

INMT week 7 Inventory Modelling (EOQ)



Class Discussion Question 1

1) What are the assumptions of the Economic Ordering Quantity model for inventory management?

Demand is constant,

Constant holding cost rate

Quantity cost is constant (no discounts)

Constant lead time

Order even when not stockout, order at a specific time

Decision value Q^* is the same

Constant order rate (Ratio is constant)

Constant supply and availability (no uncertainty in supply i.e., Deterministic demand)

Constant manufacturing time (interesting one, not technically true. Next model looks at it.)

2) Show how to find Q^* using differential calculus.

$$Q^* = (2 \times \text{annual demand} \times \text{ordercost} / \text{handling cost})^{1/2}$$

$$\text{Total annual cost} = \text{Holding} + \text{Ordering}$$

3) **Soft Drinks at R&B.** Suppose that the R&B Beverage Company has a soft drink product that shows a constant annual demand rate of 3600 cases. A case of the soft drink costs R&B \$3. Ordering costs are \$20 per order and holding costs are 25% of the value of the inventory. R&B has 250 working days per year, and the lead time is 5 days. Identify the following aspects of the inventory policy. **EOQ**

a. Economic order quantity

Q^* Total cost

b. Reorder point

= Annual Holding Cost + Annual Ordering Cost

c. Cycle time

= $1/2 Q^* Ch + D/Q^* Co$

d. Total annual cost

Need to find derivative with respect to Q .

$$d(TC)/dQ = 1/2 Ch + (D/Q^2) Co = 0$$

$$1/2 Ch = (D/Q^2) Co$$

$$Q^2 = (2DCo)/Ch$$

$$Q = ((2DCo)/Ch)^{1/2}; Q > 0$$

$$D = 3600$$

$$Ch = \$3$$

$$I = 25\%, \text{ Annual holding cost} = .75 \times 3$$

$$Co = \$20$$

$$\text{days/year} = 250 \text{ days, } m \text{ (lead time)} = \text{days}$$

2. Reorder point

$$EOQ = ((2DCo)/Ch)$$

$$d = D/\text{days}$$

$$d = 3600/250$$

$$d = 14.4$$

$$\text{reorder point} = m.d$$

$$= 5 \times 14.4$$

$$= 72 \text{ cases, so when at 72 stock need to reorder or will run out}$$

4. Total annual cost = Holding + Ordering

$$= (1/2) Q^* Ch + (D/Q^*) Co$$

$$= (1/2) \times (438.2) \times (\$3) + (3600/438.2) \times \$20$$

$$= \$164.3 + \$164.3 \text{ (should be the same)}$$

$$= \$328.6$$

Complete Practice Examples Q1 and Q2 on Excel

3. Cycle time (how many times need to order) (time that has elapsed between orders)

$$\text{Days/Number of orders (Annual Demand (D) / } Q^*)$$

$$\# \text{ Cycles in a year} = 3600/438.2$$

$$= 8.2 \text{ times}$$

$$\text{Cycle time} = \text{number of days} / (D/Q^* \text{ same as number of orders}) = 250/8.2 = 30.4 \text{ days}$$

Class Discussion Question 2

1) What are the main assumptions of the production lot size model of inventory management ?

2) What are the main differences between the production lot size model and EOQ?

3) Baseball Bats. All-Star Bat Manufacturing, Inc., supplies baseball bats to major and minor league baseball teams. After an initial order in January, demand over the sixmonth baseball season is approximately constant at 1000 bats per month. Assume that the bat production process can handle up to 4000 bats per month, the bat production setup costs are \$150 per setup, the production cost is \$10 per bat, and the holding costs have a monthly rate of 2%. **LO 2**

- a. What production lot size would you recommend to meet the demand during the baseball season?
- b. If All-Star operates 20 days per month, how often will the production process operate?
- c. If All-Star operates 20 days per month, what is the length of a production run?

Complete Practice Examples Q3 on Excel

Practice Example Excel Lab Q1

Automobile Generators. Westside Auto purchases a component used in the manufacture of automobile generators directly from the supplier. Westside's generator production operation, which is operated at a constant rate, will require 1000 components per month throughout the year (12,000 units annually). Assume that the ordering costs are \$25 per order, the unit cost is \$2.50 per component, and annual holding costs are 20% of the value of the inventory. Westside has 250 working days per year and a lead time of 5 days. **EOQ**

- a. What is the EOQ for this component?
- b. What is the reorder point?
- c. What is the cycle time?
- d. What are the total annual holding and ordering costs associated with your recommended EOQ?

Practice Example Excel Lab Q2

Diesel Fuel. The Metropolitan Bus Company (MBC) purchases diesel fuel from American Petroleum Supply. In addition to the fuel cost, American Petroleum Supply charges MBC \$250 per order to cover the expenses of delivering and transferring the fuel to MBC's storage tanks. The lead time for a new shipment from American Petroleum is 10 days; the cost of holding a gallon of fuel in the storage tanks is \$0.04 per month, or \$0.48 per year; and annual fuel usage is 150,000 gallons. MBC buses operate 300 days a year. **EOQ**

- a. What is the optimal order quantity for MBC?
- b. How frequently should MBC order to replenish the gasoline supply?
- c. The MBC storage tanks have a capacity of 15,000 gallons. Should MBC consider expanding the capacity of its storage tanks?
- d. What is the reorder point?

Practice Example Excel Lab Q3

Notebook Computers. EL Computer produces its multimedia notebook computer on a production line that has an annual capacity of 16,000 units. EL Computer estimates the annual demand for this model at 6000 units. The cost to set up the production line is \$2345, and the annual holding cost is \$20 per unit. Current practice calls for production runs of 500 notebook computers each month. **Lot Size**

- a. What is the optimal production lot size?
- b. How many production runs should be made each year? What is the recommended cycle time?
- c. Would you recommend changing the current production lot size policy from the monthly 500-unit production runs? Why or why not? What is the projected savings of your recommendation?