

10. Workers come to tool store room to receive special tools (required by them) for accomplishing a particular project assigned to them. The average time between two arrivals is 60 seconds and the arrivals are assumed to be in Poisson distribution. The average service time (of the tool room attendant) is 40 seconds. Determine.

- (a) Average queue length.
- (b) Average length of non-empty queues.
- (c) Average number of workers in system including the worker being attended
- (d) Mean waiting time of an arrival
- (e) Average waiting time of an arrival (worker) who waits and
- (f) The type of policy to be established. In other words, determine whether to go in for an additional tool store room attendant which will minimize the combined cost of attendants idle time and the cost of worker's waiting time. Assume the charges of a skilled worker Rs. 4 per hour and that of tools store room attendant Rs. 0.75 per hour.

NOVEMBER/DECEMBER 2018

**MCM24 — QUANTITATIVE TECHNIQUES
FOR BUSINESS DECISIONS**

Time : Three hours

Maximum : 75 marks

SECTION A — (5 × 6 = 30 marks)

Answer ALL questions.

- 1. (a) Explain the phases of project management.
Or
(b) What are the advantages and limitations of linear programming?
- 2. (a) List out the factors affecting inventory control.
Or
(b) An aircraft uses rivets at an approximately constant rate of 5,000 Kg per year. The rivets cost Rs. 20 per kg. and the company personnel estimate that it costs Rs. 200. to place an order and the carrying cost of inventory is 10% per year.

- (i) How frequently should orders for rivets be placed, and what quantities should be ordered for?
- (ii) If the actual costs are Rs. 500 to place an order and 15% for carrying cost, the optimum policy would change. How much is the company losing per year because of imperfect cost information.

3. (a) Obtain an initial basic feasible solution to the following transportation problem:

| Warehouse | Stores | | | | Availability |
|-----------|--------|----|-----|----|--------------|
| | I | II | III | IV | |
| A | 7 | 3 | 5 | 5 | 34 |
| B | 5 | 5 | 7 | 6 | 15 |
| C | 8 | 6 | 6 | 5 | 12 |
| D | 6 | 1 | 6 | 4 | 19 |
| Demand | 21 | 25 | 17 | 17 | 80 |

Or

- (b) Find the initial solution to the following T.P. using VAM.

| | | Destination | | | | Supply |
|---------|----------------|----------------|----------------|----------------|----------------|--------|
| | | D ₁ | D ₂ | D ₃ | D ₄ | |
| Factory | F ₁ | 3 | 3 | 4 | 1 | 100 |
| | F ₂ | 4 | 2 | 4 | 2 | 125 |
| | F ₃ | 1 | 5 | 3 | 2 | 75 |
| Demand | | 120 | 80 | 75 | 25 | 300 |

- (a) Formulate this into a transportation problem to maximise profit
- (b) Find the solution using VAM method
- (c) Test for optimality and find the optimum solution.

9. A city corporation has decided to carry out road repairs on main four arteries of the city. The government has agreed to make a special grant of Rs. 50 Lakhs towards the cost with a condition that the repair must be done at the lowest cost and quickest time. If conditions warrant, then a supplementary token grant will also be considered favourably. The corporation has floated tenders and 5 contractors have sent in their bids. In order to expedite work one road will be awarded to only one contractor.

| Contractors/Road | Cost of repairs (Rs. lakhs) | | | |
|------------------|-----------------------------|----------------|----------------|----------------|
| | R ₁ | R ₂ | R ₃ | R ₄ |
| C ₁ | 9 | 14 | 19 | 15 |
| C ₂ | 7 | 17 | 20 | 19 |
| C ₃ | 9 | 18 | 21 | 18 |
| C ₄ | 10 | 12 | 18 | 19 |
| C ₅ | 10 | 15 | 21 | 16 |

- (a) Find the best way of assigning the repair work to the contractors and the costs
- (b) If it is necessary to seek supplementary grants, then what should be amount sought?
- (c) Which of the five contractors will be unsuccessful in his bid?

