OSCM Study Guide

Chapters 20 & 21

Inventory Management & Material Requirements Planning

Prepared for Quiz 2 Review

Interview-Ready Knowledge: Instant Recall Concepts

Why This Matters for Your Career

In interviews at companies like Amazon, Tesla, Nike, Apple, Target, and Starbucks,
you will be expected to explain these concepts clearly and confidently.

No notes. No hesitation. Instant recall.

Chapter 20: Inventory Management

Think: Amazon warehouses, Target distribution centers, Starbucks supply chain

What is Inventory?

Inventory is the stock of any item or resource used in an organization. This includes raw materials, work-in-process, finished goods, and supplies.

Five Reasons Companies Hold Inventory

Memorize these for interviews!

Reason	Real-World Example
1. Independence of Operations	Tesla keeps battery cells in stock so the assembly line doesn't stop if a shipment is delayed
2. Production Scheduling Flexibility	Nike can smooth production during slow seasons by building inventory for holiday demand
3. Meet Demand Variation	Starbucks stocks extra pumpkin spice supplies for unexpected autumn demand spikes
4. Safeguard Against Delivery Issues	Apple holds safety stock in case chip suppliers face delays
5. Economic Purchase Order Size	Target orders full truckloads to get quantity discounts

Independent vs. Dependent Demand

CRITICAL DISTINCTION - know this cold!

Feature	Independent Demand	Dependent Demand
Definition	Demand NOT related to other items	Demand DERIVED from another item
How Determined	Must be FORECASTED	CALCULATED from parent item
Certainty	Uncertain (need safety stock)	Certain (based on production schedule)
Example	Demand for iPhones at Apple Store	Demand for iPhone screens (4 per phone)
Management System	EOQ, P-Model, Q-Model	MRP (Chapter 21)

Inventory Costs

Cost Type	What It Includes	Symbol
Holding Cost (H)	Storage, insurance, obsolescence, capital tied up	H = annual cost per unit
Ordering/Setup Cost (S)	Paperwork, shipping, machine setup time	S = cost per order
Shortage Cost	Lost sales, backorder costs, customer goodwill loss	Varies by situation

Single-Period Model (Newsvendor Problem)

Used for ONE-TIME purchasing decisions with perishable or seasonal items.

Real-World Examples:

- Newspaper vendor deciding how many papers to stock
- Starbucks ordering holiday merchandise
- Amazon stocking limited-edition items

Key Formulas

Cost	Formula & Meaning
Underage Cost (Cu)	Cu = Revenue - Cost = Lost profit from NOT having enough
Overage Cost (Co)	Co = Cost - Salvage Value = Loss from having TOO MUCH
Optimal Service Level	P(Demand ≤ Q) = Cu / (Cu + Co)

Multi-Period Inventory Models

Used when items are reordered repeatedly over time.

Q-Model vs. P-Model Comparison

KNOW THIS TABLE - it appears on every exam!

Feature	Q-Model (Fixed-Order Quantity)	P-Model (Fixed-Time Period)
Also Called	EOQ Model, Continuous Review	Periodic Review, Fixed-Order Interval
Trigger	EVENT triggered (hits reorder point)	TIME triggered (review period arrives)
Order Quantity	Q = CONSTANT (same each time)	q = VARIABLE (changes each time)
Recordkeeping	PERPETUAL (continuous monitoring)	PERIODIC (counted at review time)
Inventory Size	SMALLER average inventory	LARGER average inventory
Best For	Expensive, critical, important items	Lower-cost items, multiple items from same supplier
Time to Maintain	HIGHER (constant monitoring)	LOWER (periodic counts only)

The EOQ Formula (Economic Order Quantity)

MEMORIZE THIS - you will calculate it on the exam!

$$EOQ = \sqrt{(2DS / H)}$$

Where:
D = Annual demand (units per year)
S = Ordering/setup cost ($ per order)
H = Holding cost ($ per unit per year)

Key Insight: At EOQ, Annual Ordering Cost = Annual Holding Cost

Reorder Point (R)

Scenario	Formula
Certain Demand	$R = d \times L$ (demand rate × lead time)
Uncertain Demand	$R = \bar{d}L + z\sigma L$ (average demand during LT + safety stock)

Safety Stock = $z \times \sigma L$
Where z = number of standard deviations for desired service level (95% → z = 1.65)

Inventory Turns

Inventory Turns = Annual Demand / Average Inventory

Average Inventory = Q/2 + Safety Stock

Higher turns = more efficient inventory management (Amazon aims for high turns!)

ABC Classification System

Based on the Pareto Principle (80/20 rule) - classifies inventory by annual dollar volume.

Class	% of Items	% of $ Value	Management Approach
A Items	~20%	~80%	Tight control, frequent review, low safety stock
B Items	~30%	~15%	Moderate control
C Items	~50%	~5%	Simple controls, larger safety stock, less frequent review

How to Calculate: Dollar Volume = Annual Demand × Unit Cost
Sort items by dollar volume (highest to lowest), then classify.

Cycle Counting

Physical inventory audit done on a rotating schedule instead of annual count.

- A items: Count frequently (daily/weekly)
- B items: Count moderately (monthly)
- C items: Count less often (quarterly)
- **Lower tolerance for A items** - they're more valuable!

Chapter 21: Material Requirements Planning (MRP)

Think: Apple coordinating iPhone components from hundreds of suppliers worldwide

What is MRP?

