UGBA 141 Discussion 5

Agenda: Review and Practice of Inventory Module

— EOQ
— (Q,R)
— (P,T)
— Newsvendor

Feb 18, 2022
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Reminder

- Check out
  - Recorded videos by Prof. Sinchaisri on (Q,R) and (P,T) https://bcourses.berkeley.edu/courses/1510160/external_tools/56745
  - Clarification questions in #3-inventory channel of Discord
- Upcoming dates
  - **Feb 20**: homework 2
  - **Feb 23**: register your project team on bCourses/People
  - **March 7**: in-class midterm exam
- Next 2 week's discussions will be midterm reviews

Content

- EOQ: Economic Order Quantity

- (Q, R): Continuous review inventory model

- (P, T): Periodic review inventory model

- Newsvendor: One-shot order

Summary

	EOQ	**(Q, R)**	**(P, T)**	**Newsvendor**
Replenish	Yes	Yes	Yes	No
Terms of interest	Order quantity Q	Order quantity Q Reorder point R	Period length P Target level T	Profit-maximizing quantity Q^*
Context	Constant demand and no lead time	Uncertain demand and lead time	Uncertain demand and lead time	Uncertain demand

EOQ

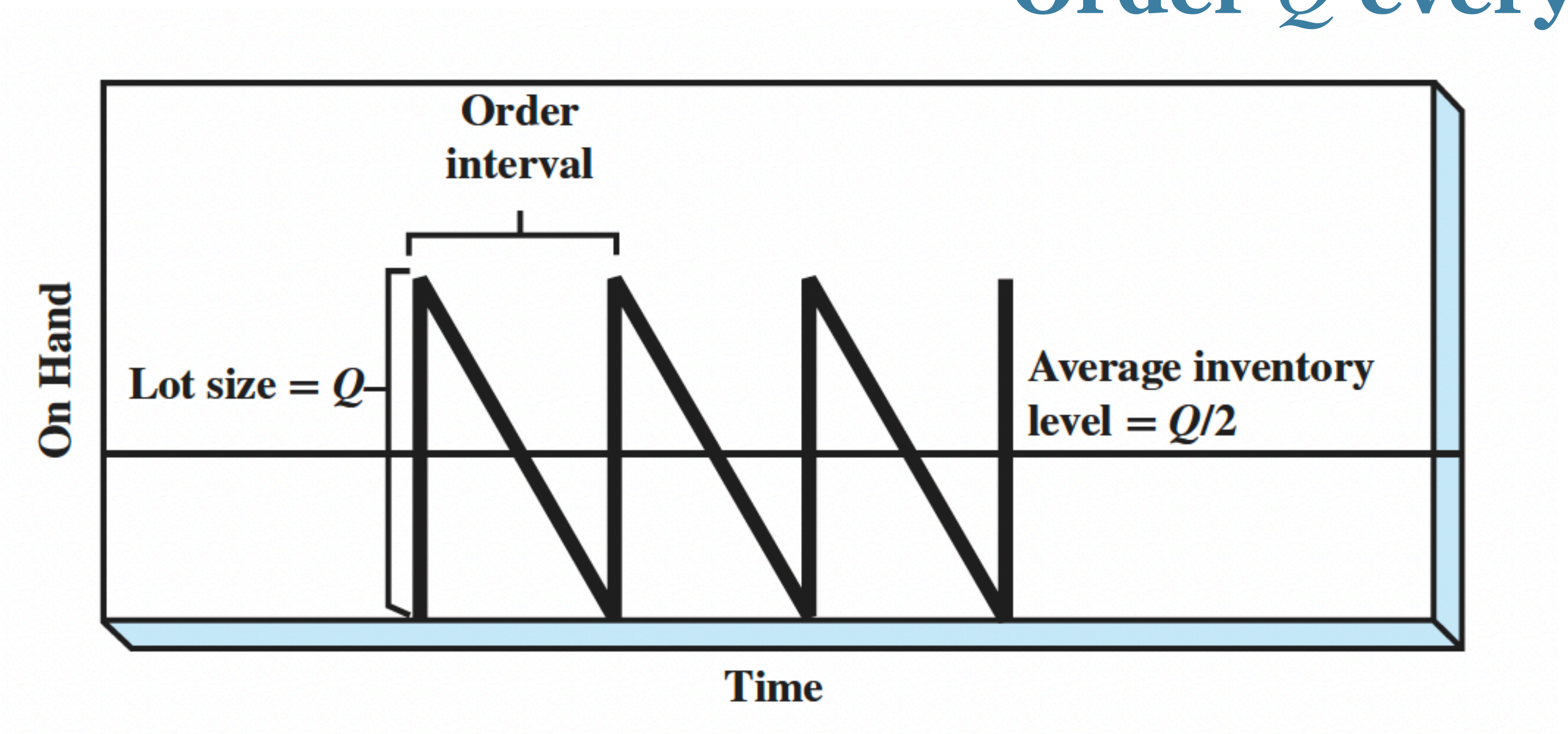
$$\text{EOQ} = \sqrt{\frac{2 \times S \times D}{h}}$$

