(7 pages)

S.No. 8963 **P 16 MBA 3 EO 2**

(For candidates admitted from 2016–2021 Batch)

M.B.A. DEGREE EXAMINATION, NOVEMBER 2023.

Business Administration — Elective

ADVANCED OPERATIONS RESEARCH

Time : Three hours Maximum : 75 marks

PART A — (10 × 2 = 20)

Answer ALL questions.

1. What is one variable unconstrained optimization?

2. Give the applications of separable programming.

3. State the properties of Markov chains.

4. Mention the steady state conditions of Markov chains.

5. Differentiate Branch and Bound technique and Branch and Cut method of integer programming.

6. What are the areas of applications of Binary Integer Programming?

7. What is dynamic programming?

8. List the applications of dynamic programming in capital budgeting.

9. What is importance of shortest path in network analysis?

10. Enlist the types of maintenance.

PART B — (5 × 5 = 25)

Answer ALL questions, choosing either (a) or (b).

11. (a) State the nature of non-linear programming problems and their applications in management.

Or

(b) Explain the general form of separable programming.

12. (a) Discuss the classification of states in Markov chains.

Or

(b) Give the steady state probabilities of M/M/1.

13. (a) Discuss the computational difficulty of integer programming.

Or

(b) You are the scheduling coordinator for a small, growing airline. You must schedule exactly one flight out of Bengaluru to each of the following cities: New Delhi, Kolkata, Mumbai and Chennai. The available departure slots are 8 A.M., 10 A.M., and 12 noon. Your airline has only two departure lounges, so at most two flights can be scheduled per slot. Demand data suggest the following expected profit contribution per flight as a function of departure time:

Expected Profit Contribution in Rs. 1,000s

	Time		
Destination	8	10	12
New Delhi	10	9	8.5
Kolkata	11	10.5	9.5
Mumbai	17	16	15
Chennai	6.4	2.5	–1

Formulate an integer programming model for this problem.

14. (a) List and explain the elements of dynamic programming.

Or

(b) What are the real-life applications of dynamic programming?

15. (a) Explain Max-Flow problem with an example.

Or

(b) A company is planning to replace an equipment whose first cost is Rs. 1,00,000. The operating and maintenance cost of the equipment during its first year of operation is Rs. 10,000 and it increases by Rs. 2,000 every year thereafter. The release value of the equipment at the end of the first year of its operation is Rs. 65,000 and it decreases by Rs. 10,000 every year thereafter. Find the economic life of the equipment by assuming the interest rate as 12%.

PART C — (3 × 10 = 30)

Answer any THREE questions.

16. Solve the following quadratic programming problem:

Maximize $f(x) = 2x_1 + 3x_2 - x_1^2 - x_2^2$

Subject to :

$x_1 + x_2 \leq 2$

$2x_1 + x_2 \leq 3$

$x_1, x_2 \geq 0$.

17. In a service department manned by one server, on an average 8 customers arrive every 5 minutes while the server can serve 10 customers in the same time assuming Poisson distribution for arrival and exponential distribution for service rate. Determine:

(a) Average number of customers in the system.

(b) Average number of customers in the queue.

(c) Average time a customer spends in the system.

(d) Average time a customer waits before being served.

(e) The probability of 12 customers waiting for service.

18. A tailor makes wool tweed sport coats and wool slacks. He is able to get a shipment of 150 square meters of wool cloth from Kashmir each month to make coats and slacks and he has 200 hours of his own labor to make them each month. A coat requires 3 square meters of wool and 10 hours to make, and a pair of pants requires 5 square meters of wool and 4 hours to make. He earns Rs. 50 in profit from each coat he makes and Rs .40 from each pair of slacks.

(a) Formulate an integer linear programming model for this problem.

(b) He wants to know how many coats and slacks to produce to maximize profit.

19. Suppose a shop needs to have a certain machine over the next five-year period. Each new machine costs Rs. 1,000. The cost of maintaining the machine during its 'i' th year of operation is as follows: m1 = Rs. 60, m2 = Rs. 80 and m3 = Rs. 120. A machine may be kept up to three years before being traded in. The trade in value after i years is S1 = Rs. 800, s2 = Rs. 600 and s3 = Rs. 500. How can the shop minimize costs over the five-year period? Give the stages in arriving the answers.

20. The computer system used for production and administration control at a large cannery is being considered for replacement. Of the available replacement system, "Challenger I" has been considered the best. However, it is anticipated that after one year, the "Challenger II" model will become available, with significant technological modifications. The salvage value projections for these three systems are summarized below. Assuming that their performance would otherwise be comparable, should we replace the existing system either this year or next year? Assume the MARR equals 12%, and a useful life of 5 years on all alternatives.

Salvage Value at End of the Year

Year	Existing Computer	Challenger I	Challenger II
0	Rs. 20,000	Rs. 25,000	Rs. 24,000
1	16,000	22,000	23,000
2	13,000	21,000	23,000
3	11,000	20,000	22,000
4	8,000	16,000	16,000
5	3,000	10,000	10,000