**INVENTORY CONTROL**

**Introduction:**

Inventory is any stock of goods that is maintained for the smooth and efficient running of a business to meet future demand.

The main objective of an inventory control problem is to find the optimum order quantity by minimizing the total expected cost or maximizing the total expected profit.

**Different costs associated with an inventory model**

1. Procurement cost (Ordering cost or setup cost):

Ordering cost is the cost associated with placing an order and setup cost is associated

with setting up of the production process to manufacture the units.

1. Holding or carrying cost:

It is the cost associated with maintaining inventory.

1. Storage cost: It is the cost of proper storage of inventory.
2. Insurance cost: It is the cost of insuring inventory against possible damage.
3. Cost due to repeated handling
4. Obsolescence cost: This cost arises generally with fashion items. The inventory manager may store a certain item which is presently in fashion. But when he releases it in the market, he may find it has gone out of fashion. The loss is called obsolescence cost.
5. Shortage cost:

This is the loss incurred if the inventory manager is unable to satisfy the demand of a customer.

1. Excess cost:

When the stock on hand is greater than the demand, the inventory manager has some excess units in hand which is of no value and hence the loss incurred is called excess cost.

**Classification of inventory models**

Inventory models may be classified according to the following:

1. By demand:
2. If the demand for the goods is constant and known then the inventory model is called a deterministic or certainity model.
3. If the demand is random, then the model is called stochastic (or random) model.
4. By number of orders placed over the planning period:
5. If only one order is placed over the planning period, then the model is called static model.
6. If two or more than two orders are placed over the planning period, then the model is called dynamic model.
7. By lead time: ( Lead time is the time interval between placing an order and getting its supply.)
8. Zero lead time: If the goods are delivered instantly on order. eg. In case of shelf items
9. Fixed positive lead time: If the goods are delivered within a fixed time after the order.
10. Random lead time: If the goods are delivered at any random time after the order.

**DYNAMIC CERTAINITY MODEL(EOQ MODEL) WITHOUT SHORTAGES AND WITH ZERO LEAD TIME**

Let (0,T) be the planning period,

D= Total demand over (0,T) (known and fixed)

Cs= Ordering cost per order independent of the order quantity

C1= Carrying cost per unit per unit time

**Assumptions**

1. Demand occurs uniformly over the planning period at the rate R=D/T per unit time.
2. Ordering cost is independent of the cost per unit.

**Policy**

Place an order for q units at each of the equidistant time points 0,t,2t,…..,(r-1)t (called reorder points) over the planning period where q is just sufficient to meet the demand over a reorder interval.

q q q

0 t 2t 3t (r-1)t T=rt

Here, T=r/t or, r=T/t

Further since total demand over (0,T) =D we have , rq=D or, r=D/q

Thus, T/t=D/q….(1)

r is called the order frequency.

The problem is to find the optimum values of t and q so as to minimize the total cost over (0,T).

Let C(q)= total cost over (0,T)

So, C(q)= total ordering cost + total carrying cost

Since the inventory situation over the reorder intervals are identical, we can write,

C(q)=r[total cost over (0,t)]

=r[ordering cost + carrying cost over (0,t)]

=D/q[Cs+ carrying cost over (0,t)]

Since demand occurs uniformly over (0,t) and the stock heights at 0 and t are respectively q and 0, so the mean stock at any point on (0,t) =(q+0)/2

The carrying cost of this stock over an interval of length t is C1qt/2.

C(q)= D/q[Cs+ C1qt/2]=D Cs/q + C1Dt/2

= D Cs/q + C1qT/2 (by (1))

Now, 



The optimum q minimizing C(q) is therefore obtained as the unique solution of



(2) is called the optimum order quantity or the economic order quantity(EOQ).

Therefore, optimum reorder interval = 

Therefore, minimum C(q) =





