Inventory Theory

Inventory :- Inventory is defined as the the 'list of goods' or 'stock of goods' which helps directly or indirectly in the production of finished good for sale.

In a manufacturing concern, it may include raw materials, work in process and stores etc. whereas in accounting language it may mean stock of finished good only.

Inventory is a service to production.

Types of Inventory :- Inventory are classified as –

1) **Direct Inventory** :- The inventory which play a direct role in the manufacturing of a product and become an integral part of the finished goods (product) are called direct inventory.

This is further classified as either raw materials, work in progress or finished goods.

2) **Indirect Inventory** :- Indirect inventories are those materials which help the raw materials to get converted into the finished goods, but do not become an integral part.

This class of inventory can include office supplies, furniture and the other tools used by a company's employees.

3) **Movement Inventory** :- It is also called transit and pipeline inventory. Transit inventories result from the need to transport items or material from one location to another i.e. there is some transportation time involved in getting from one location to another.

Ex coal is transported by trains.

4) **Buffer Inventory** :- It is sometimes called safety stock inventory. It is used to protect against the uncertainties of demand and supply because the organization may not known the actual demand.

5) **Anticipation Inventory** :- Anticipation inventory is the inventory kept at hand by a company or business to meet the seasonal demand of customers.

6) **Decoupling Inventory** :- Decoupling inventory refers to inventory that's set aside in the case of stoppage in production.

7) **Cycle Inventory :-** Cycle inventory is the portion of an Inventory that the seller cycles through to satisfy regular sales order. The quantity of a cycle stock inventory is equal to the total on-hand inventory minus the safety stock inventory.

Inventory Costs (Costs Associated with inventories) :-

cost involved involved in inventory are as follows –

1) **Purchase Cost :-** The cost of purchasing a unit of an item is called purchase cost. It is also considered as production cost if the items are produced within the organization. The unit price of the item depends on the size of the quantity ordered or purchased.

i.e. purchase Cost = price per unit × Demand per unit time

2) **Ordering Cost / Set-up Cost (A) :-** It is the cost of placing an order from a vendor. It includes costs associated with processing the purchase order, transportation, inspection for quality and so on.

when units are produced within the organization then it is termed as set up cost.

3) <u>Carrying Cost</u> :- It is also known as holding cost or storage cost. Carrying cost represents the cost that is associated with storing an item in inventory. It is denoted by h.

4) <u>Shortage Cost or Stock out Cost</u> :- when an item cannot be supplied on the customer's demand, the penalty cost for running out of stock is called shortage cost or stock out cost.

Stock out cost or sometimes called the unsatisfied demand cost means the cost associated with not serving the customers. If the stock out is internal then it result in idle time for mean men and machines or that the work is delayed.

while if the stock out is external, it would result in a loss of potential sales or loss of customers goodwill.

5) **Cost Obsolescence** :- It estimates the rate at which the value of the stored product drops because it market value or quality falls.

Inventory Model :- Inventory model is a mathematical model that helps business in determining the right quantity of inventories that should be maintained in a production process.

Inventory models help companies to know when to order (i.e. time) new inventory and how much quantity is necessary.

An inventory model may be of independent demand or dependent demand. In an independent demand model, the demand of an item is independent of the demand of other items in inventory. Example - inventory of finished goods.

In a dependent model, the demand of an item is dependent upon the demand of other items in inventory. for example - inventory of assembly components.

Inventory models can be classified as –

1) **Models without Quantity Discount** :– It is also known as independent demand models. Models without quantity discount are further classified as –

i) **Single Item Deterministic Models** :– In this model, the demand for an item is assumed to be constant and uniform. Here deterministic means known with certainty. Deterministic models are further divided into following –

(a) Basic EOQ model

(b) EOQ with infinite production rate

(c) EOQ with finite production rate.

ii) **Probabilistic Models** :– These models are based on assumptions that the demand for an item varies i.e. there is a degree of uncertainty attached to demand variables. It is also following types –

(a) Single Period Probabilistic model No set up cost

(b) Single Period Probabilistic model with set up cost

2) **Models with Quantity Discount** :- It is also called dependent demand models.

Example - demand for wheels in a car assembly plant is directly related to the number of car being produced.

Assumptions in Deterministic Models :- The following assumptions are made in deterministic models :-

1) The demand of item is known exactly for a given period.
2) The demand of the item occurs uniformly over a period of time.
3) The cost of placing an order is fixed and does not vary with the lot size.
4) The inventory carrying charges are directly proportional to the order quantity.
5) The price per unit is fixed and its independent of the order size.
6) Orders are received instantaneously.

