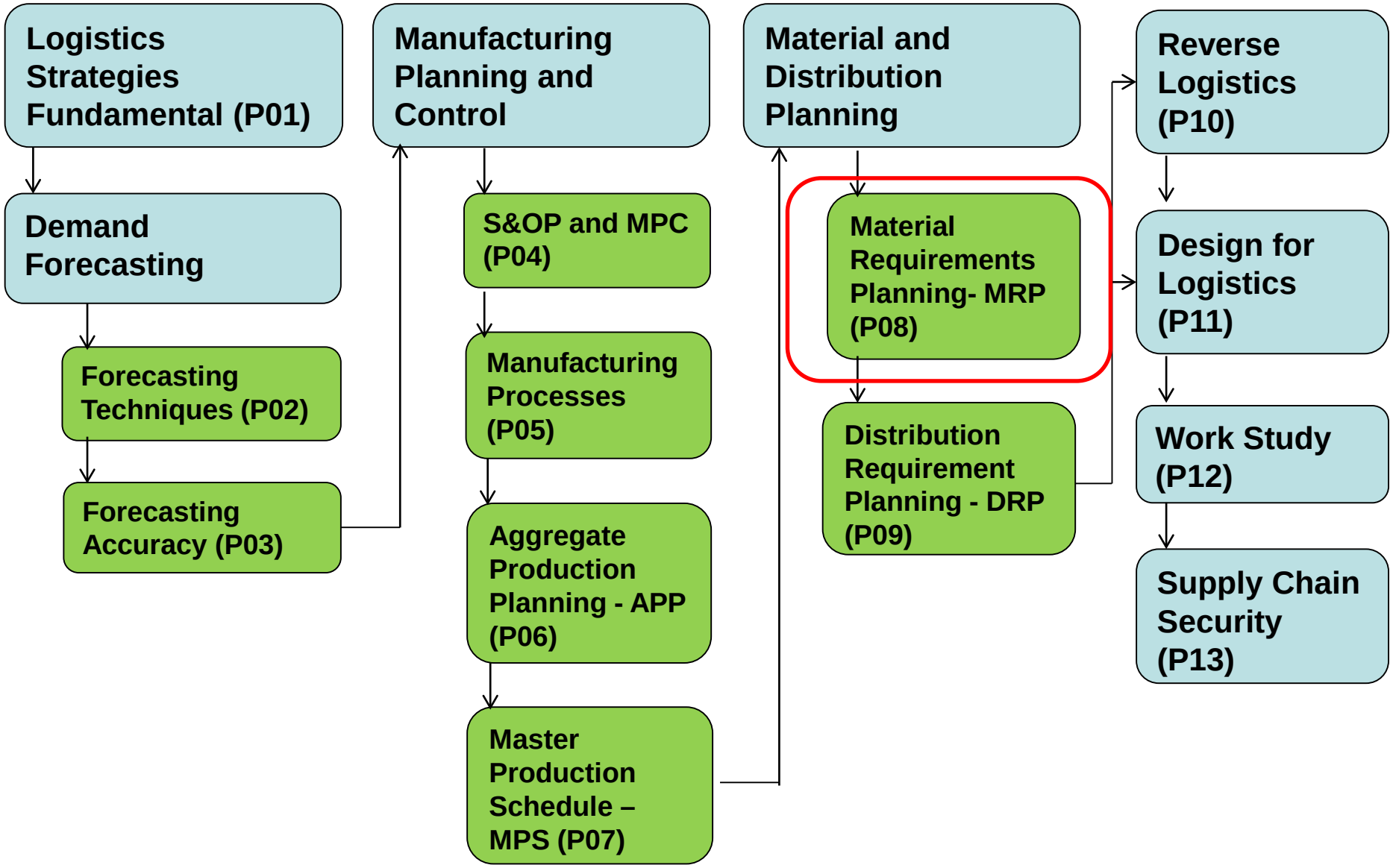
Problem 08
Let's Plan for the Materials

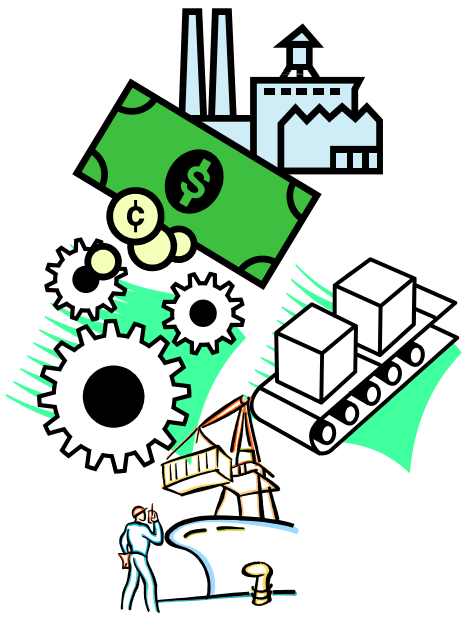
SCHOOL OF ENGINEERING

E222 – Logistics Planning and Control

E222 Logistics Planning and Control – Topic Tree



P08 – Let's Plan for the Materials



