

**S.No. 9004**

**P 22 MBACC 33**

(For candidates admitted from 2022–2023 onwards)

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

**Business Administration**

**OPERATIONS RESEARCH**

**Time : Three hours**

**Maximum : 75 marks**

**PART A — (20 Marks)**

**Answer ALL questions.**

**I. (A) Multiple Choice Questions: (5 × 1 = 5)**

**1. For any primal problem and its dual —————**

- (a) optimal value of objective function is same**
- (b) dual will have an optimal solution if primal does too**
- (c) primal will have an optimal solution if dual does too**
- (d) both primal and dual cannot be infeasible**

2. The transportation problem deals with the transportation of
- (a) a single product from a source to several destinations
  - (b) a single product from several sources to several destinations
  - (c) a single product from several sources to a destination
  - (d) a multi -product from several sources to several destinations
3. The difference between total and free float is \_\_\_\_\_
- (a) total
  - (b) free
  - (c) independent
  - (d) interference
4. Which of the following criterion is not used for decision-making under uncertainty?
- (a) Maximin
  - (b) Maximax
  - (c) Minimax
  - (d) Minimize expected loss

5. While assigning random numbers in Monte Carlo simulation, it is \_\_\_\_\_
- (a) not necessary to assign the exact range of random number interval as the probability
  - (b) necessary to develop a cumulative probability distribution
  - (c) necessary to assign the particular appropriate random numbers
  - (d) all of the above
- (B) Fill in the blanks : (5 × 1 = 5)
6. If any value in XB column of final simplex table is negative then the solution is \_\_\_\_\_
7. The assignment problem is always a \_\_\_\_\_ matrix.
8. In the basic EOQ model, if the lead time increases from 2 to 4 days, the EOQ will \_\_\_\_\_.
9. In game theory, the outcome or consequence of a strategy is referred to as the \_\_\_\_\_.
10. The average arrival rate in a single server queuing system is 10 customers per hour and average service rate is 15 customers per hour. The average time that a customer must wait before it is taken up for service shall be \_\_\_\_\_ minutes.

II. Answer ALL questions : (5 × 2 = 10)

11. List the merits and limitations of operations research.
12. What is an unbalanced transportation problem? How do balance it?
13. What are the costs associated with EOQ?
14. Define Expected Money Value.
15. Give the uses of Markovian analysis for business decision making.

PART B — (5 × 5 = 25)

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

16. (a) Solve the following linear programming problem graphically

$$\text{Maximize } Z = x + 4y$$

Subject to :

$$x + y \leq 50$$

$$3x + y \leq 90$$

$$X \geq 0, y \geq 0$$

Or

- (b) Write the steps in finding the duality of a linear programming problem.

17. (a) Find solution using Vogel's Approximation method :

| Origin | Destination |   |    | Supply |
|--------|-------------|---|----|--------|
|        | 1           | 2 | 3  |        |
| 1      | 2           | 7 | 4  | 5      |
| 2      | 3           | 3 | 1  | 8      |
| 3      | 5           | 4 | 7  | 7      |
| 4      | 1           | 6 | 2  | 14     |
| Demand | 7           | 9 | 18 |        |

Or

- (b) A plant manager has four subordinates and four tasks to be performed. The subordinates differ in efficiency and the tasks differ in their intrinsic difficulty. This estimate of the times each man would take to perform each task is given in the effectiveness matrix below.

|   | I  | II | III | IV |
|---|----|----|-----|----|
| 1 | 8  | 26 | 17  | 11 |
| 2 | 13 | 28 | 4   | 26 |
| 3 | 38 | 19 | 18  | 15 |
| 4 | 19 | 26 | 24  | 10 |

How should the tasks be allocated, one to a man, so as to minimize the total man hours?

18. (a) Draw the network diagram and determine the critical path for the following project.

Activity      1-2 1-3 1-4 2-5 3-6 3-7 4-7 5-8 6-8 7-9 8-9

Time (weeks) 5    6   3    5   7   10 4    2   5    6   4

Or

- (b) ABC Ltd. uses EOQ logic to determine the order quantity for its various components and is planning its orders. The annual consumption is 80,000 units, cost of placing one order is Rs. 1,200, Cost per unit is Rs.50 and carrying cost is 6% of unit cost. Find EOQ, Number of orders per year, ordering cost and carrying cost and Total cost of inventory.

