Production Planning & Control BMM4823

Material Requirement Planning

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Chapter Description

- Aims
  - To understand the control systems of Material Requirement Planning (MRP), material resource planning (MRPII) and Enterprise Resource Planning (ERP)
  - To apply MRP in production system by calculating the requirement of raw materials or parts

- Expected Outcomes
  - Able to apply MRP system for production planning
  - Able to apply lot sizing techniques in computing the required parts
  - Able to differentiate between MRP, MRPII and ERP.

- References
- Heizer, J and Render,B. 2011. Principles of Operations Management, 8th Edition, Pearson Prentice Hall, Inc.

Introduction

A control system on inventory by using computer

Determine parts, components and materials to be manufactured or ordered

Data system should be accurate

Master production schedule to time phased requirement

Dependent demand

Dependent demand

The demand is related to each demand of related item

End item demand will determine the demand for others

MRP depends of dependent demand

Master Production Schedule (MPS)

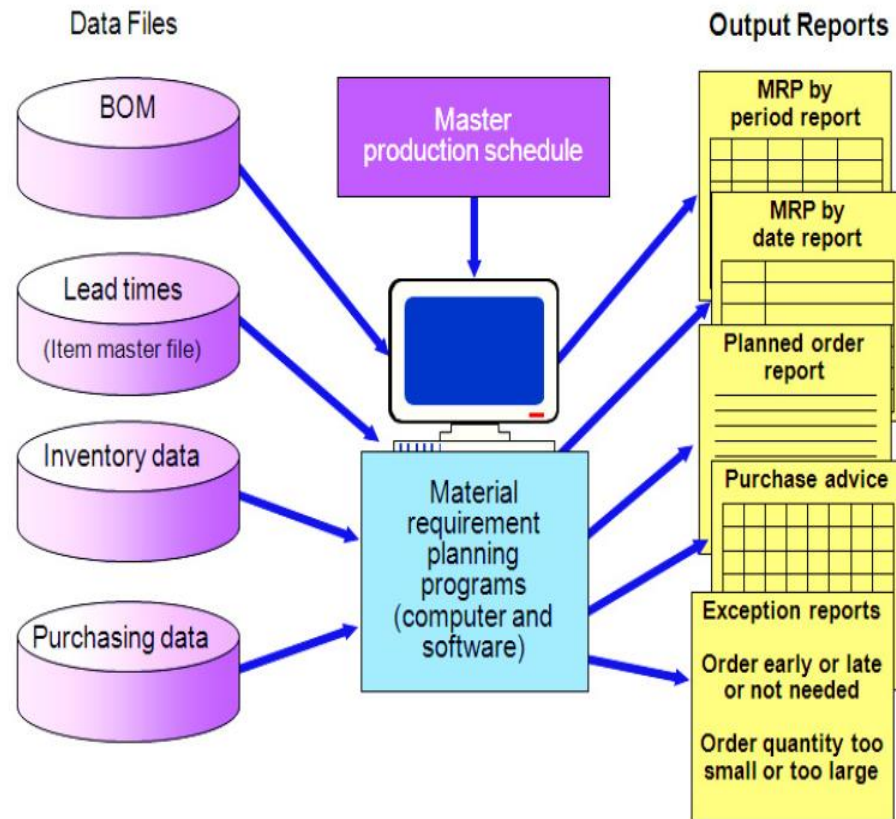Is an overall plan for production within a certain period

It is based on customer orders, sales orders and forecast

It is specify what to be made and when to produce it

Normally from MPS will transfer to MRP

Running by weekly compared to MRP by daily

MRP Structure

Source : Heizer & Render 2011

Master Planning Schedule

Make to order

Assemble to stock

Make to stock

Aggregate Production Planning

Part of production control on;

