

Homework 7 Solutions

1) a) $\mu_L = 240/6 = 40$ $\sigma_L = 24.495/\sqrt{6} = 10$

b) $Q_0 = \sqrt{\frac{2 \times 1000 \times 240}{40}} = 110$

$$1 - F(R_0) = \frac{110 \times 40}{80 \times 240} = 0.23$$

$$F(R_0) = 0.77 \Rightarrow R_0 = \mu_L + \sigma_L \cdot z$$

$$z = 0.74$$

$$\Rightarrow R_0 = 40 + 10 \times 0.74 = 47$$

$$h(R_0) = \sigma_L \cdot L(z) = 10 \times 0.1334 = 1.334$$

$$Q_1 = \sqrt{\frac{2 \times 240 \times (1000 + 80 \times 1.334)}{40}} = 115$$

$$1 - F(R_1) = 0.24$$

$$F(R_1) = 0.76$$

$$z = 0.71$$

$$\Rightarrow R_1 = 40 + 10 \times 0.71 \approx 47$$

$$h(R_1) = 1.334 \Rightarrow Q_2 = 115 = Q_1$$

So, $(Q, R) = (115, 47)$

$$b) s = R - \mu = 47 - 40 = 7 \text{ units}$$

$$c) \text{ Holding cost} = h \times \left(\frac{Q}{2} + R - \mu \right) = 40 \times \left(\frac{115}{2} + 7 \right) \\ = 2580$$

$$\text{Setup cost} = \frac{K \cdot \lambda}{Q} = \frac{1000 \times 240}{115} = 2087$$

$$\text{Stockout cost} = p \cdot \frac{\lambda \cdot n(R)}{Q} = \frac{80 \times 240 \times 1.334}{115} = 222.72$$

$$T.C. = 4889.72$$

d) if variability was '0' \Rightarrow like in EOQ

$$\text{Total Cost EOQ} = \sqrt{2 \times K \times \lambda \times h} = 4381.78$$

$$\text{Cost of uncertainty} = 4889.72 - 4381.78 = 507.94$$

$$e) P(D_L \leq R) = F(R) = 0.76 \Rightarrow 76\%$$

$$f) \frac{n(R)}{Q} = \frac{1.334}{115} = 1.16\%$$

Question 2)

- a) Existing facilities typically have parallel picking aisles that, depending on the size of the distribution center, may be divided by one or more cross aisles. This structure forces workers to travel to pallet locations by moving only 'north-south and east-west'
- b) The basic assumptions of conventional designs are picking and cross aisles must be straight, and cross aisles must meet picking aisles only at right angles. The drawbacks of the conventional design are it focuses on maximizing storage density rather than minimizing operational cost.
- c) "Cross aisle model" inserts two diagonal cross aisles that originate from a single pickup and deposit point. The two diagonal cross aisles make a "V," which allows forklift drivers a straight-line advantage during the travel to and from the pick locations.