- Explain Material Requirement Planning (MRP)
- Interpret Bill of Material Structure
- Generate and update MRP
- Explain the pros and cons of MRP Updating Approaches
  - Regenerative Method
  - Net Change Method

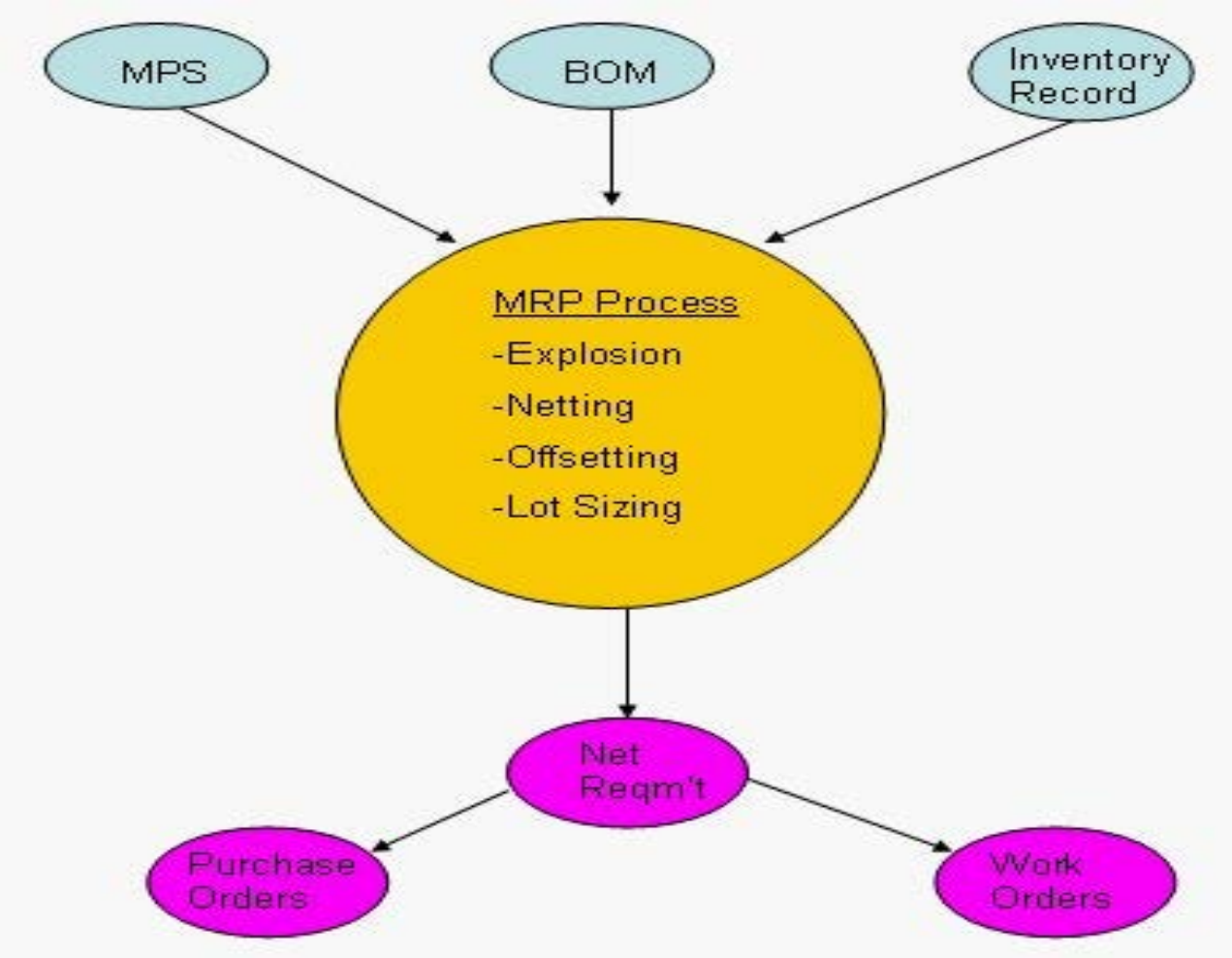
Material Requirement Planning (MRP)

