Homework 4 Solution

1) Assumptions of the basic EOQ Model:

a) Demand is deterministic. There is no uncertainty about the quantity or timing of the demand.

b) Demand is constant over time. It can be represented as a straight line so that if annual demand is 365 units, this translates into a daily demand of 1.

c) Placing an order incurs a constant setup cost. Regardless of the size of the lot and status of the supplier, the setup cost is the same.

d) Products can be analyzed singly. Either there is only a single product or conditions exist that ensure separability of products.

e) Inventory carrying cost is incurred based on value of average on-hand inventory.

f) Instantaneous batch delivery follows a deterministic lead-time.

 g) All replenishment orders are for the same quantity, and that quantity is not limited.

h) No shortages are allowed.

2)

\[ \lambda = 3000 \text{ units/yr}, \]

\[ c = 30 \text{ dollars/unit}, \]

\[ I = 0.5 \text{ dollars/dollar}, \]

\[ h = Ic = 0.5 \times 30 = 15 \text{ dollars/unit}, \]

\[ K = 75 \text{ dollars/order}. \]

a)

\[
Q^* = \sqrt{\frac{2K\lambda}{h}} = \sqrt{\frac{2 \times 75 \times 3000}{15}} = 173.2
\]
b) $T = \frac{Q^*}{\lambda} = \frac{173.2}{3500} = 0.05\overline{77}35$ yrs, $0.05\overline{77}35 \times 52 = 3$ weeks. Since orders are received in two weeks, the reorder point is $173.2/3 \times 2 = 115.5$.

c) The average annual holding and setup costs with the optimal policy

$$\sqrt{2K \lambda h} = \sqrt{2 \times 75 \times 3000 \times 15} = 2598.1.$$  $52/3 \times 75 = 1300$ of this is setup cost and $1298.1$ is holding cost.

Current policy orders every 2 months, that is, 6 times a year. This yields an annual setup cost of $6 \times 75 = 450$. So the order quantity is $3000/6 = 500$. Then the average inventory is $500/2 = 250$. Then the annual holding cost is $15 \times 250 = 3750$.

The current policy incurs additional holding cost of $3750 - 1298.1 = 2451.9$. On the other hand, annual setup cost with the current policy is $1300 - 450 = 850$ dollars less than the optimal policy.

d) If the orders were received 8 weeks after they are placed, the management would have to order $8/3 = 2.66$ cycles in advance. The reorder point would be identical to the case in (b), which is 115.5 units, since the inventory level 8 weeks before the replenishment time would be identical to the inventory level 2 weeks before the replenishment. (Remember that the inventory is depleted every 3 weeks.)