19. (a) What are the decision-making environments? Explain with examples.

Or

- (b) Find solution of game theory problem using principle of dominance method

| Player A | Player B |    |    |    |    |
|----------|----------|----|----|----|----|
|          | B1       | B2 | B3 | B4 | B5 |
| A1       | 2        | 4  | 8  | 3  | 4  |
| A2       | 5        | 6  | 7  | 3  | 8  |
| A3       | 6        | 7  | 8  | 9  | 7  |
| A4       | 4        | 2  | 4  | 8  | 3  |

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20. (a) The counter of a bank branch performs the transactions with a mean time of 2 minutes. The customers arrive at a mean rate of 20 customers/hour. If we assume that arrivals follow a Poisson process and that the service time is exponential, determine :

- Percentage of the time the bank teller is idle
- Mean waiting time of the customers
- Percentage of customers that wait in a queue

Or

- (b) Discuss the advantages, disadvantages and limitations of simulation

PART C — (3 × 10 = 30)

Answer any THREE questions.

21. Solve the following LPP using simplex method :

Maximize  $Z = 50x + 60y$

Subject to :

$$2x + y \leq 300$$

$$3x + 4y \leq 509$$

$$4x + 7y \leq 812$$

$$x, y \geq 0$$

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22. A company is producing a single product and selling it through five agencies situated in different cities. All of a sudden, there is a demand for the product in five more cities that do not have any agency of the company. The company is faced with the problem of deciding on how to assign the existing agencies to dispatch the product to the additional cities in such a way that the travelling distance is minimised. The distances (in km) between the surplus and deficit cities are given in the following distance matrix.

| Surplus City | Deficit City |     |     |     |     |
|--------------|--------------|-----|-----|-----|-----|
|              | I            | II  | III | IV  | V   |
| A            | 160          | 130 | 175 | 190 | 200 |
| B            | 135          | 120 | 130 | 160 | 175 |
| C            | 140          | 110 | 155 | 170 | 185 |
| D            | 50           | 50  | 80  | 80  | 110 |
| E            | 55           | 35  | 70  | 80  | 105 |

Determine the optimum assignment schedule.

23. A project has the following time estimates (days) :

| Activity             | A | B | C  | D  | E  | F    | G    | H | I |
|----------------------|---|---|----|----|----|------|------|---|---|
| Predecessor Activity | — | A | A  | B  | C  | D, E | D, E | F | G |
| Least time           | 2 | 3 | 8  | 9  | 8  | 16   | 19   | 2 | 1 |
| Greatest time        | 4 | 6 | 10 | 12 | 9  | 21   | 22   | 5 | 3 |
| Most likely time     | 6 | 9 | 12 | 15 | 10 | 26   | 25   | 8 | 5 |

- Construct the network diagram
- Estimate the expected time and variance
- Find out the critical path
- What is the probability of completing the project 3 days earlier than critical path?

24. Consider the following pay-off matrix:

| Alternative | Pay-off |    |    |    |
|-------------|---------|----|----|----|
|             | A1      | A2 | A3 | A4 |
| E1          | 7       | 12 | 20 | 27 |
| E2          | 10      | 9  | 10 | 25 |
| E3          | 23      | 20 | 14 | 23 |
| E4          | 32      | 24 | 21 | 17 |

Using :

- Minimax
- Maximax
- Equally likely and
- Minimax regret criterion, find the best alternative

25. A company manufactures around 200 mopeds. Depending upon the availability of raw materials and other conditions the daily production has been varying from 196 moped to 204 moped, whose probability distribution is as given below :

|                    |      |      |      |      |      |      |      |      |      |
|--------------------|------|------|------|------|------|------|------|------|------|
| Production per day | 196  | 197  | 198  | 199  | 200  | 201  | 202  | 203  | 204  |
| Probability        | 0.05 | 0.09 | 0.12 | 0.14 | 0.20 | 0.15 | 0.11 | 0.08 | 0.06 |

The finished mopeds are transported in a specially designed three storeyed lorry that can accommodate only 200 moped. Using the following 15 random numbers 82, 89, 78, 24, 53, 61, 18, 45, 04, 23, 50, 77, 27, 54, 10, simulate the process to find out :

- (a) What will be the average number of mopeds waiting in the factory?
  - (b) What will be the average number of empty spaces on the lorry?
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