- (ii) On the average, how long the customer will have to wait before reaching the server?
- (iii) The length of the drive way required to accommodate all the arrivals, in the average, if 20 feet of drive way is required for each that is waiting for service.

Or

- (b) Discuss the elements of the queuing system.

SECTION B — (3 × 15 = 45 marks)

Answer any THREE questions.

6. For a company engaged in the manufacture of three products, viz x, y and z the available data are given below

| Minimum sales requirements | |
|----------------------------|-------------------------------------|
| Product | Minimum sales requirements per unit |
| X | 10 |
| Y | 20 |
| Z | 30 |

| Operation, required processing times and capacity | | | | |
|---|--------------------------------|---|---|-------------------------------|
| Operation | Time (hr) required per item of | | | Total available hrs per month |
| | X | Y | Z | |

| | | | | |
|---|---|---|---|-----|
| 1 | 1 | 2 | 2 | 200 |
| 2 | 2 | 1 | 1 | 220 |
| 3 | 3 | 1 | 2 | 180 |

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| Profit (Rs.) per unit | |
|-----------------------|-----------------------|
| Product | Profit (Rs.) per unit |
| X | 10 |
| Y | 15 |
| Z | 8 |

Find out the product mix to maximize profit.

7. A dealer supplies you the following information with regard to a product dealt in by him.

Annual demand: 10,000 units, ordering cost Rs. 10 per order, price Rs. 20 per unit.

Inventory carrying cost: 20% of the value of inventory per year.

The dealer is considering the possibility of allowing some back order (stock out) to occur. He has estimated that the annual cost of back ordering will be 25% of the value of inventory.

- (a) What should be the optimum number of units of the product he should buy in one lot?
- (b) What quantity of the product should be allowed to be back-ordered, if any?
- (c) What would be the maximum quantity of inventory at any time of the year?
- (d) Would you recommend to allow back-ordering? If so, what would be the annual cost saving by adopting the policy of back-ordering?

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8. A company has four manufacturing plants and five warehouses. Each plant manufactures the same product which is sold at different prices at each warehouse area. The cost of manufacturing and cost of raw-materials are different in each plant due to various factors. The capacities of the plants are also different. The data are given in the following table

| Item | Plant | | | |
|----------------------------------|-------|-----|-----|----|
| | 1 | 2 | 3 | 4 |
| Manufacturing (Rs.) per unit | 12 | 10 | 8 | 7 |
| Raw material cost (Rs.) per unit | 8 | 7 | 7 | 5 |
| Capacity per unit time | 100 | 200 | 120 | 80 |

The company has five warehouses. The sales prices, transportation costs and demands are given in the following table

| Ware house | Transportation cost (Per unit) | | | | Sales price (Rs. per unit) | Demand |
|------------|--------------------------------|---|---|----|----------------------------|--------|
| | 1 | 2 | 3 | 4 | | |
| A | 4 | 7 | 6 | 3 | 30 | 80 |
| B | 8 | 9 | 7 | 8 | 32 | 120 |
| C | 2 | 7 | 6 | 10 | 28 | 150 |
| D | 10 | 7 | 5 | 8 | 34 | 70 |
| E | 2 | 5 | 8 | 9 | 30 | 90 |

4. (a) A company has a team of four salesmen and there are four districts where the company wants to start its business after taking into account the capabilities of salesmen and the nature of districts, the company estimates that the profit per day in rupees for each salesman in each district is as below:

| Sales man | District | | | |
|-----------|----------|----|----|----|
| | 1 | 2 | 3 | 4 |
| A | 16 | 10 | 14 | 11 |
| B | 14 | 11 | 15 | 15 |
| C | 15 | 15 | 13 | 12 |
| D | 13 | 12 | 14 | 15 |

Find the assignment of salesmen to various districts which will yield maximum profit.

Or

- (b) Define assignment method. What are the special cases in assignment problems?
5. (a) A bank plans to open a single server drive-in-banking facility at a particular centre. It is estimated that 28 customers will arrive each hour on an average. If, on an average it requires 2 minutes to process a customer's transaction, determine.
- (i) The proportion of time that the system will be idle.