

Material Requirement Planning (MRP)

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What is MRP?

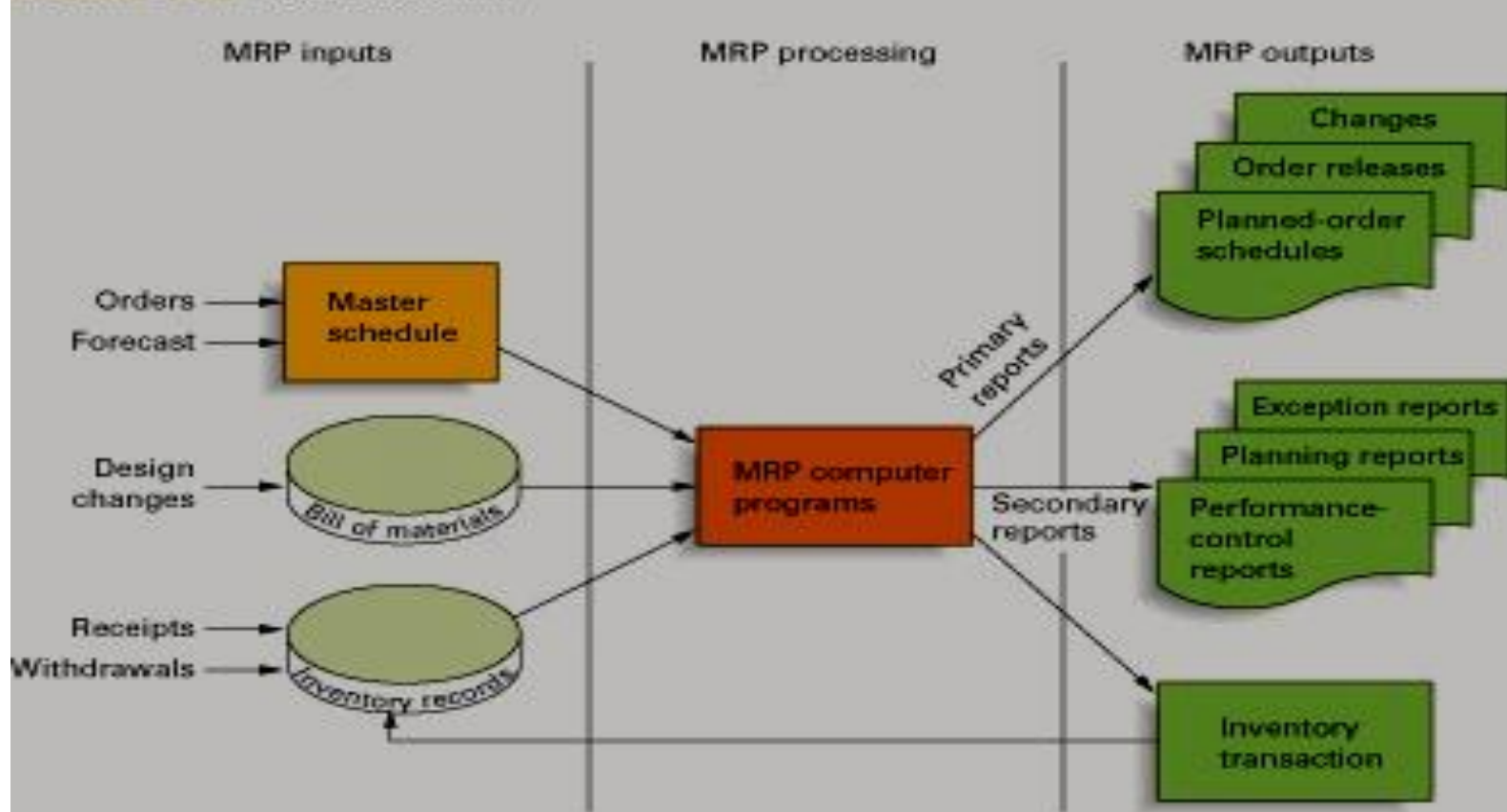
- a system that controls inventory levels, plans production, helps supply management with important information, and helps with the manufacturing control system with respect to the production of assembled parts.

