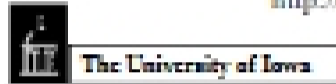


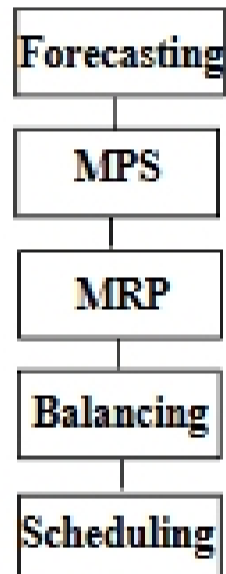
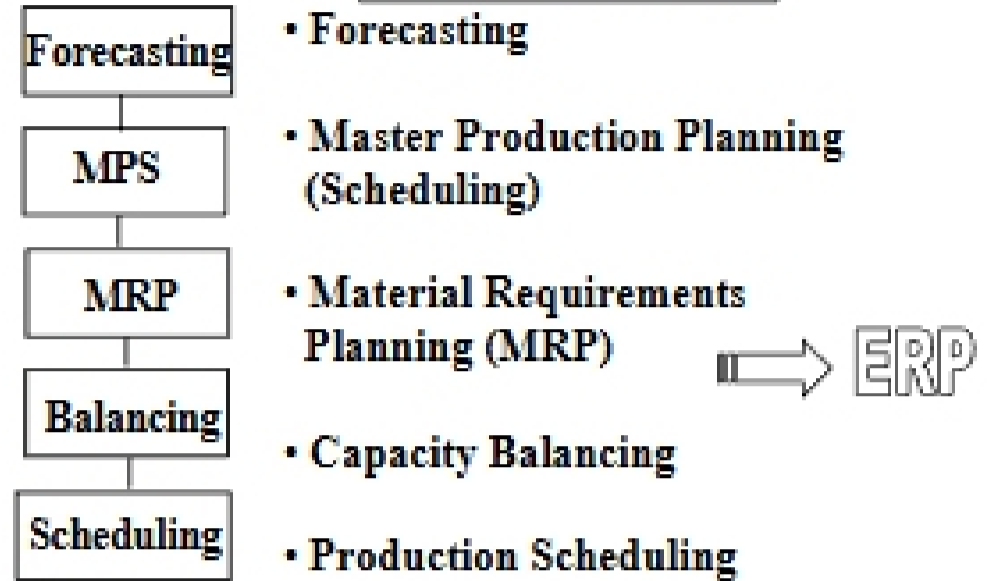
# PRODUCTION PLANNING AND SCHEDULING Part 1

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## Planning Hierarchy



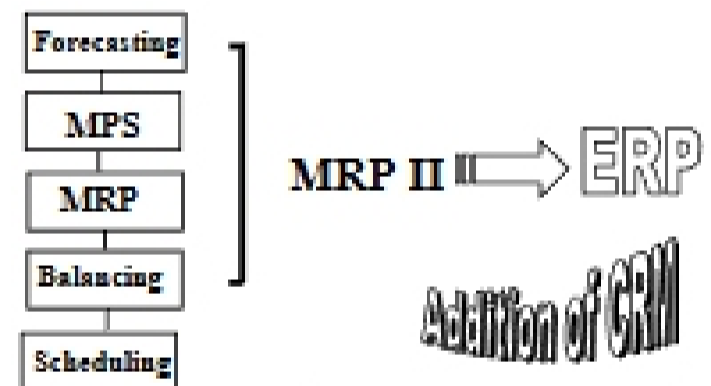
MRP II (Manufacturing Resource Planning II)

$$ERP = MRP II + \dots$$



## History of ERP

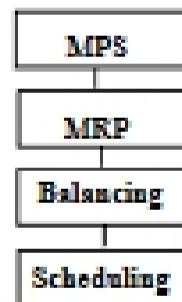
- 1970's MRP Material Requirements Planning
- 1980's MRPII Manufacturing Resource Planning
- 1990's ERP Enterprise Resource Planning (e.g., SAP system)



**Master Production Schedule** specifies Sequence and Quantity of Products (C)

EXAMPLE

Jan	Feb	March	Month
200 C1	195 C4	385 C1	
150 C7	150 C7	160 C6	
180 C14	180 C12	670 C7	
	128 C17	230 C9	



