MRP: MATERIAL REQUIREMENTS PLANNING

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BUS 786: Operations Analysis

MRP Introduction

• Inventory chapter: demand is external to the firm
  – EX: Demand for cars & trucks
  – Methods that are best applied to finished goods
• MRP chapter: demand is internal to the firm
  – EX: Demand for engines, seats, wheels, etc.
  – Methods best applied to components & sub-assemblies
  – Demand for “lower level” items is driven by demand for final products

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MRP Introduction – 2

- **Goal:** To determine how much & when to order or produce (still)
- **However:**
  - Don’t hold any unneeded inventory
  - Order & produce goods as late as possible
  - Lead time is of primary importance
  - Costs are of secondary importance

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### Product Structure Tree

<table>
<thead>
<tr>
<th>Level</th>
<th>Component(s)</th>
<th>Lead Time (weeks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Skateboard</td>
<td>L = 1w</td>
</tr>
<tr>
<td>1</td>
<td>Deck (1)</td>
<td>L = 3w</td>
</tr>
<tr>
<td></td>
<td>Truck (2)</td>
<td>L = 1w</td>
</tr>
<tr>
<td></td>
<td>Grip Tape (1)</td>
<td>L = 1w</td>
</tr>
<tr>
<td>2</td>
<td>Bolt (4)</td>
<td>L = 2w</td>
</tr>
<tr>
<td></td>
<td>Wheel (2)</td>
<td>L = 1w</td>
</tr>
<tr>
<td></td>
<td>Small Nut (4)</td>
<td>L = 1w</td>
</tr>
<tr>
<td>3</td>
<td>Bearings (2)</td>
<td>L = 2w</td>
</tr>
<tr>
<td></td>
<td>Large Nut (1)</td>
<td>L = 1w</td>
</tr>
</tbody>
</table>
Notes on Product Structure Tree

• Each item has:
  – A quantity per parent item (not per final product)
  – Lead time (L) includes
    • Ordering & delivery time (if purchasing)
    • Setup, Moving, Assembly, Finishing, Drying, Packaging, etc. (if manufacturing)
    • In our text, L is taken as fixed, regardless of Q
    • In practice, L varies with the production rate

  EX: L = Q/p = 100 items/50 items per week = 2 weeks

Simple, Single Order Example

• Suppose there’s an order for 50 skateboards that’s due in 10 weeks
• How much & when to order/make each item?
• Method: Work down the tree, using the material requirements and lead times
• Demand for 50 boards in week 10 requires:
  – 50 decks ready in week 9 → order 50 decks in week 6
  – 100 trucks ready in week 9 → start assembling in week 8
  – 50 grip tapes ready in week 9 → order 50 tapes in week 8
Simple Order – continued (1)

Start assembling 100 trucks in week 8 requires:
- 400 bolts ready in week 8 → order them in week 6
- 200 wheels ready in week 8 → start assembling in week 7
- 400 small nuts ready in week 8 → order them in week 7

Start assembling 200 wheels in week 7 requires:
- 400 bearings ready in week 7 → order them in week 5
- 200 large nuts ready in week 7 → order them in week 6

This gives the “gross material requirements plan”

Simple Order – continued (2)

- This example only has 1 order & 1 product
  - Shows the main timing & amounts
- However, typical complications include:
  - *On-hand Inventory* reduces net requirements
  - *Multiple Orders* due at various times
  - *Multiple Products* which share components
  - *Scheduled Receipts* which are items scheduled to arrive due to a previously released order