CHAPTER 15
INVENTORY CONTROL

3. D = 1,000 units/year, H = $100/unit/year, S = $25/order.

\[ Q_{\text{opt}} = \sqrt{\frac{2DS}{H}} = \sqrt{\frac{2(1000)25}{100}} = 22.36 \rightarrow 22 \text{ units or 23 units} \]

5. T = 4 weeks, L = 3 weeks, \( \bar{d} = 150 \) pounds/week, \( \sigma_d = 30 \) pounds/week, service level = 0.98 (probability of no stockout), and I = 500 pounds.

\[ z = 2.054 \]

\[ q = \bar{d}(T + L) + z\sigma_{T+L} - I \]

\[ \sigma_{T+L} = \sqrt{T + L \cdot \sigma_d} = \sqrt{4 + 3 \cdot 30} = 79.3725 \]

\[ q = 150(4+3) + 2.054(79.3725) - 500 = 713.03 \rightarrow 713 \text{ pounds} \quad \text{[May be safer to round up to 714 pounds]} \]

7. T = 30 days, L = 2 days, \( \bar{d} = 5 \) units/day, \( \sigma_d = 1 \) unit/day, service level = 0.98 (probability of no stockout), and I = 35 units.

\[ z = 2.054 \]

\[ q = \bar{d}(T + L) + z\sigma_{T+L} - I \]

\[ \sigma_{T+L} = \sqrt{T + L \cdot \sigma_d} = \sqrt{30 + 2 \cdot 1} = 5.657 \]

\[ q = 5(30 + 2) + 2.054(5.657) - 35 = 136.62 \rightarrow 137 \text{ units} \quad \text{[Round up]} \]

The most he would ever order would be when on-hand inventory I = 0.

\[ q = 5(30 + 2) + 2.05(5.657) = 171.62 \rightarrow 172 \text{ chips} \]
12. \(D = 2,000\) units/year, \(C = $25/\text{unit}\), \(H = $5/\text{unit/year}\), \(S = $10/\text{order}\).

a. \(Q_{opt} = \sqrt{\frac{2DS}{H}} = \sqrt{\frac{2(2000)10}{5}} = 89.44 \rightarrow 89\) units or 90 units

b. At \(Q = 89\) units, Ordering cost = \(\frac{D}{Q}S = \frac{2000}{89} (10) = $224.72\)

c. At \(Q = 89\) units, Holding cost = \(\frac{Q}{2}H = \frac{89}{2} (5) = $222.50\)

14.

<table>
<thead>
<tr>
<th>Quantity range</th>
<th>Cost (C)</th>
<th>“basic EOQ”</th>
<th>Feasible?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 100 pounds</td>
<td>$20 per pound</td>
<td>219 pounds</td>
<td>No</td>
</tr>
<tr>
<td>100 to 999 pounds</td>
<td>$19 per pound</td>
<td>225 pounds</td>
<td>Yes</td>
</tr>
<tr>
<td>1,000 or more pounds</td>
<td>$18 per pound</td>
<td>231 pounds</td>
<td>No</td>
</tr>
</tbody>
</table>

Note: \(EOQ = \sqrt{\frac{2DS}{iC}}\)

Therefore, calculate total cost at \(Q=225\) @ \(C=$19/\text{unit}\), and at \(Q=1000\) @ \(C=$18/\text{unit}\)

\[TC_{Q=225,C=19} = DC + \frac{D}{Q}S + \frac{Q}{2}iC = 3000(19) + \frac{3000}{225} \cdot 40 + \frac{225}{2} \cdot (0.25)19 = $58,067\]

\[TC_{Q=1000,C=18} = DC + \frac{D}{Q}S + \frac{Q}{2}iC = 3000(18) + \frac{3000}{1000} \cdot 40 + \frac{1000}{2} \cdot (0.25)18 = $56,370\]

The optimal order quantity is 1,000 units at a cost of $18 per pound.

16. \(D = 5,000\) units/year, \(C = $3/\text{unit}\), \(S = $10/\text{order}\), \(i = 20\%\), \(L = 3\) weeks, \(\bar{d} = 100\) units/week, \(\sigma_d = 30\) units/week, service level = 0.95 (probability of no stockout).

a. \(Q_{opt} = \sqrt{\frac{2DS}{H}} = \sqrt{\frac{2DS}{iC}} = \sqrt{\frac{2(5000)10}{.20(3)}} = 408.25 \rightarrow 408\) bottles

b. \(\sigma_L = \sqrt{L} \cdot \sigma_d = \sqrt{3} \cdot 30 \approx 52\) units

\[z = 1.645\]

\[R = \bar{d}L + z\sigma_L = 100(3) + (1.645)52 = 300 + 85.54 = 385.54 \rightarrow 386\] bottles \([Round up]\)
26. C = $35/unit, i = 20%, D = 1,000 units/year, S = $20/order,
\[
\bar{d} = \frac{D}{365 \text{ working days/year}} = \frac{1000}{365} \approx 2.74 \text{ units/day}, \ \sigma_d = 3 \text{ units/day}, L = 4 \text{ days},
\]
service level (probability of no stockout) = 0.98.
\[
Q_{opt} = \sqrt{\frac{2DS}{iC}} = \sqrt{\frac{2(1000)(20)}{.20(35)}} = 75.59 \rightarrow 75 \text{ or } 76 \text{ tires}
\]
\[
\sigma_L = \sqrt{\frac{L}{\sigma_d}} = \sqrt{\frac{4}{3}} = 6 \text{ tires}
\]
z = 2.054
\[
R = \bar{d}L + z\sigma_L = (1000/365)(4) + (2.054)6 = 10.959 + 12.324 = 23.283 \rightarrow 24 \text{ tires}
\]
[Round up]
Order 76 tires when the on-hand inventory level reaches 24 tires.

28.

<table>
<thead>
<tr>
<th>Quantity range</th>
<th>Cost (C)</th>
<th>“basic EOQ”</th>
<th>Feasible?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 2500 pounds</td>
<td>$0.82 per pound</td>
<td>4277 pounds</td>
<td>No</td>
</tr>
<tr>
<td>2500 to 4999 pounds</td>
<td>$0.81 per pound</td>
<td>4303 pounds</td>
<td>Yes</td>
</tr>
<tr>
<td>5,000 or more pounds</td>
<td>$0.80 per pound</td>
<td>4330 pounds</td>
<td>No</td>
</tr>
</tbody>
</table>

Note: EOQ = \sqrt{\frac{2DS}{iC}}

Therefore, calculate total cost at Q=4303, C=$0.81, and at Q=5000, C=$0.80

\[
TC_{Q=4303,C=0.81} = DC + \frac{D}{Q}S + \frac{Q}{2}iC = 50000(0.81) + \frac{50000}{4303}30 + \frac{4303}{2}(.20)(0.81) = $41197.14
\]

\[
TC_{Q=5000,C=0.80} = DC + \frac{D}{Q}S + \frac{Q}{2}iC = 50000(0.80) + \frac{50000}{5000}30 + \frac{5000}{2}(.20)(0.80) = $40700.00
\]

The optimal order quantity is 5,000 units at a cost of $0.80 per pound.