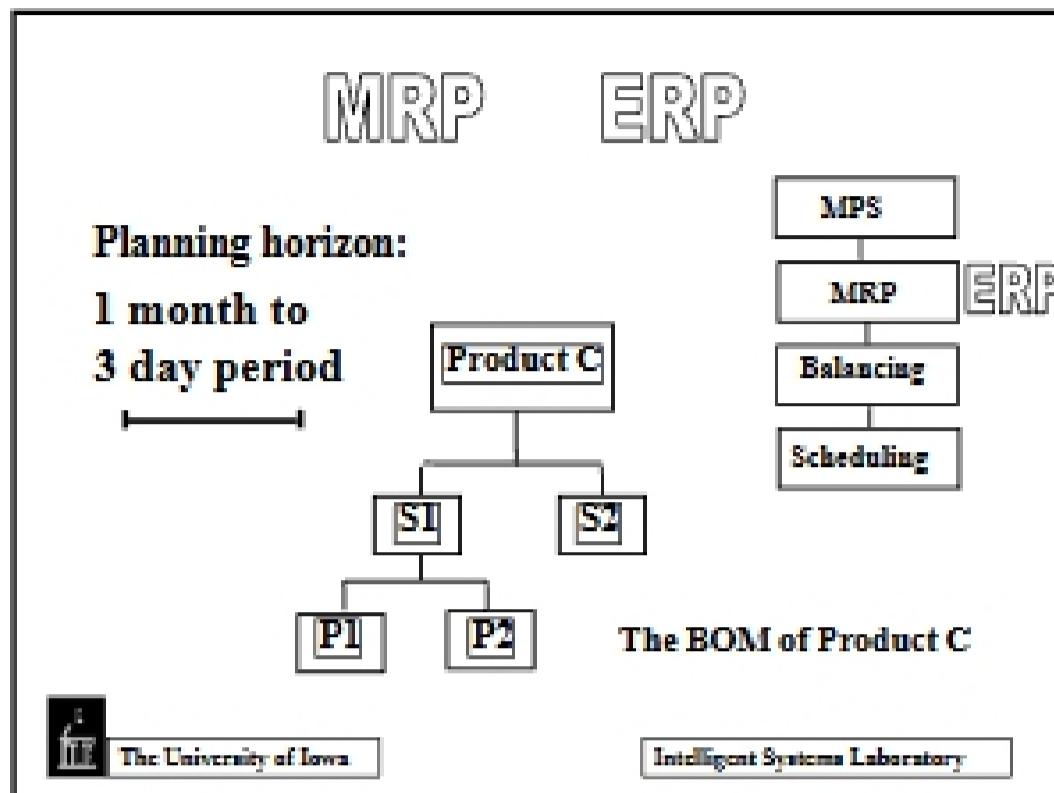
ERP systems are used from

- Automotive industry

to

- Pharmaceutical industry





