MRP: Material Requirements Planning
Manufacturing Resource Planning
Make to Order (*Pull*)
Initiate production at the moment that a customer places a firm order.

Assemble to Order
Pre-produce & store sub-assemblies; finish when customer places order.

Make to Stock (*Push*)
Pre-produce and store in anticipation of forthcoming customer orders.
JIT / MRP

**JIT (Demand Flow)**
- As needed …
- “Pull”
- Low variability
- High predictability *(by definition)*
- Kanban

**MRP**
- In anticipation …
- “Push”
- High variability
- High predictability *(Inventory buffers low predictability)*
- Computer-intensive
How much of an item is needed to meet demand? When?

What parts and components are required? When?

When to order parts and components?
MRP

Core Concepts

• Dependent Demand
  …Production (or procurement) of parts and materials is directly linked to demand for the final product

• Time-phased Scheduling
  …Parts and components must be ordered in advance to accommodate lead times between order placement and receipt
MRP

Building Blocks

• Bill of Material
  ...Hierarchical structure of a product, including quantities
  ...Material - Parts - Components - Sub Assemblies

• Routing
  ...Detailed production steps in required sequence
  ...Activity equivalent to BOM

• Demand forecast
  ...Independent => Dependent
Requirements Planning

Determining the levels of inputs needed to produce a desired level of output

\[
\text{Gross Reqs. (Demand)} + \text{Planned End Inv.} - \text{Starting Inv.} = \text{Net Reqs.}
\]

**EXPLODED Bill of Material**
Requirements extended successively to each level of the bill of material
Create a schedule to satisfy demand.
## Lead Time Offset

### Table

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### Notes

- **LT** = 1 day

### Formulas

- **Demand**: When Required
- **Lead Time Offset**: Manufacturing Order (MO)
- **Purchase Order (PO)**

...
## Generate Requirements

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### Parts

- **Part(QTY)**: LT
- **BOM Explosion**
- **Spare Parts**

**Diagram:**

- **A**
  - **B(4)**
    - **D(2)**
    - **E(1)**
  - **C(2)**
  - **D(3)**
  - **F(2)**

**Day 10:**

- **A**: 50
- **B**: 20
- **C**: 200
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A: Required
B: Required
C: Required
D: Required
E: Required
F: Required

Order placement:

A: 50
B: 20 200
C: 100
D: 40+15 400 300
E: 20 200
F: 200

Part(QTY) LT

Diagram:
MRP

Finishing the Job

• Consolidate requirements
  ...By part / material
  ...By due date

• Determine economic lot sizes
  ...Order costs
  ...Quantity discounts
  ...Inventory carrying costs

• Issue MOs and POs
MRP

**Key Variables**

- Forecasts (Independent Demand)
- Bill of Material => Dependent Demand
- Lead Time (by component)
- Ordering Rules (e.g. EOQ)
# Materials Requirements Planning (MRP)

## Key Questions

- How much of an item is needed to meet demand? When?
- What parts and components are required? When?
- When to order parts and components?

## Key Variables

- Forecasts (Independent Demand)
- Bill of Material (Dependent Demand)
- Lead Time (by component)
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