Production Planning and Control 11

School of Engineering
The University of the Thai Chamber of Commerce
Production Planning & Control

Work Order (Discrete) Repetitive (Process) CO/BY Product (One to Many)

DRP MPS/RCP MRP/CRP Finite Schedule Advance Planning & Scheduling (Constraint Base Planning or optimization)

Final Inspections Warehouse Management Inventory Control

Production Analysis
- Productivity/Efficiency
- Utilization
- Down Time
- Scrap/Yield
- Costing/WIP

Material Inspections
Inventory Control

Requisition Purchase Order Contract Order Supply Schedule

Warehouse Management
Inventory Control

Shop Floor Control Manufacturing Execution System (MES) Bar-coding System Quality Management

Warehouse

Production

Input

Process

Output

Demand
- Forecast
- Sales Order

Internet Info

EDI
Material Management

Order Review

Customer
- Forecast
- Sales Orders

Planning
- MPS/RCP
- MRP/CRP
- DRP
- Finite Schedule
- APS

Requisition
(Budget Control and Approval)

Purchase Order

Purchase Order
Contract Order
Supplier Schedule

Approval

Material Inspection
Inventory Control

Production Control

Stocking

Purchase
Order

Supplier

Buy Side
Automatic Replenishment

EDI

Internet Info

Supplier

Delivery

VMI
(vendor Manage Inventory)

Purchasing Analysis
- Purchasing cost movement
- Supplier Performance
- P/O Status by Due Date, Vendor

VMI

Mat'L Conf.

Order

VMI

(vendor Manage Inventory)

Buy Side Automatic Replenishment

Purchasing
Analysis

- Purchasing cost movement
- Supplier Performance
- P/O Status by Due Date, Vendor

Supplier

Delivery

VMI
(vendor Manage Inventory)

Buy Side Automatic Replenishment

Purchasing Analysis
- Purchasing cost movement
- Supplier Performance
- P/O Status by Due Date, Vendor

Supplier

Delivery

VMI
(vendor Manage Inventory)
Agenda

• MRP (Material requirements planning)
• MRP II
• ERP (Enterprise resource planning)
• **Material requirements planning (MRP):** Computer-based information system that translates master schedule planning requirements for end items into time-phased requirements for subassemblies, components, and raw materials.

• เป็นเทคนิคการวางแผนควบคุมสินค้าที่เกี่ยวกับชิ้นส่วนที่ใช้ประกอบสินค้าสำเร็จรูป ตลอดจนส่วนประกอบต่างๆ
ประโยชน์ของ MRP

1. สามารถตอบสนองคำสั่งซื้อของลูกค้าได้ตรงตามกำหนดเวลา

2. สามารถตอบสนองต่อการเปลี่ยนแปลงแปลงที่รวดเร็วของตลาด

3. ลดระดับปริมาณ Inventory ให้น้อยลง
Independent and Dependent Demand

Independent demand is uncertain.

Dependent demand is certain.
การวางแผน MRP จำเป็นต้องทราบ

1. ตารางการผลิตหลัก
2. ข้อกำหนดลักษณะเฉพาะของวัสดุหรือใบแสดงรายการวัสดุ (BOM)
3. การลงบันทึกรายการและปริมาณ inventory ที่ถูกต้อง
4. รายการคำสั่งซื้อที่ชัดเจน
5. Lead time ที่ชัดเจนของส่วนประกอบแต่ละชิ้น
MRP Inputs
- Master schedule
- Bill of materials
- Inventory records

MRP Processing
- MRP computer programs

MRP Outputs
- Changes
- Order releases
- Planned-order schedules
- Exception reports
- Planning reports
- Performance-control reports

Primary reports
- Order releases
- Planned-order schedules

Secondary reports
- Exception reports
- Planning reports
- Performance-control reports

Production Planning and Control
Objectives of MRP

– To determine the materials required
  • What is required
  • How much is required
  • When it is required

– To establish and maintain priorities

– What sort of changes would necessitate replanning?
MRP Inputs

• Master Production Schedule
  Time-phased plan specifying timing and quantity of production for each end item.

• Material Requirement Planning Process
Master Schedule

*Master schedule*: One of three primary inputs in MRP; states which end items are to be produced, when these are needed, and in what quantities.

*Cumulative lead time*: The sum of the lead times that sequential phases of a process require, from ordering of parts or raw materials to completion of final assembly.
Planning Horizon

Figure 13.4
Bill of Materials

**Bill of materials (BOM):** One of the three primary inputs of MRP; a listing of all of the raw materials, parts, subassemblies, and assemblies needed to produce one unit of a product.