Major Objective of MRP

- Determine Requirements – Calculated to meet product requirements defined in the MPS
 - ☐ What to order
 - ☐ How much to order
 - ☐ When to order
 - ☐ When to schedule delivery
- Keep Priorities Current

Overview of MRP

FIGURE 14.2 Overview of MRP



Dependent Demand

- Demand for items that are subassemblies or component parts to be used in production of finished goods.
- Once the independent demand is known, the dependent demand can be determined.

MRP Input

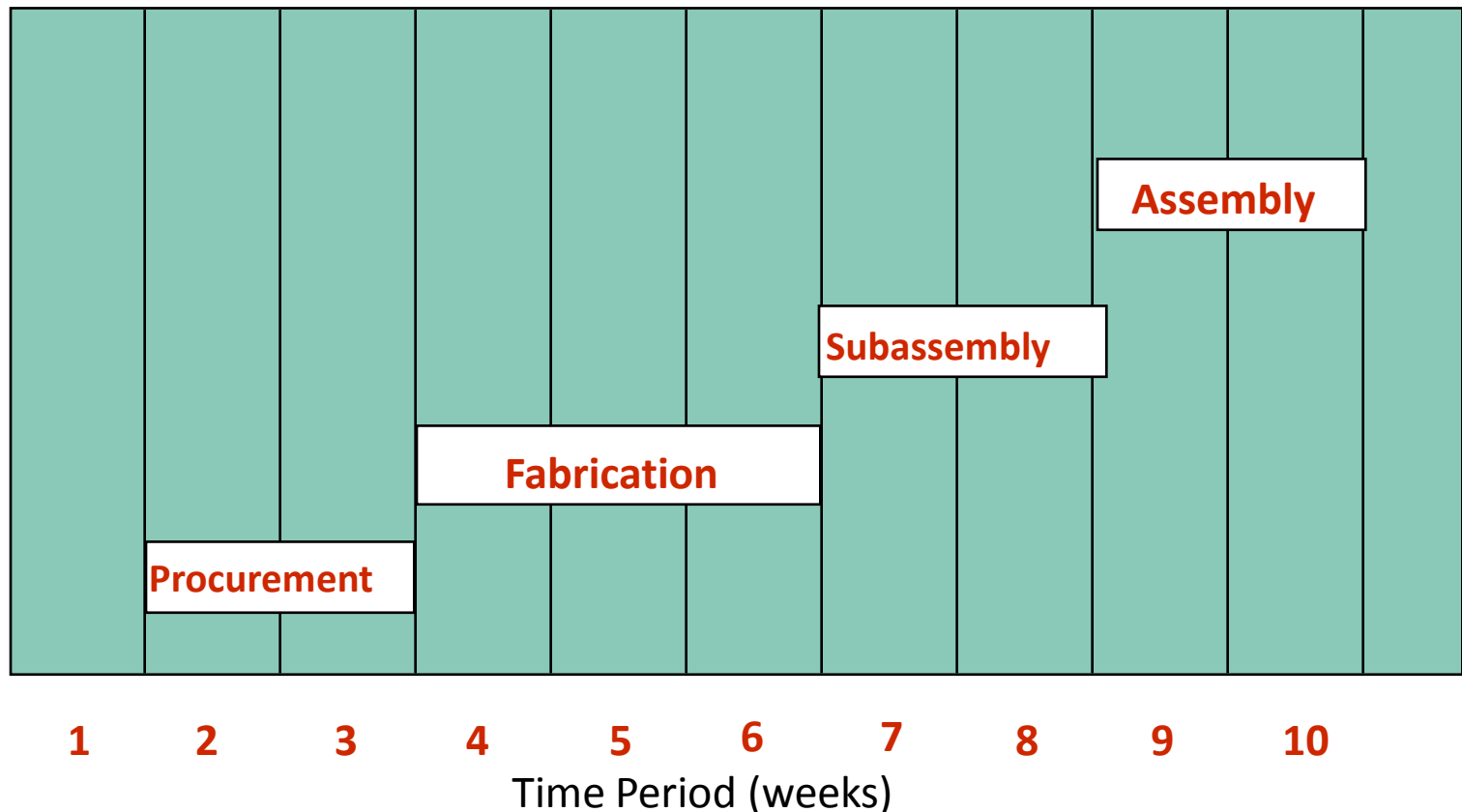
Requirements for Effective Use of Dependent Demand Inventory Models:

- ☐ **Master Production Schedule**
- ☐ **Bills of Materials**
- ☐ **Accurate Inventory records**

Master Production Schedule

- ❑ The master production schedule specifies
 - Which end items or finished products the company is to produce,
 - How many are needed, and when they are needed.
- ❑ The numbers that are on the master production schedule represent
 - Production, not demand,
 - May be a combination of customer orders and demand forecasts
 - Gives what needs to be produced.

