabilities of the salesman and the nature of districts, the marketing manager estimates that sales per month (in thousand rupees) for each salesman in each district would be as follows:

DISTRICTS

SALESMAN	A	B	C	D	E
1	32	38	40	28	40
2	40	24	28	21	36
3	41	27	33	30	37
4	22	38	41	36	36
5	29	33	40	35	39

Find the assignment of salesman to district that will result in maximum sales.

5. A book store wishes to carry ‘Saam Ved’ in stock. Demand is probabilistic and replenishment of stock takes 2 days. The probabilities of demand are given below:

Demand (daily)	0	1	2	3	4
Probability	0.05	0.10	0.30	0.45	0.10

Each time an order is placed, the store incurs an ordering cost of Rs. 10 per order. The store also incures a carrying cost of Rs. 0.50 per book per day. The inventory carting cost is calculated on the basis of stock at the time of each day.

The manager of the book store wishes to compare two options for his inventory decision:

A: Order 5 books when the inventory at the beginning of the day plus orders outstanding is less than 8 books.

B: Order 8 books when the inventory at the beginning of the day plus orders outstanding is less than 8 books.

Currently (beginning of 1st day) the store has stock of 8 books plus 6 books ordered 2 days ago and expected to arrive next day. Using Monte-Carlo simulation for 10 cycles, recommend which option the manager should choose?

The two digits random numbers are given below:

89, 34, 78, 63, 61, 81, 39, 16, 13, 73

6. A business man has two independent investment portfolios A and B available to him, but he lacks capital to undertake both of them simultaneously. He can choose A first and then stop, or if A is not successful, then take B or vice-versa. The probability of success of A is 0.6, while for B it is 0.4. Both investment schemes require an initial capital outlay of Rs. 10,000 and both return nothing if the venture is unsuccessful. Successful completion of A will return Rs. 20,000 (over cost) and successful completion of B will return Rs. 24,000 (over cost). Draw decision tree and determine the best strategy.

7. (a) Machine A costs Rs. 9000. Annual operating costs are Rs. 200 for the first year, and then increase by Rs. 2000 every year. Determine the best age at which to replace the machine. If the optimum replacement policy is followed, what will be the average yearly cost of owning and operating the machine? (Assume that the machine has no resale value when replaced and that future costs are not discounted).

(b) Machine B costs Rs. 10000. Annual operating costs are Rs. 400 for the first year, and then increase by Rs. 800 every year. You have now a machine of type A which is one year old. Should you replace it with B, and if so when?

(c) Suppose you are, just ready to replace machine A with another machine of the same types, when you hear that machine B will become available in a year. What should you do?

8. Two competitors are competing for the market share of the similar product. The payoff matrix in terms of their advertising plan is shown below:

	Competitors B		
Competitor A	No Advertising	Medium Advertising	Heavy Advertising
No Advertising	10	5	-2
Medium Advertising	13	12	13
Heavy Advertising	16	14	10

Suggest optimal strategies for the two firms and the net outcome thereof.

9. Tasks A, B, C, ……. H, I constitute a project. The notation x < y means that the task x must be finished before y can begin with this notation.

A < D, A < E, B V F, D < F, C < G, C< H, F < I, G < I

Draw a graph to represent the sequence of tasks and find the minimum time of completion of each task is as follows:

Task:	A	B	C	D	E	F	G	H	I
Time:	8	10	8	10	16	17	18	14	9

10. (a) (i) What are the essential characteristics of the queuing process?

(ii) Write short note on queuing models.

(b) Find the sequence that minimizes the total elapsed time required to complete the following tasks on two machines:

	A	B	C	D	E	F	G	H	I
I Machine	2	5	4	9	6	8	7	5	4
II Machine	6	8	7	4	3	9	3	8	11