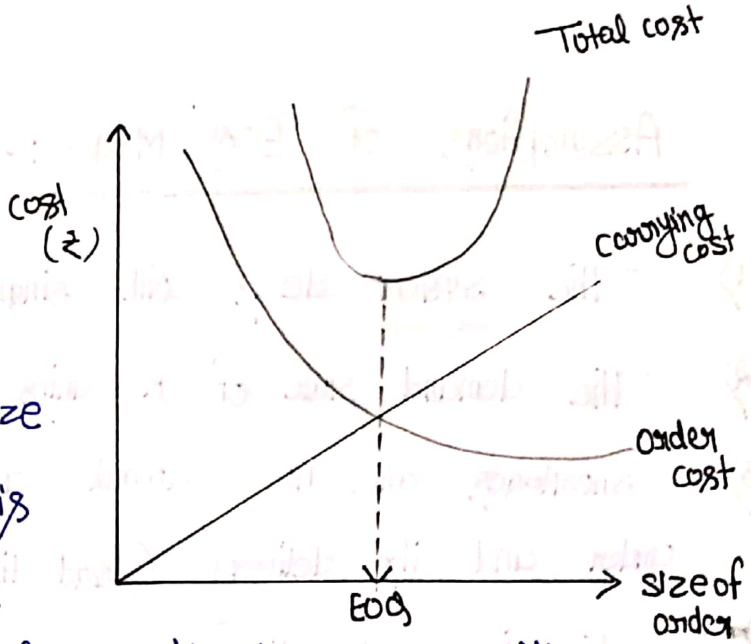
Basic Economic Order Quantity (EOQ) Models

The simplest form of the economic order quantity model on which all other model versions are based is called the basis EOQ model. It is also known as 'standard Order Quantity' or 'Economic lot size'.

In determining 'Economic order Quantity' it is assumed that the cost of managing the inventory costs of two parts i.e.

(i) Ordering Cost and

(ii) Carrying cost



From the figure, it can be seen that ordering cost of an item is decreasing as the size of the order is increasing. This happens because total number of orders for a particular item will decrease resulting in decrease in total order cost. As a result, carrying cost in increasing because firm keeps more items in stock.

The quantity may be calculated with the help of the following formula –

$$\boxed{EOQ = \sqrt{\frac{2AD}{h}}}$$

where D = Annual quantity used (in units)
A = Cost of placing an order
h = cost of holding one unit.

Assumptions of EOQ Model :-

1) The system deals with single item.
2) The demand rate of R units per time is known & constant.
3) Shortages are not allowed and the time b/w placing an order and its delivery (lead time) is zero.
4) T is cycle time.
5) The inventory holding cost, h per unit per time unit and ordering cost A per order is known and constant.
6) Replenishment rate (the rate at which inventory travels from the manufacture to the supplier) is infinite.

Limitations of EOQ :-

The limitations are as follows -

1) In pratice, the demand is neither known with certainty nor is uniform over the time period.

2) It is not easy to measure the inventory holding cost and ordering cost accurately. The ordering cost may not be fixed but will depend on the order quantity Q.

3) The assumptions of zero lead time and that the inventory level will reach to zero at the time of next order is not possible.

4) The stock depletion is rarely uniform and gradual.

Economics Lot Size Model without Shortages :-

There are two models of the EOQ problem when demand is assumed to be fixed & completely pre-determined -

1) EOQ with Infinite Production Rate
2) EOQ with finite Production Rate.

EOQ with Infinite Production Rate :-

The model is based on the following assumptions -

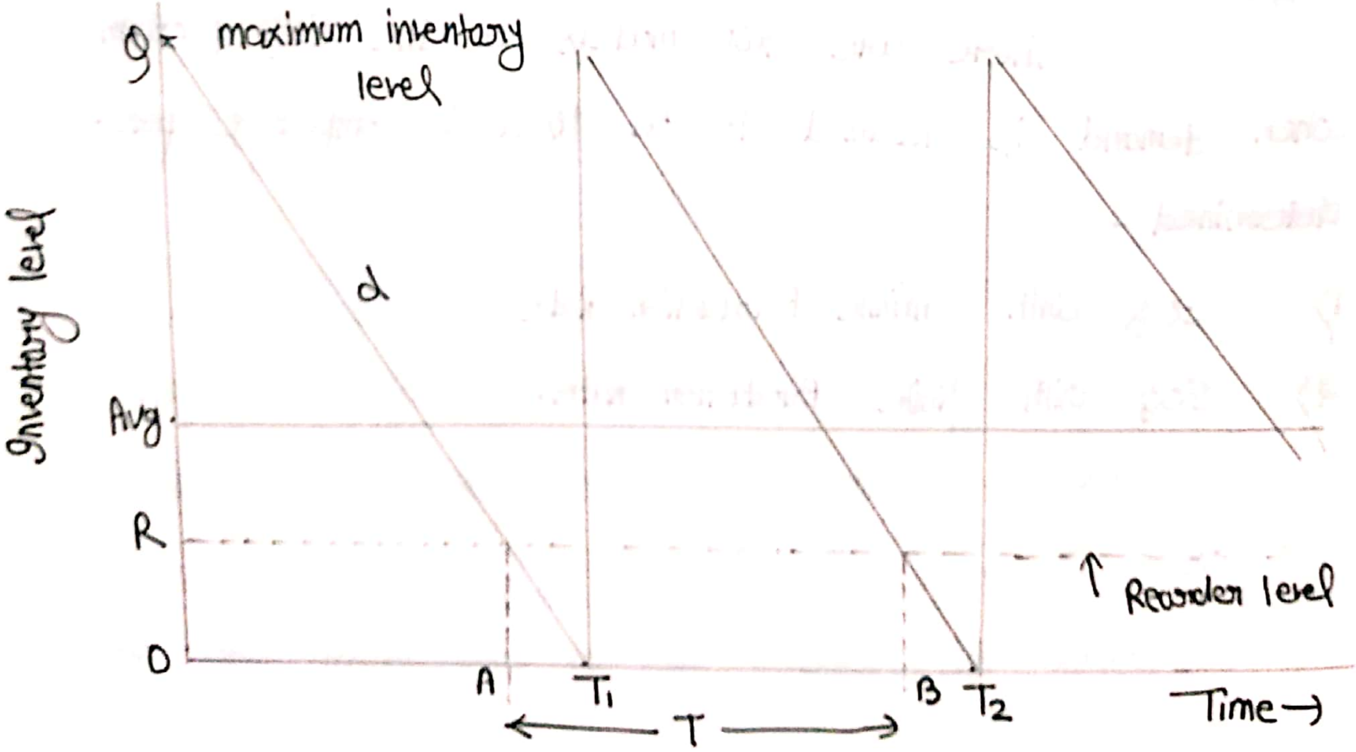
1) The demand for the item is certain, continuous and constant over time.