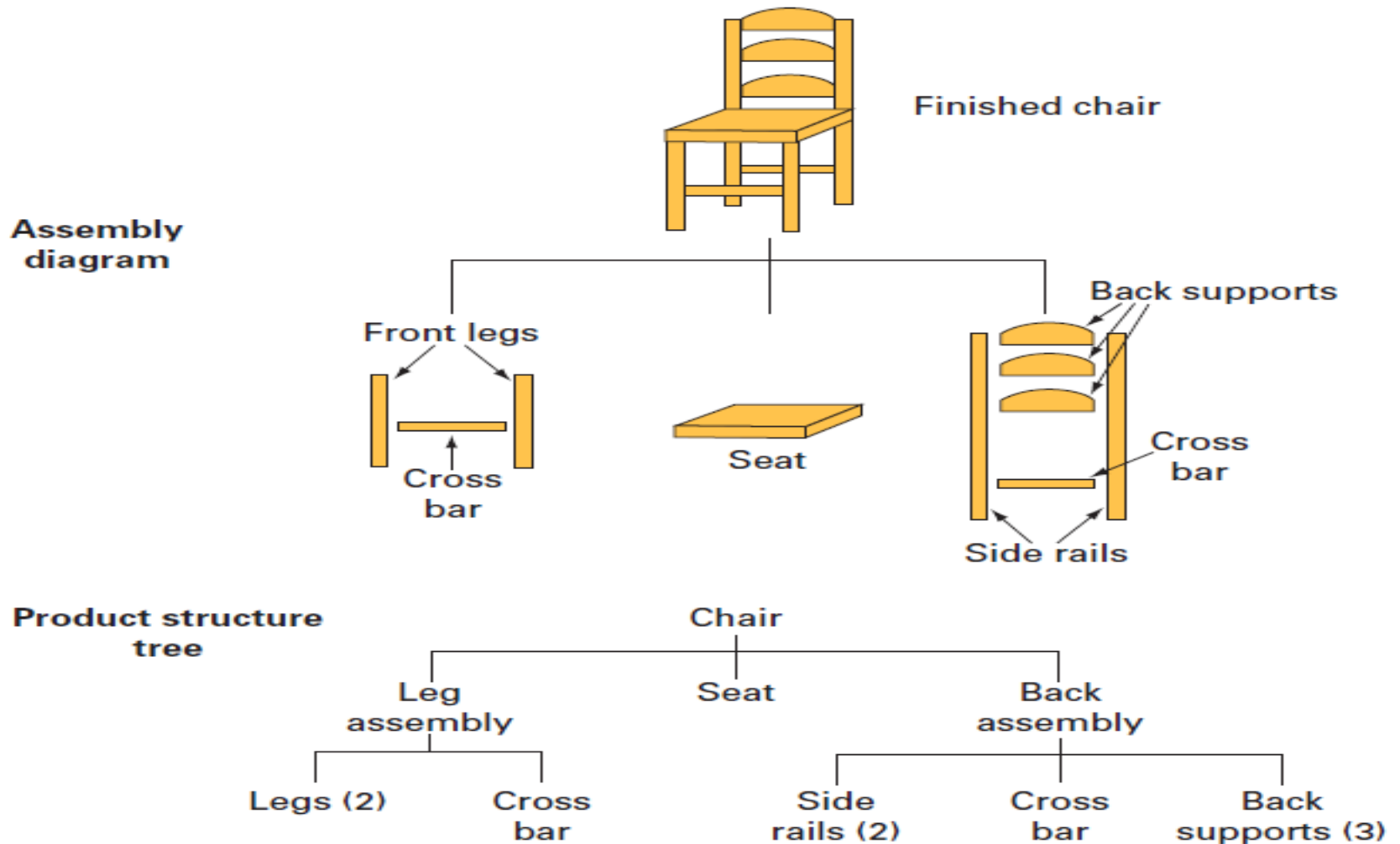
- Cumulative lead time: The sum of the lead times that sequential phases of a process require, from ordering of parts or raw materials to completion of final assembly.



