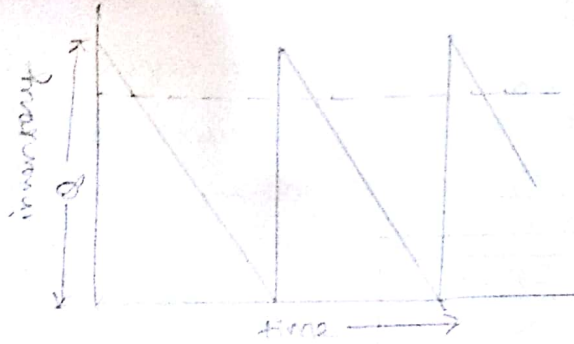


Deterministic inventory problem with no shortage:



Assumptions:

- Demand is known and uniform
- D denotes the total no. of units purchased or produced in a total period of time.
- Shortage are not permitted. As soon as the level of inventory reaches zero, the inventory is fulfilled instantly.
- Assuming lead time is zero
- Setup / ordering cost per production run is C_0
- Holding cost is C_1 per unit.

$$C_1 = I \times C$$

where C is the unit cost and I is called inventory

- Carrying charge expressed as a percentage of the value of the average inventory.

$$\text{total time period} = n \times t$$

t is the time taken for each production and n is the number of productions.

$$D = n \times Q$$

Average amount of inventory:

Total inventory of the time period t is area of the triangle = $\frac{1}{2} \times Q \times t$.

$$\therefore \text{Average inventory at any time} = \frac{\frac{1}{2} Q t}{t} = \frac{1}{2} Q$$

$$\text{Total annual holding cost } f(Q) = \frac{1}{2} Q C_1$$

$$\text{Total annual ordering cost } g(Q) = n \times C_0 = \frac{D}{Q} C_0$$

Total cost of inventory is minimum where ordering cost and carrying cost are equal.

$$f(Q) = g(Q)$$

$$\frac{1}{2}QC_1 = \frac{D}{Q}C_0$$

$$Q^2 = \frac{2DC_0}{C_1}$$

$$\therefore Q^0 = \sqrt{\frac{2DC_0}{C_1}}$$

Optimum no of orders placed per year = $\frac{D}{Q^0}$

$$\text{Total annual cost } T = \frac{1}{2}Q^0C_1 + \frac{D}{Q^0}C_0$$

$$T = \sqrt{2DC_1C_0}$$

- 9) An oil engine manufacturer purchased lubricants at the rate of Rs 42 per piece from a vendor. The requirement of this lubricant is 1800 per year. What should be the order quantity per order so that the total inventory cost be minimum, if the cost per placement of an order is Rs 16 and inventory carrying charge per piece per year is 20 p.

$$D = 1800$$

$$C_0 = \text{Rs } 16$$

$$C_1 = I \times C = \frac{20}{100} \times 42 = \text{Rs } 8.40$$

$$Q^0 = \sqrt{\frac{2 \times 1800 \times 16}{8.40}} = 83$$

$$\text{Runs} = \frac{D}{Q^0} = \frac{1800}{83}$$

Answer

Q) A manufacturing company purchase 9000 parts for its annual requirements ordering one month usage at a time. Each part costs Rs 20. The ordering cost per order is Rs 15. Carrying charges are 15% of the average inventory per year. You have been assigned to suggest a more economical purchasing policy, what advice would you offer and how much would it save the company per year.

$$D = 9000$$

$$Q = \frac{9000}{12} = 750$$

$$C_o = Rs 15 \times 12 = Rs 180$$

$$\text{Average inventory} = \frac{1}{2} \times 750$$

$$C_1 = \left(\frac{15}{100} \times 20 \right) \times \frac{1}{2} \times 750 = Rs 1125.$$

$$\text{Total cost} = Rs 1125 + 180 = Rs 1305.$$

$$Q^o = \sqrt{\frac{2 \times 9000 \times 15}{3}} = 300 \text{ units}.$$

$$\begin{aligned} \text{now, Total cost} &= \frac{1}{2} \times 300 \times 3 + \frac{9000}{300} \times 15 \\ &= 450 + 450 = Rs 900 \end{aligned}$$

$$\begin{aligned} \therefore \text{Savings} &= Rs (1305 - 900) \\ &= Rs 405. \end{aligned}$$