Engineering Management

Transportation Model

EXERCISE: NORTH-WEST CORNER METHOD

- A dairy firm has three plants located throughout a state. Daily milk production at each plant is as follows:

  Plant 1: 6 million litres; Plant 2: 1 million litres and Plant 3: 10 million litres

Each Day the firm must fulfil the needs of its distribution centres. Minimum requirement at each centre is as follows:

Distribition centre 1: 7 million litres

Distribition centre 2: 5 million litres

Distribition centre 3: 3 million litres

Distribition centre 4: 2 million litres

Cost of shipping one million litres of milk from each plant to each distribution centre is given in the following table in hundred of BDT.

	DC1	DC2	DC3	DC4
Plant 1	2	3	11	7
Plant 2	1	0	6	1
Plant3	5	8	15	9

Find its initial basic feasible solution by North-west corner rule

EXERCISE: NORTH-WEST CORNER METHOD

- Start with the north-west (upper left) corner cell of the transportation matrix. Compare the supply of source 1 (S_1) with the demand of destination 1 (D_1).
  - $S_1 > D_1$, set $X_{11} = D_1$ and proceed horizontally to cell (1,2)
  - If $S_1 = D_1$, set $X_{11} = D_1$ and proceed diagonally to cell (2,2)
  - If $S_1 < D_1$, set $X_{11} = S_1$ and proceed vertically to cell (2,1)

- Continue the procedure, step by step, away from the north-west corner cell till an allocation is made in the south-east corner cell.

	DC1	DC2	DC3	DC4
Plant 1	6 2	3	11	7
Plant 2	1 1	0	6	1
Plant 3	5	5 8	3 15	2 9

EXERCISE: NORTH-WEST CORNER METHOD

- It can be easily seen that the proposed solution is a feasible solution since all the supply and requirement constraints are fully satisfied.

- The transportation cost with the solution is

  Z= BDT (2X6 + 1X1 + 8X5 + 15X3 + 9X2) X 100

  = BDT 11, 600/00

EXERCISE: LEAST COST METHOD

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	DC1	DC2	DC3	DC4
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Find its initial basic feasible solution by Least Cost method.

EXERCISE: LEAST COST METHOD

- Here, the lowest cell is (2,2) and maximum possible allocation (meeting supply and requirement positions) is made here. Evidently, maximum feasible allocation I cell (2, 2) is 1 m litres. This meets the supply position of plant 2. Therefore, row 2 is crossed out, indicating that no allocations are to be made in cells (2,1), (2,3), and (2,4).
- The next lowest cell (excluding the cells in row 2) is (1,1) and maximum possible allocation (meeting supply and requirement positions) of 6 is made here. Now row 1 is crossed out.
- Next lowest cell in row 3 is (3,1) and allocation is 1 is done here.
- Likewise allocations of 4, 2, and 3 are done in cells (3,2), (3,4) and (3,3) respectively.

	DC1		DC2		DC3		DC4	
Plant 1	6	2		3		11		7
Plant 2		1	1	0		6		1
Plant3	1	5	4	8	3	15	2	9

EXERCISE: LEAST COST METHOD

- It can be easily seen that the proposed solution is a feasible solution since all the supply and requirement constraints are fully satisfied.

- The transportation cost with the solution is

  Z= BDT (2X6 + 0X1 + 5X1 + 8X4 +15X3 + 9X2) X 100

  = BDT (12+0+5+32+45+18) X 100

  = BDT 11, 200/00

Inventory Management

Continuous (Q) Review System Example: A computer company has annual demand of 10,000. They want to determine EOQ for circuit boards which have an annual holding cost (H) of \$6/unit, and an ordering cost (S) of \$75. They want to calculate TC and the reorder point (R) if the purchasing lead time is 5 days.

- EOQ (Q)

$$Q = \sqrt{\frac{2DS}{H}} = \sqrt{\frac{2 * 10{,}000 * \$75}{\$6}} = 500\,\text{units}$$

- Reorder Point (R)

$$R = \text{Daily Demand x Lead Time} = \frac{10{,}000}{250\,\text{days}} * 5\,\text{days} = 200\,\text{units}$$

- Total Inventory Cost (TC)

$$TC = \left(\frac{10{,}000}{500}\right)\$75 + \left(\frac{500}{2}\right)\$6 = \$1500 + \$1500 = \$3000$$

Exercise

- A local distributor for a national tire company expects to sell approximately 9,600 steel-belted radial tires of a certain size and tread design next year. Annual carrying cost is $16 per tire, and ordering cost is $75. The distributor operates 288 days a year.
  a. What is the EOQ?
  b. How many times per year does the store reorder?
  c. What is the length of an order cycle?
  d. What will the total annual cost be if the EOQ quantity is ordered?

- **Solution**

  D = 9,600 tires per year
  H = $16 per unit per year
  S = $75

Exercise

- EOQ, $Q_0 = \sqrt{(2DS/H)} = \sqrt{(2X9600X75)/16)} = 300$ tires
- Number of orders per year: $D/Q = 9600/300 = 32$ *orders*
- Length of order cycle: Q/D = 300/9600=1/32 of a yr.

  = (1/32)X 288 days = 9 workdays
- TC = Carrying cost + Ordering cost
  $= (Q/2)H + (D/Q)S$
  = (300/2)16 + (9,600/300)75
  = \$2,400 + \$2,400
  = \$4,800