Bill of Material (BOM)

- BOM: 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.

Product Structure Tree



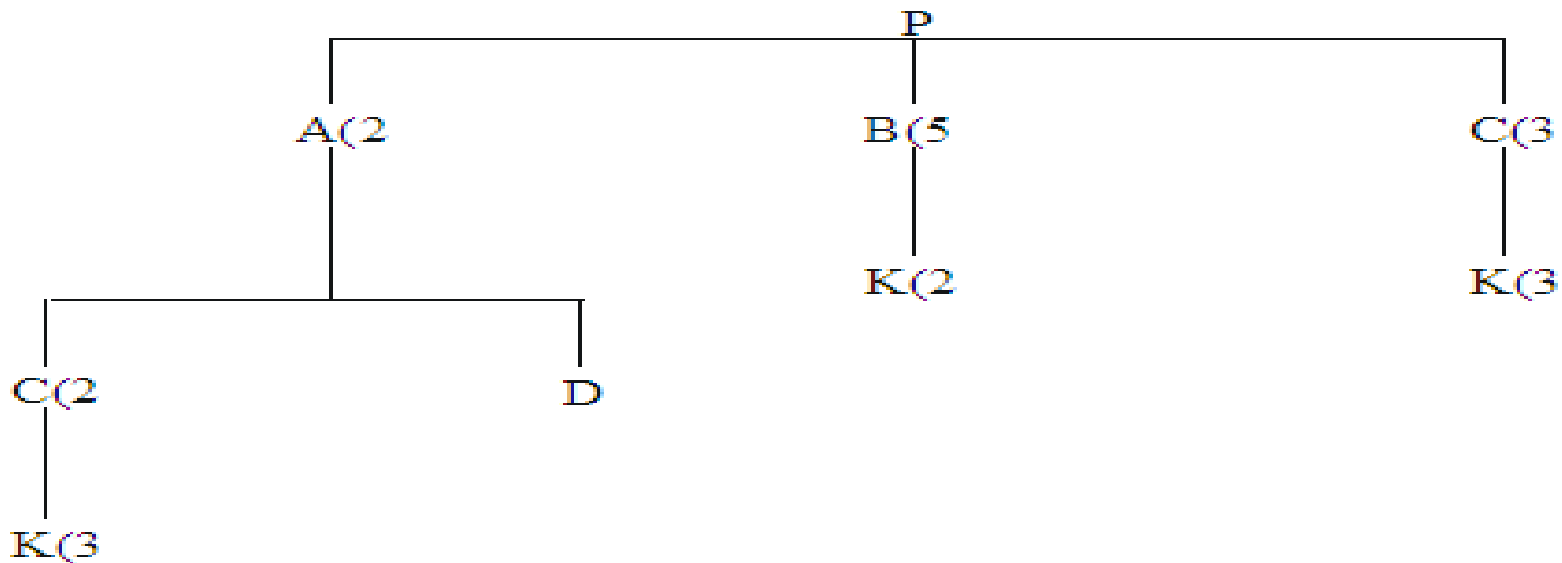
Example 5.1

Question: Use the information presented in product structure tree, do the following:

- Determine the quantities of B, C, D, E and F needed to assemble one X
- Determine the quantities of these components that will be required to assemble 10Xs, taking into account the quantities on hand (i.e., in inventory) of various components: **B (OH:4); C (OH:10); D (OH:8); E(OH:60)**

Example 5.1

Exercise



- Using the product-tree shown, determine the following:
 - a) the quantity of component K that will be needed to assemble 80 units of P, assuming no on-hand inventory exists.
 - b) the quantity of component K needed to assemble 80 units of P, given on-hand inventory of 30 A's, 50 B's and 20 C's

Answer

A)	A leg:	$2 \times 2 \times 3 = 12$ per 1 P.	Total = 31 per P or 2480 for 80 P's.
	B leg:	$5 \times 2 = 10$ per 1 P.	
	C leg:	$3 \times 3 = 9$ per 1 P.	
B)	A leg:	$80 \times 2 = 160$ A's needed.	$160 - 30$ A's on-hand = 130 additional A's needed.
		$130 \times 2 = 260$ C's needed.	$260 - 20$ C's on-hand = 240 additional C's needed.
		$240 \times 3 = 720$ K's needed.	
	B leg:	$80 \times 5 = 400$ B's needed.	$400 - 50$ B's on-hand = 350 additional B's needed.
		$350 \times 2 = 700$ K's needed.	
	C leg:	$80 \times 3 = 240$ C's needed (on-hand used in A leg).	
		$240 \times 3 = 720$ additional K's needed.	
Thus, $720 + 700 + 720 = 2,140$ K's are needed.			