MRP = The logic that determines WHAT parts are needed, HOW MANY, and WHEN to order them to produce finished products.

MRP manages **DEPENDENT DEMAND** items - things needed to make something else.

MRP vs. Traditional Inventory Models

Feature	EOQ/Traditional	MRP
Demand Type	Independent (forecasted)	Dependent (calculated)
Order Timing	Reorder point triggers	Backward scheduled from need date
Lot Sizing	Fixed EOQ	Lot-for-lot or dynamic

Three Inputs to MRP

MEMORIZE THESE THREE!

Input	What It Contains	Think Of It As...
1. Master Production Schedule (MPS)	WHAT end items to make, HOW MANY, and WHEN	The game plan
2. Bill of Materials (BOM)	Complete list of parts and quantities needed for each product	The recipe
3. Inventory Records File	On-hand inventory, on-order, lead times, lot sizes	What's in the pantry

Bill of Materials (BOM) / Product Structure Tree

Shows HOW a product is put together, level by level.

Key Terms:

- **Level 0:** The finished product (end item)
- **Level 1, 2, 3...:** Components at each level below
- **Low-Level Coding:** Assigns item to its LOWEST level in the BOM (ensures all requirements calculated together)
- **Parent:** Item directly above in structure
- **Component:** Item directly below in structure

MRP Record Terminology

Know EVERY term in this table!

Term	Definition
Gross Requirements	Total quantity needed in a time period (from MPS or parent items)
Scheduled Receipts	Orders already placed that will arrive (cannot be changed!)
Projected On-Hand	Expected inventory at end of period = Prior OH + Receipts - Gross Req
Net Requirements	What we actually need to order = Gross Req - On-Hand - Scheduled Receipts
Planned Order Receipts	When we PLAN to receive ordered items
Planned Order Releases	When to RELEASE the order (receipt date - lead time) = OFFSET

The MRP "Explosion" Process

Called "explosion" because one end item creates demand for MANY component parts.

1. Start with Level 0 (finished goods) gross requirements from MPS
2. Calculate net requirements using on-hand and scheduled receipts
3. Determine planned order receipts (based on lot sizing)
4. OFFSET by lead time to get planned order releases
5. Move to Level 1 - parent's planned order releases become children's gross requirements
6. Repeat for all levels

Time Fences

Define how much the MPS can be changed within different time horizons.

- **Frozen Zone:** No changes allowed (materials committed)
- **Slushy Zone:** Changes allowed with management approval
- **Liquid Zone:** Changes allowed freely

MRP Lot Sizing Methods

Compare costs - which method results in lowest total cost?

Method	How It Works	Pros/Cons
Lot-for-Lot (L4L)	Order EXACTLY what's needed each period	+ Minimizes holding cost - High ordering cost
EOQ	Order fixed EOQ quantity regardless of requirements	+ Balances costs - May create leftover inventory
Least Total Cost (LTC)	Select lot size where holding cost ≈ ordering cost	+ Dynamic lot sizing - More calculation
Least Unit Cost (LUC)	Select lot size with lowest cost per unit	+ Considers total cost per unit - Complex

MRP vs. ERP

MRP	ERP (Enterprise Resource Planning)
Focuses on MATERIALS and production planning	Integrates ALL business functions: finance, HR, sales, manufacturing, etc.
Answers: What, How Many, When to order	Provides company-wide visibility and data integration
MRP is a SUBSET of ERP	Examples: SAP, Oracle, Microsoft Dynamics

Quick Reference: Key Formulas & Terms

Chapter 20 Formulas

Formula	Purpose
EOQ = $\sqrt{(2DS/H)}$	Find optimal order quantity
R = d × L	Reorder point (certain demand)
R = $\bar{d}$L + zσL	Reorder point with safety stock
Safety Stock = zσL	Extra inventory for uncertainty
Inventory Turns = D / (Q/2 + SS)	Measure of inventory efficiency
Total Cost = (D/Q)×S + (Q/2)×H	Annual ordering + holding cost
Service Level = Cu/(Cu+Co)	Single-period optimal stocking level

Chapter 21 Key Calculations

Calculation	Formula
Net Requirements	Gross Req - Projected On-Hand - Scheduled Receipts
Projected On-Hand	Prior On-Hand + Receipts - Gross Requirements
Planned Order Release	Planned Receipt Date OFFSET by Lead Time
Component Gross Requirements	Parent Planned Order Release × Quantity per Parent

Interview Prep: What Employers Want to Hear

Q: "How would you reduce inventory costs?"
A: I'd analyze ABC classification to focus on high-value items, implement cycle counting, calculate EOQ to optimize order quantities, and use MRP for dependent demand items to avoid excess inventory.

Q: "Explain EOQ in simple terms."
A: EOQ finds the sweet spot between ordering too often (high ordering costs) and ordering too much (high holding costs). At EOQ, these two costs are equal.

Q: "What's the difference between MRP and ERP?"
A: MRP focuses specifically on material planning - what, when, and how much to order. ERP integrates MRP with all other business functions like finance, HR, and sales into one system.

Q: "When would you use a Q-model vs. P-model?"
A: Q-model for expensive, critical items that need constant monitoring. P-model for lower-cost items or when ordering multiple items from the same supplier at fixed intervals.

Remember: In interviews, confidence comes from preparation. Know these concepts cold!