2) The lead time, that is the time between placing an order and its delivery, is known and fixed. Thus, when the lead-time is zero, the delivery of time is instantaneous.

3) The purchase price of the item is constant, i.e. no discount is available on purchase of large lots.

4) within the range of the quantities to be ordered, the per unit holding cost and ordering cost are constant.

5) Shortages are not allowed.



Suppose that we begin with a stock of Q on the time 0. This will be consumed at the rate of d units per day, say, If the stock can be replenished instantaneously, i.e. the lead time is zero, then a fresh order would be made and the inventory obtained at point T_1 then T_2.

And if the lead time is +ve, equal to L, we would place an order at point A. This is called the re-order level or the reorder point R.

Here, maximum inventory level = Q

& minimum inventory = 0

$\therefore$ average inventory level $= \frac{Q+0}{2} = \frac{Q}{2}$

Now, the total variable cost of managing the inventory per year

$$T(Q) = O(Q) + H(Q)$$

where, Q = the ordering quantity

$T(Q)$ = total annual inventory cost

$O(Q)$ = total annual ordering cost

$H(Q)$ = total annual holding cost

Total Annual ordering cost

$$O(Q) = N \times A$$

where $N = \frac{D}{Q}$

So,

$$O(Q) = \frac{D}{Q} A$$

and total annual holding cost

$$H(Q) = \text{Average inventory} \times \text{inventory carrying cost}$$

$$= \frac{Q}{2} \cdot h$$

Therefore,

$$\boxed{T(Q) = \frac{D}{Q} A + \frac{Q}{2} h}$$

If cost per unit or price is c and inventory carrying cost per year (percentage) is i then

$$\boxed{h = ic}$$

Alternative Method :-

since, $EOQ = Q^* = \sqrt{\frac{2AD}{h}} = \sqrt{\frac{2AD}{ic}}$

1) Now, minimal inventory cost can be determined by putting $Q = Q^*$ in cost equation -

$$T(Q^*) = \frac{D}{Q^*} A + \frac{Q^*}{2} h$$

or
$$T(Q^*) = \frac{DA}{\sqrt{\frac{2AD}{h}}} + \frac{\sqrt{\frac{2AD}{h}} \cdot h}{2}$$

or
$$\boxed{T(Q^*) = \sqrt{2ADh} = \sqrt{2ADic}}$$

2) Optimal interval between any two consecutive orders is

$$\boxed{T^* = \frac{Q^*}{D}}$$

where T^* is also called the inventory cycle time.

3) The optimal number of orders place per year

$$\boxed{N^* = \frac{1}{T^*}}$$

Example – A company requires 16000 units of raw material costing Rs 2 per unit. The cost of placing an order is Rs. 45 and the carrying cost are 10% per year per unit of the average inventory. Determine –

(i) The economic order quantity

(ii) cycle time

(iii) total variable cost of managing the inventory.

Solution – Given that – $D = 16000$ units

$A = ₹\ 45$

$C = ₹\ 2$ per unit

$i = 10\% = 0.1$

(i)

$$EOQ = Q^* = \sqrt{\frac{2AD}{iC}}$$

$$= \sqrt{\frac{2 \times 45 \times 16000}{0.1 \times 2}} = 2684 \text{ (approx)}$$

(ii)

$$\text{cycle time } T^* = \frac{Q^*}{D} = \frac{2684}{16000} = 0.167 \text{ year}$$

$$= 2 \text{ month}$$

(iii) Total variable cost of managing the inventory

$$T(q^*) = \sqrt{2ADic}$$

$$= \sqrt{2 \times 45 \times 16000 \times 0.1 \times 2}$$

$$= 536.65 \text{ ₹} \quad \text{Ans}$$

Example – A Company needs 600 units per month, the procurement cost is ₹ 36 per order, the cost of holding it in stock is ₹ 1.20 per unit per year, determine the quantity that should be procured at a time to optimise the cost involved and

(a) Time between two consecutive orders.