Inventory Records

- One of the three primary inputs in MRP
- Includes information on the status of each item by time period
 - Gross requirements
 - Schedule receipts
 - Projected on hand
 - Net requirements
 - Planned-order receipts
 - Planned-order releases

Example: MRP worksheet

	Week	1	2	3	4	5
Part Lead Time	Gross requirements					
	Scheduled receipts					
	Projected available					
	Net requirements					
	Planned order receipt					
	Planned order release					

MRP Processing

- Planned-order receipts
 - Quantity expected to received at the beginning of the period
- Planned-order releases
 - Planned amount to order in each time period

Example 5.2

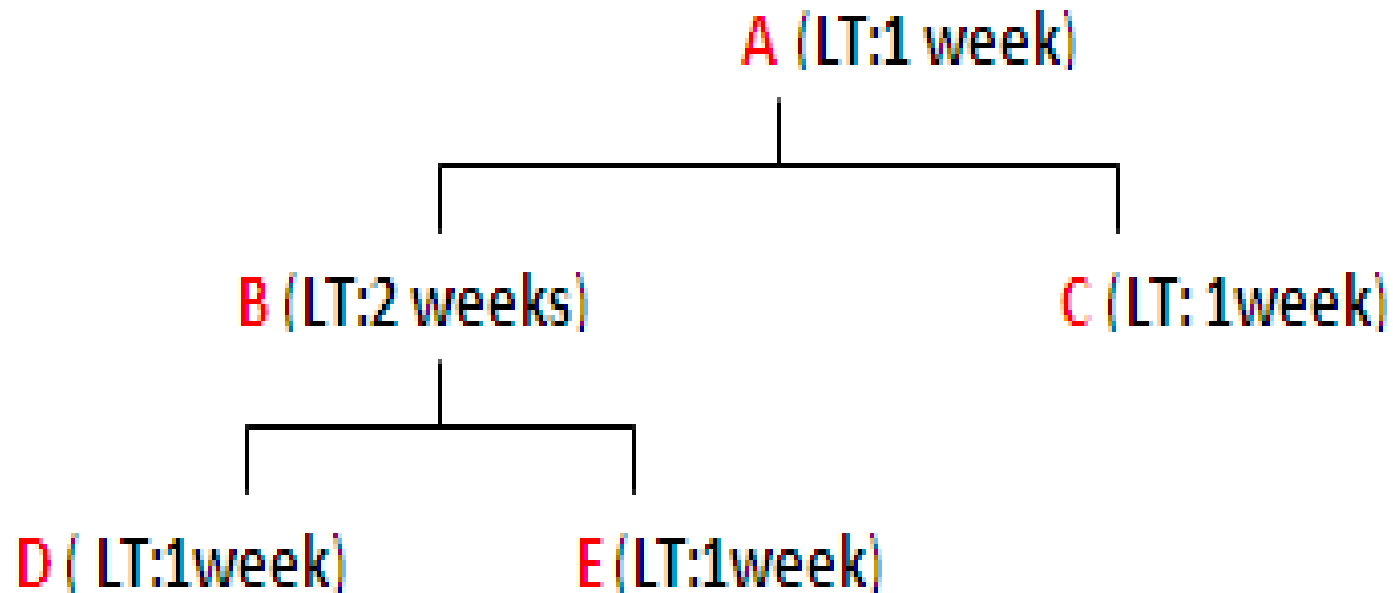


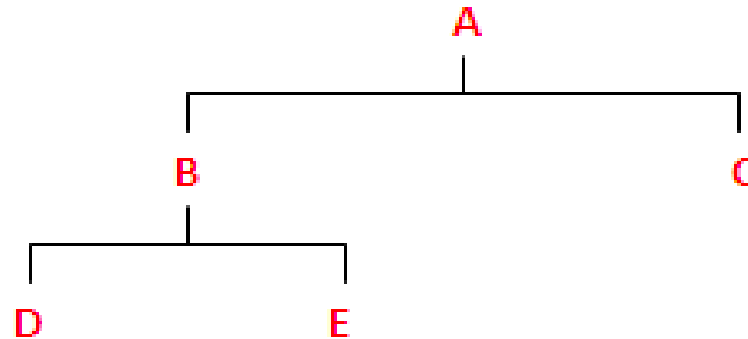
Figure 4.11: Product tree with Lead Time

Example 5.2

Question : Using the product tree and lead times shown in figure 4.11, complete the following table to determine the planned order receipts and release. There are 50 As required in week 5 and 100 in week 6.

	Week	1	2	3	4	5	6
Part A Lead time: 1 week	Planned order receipt Planned order release				50	50 100	100
Part B Lead time: 2 week	Planned order receipt Planned order release		50	100	50	100	
Part C Lead time: 1 week	Planned order receipt Planned order release			50	50 100	100	
Part D Lead time: 1 week	Planned order receipt Planned order release	50	50 100	100			
Part E Lead time: 1 week	Planned order receipt Planned order release	50	50 100	100			

Exercise



- Using the following product tree, determine the planned order receipts and release if 200 As are to be produced in week 5. All lead times are one week excepts for component E, which has lead time of two weeks.

Answer

	Week	1	2	3	4	5
Part A Lead time: 1 week	Planned order receipt Planned order release				200	200
Part B Lead time: 1 week	Planned order receipt Planned order release			200	200	
Part C Lead time: 1 week	Planned order receipt Planned order release			200	200	
Part D Lead time: 1 week	Planned order receipt Planned order release		200	200		
Part E Lead time: 2 week	Planned order receipt Planned order release	200		200		

MRP Processing

- Gross requirements
 - Total expected demand
- Net requirements
