Chapter 14

14.2  a. What is the EOQ?

\[ D = 200,000 \text{ units per year} \]

\[ S = 96 \text{ $ per order} \]

\[ C = .30(37.50) = 11.25 \text{ $ carrying cost per year per unit held} \]

\[
EOQ = \sqrt{\frac{2DS}{C}}
\]

\[
= \sqrt{\frac{2(200,000)(96)}{.30(37.50)}}
\]

\[ = 1,847.52 \rightarrow 1,848 \text{ units [or 1,847 units]} \]

b. What is the TSC at the EOQ?

\[ TSC = CQ/2 + SD/Q \]

\[ = .30(37.50)(1848)/2 + 96(200,000)/1848 \]

\[ = 10,395.00 + 10,389.61 \]

\[ = $20,784.61 \]

c. How much would the TSC increase if the order quantity must be 2,500 units because of a standard shipping-container size?

\[ TSC = CQ/2 + SD/Q \]

\[ = .30(37.50)(2500)/2 + 96(200,000)/2500 \]

\[ = 14,062.50 + 7,680 \]

\[ = $21,742.50 \]

So TSC would increase by \((21,742.50 – 20,784.61) = $957.89.\)
Chapter 14 – Inventory Management

14.5

a. How many boxes of sterile bandages should be ordered each time an order is placed?

\[ D = 12(3,500) = 42,000 \text{ boxes per year} \]

\[ S = 25 \text{ $ per order} \]

\[ C = 2.90 \text{ $ carrying cost per year per box held} \]

\[ \text{EOQ} = \sqrt{\frac{2DS}{C}} \]

\[ = \sqrt{\frac{2(42,000)(25)}{2.90}} \]

\[ = 850.96 \text{ or, say, 851 boxes} \]

b. How many orders per year should be expected?

\[ \frac{D}{Q} = \frac{42,000}{851} = 49.35 \text{ orders per year (an average; not rounded)} \]

c. What is the expected TSC per year?

\[ \text{TSC} = \frac{CQ}{2} + \frac{SD}{Q} \]

\[ = 2.90(851)/2 + 25(42,000)/851 \]

\[ = 1,233.95 + 1,233.84 \]

\[ = $2,467.79 \]

d. How many days should one order last, on average?

\[ 365\left(\frac{Q}{D}\right) = 365\left(\frac{851}{42,000}\right) = 7.4 \text{ days} \]
14.7  a. What is the EOQ for the crude oil?

\[ D = 600,000 \text{ barrels per year} \]
\[ S = 11,600 \text{ $ per order} \]
\[ C = .30(38.00) = 11.4 \text{ $ carrying cost per year per barrel held} \]
\[ p = 12,000 \text{ barrels per day supply rate} \]
\[ d = 5,000 \text{ barrels per day demand rate} \]

\[ \text{EOQ} = \sqrt{\frac{2DSp}{C(p-d)}} \]
\[ = \sqrt{\frac{2(600,000)(11,600)(12,000)}{.30(38.00)(12,000-5,000)}} \]
\[ = 45,752 \text{ barrels} \]

b. What is the TSC at the EOQ?

\[ \text{TSC} = CQ(p-d)/[2p] + SD/Q \]
\[ = .30(38.00)(45,752)(12,000-5,000)/[2(12,000)] + 11,600(600,000)/45,752 \]
\[ = 152,125.40 + 152,124.50 \]
\[ = $304,249.90 \]

c. How many days worth of demand are supported by each order of crude oil?

\[ Q/d = 45,752 / 5,000 = 9.15 \text{ days} \]

d. How much needed storage capacity is expected for the crude oil?

\[ \text{maximum inventory} = (p-d)Q/p = (12,000-5,000)(45,752)/12,000 = 26,688.7 \]
14.8  

a. What quantity of coal should Ohio Electric order each time it places an order?

\[
D = 365(1,400) = 511,000 \text{ tons per year} \\
S = 675 \ \text{$ per order} \\
C = .28(16.50) = 4.62 \text{ $ carrying cost per year per ton held} \\
p = 9,000 \text{ tons per day supply rate} \\
d = 1,400 \text{ tons per day demand rate}
\]

\[
EOQ = \sqrt{\frac{2DSp}{C(p-d)}}
\]

\[
= \sqrt{\frac{2(511,000)(675)(9,000)}{.28(16.50)(9,000 - 1,400)}}
\]

\[
= 13,298 \text{ tons}
\]

b. What is the annual TSC that Ohio Electric should expect?