**Product structure tree:** Visual depiction of the requirements in a bill of materials, where all components are listed by levels.
Bill of Materials

• Single Level

- Table 100
  - Base 300
  - Top 025
  - Hardware Kit 822

• Multilevel

- Table 100
  - Base 300
  - Leg 306
  - Leg Bolts 326
  - Frame 357
  - Top 025
  - Boards 031
  - Glue 075
  - Hardware Kit 822
Parent-component Relationship

- The multilevel bill is made up of subassemblies. The base, the top, and the hardware all represent subassemblies.
- The subassemblies reflect the way manufacturing plans to build the product.
- The lowest items on the bill are purchased parts.
- All parts and subassemblies have unique part numbers.
- By convention, the final assembly is considered level zero. Levels down the bill are numbered consecutively.
- The multilevel bill is a collection of single level bills. Each single level bill shows the parts to make one parent.
- To make maintenance easier, the computer stores single level bills only.
- Items can be both parents of components and components of other parents.
Product Structure Tree
A product structure tree for end item x

Level

0

1

B(2)  C

2

D(3)  E  E(2)  F(2)

3

E(4)
Example 1

- Determine the quantities of B, C, D, E and F needed to assemble one X.
- Determine the quantities of these quantities that will be required to assemble 10 Xs taking into account the quantities on hand (i.e., in inventory) of various components:

<table>
<thead>
<tr>
<th>Component</th>
<th>On Hand</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>4</td>
</tr>
<tr>
<td>C</td>
<td>10</td>
</tr>
<tr>
<td>D</td>
<td>8</td>
</tr>
<tr>
<td>E</td>
<td>60</td>
</tr>
</tbody>
</table>
Solution:

- B: 2, C: 1, D: 6, E: 28, F: 2
Solution

\[ n = 10 \]

• Thus B: 16, C: 0, D: 40, E: 116, F: 0

\[ B: 2 \times 10 = 20 \]
\[ B(2) \]
\[ D: 3 \times 16 = 48 \]
\[ -8 \]
\[ D(3) \]
\[ E: 1 \times 16 = 16 \]
\[ E \]
\[ E(2) \]
\[ E(4) \]
\[ C: 1 \times 10 = 10 \]
\[ C \]
\[ (No \ lower-level \ components \ required) \]
Determine the quantities of these quantities that will be required to assemble 20 Xs taking into account the quantities on hand (i.e., in inventory) of various components:

<table>
<thead>
<tr>
<th>Component</th>
<th>On Hand</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>25</td>
</tr>
<tr>
<td>C</td>
<td>10</td>
</tr>
<tr>
<td>D</td>
<td>35</td>
</tr>
<tr>
<td>E</td>
<td>160</td>
</tr>
</tbody>
</table>
• Determine the quantities of these quantities that will be required to assemble 20 Xs taking into account the quantities on hand (i.e., in inventory) of various components:

<table>
<thead>
<tr>
<th>Component</th>
<th>On Hand</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>25</td>
</tr>
<tr>
<td>C</td>
<td>110</td>
</tr>
<tr>
<td>D</td>
<td>68</td>
</tr>
<tr>
<td>E</td>
<td>160</td>
</tr>
</tbody>
</table>
Problem

Given the following parents and components, construct a product tree. Figures in brackets show the quantities per item.

<table>
<thead>
<tr>
<th>Parent</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Component</td>
<td>B (2)</td>
<td>E (2)</td>
<td>G (2)</td>
<td>G (4)</td>
</tr>
<tr>
<td></td>
<td>C (4)</td>
<td>F (1)</td>
<td></td>
<td>F (3)</td>
</tr>
<tr>
<td></td>
<td>D (3)</td>
<td></td>
<td></td>
<td>H (2)</td>
</tr>
</tbody>
</table>

• Number of Gs needed?
• Purchased components?
**Problem - Solution**

- Number of Gs needed? 24
- Purchased components? G, F, H, D
Given the following parents and components, construct a product tree. Figures in brackets show the quantities per item.

- Number of Fs needed?
- Purchased components?