- **An MRP system generates time-phased requirements for components or raw materials to be used for production.**
- **The inputs to a MRP system are**

1. **Inventory record**
2. **Master production schedule (MPS)**
3. **Bill of material (BOM)**
   - **BOM is a listing of all sub-assemblies, intermediates, parts and raw materials that go into making the parent assembly showing the quantities of each required to make an assembly (APICS Definition)**

- **MRP output is net requirement, used in generating purchase and work orders.**

MRP System Overview

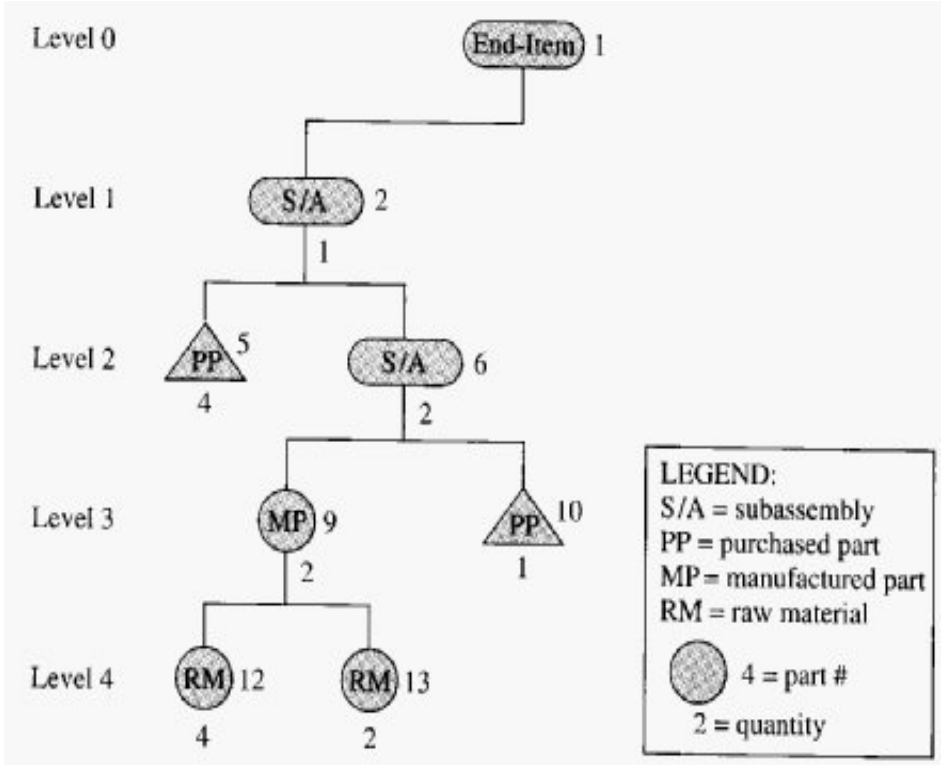


MRP Process Sequence

- **Explosion : Use information from MPS and BOM to derive quantity required for every product component and raw material**
- **Netting : Gross requirements are adjusted (at every level of the BOM & for each time bucket) to account for inventory and receipts**
- **Offsetting : Timing of order release is determined, to take into account production and supplier lead times**
- **Lot sizing : Batch size to be purchased or produced is determined**

