Lecture 28
SL

classmate
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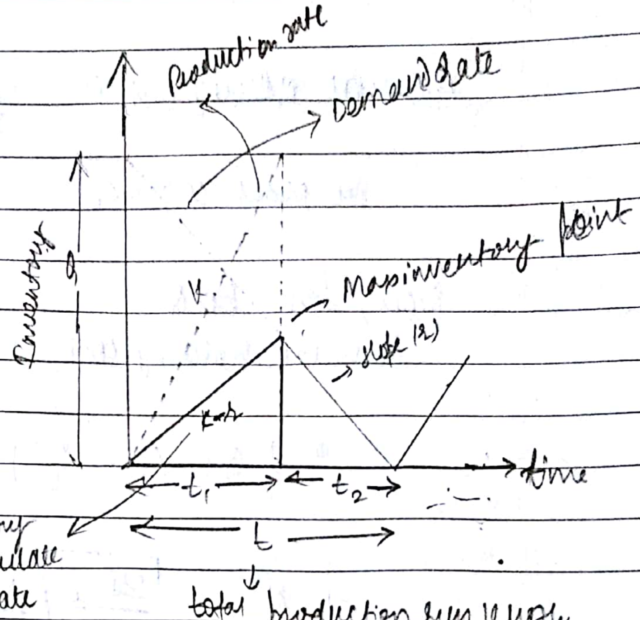
EOQ problem with finite replenishment

Min inventory
y at EOQ



Assume that each product run of length t consist of two parts t_1 and t_2.

1. The inventory is building up at a constant rate of $k-r$ units, per unit of time during
2. There is no production during the time period t_2 and the inventory is decreasing at the rate of r per unit of time.

Total inventory $Q = k \cdot t_1$

$\Rightarrow t_1 = \frac{Q}{k}$

During production period t_1, inventory is increasing at rate k and decreasing a rate r. Thus inventory accumulates at rate $(k-r)$.

$\therefore$ Max inventory
$= (k-r)t_1$

Holding cost = Average inventory $\times$ holding cost per unit
$= \frac{1}{2} Q C_1$

Average inventory $= \frac{1}{2} \times (k-r) t_1 = \frac{1}{2} Q (1 - r/k)$

Per unit per year holding cost $= C_1$

$\therefore$ Annual holding cost $= C_1 \times$ Avg. inventory
$= \frac{1}{2} Q C_1 (1 - r/k)$

Annual ordering cost is $\frac{C_o D}{Q}$

per order cost $= C_o$

Now, for EOQ
Annual holding cost = Annual ordering cost

$$\therefore \frac{1}{2} Q C_1 \left(1 - \frac{r}{k}\right) = \frac{C_o D}{Q}$$

$$\Rightarrow Q^o = \sqrt{\frac{2 D C_o}{C_1} \left(\frac{k}{k-r}\right)}$$

Optimum no. of production run

$$\frac{D}{Q^o} = \sqrt{\frac{D C_1}{2 C_o} \left(1 - \frac{r}{k}\right)}$$

Total annual cost = ordering cost + holding cost

Q. A contractor has to supply 10000 bearings per day to an automobile manufacturer. He finds that when he starts the production run, he can produce 25000 per day. The cost of holding in stock for Rs. 2 and the setup cost of product run is ₹ 1800. How frequently should the production run be made? Assume that there are 300 working days in a year.

$C_1 = 2$ $\quad\quad$ $D = 10000 \times 300$ per year

$C_o = 1800$

$k = 25000$ $\quad$ $r = 10000$

$$Q_o = \sqrt{\frac{2 D C_o}{C_1} \left(\frac{k}{k-r}\right)} = \sqrt{\frac{2 \times 10000 \times 300 \times 1800}{2} \left(\frac{25000}{15000}\right)}$$

$$= \sqrt{9000000000}$$

$$= 94,868$$

$$t_1 = \frac{Q^0}{k} = \frac{94868}{25000} = 3.79$$

$$t_2 = \frac{Q^0}{r} = \frac{94,868}{10000} = 9.48$$

Q. A manufacturing company needs 25000 units of a particular component every year. The company buys ~~the~~ it at Rs 30 per unit. The order processing cost of this part is estimated at Rs. 15 and the cost of carrying a part in stock comes to about Rs. 4/year. A company can manufacture this part internally. In that case, saves 20% of the price. However it estimates the setup cost of Rs. 250 per production run. Annual production rate would be 4800 units. However, the inventory holding cost remain unchanged.

a) Determine the EOQ and optimal no. of orders placed in a year.

b) Determine the optimal production cost size and the average deviation of the production run.

c) Should the company manufacture the component internally or continue to purchase it from the supplier?

$D = 2500$ $\quad C_o = 15$

$C_1 = 4$

~~$k = 4800$ $\quad r =$~~

$$Q_0 = \sqrt{\frac{2DC_0}{C_1}} = \sqrt{\frac{2 \times 2500 \times 15}{4}} = 137$$

$$\frac{D}{Q^0} = \frac{2500}{137}$$

Now,

$C_1 = 4$ $\quad r = 2500$

$C_0 = 250$ $\quad k = 4800$

$$Q_0 = \sqrt{\frac{2DC_0}{C_1}\left(\frac{k}{k-r}\right)}$$

$$= \sqrt{\frac{2 \times 2500 \times 250}{4} \times \frac{4800}{2300}} = 808.$$

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Purchase cost = 2500×30

Holding cost = $4 \times \frac{1}{2} \times 137 = 274$

Annual ordering cost = $\frac{D}{Q} C_0$

$= \frac{2500}{137} \times 15 = 274$

$TC = D \times C + \frac{D}{Q_0} \times C_0 + \frac{1}{2} \times Q_0 \times C_h$

$= 2500 \times 30 + \frac{2500}{137} \times 15 + \frac{1}{2} \times 4 \times 137$

$= 75,548$ /-

80% × 30

If produced internally

$TC = 2500 \times 24 + \frac{2500}{808} \times 250 + \frac{1}{2} \times 808 \times 4 \times \left(\frac{4800-2400}{480}\right)$

$= 60000 + 774 + \cancel{1616}\ 774$

$= 61,548$