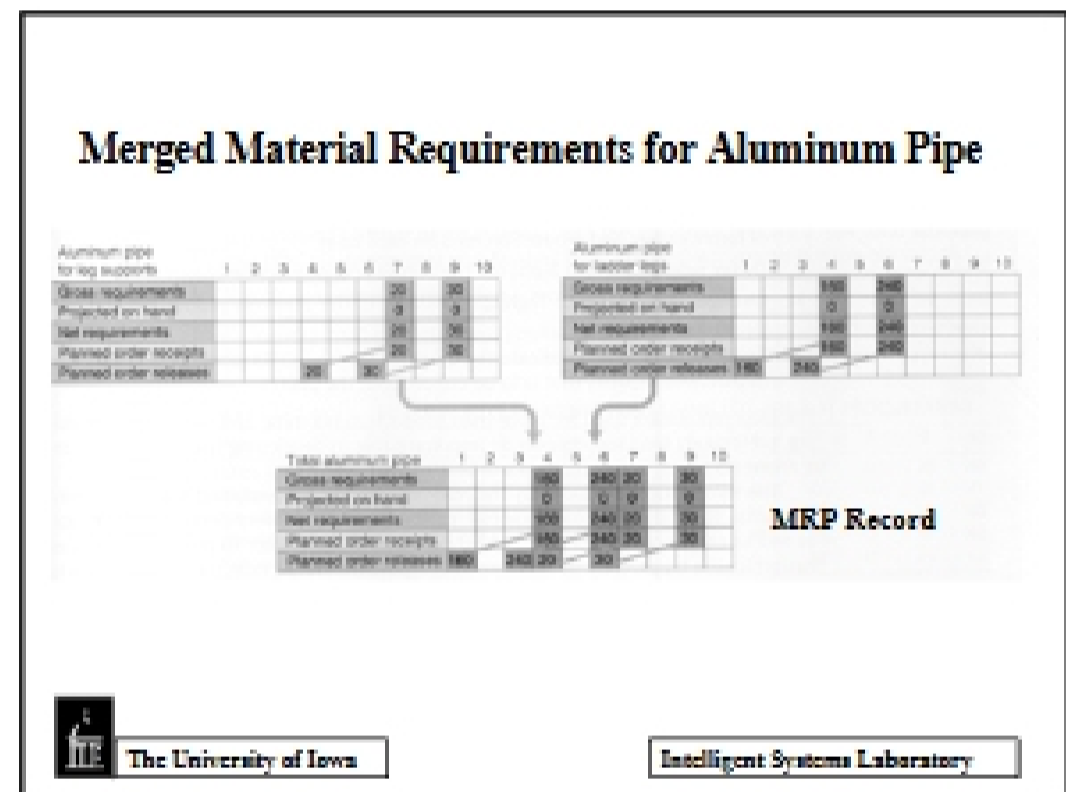
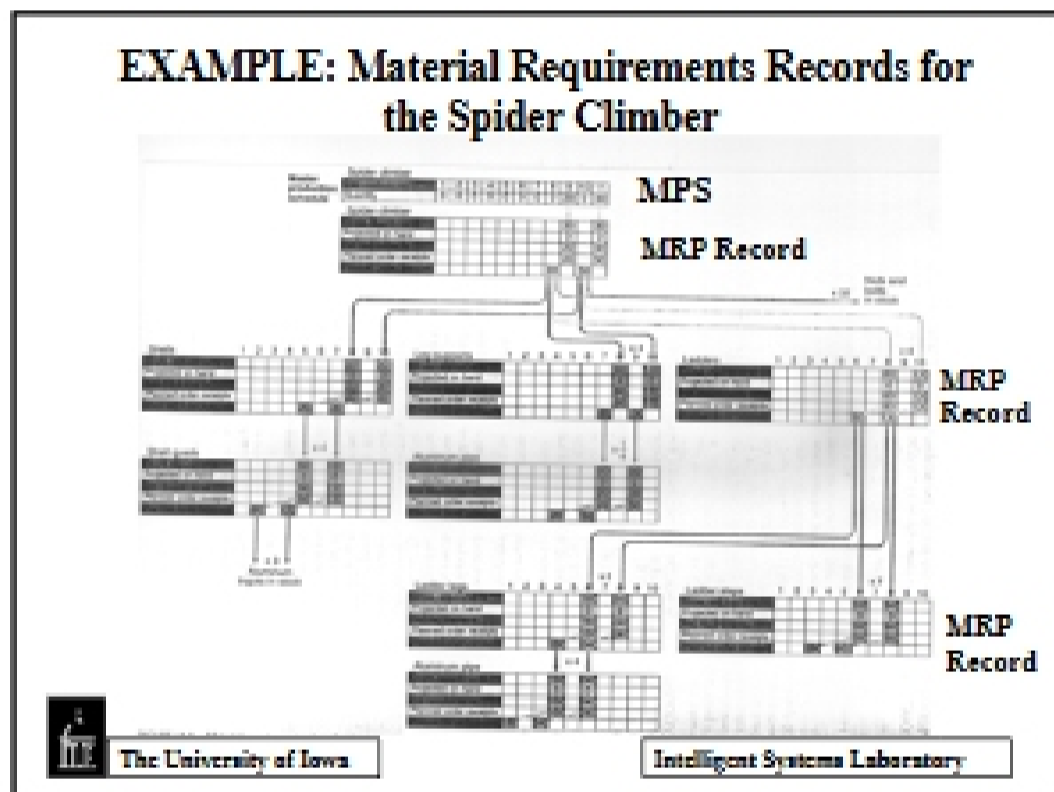
## MRP and ERP Systems