MRP Explosion – illustration

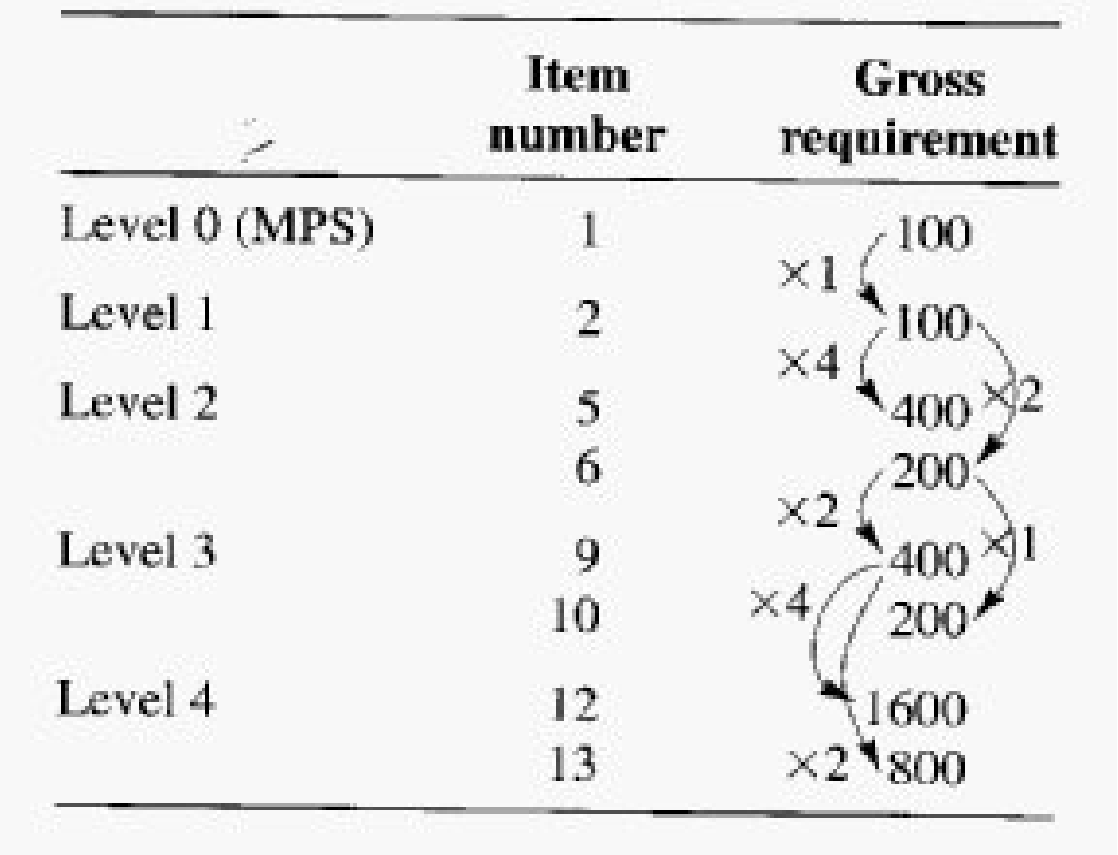
BOM Information



	Item number	Gross requirement
Level 0 (MPS)	1	100
		×1
Level 1	2	100
		×4
Level 2	5	400 ×2
	6	200
		×2
Level 3	9	400 ×1
	10	×4 200
Level 4	12	1600
	13	×2 800