Time phased

Production rates
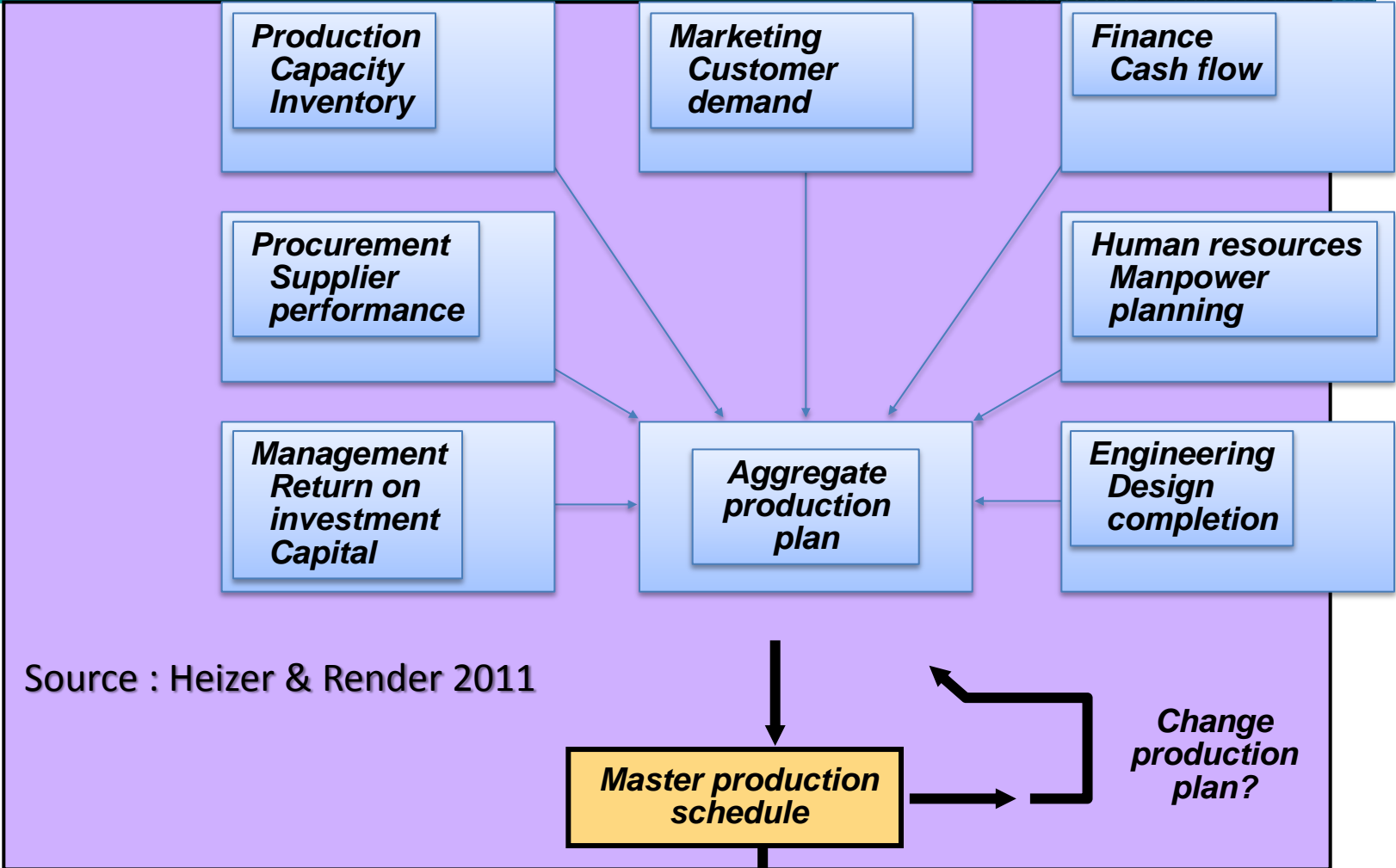
Workforce level

Inventory planning

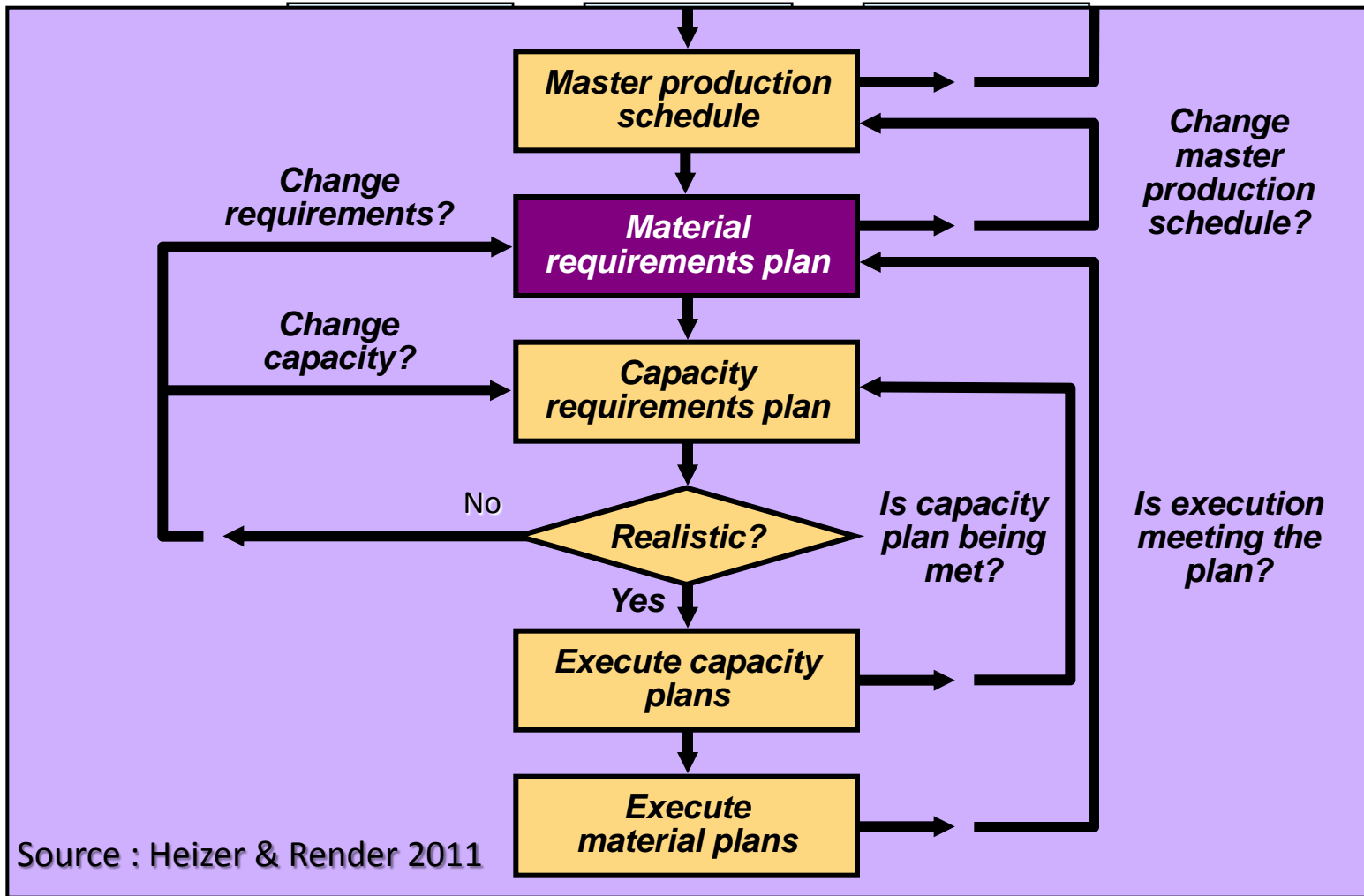Capacity limitation

Overtime

Subcontract

Aggregate Production Plan

Production plan based Television Model

Month	January				February			
Television	1000				1500			
Weeks	1	2	3	4	1	2	3	4
14 in	100		100	100	100	100	100	100
29in	200		200		150			150
32in	100	100		100	200	200	200	200