**Backward (top down) generation of a production plan**

**Forward (push) implementation of the production plan**

**Note: Kanban systems are pull systems**

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## Basic MRP (ERP) Record

From the previous production stage or storage

Period	1	2	3	4	5	
Gross requirements		10		40	10	OUT
Scheduled receipts		50				
On hand	4	54	44	44	4	-6
Planned order releases	50					

Lead time = 1 period  
Lot size = 50  
Safety stock = 4

**Note: On hand should be  $\geq$  Safety stock**

Lead time

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## The Basic MRP (ERP) Record "Arithmetic"

Period	1	2	3	4	5
Gross requirements		10		40	10
Scheduled receipts		+ 50		-	-
On hand	4	54	44	44	4
Planned order releases					

Lead time = 1 period  
Lot size = 50  
Safety stock = 4

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### Question?

Period	1	2	3	4	5
Gross requirements		10		40	10
Scheduled receipts		<del>50</del>		<del>50</del>	<del>50</del>
On hand	4	54	44	4	-6
Planned order releases				50?	

Lead time = 1 period  
Lot size = 50  
Safety stock = 4

### What 50?

What will a 50 do to the MRP record?

### The Answer

Period	1	2	3	4	5
Gross requirements		10		40	10
Scheduled receipts		<del>50</del>		<del>50</del>	<del>50</del>
On hand (safety stock)	4	54	44	44	4
Planned order releases	50			50	

Lead time = 1 period  
Lot size = 50  
Safety stock = 4

Previously omitted  
New order release

### Explosion of Requirements for Subassembly S1 and Part P2

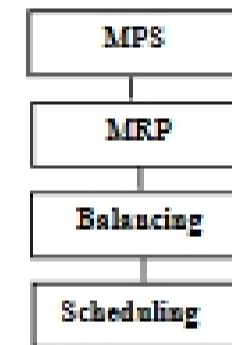
S1

Period	1	2	3	4	5
Gross requirements		10		40	10
Scheduled receipts	50				50
On hand	4	54	44	4	4
Planned order releases				50	

P2

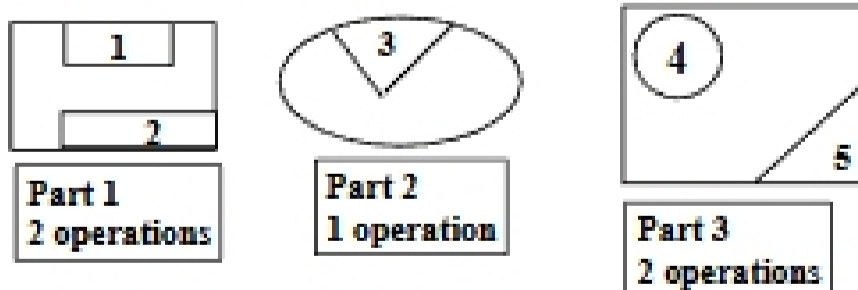
Period	1	2	3	4	5
Gross requirements				50	
Scheduled receipts				100	
On hand	0	0	0	5	58
Planned order releases			100		

### CAPACITY BALANCING

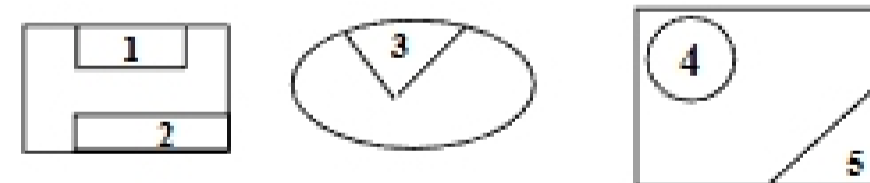


### 8 hour period

5 operations to be assigned to 2 machines



NOTE: Operation is a set of tasks (e.g., removal of machining features) of a part is performed on one machine



### The result of capacity balancing

Machine	Operations	Capacity [minutes]
Machine 1	1, 4	420
Machine 2	2, 5, 3	480