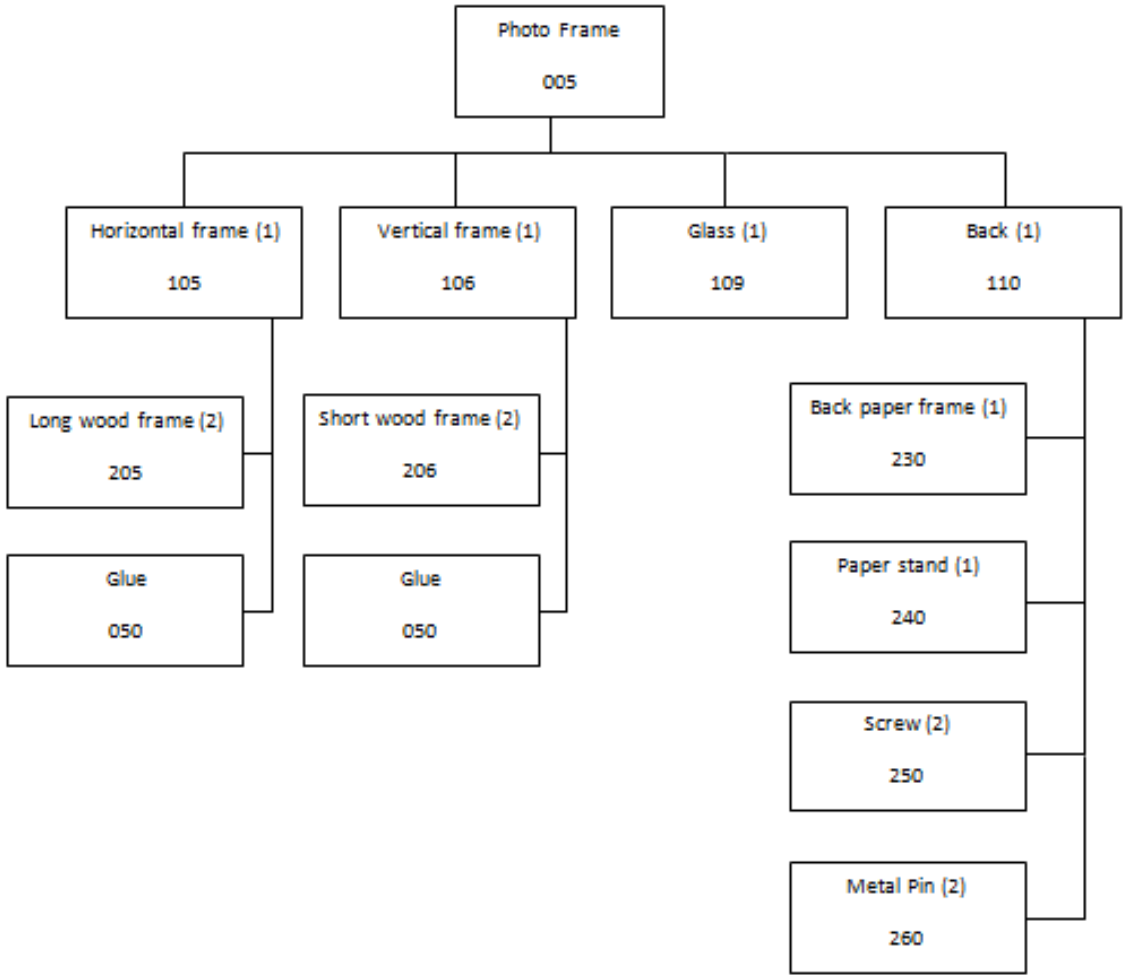
MRP Explosion – illustration

BOM Information



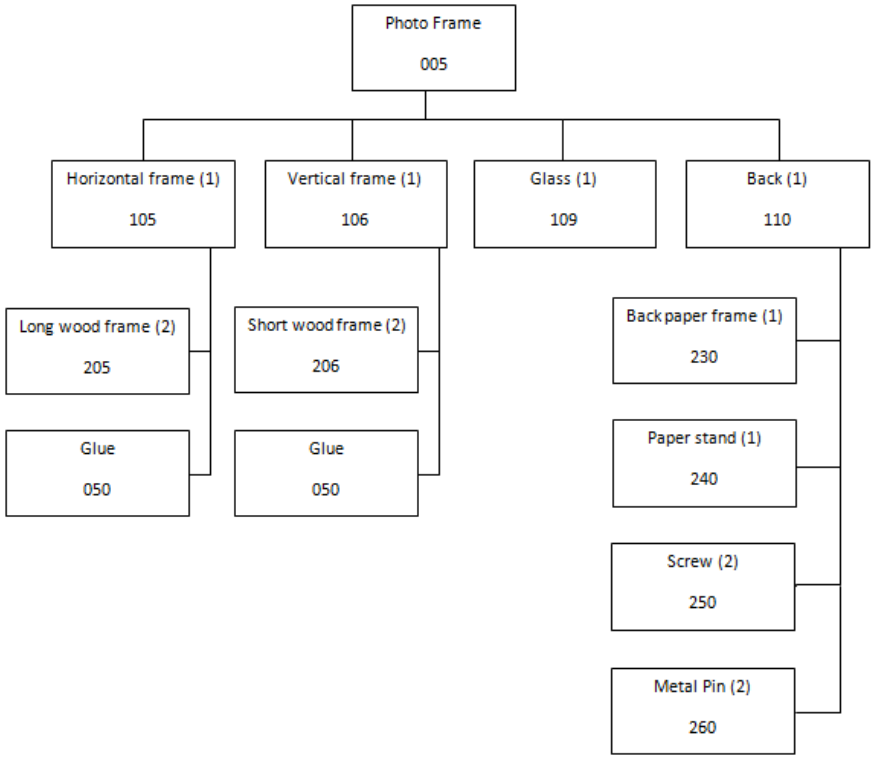
Bill of Material (Multilevel Bill)