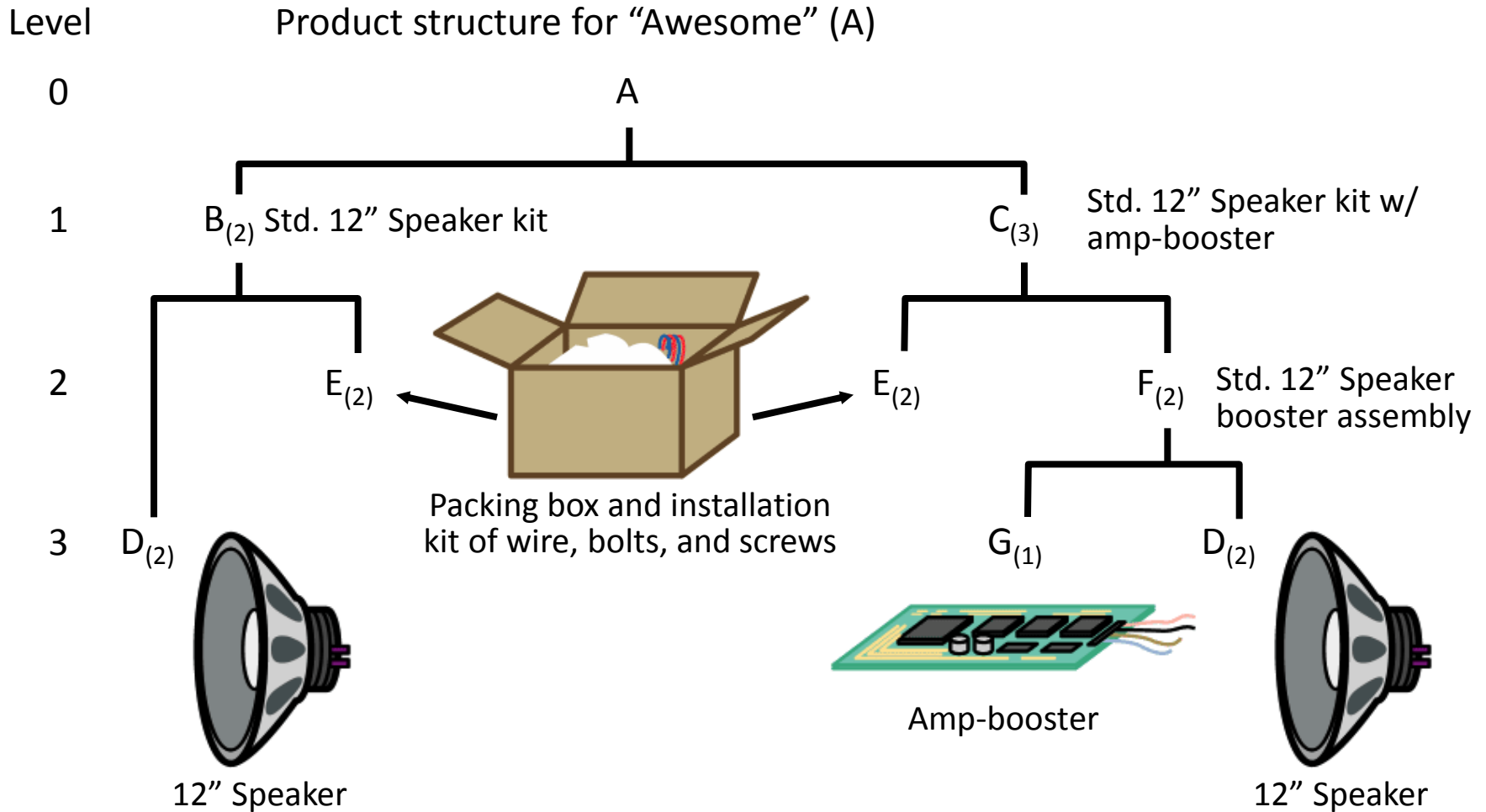Source : Heizer & Render 2011

Source : Heizer & Render 2011

Bill of Materials (BOM)