(b) Number of orders per year

(c) The optimal cost.

Sol According to questions,

D = annual consumption

$= 600 \times 12 = 7200$ units

$A = ₹\ 36$ per unit

$h = 1.20$ ₹ per unit $= ₹\ 120$

$$\therefore \quad EOQ = \sqrt{\frac{2AD}{h}}$$

$$q^* = \sqrt{\frac{2 \times 7200 \times 36}{1.20}} = 658 \text{ units}$$

(a) Time between two consecutive order

$$T^* = \frac{Q^*}{D}$$

$$= \frac{658}{7200} = 0.091 \text{ year} = 1.092 \text{ month}$$

(b) Number of order per year

$$N = \frac{1}{T^*} = \frac{1}{0.091} = 10.86 \approx 11$$

(c) optimal cost

$$T(Q^*) = \frac{D}{Q} \cdot A + \frac{Q}{2} \cdot h$$

$$= \frac{7200}{658} \times 36 + \frac{658}{2} \times 1.2$$

$$= 393.92 + 394.8 = 788.72 \text{ ₹}$$

Ques The annual demand for an item is ₹ 3200 parts. The unit cost is ₹ 6 and the Inventory carrying charges are estimated as 25% per annum. If the cost of one procurement is ₹ 150 find – (a) EOQ.

(b) Time b/w two consecutive orders

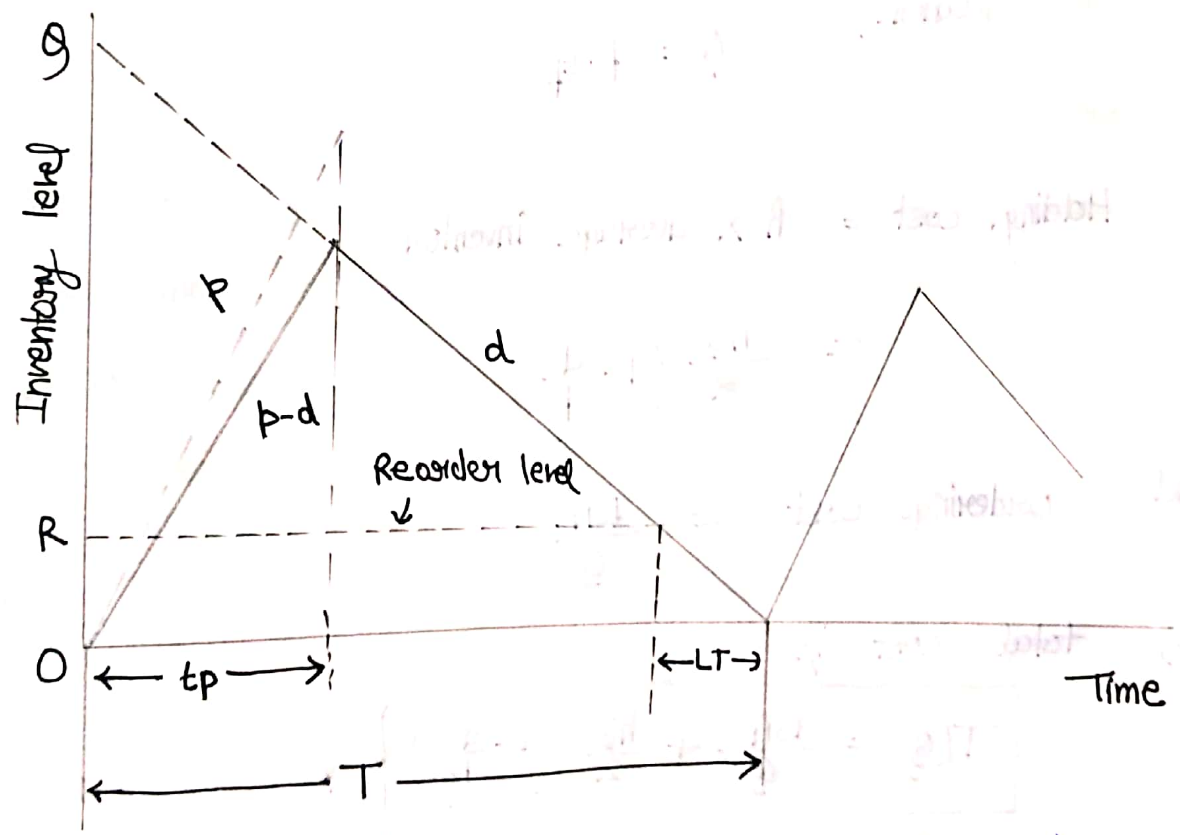
(c) Number of order per year

(d) The optimal cost.

EOQ with Finite Production Rate :-

The finite production rate model is also called the economic production Quantity (EPQ) model.

As in the EOQ model, assume that the inventory at the beginning is zero. It assumes that the quantity ordered is produced at a uniform rate p, the production facility is set up to produce Q units.



Here the total order quantity Q is produced over a period t_p, which is defined by the production rate p.

Let daily consumption rate or demand rate is d.