D = demand per cycle

S = setup fixed cost incurred per order

h = holding cost per unit per cycle

"Order Q every cycle"



Practice Problem: EOQ

$$\text{EOQ} = \sqrt{\frac{2 \times S \times D}{h}}$$

D = demand per cycle

S = setup fixed cost incurred per order

h = holding cost per unit per cycle

Problem. In a hardware warehouse, the independent demand for a commonly used bolt is 500 units per month. The ordering cost is \$30 per order placed. The carrying cost is 25 percent per year, and each unit costs \$.50.

a. According to the EOQ formula, what lot size should this product have?

b. How often should this product be purchased?

c. A quality team has found a way to reduce ordering costs to \$5. How will that change the lot size and the frequency of purchasing for this product?

(Q, R)

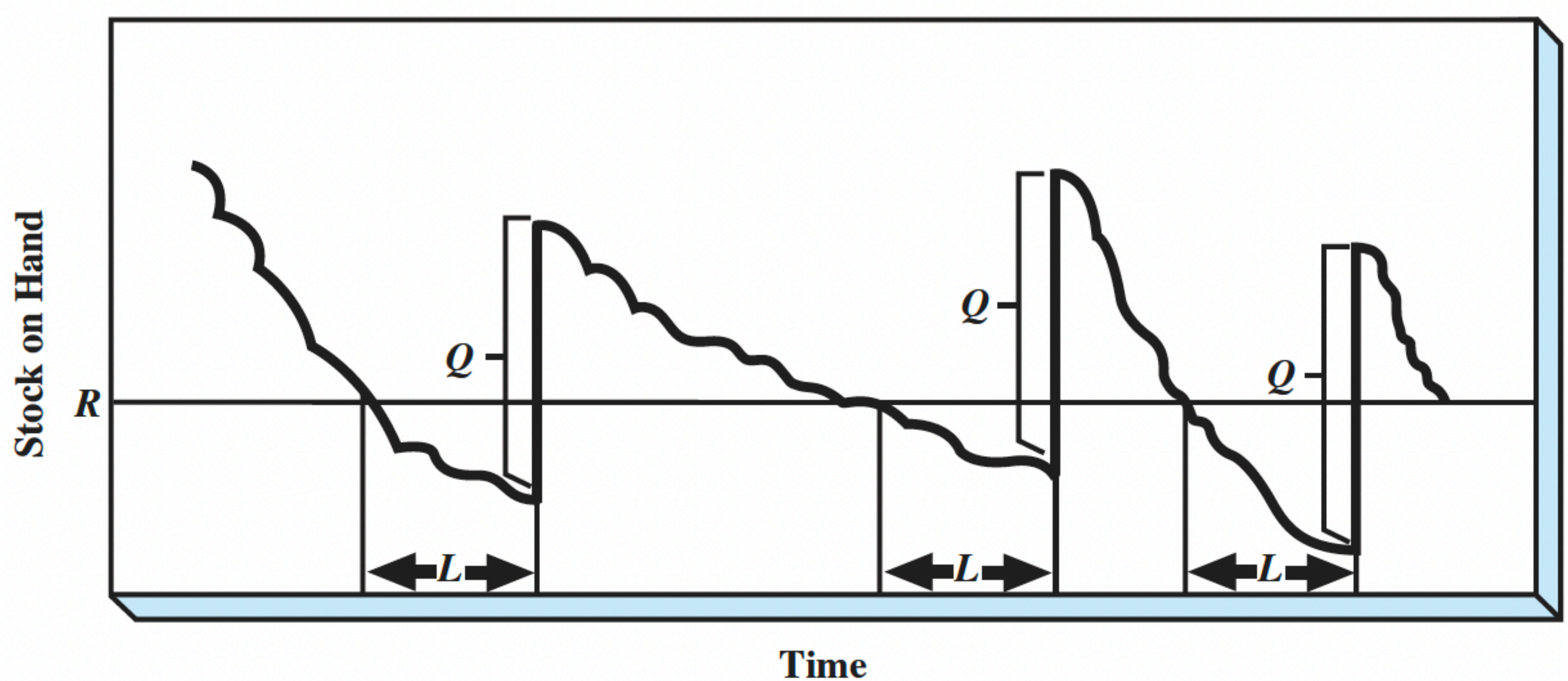
$$Q = \text{EOQ} = \sqrt{\frac{2 \times S \times D}{h}}, R = \mu_{LT} + z\sigma_{LT}$$