- Detail list of components or parts to be assembled into a product

- Item above – called parent

- Item below – called children

- Simple and easy to understand

Bill of Materials (BOM)

Level   Product structure for "Awesome" (A)

0   A

1   B$_{(2)}$ Std. 12" Speaker kit   C$_{(3)}$ Std. 12" Speaker kit w/
                                                                          amp-booster

2   E$_{(2)}$ E$_{(2)}$ F$_{(2)}$ Std. 12" Speaker
                                                                              booster assembly

Packing box and installation
kit of wire, bolts, and screws

3   D$_{(2)}$ G$_{(1)}$ D$_{(2)}$

Amp-booster

12" Speaker   12" Speaker

Communitising Technology

Bill of Materials (BOM)

Part B: *2 x number of As =*   (2)(50) =   100
Part C: *3 x number of As =*   (3)(50) =   300
Part D: *2 x number of Bs*
            + 2 x number of Fs = (2)(100) + (2)(300) = 800
Part E: *2 x number of Bs*
            + 2 x number of Cs = (2)(100) + (2)(150) = 500
Part F: *2 x number of Cs =*   (2)(150) =   300
Part G: *1 x number of Fs =*   (1)(300) =   300

Source : Heizer & Render 2011
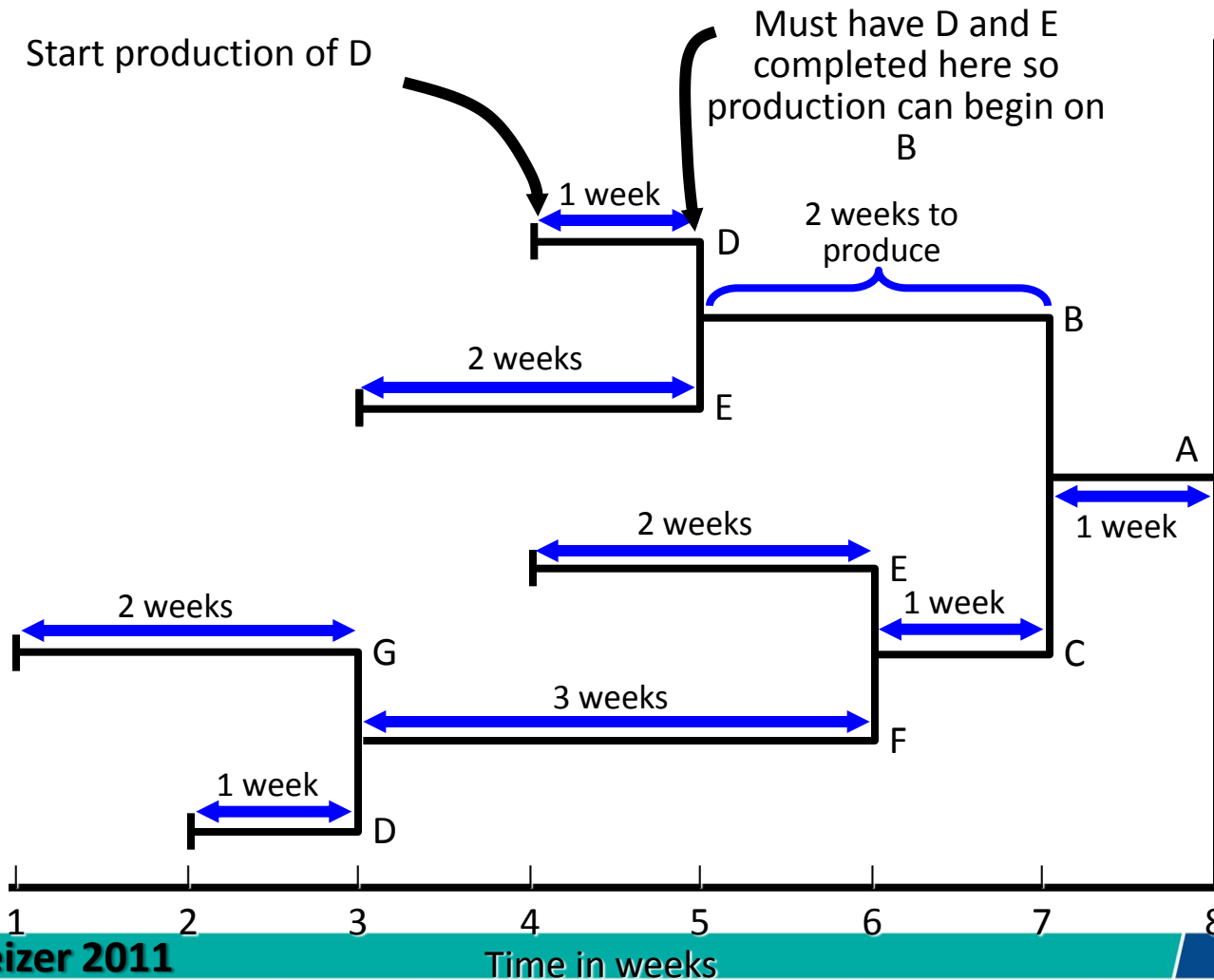
Gross Requirement