Maximum inventory at the end of production

$$S_{m} = (p-d)\, t_p$$

Therefore

$$\text{average inventory} = \frac{(p-d)\, t_p}{2}$$

$$= \frac{p t_p}{2}\left(1-\frac{d}{p}\right)$$

$$= \frac{Q}{2}\left(1-\frac{d}{p}\right)$$

where,

$$Q = p \cdot t_p$$

So,

$$\text{Holding cost} = h \times \text{average inventory}$$

$$= \frac{hQ}{2}\left(1-\frac{d}{p}\right)$$

and

$$\text{ordering cost} = \frac{DA}{Q}$$

Thus, total cost is

$$\boxed{T(Q) = \frac{DA}{Q} + \frac{hQ}{2}\left(1-\frac{d}{p}\right)}$$

From this, the optimal order quantity -

$$Q^* = \sqrt{\frac{2AD}{h\left(1-\frac{d}{p}\right)}} = \sqrt{\frac{2AD}{h}}\sqrt{\frac{p}{p-d}}$$

So,

$$T(Q^*) = \sqrt{2AhD\left(1-\frac{d}{p}\right)}$$

Reorder level = consumption rate × lead time

Length of each production run

$$\boxed{t_p = \frac{Q}{p}}$$

Ques- An item is produced at the rate of 128 units per day. The annual demand is 6400 units. The set up cost for each production run is ₹ 24 and inventory carrying cost is ₹ 3 per unit per year. There are 250 working days for production each year. Develop an inventory policy for this item.

Sol - Given that $p = 128$ units per day

$D = 6400$ units per year

or $d = \frac{6400}{250}$ unit per day

or $d = 25.6$ per ~~year~~ day

$A = ₹\ 24$

$h = ₹\ 3$

working days = 250 per year

(i)
$$EOQ = \sqrt{\frac{2AD}{h\left(1-\frac{d}{p}\right)}}$$

$$Q^* = \sqrt{\frac{2 \times 24 \times 6400}{3\left(1-\frac{25.6}{128}\right)}}$$

$$= \sqrt{128000} = 358 \text{ units}$$

(ii) Number of production per year

$$N = \frac{D}{Q^*}$$

$$= \frac{6400}{358} = 18 \text{ (approx)}$$

(iii) optimum length of each production run

$$t_p = \frac{Q}{p}$$

$$= \frac{358}{128} = 2.8 \text{ days}$$

(iv) Total minimum inventory cost

$$T_c = \sqrt{2AhD\left(1-\frac{d}{p}\right)}$$

$$= \sqrt{2 \times 24 \times 3 \times 6400\left(1-\frac{25.6}{128}\right)}$$

$$= \sqrt{737280} = 859 \text{ (approx)}$$

Ques- An item has annual consumption of 10,600 units per year. The ordering cost is ₹ 30 per order and unit cost of the item is ₹ 2. The inventory holding cost is estimated as 20% of average value of inventory. The inventory consumption rate is 20 units per day while the arrival of items is gradual at a rate of 25 units per day. Find out all inventory policy.

Economic Lot Size Model with Shortages –

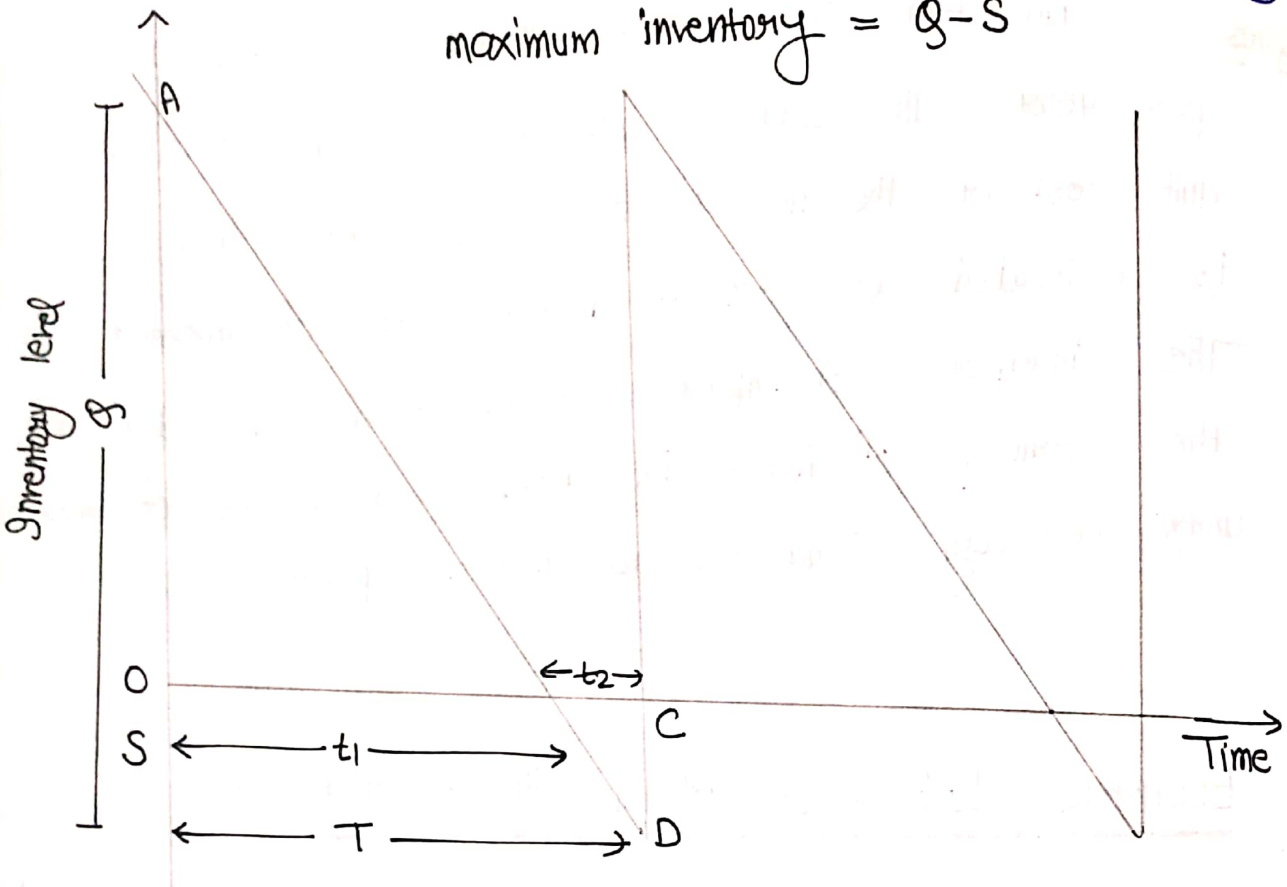
Stock outs or shortages are not always undesirable. If customers are ready to wait to accept a back order when an item is out of stock, it is economical to permit shortages since the sale is not lost. Again there are two cases –