μ_{LT} = mean demand during lead time (LT)

σ_{LT} = demand standard deviation during lead time (LT)

z = z score (from reading standard normal table)

"Order Q when inventory drops to reorder point R"



Practice Problem: (Q, R)

$$Q = \text{EOQ} = \sqrt{\frac{2 \times S \times D}{h}}, R = \mu_{LT} + z\sigma_{LT}$$

μ_{LT} = mean demand during lead time (LT)

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Problem. Part number XB-2001 has an annual independent demand as spare parts of 4000 units, a setup cost of $100, a carrying cost of 30 percent per year, and an item cost of $266.67. The production facility is open 5 days per week and 50 weeks per year, making a total of 250 productive days per year. The lead time for this product is nine days, and the standard deviation of demand is two units per day. The firm wants to have a 95 percent service level for this spare part.

a. Compute Q, using the EOQ formula.

b. Compute R.

c. If the firm were using a Q system of inventory control (continuous review), interpret the results of your computations.

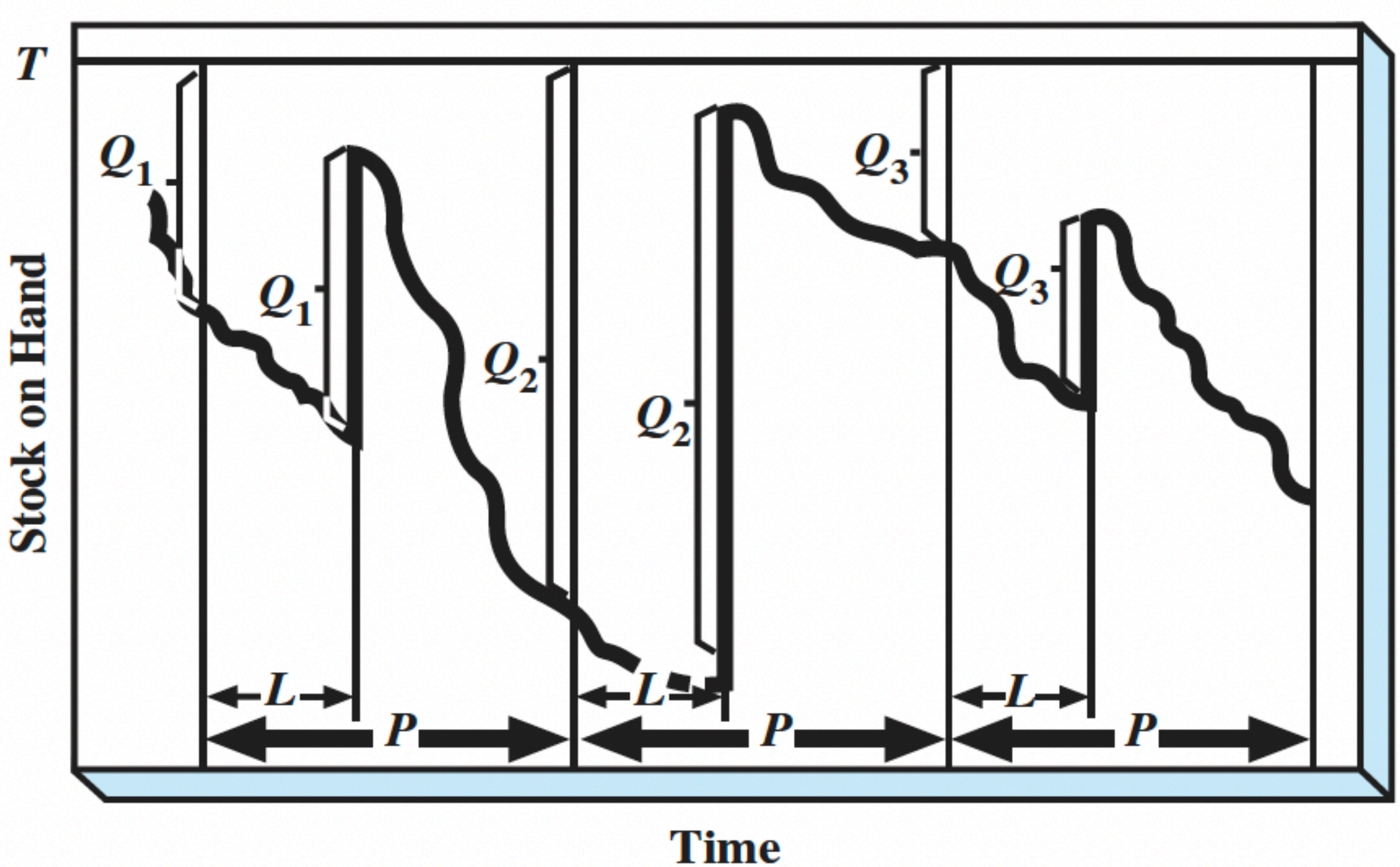
(P, T)

$$P = \frac{\text{EOQ}}{D} = \sqrt{\frac{2S}{Dh}}, T = \mu_{P+LT} + z\sigma_{P+LT}$$

μ_{P+LT} = mean demand during $P + LT$

σ_{P+LT} = demand standard deviation during $P + LT$

z = z score (from reading standard normal table)