 - Actual amount needed in each time period

Net Requirements = Gross Requirements – Available Inventory
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- Planned on hand
 - Expected inventory on hand at the beginning of each time period

Available Inventory = Projected on hand – Safety stock – Inventory allocated to other items
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Example 5.3

- Complete the following table. Lead time for the part is two weeks. The order quantity (lot size) is 100 units

Week	1	2	3	4
Gross requirements		50	45	20
Projected available 75				
Net requirements				
Planned order receipt				
Planned order release				
Week	1	2	3	4
Gross requirements		50	45	20
Projected available 75	75	25	80	60
Net requirements			20	
Planned order receipt			100	
Planned order release	100			

Exercise

- Complete the following table. Lead time for the part is two weeks, and the order quantity is 40. What action should be taken?

Week	1	2	3	4
Gross requirements	20	15	10	20
Projected available 40				
Net requirements				
Planned order receipt				
Planned order release				

Answer

Week	1	2	3	4
Gross requirements	20	15	10	20
Projected available 40	20	5	35	15
Net requirements	40		15	
Planned order receipt			40	
Planned order release				

Answer: An order for 40 should be released in week 1

MRP Processing

- Scheduled receipts
 - Open orders (orders that have been placed and are) scheduled to arrive from vendors or elsewhere in the pipeline by the beginning of a period.

Example 5.4

- Complete the following table. Lead time for the item is two weeks and the order quantity is 200. What action should be taken?

Week	1	2	3	4
Gross requirements	50	250	100	50
Scheduled receipts		200		
Projected available 150				
Net requirements				
Planned order receipt				
Planned order release				
Week	1	2	3	4
Gross requirements	50	250	100	50
Scheduled receipts		200		
Projected available 150	100	50	150	100
Net requirements			50	
Planned order receipt				
Planned order release	200			

Exercise

- Complete the following table. Lead time for the part is two weeks. The lot size is 100. What is the projected available at the end of week 3? When is it planned to release an order?