1) EOQ with infinite Production Rate
2) EOQ with finite Production Rate

1) EOQ with Infinite Production Rate :–

In this model shortages are permitted. The situation is illustrated as follows –

maximum inventory = $Q-S$



S below the zero level indicates negative inventory i.e. number of units backordered. Back orders are carried out as the fresh stock arrives.

The inventory cycle T would be divided in two phases. t_1 = time when inventory is on hand and orders filled.

t_2 = time when shortages are allowed and all the orders are placed on backorder.

i.e. $T = t_1 + t_2$

$\therefore$ Annual ordering cost $= \frac{D}{Q} A$

Holding cost $= \frac{Q-S}{2} \cdot h t_1$

where $t_1 = \frac{T(Q-S)}{Q}$

So, holding cost, (during cycle T)

$$= \frac{Q-S}{2} \cdot h \cdot \left(\frac{T(Q-S)}{Q}\right)$$

$$= \frac{(Q-S)^2 \cdot h \cdot T}{2Q}$$

Annual holding cost $= \frac{(Q-S)^2 \cdot h}{2Q}$

Shortage cost – Let S represents maximum level of shortages.

So, average level of shortage $= \frac{S}{2}$

$\therefore$ Shortage cost (during cycle T) $= \frac{S}{2} b t_2$

where $b =$ backorder cost & $t_2 = \frac{TS}{Q}$

So, shortage cost per cycle $= \frac{S}{2} b \frac{TS}{Q} = \frac{bTS^2}{2Q}$

Therefore, annual shortage cost $= \frac{bS^2}{2Q}$

Therefore, Total cost = ordering cost + holding cost + Shortage cost

or $T(Q) = O(Q) + h(Q) + S(Q)$

$$T(Q) = \frac{D}{Q}A + \frac{(Q-S)^2 h}{2Q} + \frac{bS^2}{2Q}$$

$$\therefore \text{EOQ} = Q^* = \sqrt{\frac{2AD}{h}\left(\frac{h+b}{b}\right)} = \sqrt{\frac{2AD}{h}}\sqrt{\frac{h+b}{b}}$$

also

$$S^* = Q^*\left(\frac{h}{h+b}\right) = \sqrt{\frac{2ADh}{hb+b^2}}$$

$$\text{maximum inventory level} = Q^* - S^*$$

$$= Q^* - Q^*\left(\frac{h}{h+b}\right)$$

$$= Q^*\left(\frac{b}{h+b}\right)$$

$$\text{Total Cost } T(Q^*) = \sqrt{2AhD}\sqrt{\frac{b}{h+b}}$$

Ques A manufacture has to supply his customer with 24000 units of his product every year. This demand is fixed and known. since the unit is used by the customer in an assembly operation and the customer has no shortage space for units the manufacture must supply a day's requirement each day. If the manufacture fails to supply the required units, the shortage cost is ₹ 2 per unit per month. The inventory carrying cost is ₹ 1 per unit per month and the set up cost per set is ₹ 3500. Determine all the inventory terms.

