





## Solutions

### Exercise 1. Solution

William Beville's computer training school, in Richmond, stocks workbooks with the following characteristics:

Demand  $D = 5000$  units/year

Ordering cost  $S = \$25$ /order

Holding cost  $H = \$4$ /units/year

a) Calculate the EOQ for the workbooks.

$$Q^* = \sqrt{\frac{2DS}{H}} = \sqrt{2 \times 5000 \times 25/4} = 250$$

b) What is the annual holding cost for the workbooks?

$$H_{annual} = \frac{Q^*}{2} \times H = \frac{250}{2} \times 4 = 500$$

c) What is the annual ordering cost?

$$S_{annual} = \frac{D}{Q^*} \times S = \frac{5000}{250} \times 25 = 500$$

### Exercise 2. Solution

The inventory item has a demand of 4,000 units per year. The cost of each unit is \$100, and the inventory carrying cost is \$100 per unit per year. The ordering cost is \$20 per order. It takes about 5 days for an order to arrive, and the demand for one week is 120 units. (This is a corporate operation, and there are 250 working days per year.)

a) What is the EOQ?

$$D = 4000, H = 100, S = 20, L = 5$$

$$Q^* = \sqrt{\frac{2DS}{H}} = \sqrt{2 \times 4000 \times 20/100} = 40$$

b) What is the average inventory if the EOQ is used?

$$Q_{average} = \frac{Q^*}{2} = 20$$

c) What is the optimal number of orders per year?

The optimal number of orders per year:

$$\frac{D}{Q^*} = \frac{4000}{40} = 100$$

d) What is the optimal number of days in between any two orders?

Dividing the number of working days by the optimal number of orders

$$\frac{250}{100} = 2.5 \text{ days}$$

e) What is the annual cost of ordering and holding inventory?

$$H_{annual} = \frac{Q^*}{2} \times H = \frac{40}{2} \times 100 = 2000$$

$$S_{annual} = \frac{D}{Q^*} \times S = \frac{4000}{40} \times 20 = 2000$$

f) What is the total annual inventory cost, including cost of the 4,000 units?

$$2000 + 2000 + 4000 \times 100 = 404000$$

g) What is the reorder point?

$$\text{Daily demand} = d = \frac{4000}{250} = 16 \text{ units/day}$$

$$\text{Lead time} = L = 5 \text{ days}$$

$$R = dL = 16 \times 5 = 80 \text{ units}$$

**More Practice Problems**

1. If  $D = 8,000$  per month,  $S = \$45$  per order, and  $H = \$2$  per unit per year,

- a) What is the economic order quantity?
- b) How does your answer change if the holding cost doubles?
- c) What if the holding cost drops in half?

2. Henry Crouch's law office has traditionally ordered ink refills 60 units at a time. The firm estimates that carrying cost is 40% of the \$10 unit cost and that annual demand is about 240 units per year. The assumptions of the basic EOQ model are thought to apply.

- a) For what value of ordering cost would its action be optimal?

If the true ordering cost turns out to be much greater than your answer to (a), what is the impact on the firm's ordering policy?

3. Matthew Liotine's Dream Store sells beds and assorted supplies. His best-selling bed has an annual demand of 400 units. Ordering cost is \$40; holding cost is \$5 per unit per year.

- a) To minimize the total cost, how many units should be ordered each time an order is placed?
- b) If the holding cost per unit was \$6 instead of \$5, what would be the optimal order quantity?

4. Southeastern Bell stocks a certain switch connector at its central warehouse for supplying field service offices. The yearly demand for these connectors is 15,000 units. Southeastern estimates its annual holding cost for this item to be \$25 per unit. The cost to place and process an order from the supplier is \$75. The company operates 300 days per year, and the lead time to receive an order from the supplier is 2 working days.

- a) Find the economic order quantity.
- b) Find the annual holding costs.

c) Find the annual ordering costs.

d) What is the reorder point?

5. Lead time for one of your fastest-moving products is 21 days. Demand during this period averages 100 units per day.

a) What would be an appropriate reorder point?

b) How does your answer change if demand during lead time doubles?

c) How does your answer change if demand during lead time drops in half?

6. Mohsen as the operations manager of a manufacturing firm wants to make purchasing decisions for a specific item. The demand of the item is 6000 per year. The cost of holding an item is 10\$ per year. The average ordering cost is 30\$ per order. It takes 5 days for an order to be delivered after the order is placed (lead time = 5 days). There are 250 working days during a year.

a) What is EOQ?

b) What is the average inventory if the EOQ is used?

c) What is the optimal number of orders per year?

d) What is the optimal number of days in between any two orders?

e) What is the annual cost of ordering and holding inventory? What is the total cost?

f) Calculate the demand during lead time (equivalently I might ask: Calculate the reorder point).

g) (robustness) Suppose Mohsen makes a mistake in estimating EOQ and estimates an order quantity equal to 220 items. Assume everything else remains the same. How this affects the total cost? (equivalently I might ask: what is the percent increase/decrease in the total cost?)

Solutions will be uploaded after the class.