Chapter 13
Decision Models for Inventory Management

Inventory Models

• Fixed order-quantity models
  – Economic order quantity
  – Production order quantity
  – Quantity discount
• Probabilistic models
• Fixed order-period models

EOQ Assumptions

• Known and constant demand
• Known and constant lead time
• Instantaneous receipt of material
• No quantity discounts
• Only order (setup) cost and holding cost
• No stockouts

Inventory Usage Over Time

EOQ Model
How Much to Order?

Why Holding Costs Increase

• More units must be stored if more are ordered

Purchase Order
Description Qty.
Microwave 1

Purchase Order
Description Qty.
Microwave 1000

Order quantity
Why Order Costs Decrease

Cost is spread over more units
Example: You need 1000 microwave ovens
1 Order (Postage $0.33) 1000 Orders (Postage $330)

Deriving an EOQ

1. Develop an expression for setup or ordering costs
2. Develop an expression for holding cost
3. Set setup cost equal to holding cost
4. Solve the resulting equation for the best order quantity

EOQ Model

When To Order

EOQ Model Equations

Expected Number of Orders = \( N = \frac{D}{Q} \)
Expected Time Between Orders = \( T = \frac{\text{Working Days}}{N} \)
\( d = \frac{D}{\text{Working Days / Year}} \)
\( ROP = d \times L \)

Production Order Quantity Model

- Answers how much to order and when to order
- Allows partial receipt of material
  - Other EOQ assumptions apply
- Suited for production environment
  - Material produced, used immediately
  - Provides production lot size
- Lower holding cost than EOQ model
EOQ-POQ Model
When To Order

POQ Model Inventory Levels

POQ Model Inventory Levels

POQ Model Equations

Quantity Discount Model
• Answers how much to order & when to order
• Allows quantity discounts
  – Reduced price when item is purchased in larger quantities
  – Other EOQ assumptions apply
• Trade-off is between lower price & increased holding cost

Quantity Discount Schedule

<table>
<thead>
<tr>
<th>Discount Number</th>
<th>Discount Quantity</th>
<th>Discount (%)</th>
<th>Discount Price (P)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0 to 999</td>
<td>No discount</td>
<td>$5.00</td>
</tr>
<tr>
<td>2</td>
<td>1,000 to 1,999</td>
<td>4</td>
<td>$4.80</td>
</tr>
<tr>
<td>3</td>
<td>2,000 and over</td>
<td>5</td>
<td>$4.75</td>
</tr>
</tbody>
</table>
Probabilistic Models

- Answer how much & when to order
- Allow demand to vary
  - Follows normal distribution
  - Other EOQ assumptions apply
- Consider service level & safety stock
  - Service level = $1 - \text{Probability of stockout}$
  - Higher service level means more safety stock
  - More safety stock means higher ROP

Probabilistic Models

When to Order?

- Optimal Order Quantity
- Reorder Point (ROP)
- Inventory Level
- Frequency
- Service Level
- Probability of stockout
- ROP
- Safety Stock (SS)
- Lead Time
- Place order
- Receive order
- Time