<table>
<thead>
<tr>
<th>Parent</th>
<th>10*A</th>
<th>B</th>
<th>C</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Component</td>
<td></td>
<td>B (2)</td>
<td>E (2)</td>
<td>G (2)</td>
</tr>
<tr>
<td></td>
<td>C (4)</td>
<td>F (4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>D (3)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Component</th>
<th>On Hand</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>125</td>
</tr>
<tr>
<td>C</td>
<td>10</td>
</tr>
<tr>
<td>D</td>
<td>18</td>
</tr>
<tr>
<td>G</td>
<td>160</td>
</tr>
</tbody>
</table>
Example

Diagram:

- E
  - F(2)
    - J(2)
    - D(4)
  - G
    - L(2)
    - J(2)
  - H
    - A(4)
    - D(2)
F: 2  
G: 1  
H: 1  
J: 2 x 2 = 4  
L: 1 x 2 = 2  
A: 1 x 4 = 4  
D: 2 x 4 = 8  
J: 1 x 2 = 2  
D: 1 x 2 = 2  

Totals: F = 2; G = 1; H = 1; J = 6; D = 10; L = 2; A = 4
Inventory Records

- One of the three primary inputs in MRP
- Includes information on the status of each item by time period
  - Gross requirements
  - Scheduled receipts
  - Amount on hand
  - Lead times
  - Lot sizes
  - And more …
Determine the low level and the quantity of each component necessary to produce 20 units of an assembly we will call Alpha.
Assembly Time Chart

Figure 13.7

- Procurement of raw material D
- Procurement of raw material F
- Procurement of part C
- Procurement of part H
- Procurement of raw material I
- Fabrication of part G
- Fabrication of part E
- Subassembly A
- Subassembly B
- Final assembly and inspection
MRP Processing

- Gross requirements (ความต้องการรวม)
- Schedule receipts (ใบรับกำหนดการผลิต)
- Projected on hand (จำนวนที่มีอยู่ในคลัง)
- Net requirements (ความต้องการสุทธิ)
- Planned-order receipts (การรับคำสั่งซื้อตามแผน)
- Planned-order releases (จำนวนที่สั่งซื้อตามแผน)
MRP Processing

- Gross requirements
  - Total expected demand
- Scheduled receipts
  - Open orders scheduled to arrive
- Planned on hand
  - Expected inventory on hand at the beginning of each time period
MRP Processing

• Net requirements
  – Actual amount needed in each time period

• Planned-order receipts
  – Quantity expected to received at the beginning of the period
  – Offset by lead time

• Planned-order releases
  – Planned amount to order in each time period
Gross and Net Requirements

• Available inventory must be taken into account
  • Net requirements = gross requirements – available inventory

• Example:
  • Gross requirements  50 units
  • Available inventory  – 20 units
  • Net requirements  30 units
MRP Schedule

<table>
<thead>
<tr>
<th>Week Number</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item:</td>
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<td></td>
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<tr>
<td>Gross requirements</td>
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<td></td>
<td></td>
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<tr>
<td>Scheduled receipts</td>
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<td></td>
</tr>
<tr>
<td>Projected on hand</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Net requirements</td>
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<td></td>
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<tr>
<td>Planned-order receipts</td>
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<tr>
<td>Planned-order releases</td>
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<td></td>
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</tbody>
</table>
Example 1:

- A firm that produces wood shutters and bookcases has received two orders for shutters: one for 100 shutters and one for 150 shutters. The 100 unit order is due for delivery at start of week 4 of the current schedule, and the 150 unit order is due for delivery at the start of week 8. Each shutter consists of two frames and four slatted wood sections. The wood sections are made by the firm, and fabrication takes one week. The frames are ordered, and lead time is two weeks. Assembly of the shutters requires one week. There is a scheduled receipt of 70 wood sections in week 1. Determine the size and timing of planned order releases necessary to meet delivery requirements under each of these conditions:
  - Lot for lot ordering (order size equal to net requirements)
  - Lot size ordering with a lot size of 320 units for frames and 70 units for wood sections.
Solution 1

- Develop a master schedule:

<table>
<thead>
<tr>
<th>Week number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity</td>
<td></td>
<td></td>
<td></td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td>150</td>
</tr>
</tbody>
</table>

- Develop a product structure tree:

```
Shutter
  - Frames (2)
  - Wood Sections (4)
```
Master schedule for shutters:

<table>
<thead>
<tr>
<th>Week number</th>
<th>Beg. Inv.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<tr>
<td>Quantity</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

Item: Shutters

- Gross requirements
- Scheduled receipts
- Projected on hand
- Net requirements
- Planned-order receipts
- Planned-order releases

Item: Frames

- Gross requirements
- Scheduled receipts
- Projected on hand
- Net requirements
- Planned-order receipts
- Planned-order releases

Item: Wood sections

- Gross requirements
- Scheduled receipts
- Projected on hand
- Net requirements
- Planned-order receipts
- Planned-order releases
Master schedule for shutters:

<table>
<thead>
<tr>
<th>Week number</th>
<th>Beg. Inv.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity</td>
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</tr>
</tbody>
</table>