- To know how many parts required by the production

- When the ordered need to released?

- When the ordered should be received?

- As example if A required in week 8, the product need to be assembled in week 7 with 1 week lead time.

- This is called lead time offset or time phasing

Gross Requirement

- Let say A = 50 units

- B= 2x50 = 100 units
- C= 3x50 = 150 units

- Therefore the production has to provide components B and C one week before the required date of A.
- The right order quantity for B and C are determined by the <u>order released</u> of the parent(s)

TABLE 14.3	Gross Material Requirements Plan for 50 Awesome Speaker Kits (As) with Order Release Dates Also Shown									
		WEEK								LEAD TIME
		1	2	3	4	5	6	7	8	
A.	Required date								50	
	Order release date							50		1 week
B.	Required date							100		
	Order release date					100				2 weeks
C.	Required date							150		
	Order release date						150			1 week
E.	Required date					200	300			
	Order release date			200	300					2 weeks
F.	Required date						300			
	Order release date			300						3 weeks
D.	Required date			600		200				
	Order release date		600		200					1 week
G.	Required date			300						
	Order release date	300								2 weeks

ITEM	ON HAND	ITEM	ON HAND
A	10	E	10
B	15	F	5
C	20	G	0
D	10		

Lot Size	Lead Time (weeks)	On Hand	Safety Stock	Allo-cated	Low-Level Code	Item Identi-fication		Week							
								1	2	3	4	5	6	7	8
Lot-for-Lot	1	10	—	—	0	A	Gross Requirements								50
							Scheduled Receipts								
							Projected On Hand 10	10	10	10	10	10	10	10	10
							Net Requirements								40
							Planned Order Receipts								40
							Planned Order Releases							40	
Lot-for-Lot	2	15	—	—	1	B	Gross Requirements							80[A]	
							Scheduled Receipts								
							Projected On Hand 15	15	15	15	15	15	15	15	
							Net Requirements							65	
							Planned Order Receipts							65	
							Planned Order Releases						65		
Lot-for-Lot	1	20	—	—	1	C	Gross Requirements							120[A]	
							Scheduled Receipts								
							Projected On Hand 20	20	20	20	20	20	20	20	
							Net Requirements							100	
							Planned Order Receipts							100	
							Planned Order Releases						100		