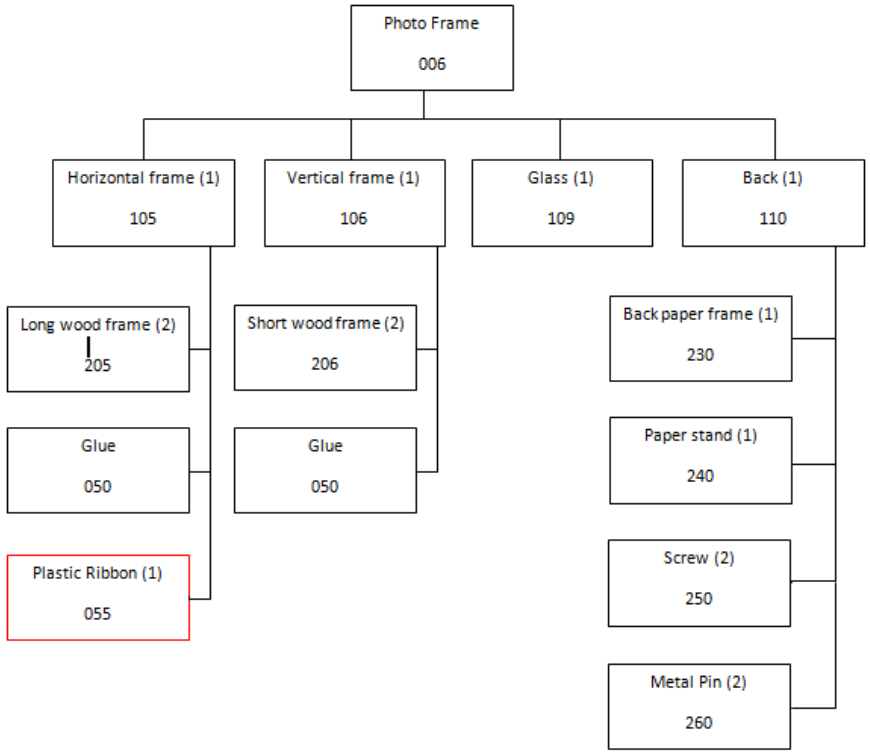
- Multilevel bills are formed as logical groupings of parts into subassemblies based on the way the product is assembled



Bill of Material (Multiple Bill)

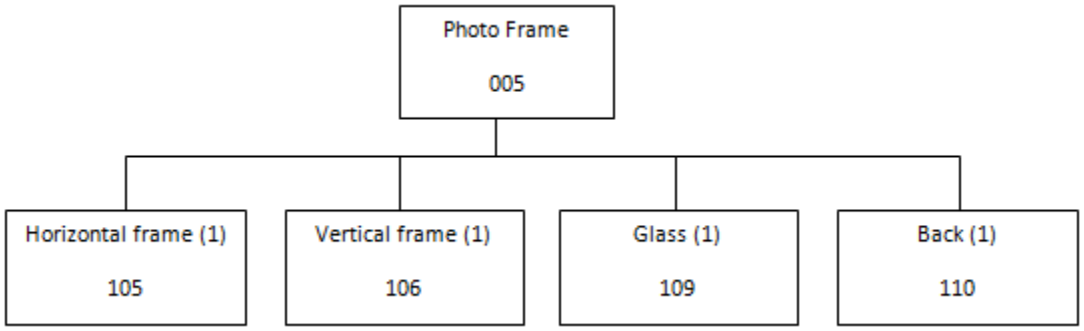
- A multiple bill is used when companies usually make more than one product, and the same components are often used in several products. This is particularly true with families of products