Sol According to the questions –

$D = 24000$ unit per year $= 2000$ unit per month

$b =$ ₹ 2 per unit per month

$h =$ ₹ 1 per unit per month

$A =$ ₹ 3500

(i)

$$EOQ = Q^* = \sqrt{\frac{2AD}{h}\left(\frac{h+b}{b}\right)}$$

$$= \sqrt{\frac{2 \times 2000 \times 3500}{1}\left(\frac{1+2}{2}\right)}$$

$$= \sqrt{21} \times 10^3 = 4583 \text{ units.}$$

(ii) Optimum level of inventory

$$= Q^* \left(\frac{b}{h+b}\right)$$

$$= 4583 \left(\frac{2}{2+1}\right) = 3055 \text{ units}$$

(iii) Optimum Scheduling period $= \frac{Q^*}{D}$

$$= \frac{4583}{2000} = 2.24 \text{ months}$$

(iv) Total cost $T(Q^*) = \sqrt{2AhD} \cdot \sqrt{\frac{b}{h+b}}$

$$= \sqrt{2 \times 3500 \times 1 \times 2000} \sqrt{\frac{2}{1+2}}$$

$$= \sqrt{\frac{28}{3}} \times 10^3$$

$$= \sqrt{9.333} \times 10^3$$

$$= 3055 \text{ ₹}$$

Ques – An item is to be supplied at a constant rate of 300 units per day. Supplies of any amount can be obtained at any required time, but each ordering cost ₹ 60, cost of holding the items in inventory is ₹ 2.0 per unit per day while the delay in the supply of the item causes a penalty of ₹ 18 per unit per day. Find out all inventory terms of the item.

EOQ with Finite Production Rate :–

Assume that, each production run of length t consist of two parts t_1 and t_2 which are further sub-divided into two parts t_{11} & t_{12} and t_{21} & t_{22}.

So,

The maximum inventory level reached at the end of time t_1 is

$$Q_1 = (p-d)\,t_{11}$$

After time t_{11}, the stock Q_1 is used up during t_{12}

i.e.

$$Q_1 = d t_{12}$$

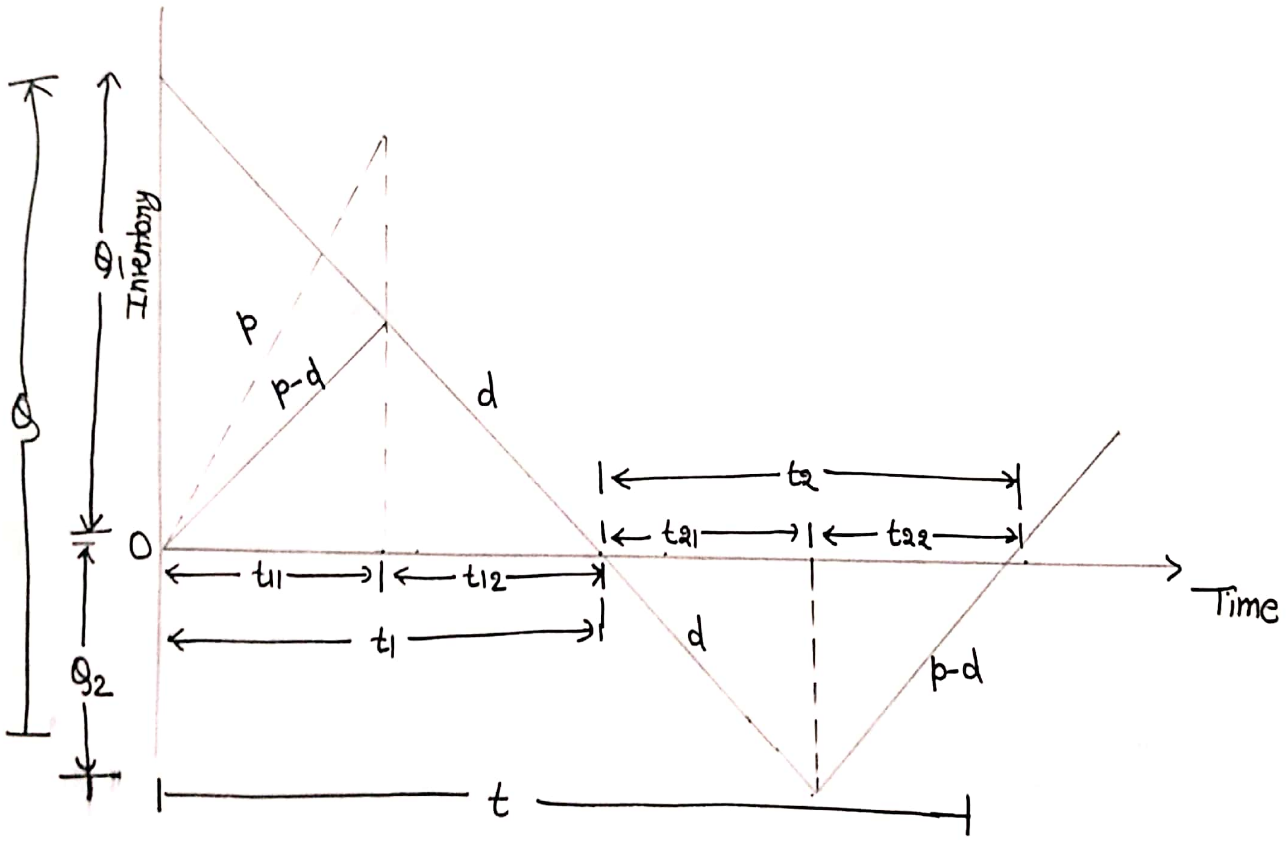
Maximum shortage occurred during time t_{21} as-