Lot Sizing techniques

- Lot for lot – also considered as a chase demand

- Economic order quantity (EOQ)

- Period order quantity
  - Varies quantity with consistent time interval
  - Use EOQ for time between orders (TBO)
  - Depends on coverage period

Lot for Lot

	1	2	3	4	5	6	7	8	9	10
Gross requirement	40	35	45	0	15	45	35	0	35	60
Schedule receipt										
Projected in hand - 40										
Net requirement	0	35	45	0	15	45	35	0	35	60
Plan order receipts		35	45	0	15	45	35	0	35	60
Plan order release	35	45	0	15	45	35	0	35	60	

Holding cost = RM2/week; Setup cost = RM100

Lot for Lot

No on-hand inventory is carried through the system
Total holding cost = RM0

There are seven setups for this item in this plan
Total setup cost = 7 x RM100 = RM700

Economic Order Quantity (EOQ)

	1	2	3	4	5	6	7	8	9	10
Gross requirement	40	35	45	0	15	45	35	0	35	60
Schedule receipt										
Projected in hand - 40			43	76	61	16	16	59	24	24
Net requirement	0	35	2				19			36
Plan order receipts		78	78				78			78
Plan order release	78	78				78			78	

Holding cost = RM2/week; Setup cost = RM100
Average weekly gross requirement = 30 EOQ = 78

Economic Order Quantity (EOQ)

Annual demand (30 x52 weeks) = **1,560**

Total cost = setup cost + holding cost

Total cost = (1,560/78) x RM100 + (78/2) x (RM2 x 52 weeks)

Total cost = RM6056

Cost for 10 weeks = RM6056 x (10 weeks/52 weeks) = RM1165

Period Order Quantity (POQ)

	1	2	3	4	5	6	7	8	9	10
Gross requirement	40	35	45	0	15	45	35	0	35	60
Schedule receipt										
Projected in hand - 40			45			80	35			60
Net requirement	0	35	0	0	15	0	0	0	35	0
Plan order receipts		80			95				95	
Plan order release	80			95				95		

POQ   = EOQ/Average weekly usage

        = 78/30

        = 2.6

        =3 weeks period

Period Order Quantity (POQ)

Setups = 3 x RM100 = RM300
Holding cost = (45 + 80 + 35 + 60) units x RM2 = RM440
Total cost = RM300 + RM440 = RM740

Lot sizing

- Lot for lot   = RM700

- EOQ   = RM775

- POQ   = RM740

- Therefore, the minimum is lot for lot method.

- ☑ Recompute the lot size when there is a change on order quantity

- ☑ Lot sizes should be always recomputed whenever there is a lot size or order quantity change

- ☑ In practice, this results in system nervousness and instability

- ☑ Lot-for-lot is suitable during good economy.

- ☑ Lot sizes can be changed to allow for any adjustments due to parts management.

MRPII

- Is called as material resource planning

- Is an extension of MRP

- Integrated method of operational and financial planning for manufacturing companies

- Is considered as a closed loop manufacturing resource planning

|		Week			
		5	6	7	8
A.	Units (lead time 1 week)				100
	Labor: 10 hours each				1,000
	Machine: 2 hours each				200
	Payable: $0 each				0
B.	Units (lead time 2 weeks,				
	2 each required)			200	
	Labor: 10 hours each			2,000	
	Machine: 2 hours each			400	
	Payable: Raw material at $5 each			1,000	
C.	Units (lead time 4 weeks,				
	3 each required)	300			
	Labor: 2 hours each	600			
	Machine: 1 hour each	300			
	Payable: Raw material at $10 each	3,000			

Enterprise Resource Planning (ERP)