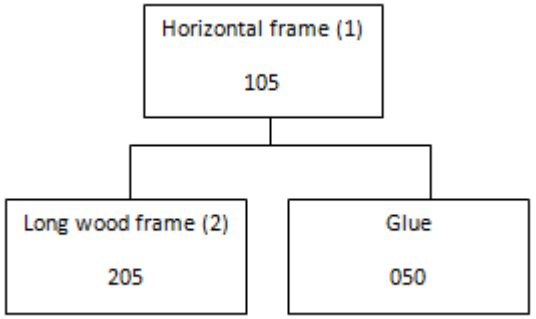


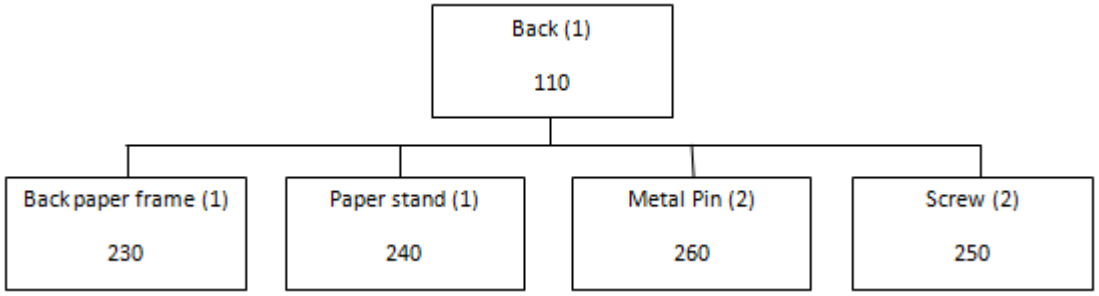


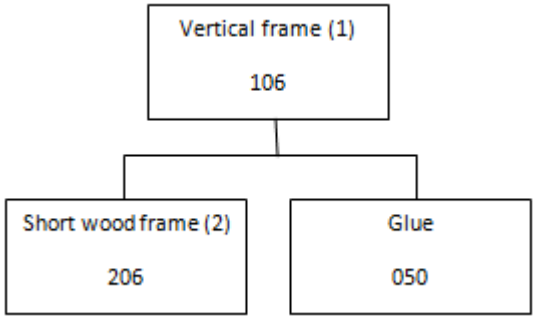
Bill of Material (Single-level Bills)

- A single-level bill of materials contain only the parent and its intermediate components









Original Material Requirements Planning

Week	0	1	2	3	4	5	6	7	8
Gross requirements		1000	1000	2000	1000	1000	1000	1000	1000
Scheduled receipts		800	0	0	0	0	0	0	0
Net requirements		-1100	-100	1900	100	-300	700	300	-100
On-hand	1300	1100	100	900	1300	300	700	1100	100
Planned receipts		0	0	2800	1400	0	1400	1400	0
Planned order release		0	2800	1400	0	1400	1400	0	

1) Referring to BOM, gross requirement for Rubber seals is **2** for each Mbox5 speakers (**explosion** of required quantities)
2) Scheduled receipts refer to castors that are to be received due to open work or purchase order (open work order is assumed here)
3) Lot size is assumed to be 1400 (**lot sizing**) Assume receipt at the beginning of the week

   Net requirement (**netting**) = Gross requirements – Scheduled receipts – On-hand quantity (previous week)

4) Offsetting process is done in Planned Order Release to cater for the **1-week lead time**

Changes that Affect MRP

- **Forecasts/ Demand (MPS) changes**
- **Product structure changes**
- **Promised deliveries arriving late**
- **Lead time changes**

- **Note: Whenever there are any changes, it should be updated accurately and quickly**

MRP Updating Methods

- **The two basic methods used to update the MRP records are:**
  - ✓ **Net Change**
  - ✓ **Regenerative**
- **A Regenerative System is updated periodically while a Net-Change system is updated continuously.**

Regenerative Method

- **The entire material plan is recalculated, based on the current MPS and exploding the entire BOM.**
- **Each item record is completely recalculated. (i.e. all part numbers are reconstructed and current planning orders are removed.)**
- **All requirements are recalculated, as are the inventory data and planned orders.**

Net Change Method

- Recalculates requirements only for those items affected by change; i.e. A partial explosion is performed, only the changes are exploded through the system, level by level. The entire plan is not regenerated.
- Only additions and deletions from the master schedule are entered.
- Production plan modified to reflect changes as they occur, e.g. some defective purchased parts had to be returned to a vendor.