“Order up to T every P periods”

Practice Problem: (P, T)

$$P = \frac{\text{EOQ}}{D} = \sqrt{\frac{2S}{Dh}}, T = \mu_{P+LT} + z\sigma_{P+LT}$$

μ_{P+LT} = mean demand during $P + LT$

σ_{P+LT} = demand standard deviation during $P + LT$

z = z score (from reading standard normal table)

Problem. Consider the product described in solved problem 2 when answering the following questions:

a. How often should orders be placed for this product if they are placed at regular intervals
using a periodic review system?
b. Compute the target inventory level.
c. State the specific decision rule for this product by using the information you have calculated so far.
d. Assume it is time for a periodic review. A check of the inventory level for this product reveals that there are 60 units on hand and 110 units on order. What should be done?

Newsvendor

Critical fractile $= \dfrac{G}{G+L}$

G = overage cost, L = underage cost

Probability of $D \leq Q*$ = critical fractile

Problem. The Johnson Shoe Company buys shoes for \$40 per pair and sells them for \$60 per pair. If there are surplus shoes left at the end of the season, all shoes are expected to be sold at the sale price of \$30 per pair. Suppose demand is normally distributed with a mean of 500 units and a standard deviation of 100 units/season. How many shoes should the Johnson Shoe Company buy?