- Is an integration system within the organisation
- Sharing data bases to related department
- Easy and fast to access related data
- Synchronized reporting and automation.
- Real time reporting
- Save time
- Fast decision

Enterprise Resource Planning (ERP)

- Integration of various modules
  - MRP
  - Finance
  - Human resource
  - Manufacturing
  - Inventory control
  - Material purchasing

Enterprise Resource Planning Systems
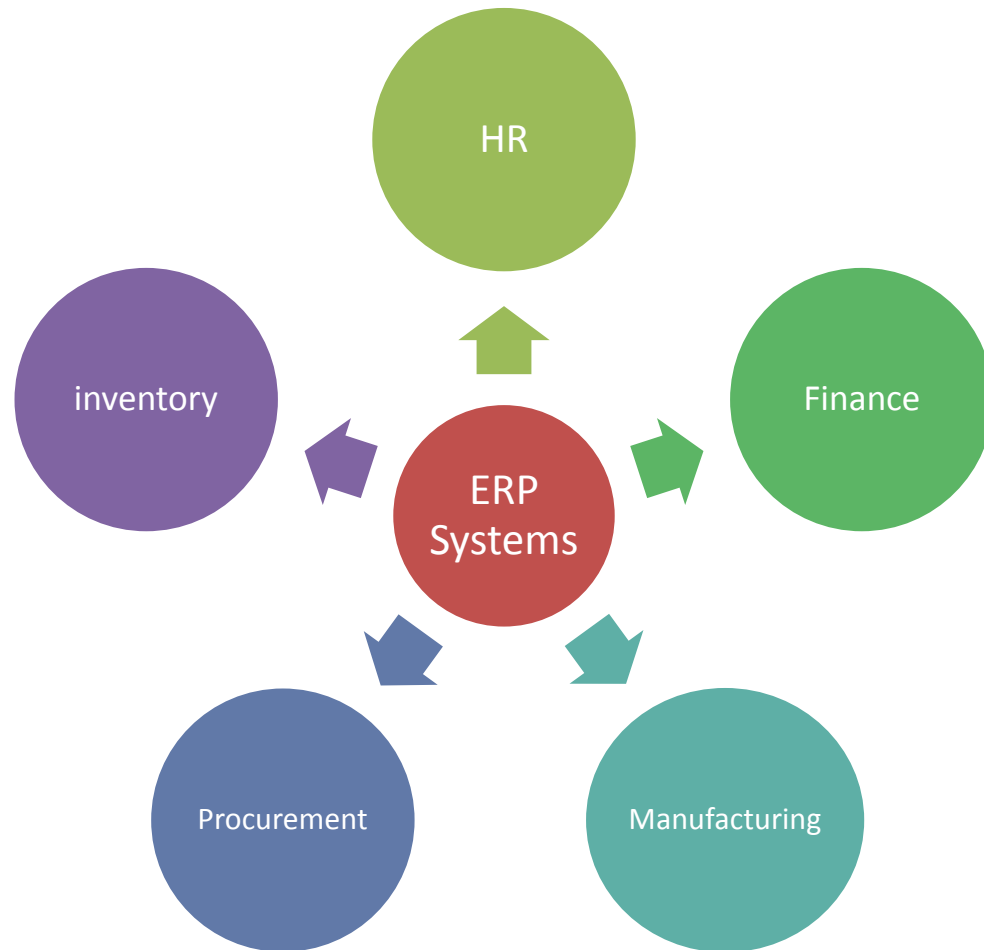
Advantages of ERP system

- Easily to monitor the current information

- Sharing databases to others

- Effective communication through reliable information

- Effective measurement company performance

- Immediately accessible

Differences

MRP	MRPII	ERP
To know the available parts in the warehouse To know when required parts To know when to order parts	Include the machine capacity scheduling Quality assurance	Include all organisation system such as; Human Resource Financial system Material management Procurement Supply chain management Etc.