$$Q_2 = d \cdot t_{21}$$

After t_{21}, shortages reducing at the time t_{22} as-

$$Q_2 = (p-d)\, t_{22}.$$

where, p = production rate & d = demand rate



Now Average inventory $= \frac{1}{2} Q_1 \frac{(t_{11}+t_{12})}{t}$

& Average shortage $= \frac{1}{2} Q_2 \frac{(t_{21}+t_{22})}{t}$

Now, Let Q is the lot size then

$$Q_1 = Q - Q_2 - dt_{11} - dt_{22}$$

Now, putting the value of t_{11} & t_{22}, we get

$$Q_1 = Q - Q_2 - d\left[\frac{Q_1}{p-d} + \frac{Q_2}{p-d}\right]$$

or

$$Q_1 + Q_2 = Q_1 - \frac{d}{p-d}(Q_1+Q_2)$$

or

$$Q_1 + Q_2 = \left[\frac{p-d}{p}\right] \cdot Q \quad \text{———} \ (A)$$

Production cycle is

$$t = t_{11} + t_{12} + t_{21} + t_{22}$$

$$= \frac{Q_1}{p-d} + \frac{Q_1}{d} + \frac{Q_2}{p-d} + \frac{Q_2}{d}$$

$$= Q_1\left[\frac{1}{p-d} + \frac{1}{d}\right] + Q_2\left[\frac{1}{p-d} + \frac{1}{d}\right]$$

$$= \frac{p}{d(p-d)}(Q_1+Q_2)$$

$$= \frac{p}{d(p-d)} \cdot \left(\frac{p-d}{p}\right) \cdot Q \qquad (\text{from eq } A)$$

$$t = \frac{Q}{d}$$

Hence, The total inventory cost is

$$T(C) = \text{Average inventory} \times \text{holding cost} + \text{Average shortage} \times \text{Shortage cost} + \text{ordering cost}$$

or

$$T(C) = \frac{1}{2} Q_1 h \frac{(t_{11}+t_{12})}{t} + \frac{1}{2} Q_2 b \frac{(t_{21}+t_{22})}{t} + \frac{dA}{Q}$$

$$= \frac{1}{2Q} \times \frac{p}{p-d}\left[h\left(\frac{p-d}{p} Q - Q_2\right)^2 + bQ_2^2 \right] + \frac{dA}{Q}$$

Optimum production lot size is given as -

$$Q^0 = \sqrt{\frac{2A(h+b)}{h \cdot b}} \times \sqrt{\frac{pd}{p-d}}$$

Optimum level of shortage is

$$Q_2^0 = Q^0 \frac{h}{h+b}\left(1 - \frac{d}{p}\right)$$

maximum inventory level is -

$$Q_1^0 = \left(\frac{p-d}{p}\right) Q^0 - Q_2^0$$

Ques- The demand for an item in a company is 18000 units per year and the company can produce items at a rate of 3000 per month. The cost of one setup is ₹ 500 and the holding cost of one unit per month is 15 paise. The shortage cost of one unit is ₹ 20 per year. Determine the optimum manufacturing quantity and the number of shortages. Also determine the manufacturing time and the time between setups.

Sol Here, $D = 18000$ units per year, $d = 1500$ units per month

$p = 3000$ units / month

$A =$ ₹ 500 per setup

$h =$ ₹ 0.15 per unit per month

$b =$ ₹ 20 / unit year $=$ ₹ 1.67 unit/month

(i) Optimum manufacturing quantity

$$Q^{0} = \sqrt{\frac{2A(h+b)}{h \cdot b}}\sqrt{\frac{pd}{p-d}}$$

$$= \sqrt{\frac{2 \times 500\,(0.15+1.67)}{0.15 \times 1.67}}\sqrt{\frac{3000 \times 1500}{3000-1500}}$$

$$= \sqrt{21796406} = 4669 \text{ units}$$

(ii) Number of shortages is given by

$$Q_2^0 = \frac{h}{h+b}\left(1-\frac{d}{p}\right) \cdot Q^0$$

$$= \frac{0.15}{0.15+1.67}\left(1-\frac{1500}{3000}\right) \times 4669$$

$$= \frac{0.15}{1.82} \times \frac{1500}{3000} \times 4669$$

$$= 192 \text{ units } (\because \text{approx})$$

(iii) Manufacturing time

$$t = \frac{Q^0}{p}$$

$$= \frac{4669}{3000} = 1.55 \text{ months}$$

(iv) Optimum cycle time between set ups

$$= \frac{Q^0}{d}$$

$$= \frac{4669}{1500} = 3.11 \text{ months}$$

Ques- A company has a demand of 12000 units / year for an item and it can produce 2000 such items per month. The cost of one set up is ₹ 400 and the holding cost / unit / month is ₹ 15, the shortage cost of one unit is ₹ 20 per year, the cost of one unit is ₹ 4. Find

(i) optimum lot size

(ii) the maximum inventory

(iii) Manufacturing time and

(iv) total time.