\[
TSC = CQ(p-d)/[2p] + SD/Q
\]

\[
= .28(16.50)(13,298)(9,000-1,400)/[2(9,000)] + 675(511,000)/13,298
\]

\[
= 25,939.97 + 25,938.11
\]

\[
= \$51,878.08
\]

c. How many days should it take to receive one shipment after it starts arriving?

\[
Q/p = 13,298 / 9,000 = 1.478 \text{ days}
\]

d. What is the maximum inventory level of coal that should be expected?

\[
\text{maximum inventory} = (p-d)Q/p = (9,000-1,400)(13,298)/9,000 = 11,229.4
\]
14.9  a. How many dozen notepads should STHDS order each time?

\[ D = 1,500 \text{ dozen per year} \]
\[ S = 35 \text{ $ per order} \]
\[ C = .40(ac) \text{ $ carrying cost per year per dozen held} \]

First, compute the EOQ at each acquisition cost level:

\[ EOQ_i = \sqrt{\frac{2DS}{C_i}} \]

For \( ac_1 = $21.95 \):
\[ EOQ_1 = \sqrt{\frac{2(1500)(35)}{.40(21.95)}} = 109.36 \text{ or 109 dozen (infeasible)} \]

For \( ac_2 = $19.95 \):
\[ EOQ_2 = \sqrt{\frac{2(1500)(35)}{.40(19.95)}} = 114.71 \text{ or 115 dozen (infeasible)} \]

For \( ac_3 = $18.95 \):
\[ EOQ_3 = \sqrt{\frac{2(1500)(35)}{.40(18.95)}} = 117.70 \text{ or 118 dozen (feasible)} \]

For \( ac_4 = $17.95 \):
\[ EOQ_4 = \sqrt{\frac{2(1500)(35)}{.40(17.95)}} = 120.93 \text{ or 121 dozen (infeasible)} \]

Next, check the total material cost for 118 dozen @ $18.95 and for 200 dozen @ $17.95:

\[ TMC = CQ/2 + SD/Q + D(ac) \]

For 118 dozen @ $18.95:
\[ TMC = .40(18.95)(118)/2 + 35(1500)/118 + 1500(18.95) \]
\[ = 447.22 + 444.92 + 28,425.00 \]
\[ = $ 29,317.14 \]

For 200 dozen @ $17.95:
\[ TMC = .40(17.95)(200)/2 + 35(1500)/200 + 1500(17.95) \]
\[ = 718.00 + 262.50 + 26,925.00 \]
\[ = $ 27,905.50 \]

STHDS should order 200 dozen at a cost of $17.95 for each dozen.
14.9 Continued

b. What would be the resulting total inventory cost per year (ordering plus carrying plus materials cost)?

\[ \text{TMC} = \$ 27,905.50 \]

c. How many orders per year should be expected?

\[ \text{D/Q} = \frac{1,500}{200} = 7.5 \text{ orders per year (an average; not rounded)} \]

d. What is the expected maximum inventory level of notepads?

\[ \text{Maximum inventory} = Q = 200 \text{ dozen} \]

e. If STHDS has only enough storage space for 150 dozen notepads, how many should it order each time?

If the maximum inventory level cannot exceed 150 dozen, then the cost of $17.95 per dozen would not be allowed since 200 dozen cannot be stored. In this case the best order quantity would be 118 dozen at $18.95 per dozen.
14.14 a. What is the order point?

This graph depicts the DDLT distribution:

\[
OP = EDDLT + z \sigma_{DDLTT}
\]

\[
= 65.5 + 1.64(10.5) = 65.5 + 17.22
\]

\[
= 82.72 \uparrow 83 \text{ units (rounded up)}
\]

c. What is the safety stock level?

\[
SS = z \sigma_{DDLTT}
\]

\[
= 1.64(10.5)
\]

\[
= 17.22 \uparrow 18 \text{ units (rounded up)}
\]
14.15 a. What is the order point?

This graph depicts the DDLT distribution:

\[ \text{OP} = \text{EDDLT} + z \sigma_{\text{DDLT}} \]

\[ = 160,000 + 1.04 (20,000) = 160,000 + 20,800 \]

\[ = $180,800 \]

c. What is the safety stock level?

\[ \text{SS} = z \sigma_{\text{DDLT}} \]

\[ = 1.04 (20,000) \]

\[ = $20,800 \]