Week	1	2	3	4
Gross requirements	20	65	35	25
Scheduled receipts 40		100		
Projected available				
Net requirements				
Planned order receipt				
Planned order release				

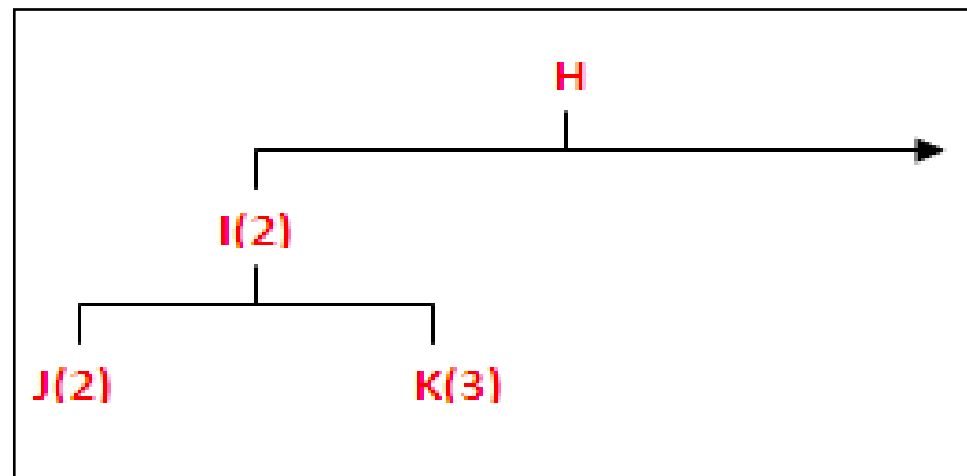
Answer

Week	1	2	3	4
Gross requirements	20	65	35	25
Scheduled receipts 40	20	100	20	95
Projected available	0	55	0	5
Net requirements	0	0	0	100
Planned order receipt		100		0
Planned order release				

***Answer: Projected available at the end of week 3 is 20
An order release is planned for the beginning of week 2***

Example 5.5

- Given the following partial product tree, explode, offset, and determine the gross and net requirements for each H,I,J, and K. There are other components, but they are not connected to this problem. This quantities required are shown in parentheses. The master production schedule calls for the completion of 50 **Hs** in week 3 and 80 in week 5. There is a scheduled receipt of 100 **Is** in week 2. There are 400 **Js** and 400 **Ks** available.



	Week		1	2	3	4	5
Part H	Gross requirements						
	Scheduled receipts						
Lead time	Projected available						
1 week	Net requirements						
	Planned order receipt						
	Planned order release						
Part I	Gross requirements						
	Scheduled receipts						
Lead time	Projected available						
2 weeks	Net requirements						
	Planned order receipt						
	Planned order release						
Part J	Gross requirements						
	Scheduled receipts						
Lead time	Projected available						
1 week	Net requirements						
	Planned order receipt						
	Planned order release						
Part K	Gross requirements						
	Scheduled receipts						
Lead time	Projected available						
1 week	Net requirements						
	Planned order receipt						
	Planned order release						

Answer

	Week	1	2	3	4	5
Part H Lead time 1 week	Gross requirements			50		80
	Scheduled receipts					
	Projected available			0	0	0
	Net requirements			50		80
	Planned order receipt			50		80
	Planned order release		50		80	
Part I Lead time 2 weeks	Gross requirements		100		160	
	Scheduled receipts		100			
	Projected available		0	0	0	
	Net requirements				160	
	Planned order receipt				160	
	Planned order release		160			
Part J Lead time 1 week	Gross requirements		320			
	Scheduled receipts					
	Projected available 400	400	80	80	80	80
	Net requirements					
	Planned order receipt					
	Planned order release					
Part K Lead time 1 week	Gross requirements		480			
	Scheduled receipts					
	Projected available 400	400	0			
	Net requirements		80			
	Planned order receipt		80			
	Planned order release	80				

MRP Output

- Primary Reports
 - ☐Planned orders
 - ☐Order releases
 - ☐Changes
- Secondary Reports
 - ☐Performance-control reports
 - ☐Planning reports
 - ☐Exception reports

Other Consideration MRP

- Safety stock
- Lot sizing
 - Lot-for-lot ordering
 - Economic order quantity
 - Fixed-period ordering

Benefit of MRP

- Low levels of in-process inventories
- Ability to track material requirements
- Ability to evaluate capacity requirements
- Means of allocating production time
- Ability to easily determine inventory usage by backflushing
- Backflushing: Exploding an end item's bill of materials to determine the quantities of the components that were used to make the item.

THANK YOU