Shutters:
- **LT = 1 week**
  - Gross requirements: 100
  - Scheduled receipts: 100
  - Projected on hand:
    - Net requirements: 100
  - Planned-order receipts: 100
  - Planned-order releases: 100

Frames:
- **LT = 2 weeks**
  - Gross requirements: 200
  - Scheduled receipts: 200
  - Projected on hand:
    - Net requirements: 200
  - Planned-order receipts: 200
  - Planned-order releases: 200

Wood sections:
- **LT = 1 week**
  - Gross requirements: 400
  - Scheduled receipts: 70
  - Projected on hand:
    - Net requirements: 330
  - Planned-order receipts: 330
  - Planned-order releases: 330

Times:
- Shutter: 2
- Frame: 4
### Master Schedule or Shutters:

<table>
<thead>
<tr>
<th>Week number</th>
<th>Beg. Inv.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
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</thead>
<tbody>
<tr>
<td>Quantity</td>
<td></td>
<td>100</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>150</td>
</tr>
</tbody>
</table>

#### Shutters:

- **LT = 1 week**
- **Lot size = lot-for-lot**

<table>
<thead>
<tr>
<th></th>
<th>Gross requirements</th>
<th>100</th>
<th></th>
<th></th>
<th></th>
<th>150</th>
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</tr>
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<tbody>
<tr>
<td></td>
<td>Scheduled receipts</td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td>Projected on hand</td>
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</tr>
</tbody>
</table>

### Frames:

- **LT = 2 weeks**
- **Lot size = multiples of 320**

<table>
<thead>
<tr>
<th></th>
<th>Gross requirements</th>
<th>200</th>
<th></th>
<th></th>
<th></th>
<th>300</th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Scheduled receipts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Projected on hand</td>
<td></td>
<td>120</td>
<td>120</td>
<td>120</td>
<td>120</td>
<td>140</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Net requirements</td>
<td>200</td>
<td>180</td>
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<td>Planned-order releases</td>
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</tbody>
</table>

### Wood Sections:

- **LT = 1 week**
- **Lot size = multiples of 70**

<table>
<thead>
<tr>
<th></th>
<th>Gross requirements</th>
<th>400</th>
<th></th>
<th></th>
<th></th>
<th>600</th>
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<tr>
<td></td>
<td>Projected on hand</td>
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<td>70</td>
<td>70</td>
<td>20</td>
<td>20</td>
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<td>20</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Net requirements</td>
<td>330</td>
<td>580</td>
<td></td>
<td></td>
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<tr>
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<tr>
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<td>Planned-order releases</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Example 2

- Consider the two product structure trees. Suppose we want to develop a material requirements plan for D given this additional information: there is a beginning inventory of 110 units of D on hand, and all items have lead times of one week. The master schedule calls for 80 units of A in week 4 and 50 units of C in week 5. Note that the requirements for B and F are not shown because they are not related to D.
## Master Schedule

<table>
<thead>
<tr>
<th>Week number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity of A</td>
<td></td>
<td></td>
<td></td>
<td>80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quantity of C</td>
<td></td>
<td></td>
<td></td>
<td>50</td>
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<td></td>
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</tbody>
</table>

### A (LT = 1)

<table>
<thead>
<tr>
<th>Beg. Inv.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross requirements</td>
<td></td>
<td></td>
<td></td>
<td>80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scheduled receipts</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Projected on hand</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net requirements</td>
<td></td>
<td></td>
<td></td>
<td>80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planned-order receipts</td>
<td></td>
<td></td>
<td></td>
<td>80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planned-order releases</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>80</td>
</tr>
</tbody>
</table>

### C (LT = 1)

<table>
<thead>
<tr>
<th>Beg. Inv.</th>
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<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross requirements</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Scheduled receipts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Projected on hand</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net requirements</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Planned-order receipts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Planned-order releases</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

### D (LT = 1)

<table>
<thead>
<tr>
<th>Beg. Inv.</th>
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<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross requirements</td>
<td></td>
<td></td>
<td></td>
<td>80</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Scheduled receipts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Projected on hand</td>
<td>110</td>
<td>110</td>
<td>110</td>
<td>110</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Net requirements</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>Planned-order receipts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>Planned-order releases</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>70</td>
</tr>
</tbody>
</table>
MRP Outputs

• Planned orders - schedule indicating the amount and timing of future orders.
• Order releases - Authorization for the execution of planned orders.
• Changes - revisions of due dates or order quantities, or cancellations of orders.
MRP Secondary Reports

• Performance-control reports: measuring deviations from plans, including missed deliveries and stockouts, and providing information that can be used to assess cost performance.