New MPS

New MPS

Week	Previous Inventory	Requirement	MPS	Projected Inventory
1	750	900	500	350
2	350	650	500	200
3	200	820	1000	380
4	380	0	0	380
5	380	680	500	200
6	200	500	500	200
7	200	420	500	280
8	280	340	500	440

Change in the requirement in week 4 will affect the MPS, which is the input to MRP (net change/regenerative updating method)

Updated MRP Record (Regenerative Method)

Regeneration

Week	0	1	2	3	4	5	6	7	8
Gross requirements		1000	1000	2000	0	1000	1000	1000	1000
Scheduled receipts		800	0	0	0	0	0	0	0
Net requirements		-1100	-100	1900	-900	100	-300	700	300
On-hand	1300	1100	100	900	900	1300	300	700	1100
Planned receipts		0	0	2800	0	1400	0	1400	1400
Planned order release		0	2800	0	1400	0	1400	1400	

- **Entire MRP record is regenerated, but changes are only in the highlighted boxes**
- **Other files such as BOM, inventory data and rest of the MRP records are also completely regenerated.**

Updated MRP Record (Net Change Method)

Net Change

Week	0	1	2	3	4	5	6	7	8
Gross requirements					0	1000	1000	1000	1000
Scheduled receipts					0	0	0	0	0
Net requirements					-900	100	-300	700	300
On-hand					900	1300	300	700	1100
Planned receipts					0	1400	0	1400	1400
Planned order release				0	1400	0	1400	1400	

- **Only records that need changing will be updated. The net change in requirements is updated in Week 4, 5, 6, 7 and 8.**
- **The blank records in the table above mean no recalculation needed unlike Regenerative method where all records are recalculated**
- **In Net Change method, the system will immediately update the net change, i.e. 0 (week 4) in gross requirements and 0(week 3 & 5) and +1400(week 4 & 7) in planned order release**
- **MRP records of other components are processed in the same manner**
- **All inventory data are kept current with the update of 'On-hand' quantities**

Regenerative Method

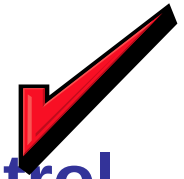
- **Suitable for fairly stable systems**
- **Disadvantages:**
- **Deterioration of MRP – status and requirements are not updated constantly.**
- **Long computer time**

- **Advantages:**
- **Less processing costs (frequency of updating is lesser for this method therefore requiring less computing power)**

Net Change Method

- **Suitable for systems that have frequent changes**
- **Disadvantages:**
- **High processing costs due to many small and frequent updates (require more computing power)**
- **Net change may generate too many action notices**

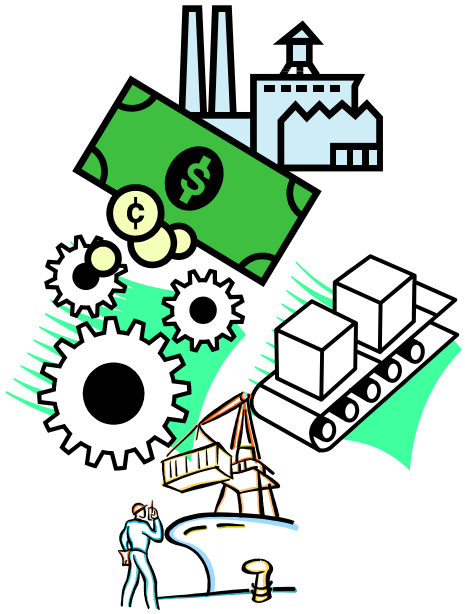
- **Advantages:**
- **Quick on-the-spot implementation**
- **Requires little computer time**
- **Up-to-date information for planning and control purposes**



Conclusion

- **Both Regenerative and Net Change methods are available and applied in conjunction in most Enterprise Resource Planning (ERP) software**
- **Regeneration is usually performed once a week or once a month to clean up all records**
- **Between regenerations, the records can be updated using the Net Change method**
- **Decision to operate Regeneration or Net Change method depends on the nature of manufacturing environment.**

Learning Outcome



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