• Planning reports: purchase commitments and other data that can be used to assess future material requirements.

• Exception reports: major discrepancies such as late and overdue orders, excessive scrap rates, reporting errors, and requirements for nonexistent parts.
Other Considerations

- Safety Stock
- Lot sizing
  - Lot-for-lot ordering
  - Economic order quantity
  - Fixed-period ordering
MRP in Services

• Food catering service
  – End item => catered food
  – Dependent demand => ingredients for each recipe, i.e. bill of materials

• Hotel renovation
  – Activities and materials “exploded” into component parts for cost estimation and scheduling
Benefits of MRP

• Low levels of in-process inventories
• Ability to track material requirements
• Ability to evaluate capacity requirements generated by a given master schedule
• Means of allocating production time
Requirements of MRP

• Computer and necessary software to handle computations and maintain records.

• Accurate and up-to-date
  – Master schedules
  – Bills of materials
  – Inventory records

• Integrity of file data
MRP II

- Expanded MRP with emphasis placed on integration
  - Financial planning
  - Marketing
  - Engineering
  - Purchasing
  - Manufacturing
Capacity Planning

**Capacity requirements planning**: The process of determining short-range capacity requirements.

**Load reports**: Department or work center reports that compare known and expected future capacity requirements with projected capacity availability.

**Time fences**: Series of time intervals during which order changes are allowed or restricted.
**Capacity Planning**

**Figure 13.15**

1. **Develop a tentative master production schedule**
2. **Use MRP to simulate material requirements**
3. **Convert material requirements to resource requirements**
4. **Is shop capacity adequate?**
   - **Yes** → **Firm up a portion of the MPS**
   - **No**
     - **Can capacity be changed to meet requirements?**
       - **No** → **Revise tentative master production schedule**
       - **Yes** → **Change capacity**
• *Enterprise resource planning (ERP)*:
  – Next step in an evolution that began with MPR and evolved into MRPII
  – Integration of financial, manufacturing, and human resources on a single computer system.
ERP Strategy Considerations

- High initial cost
- High cost to maintain
- Future upgrades
- Training
Problem 1

- The following product structure tree indicates the components needed to assemble one unit of product W. Determine the quantities of each component needed to assemble 100 units of W.
Solution:

```
W 100
  |  |
  A 2×100=200  B(2)  C(4)
  |    |            |
1  1×100=100  2×100=200  4×100=400
  |       |
  D(2)  E  E(2)  F  D(3)  G(2)
  2×100=200 1×100=100 2×200=400 1×200=200 3×400=1200 2×400=800
  |       |
2  3  3
  D  4×800=800
  1×800=800
```
## Solution

<table>
<thead>
<tr>
<th>Level</th>
<th>Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>W</td>
<td>100</td>
</tr>
<tr>
<td>1</td>
<td>A</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>400</td>
</tr>
<tr>
<td>2</td>
<td>E</td>
<td>500</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td>G</td>
<td>800</td>
</tr>
<tr>
<td>3</td>
<td>D</td>
<td>1400</td>
</tr>
</tbody>
</table>
Problem 2

• The product structure tree for and item E follows. The manager wants to know the material requirements for ordered part R that will be needed to complete 120 units of E by the start of week 5. Lead times for items are one week for level 0 items, one week for level 1 items, and two weeks for level 2 items. There is a schedules receipt of 60 units of M at the end of week 1 and 100 units of R at the start of week. Lot for lot ordering in used.
Problem 2
Solution:
### Master schedule for E

<table>
<thead>
<tr>
<th>Week number</th>
<th>Beg. Inv.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Quantity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>120</td>
</tr>
</tbody>
</table>

#### Item: E  LT = 1 week

- **Gross requirements**: 120
- **Scheduled receipts**: 120
- **Projected on hand**: 120
- **Net requirements**: 120
- **Planned-order receipts**: 120
- **Planned-order releases**: 120

**Multiplied by 3 (see product tree)**

### Item: M  LT = 1 week

- **Gross requirements**: 360
- **Scheduled receipts**: 60
- **Projected on hand**: 60
- **Net requirements**: 300
- **Planned-order receipts**: 300
- **Planned-order releases**: 300

**Multiplied by 2 (see product tree)**

### Item: R  LT = 2 weeks

- **Gross requirements**: 600
- **Scheduled receipts**: 100
- **Projected on hand**: 100
- **Net requirements**: 500
- **Planned-order receipts**: 500
- **Planned-order releases**: 500