

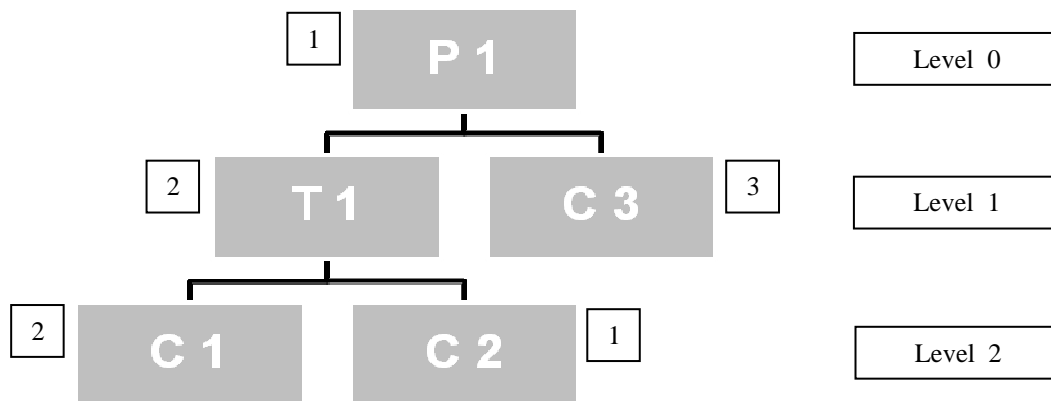
MRP I SYSTEMS AND MRP II SYSTEMS

GUIDED PROBLEM - 1

Exercise: Calculate the Material Requirement Planning for the product P1 in the following case:

(We introduce each INPUT we will require to make the calculation of the manufacture and purchase orders)

Structure of the product P1 to be manufactured:



- By agreement, **level 0** is the finished product level; therefore, it is that of *finished product P1*. In level 1, there is an assembly T1 and a component C3. In level 2, we have the two components of subassembly T1.
- Each level step (0 to 1) indicates a stage in the manufacture process, which can be translated, in general, as an intermediate storage.

Production master schedule

In our case, P1 and C3 are independent demand products, that is, they are manufactured under the demand of external customers. P1 is a finished product and C3 is a component that, besides, is sold as a spare part.

The production master plan we should meet is the following:

Products\Date	01-Apr	08- Apr	15- Apr	22- Apr
P1	240	220	260	200
C3	250	220	270	310

The information about the finished product P1 and each subassembly and component which form it the system will require and we are going to use is:

PRODUCTS	SFT STOCK	REP TERM MANUF TERM	% FAILURES	AVAIL STOCK	LOT
P1	5	1	0	3	M5
T1	0	2	2	4	M10
C3	9	1	4	12	M25
C1	6	1	5	9	M50
C2	8	1	6	12	M25

From this information a MRP I system carries out the following steps:

- a) A file is generated (as in the figure) of the final product P1 (Level 0) with requirement dates in columns and with gross requirements, available stock, net requirements and manufacture order launch in rows.

P1	04-Mar	11- Mar	18- Mar	25- Mar	01-Apr	08- Apr	15- Apr	22- Apr
Gross requirements								
Available stock								
Net requirements								
M.O. launches								

- The gross requirements of each reference of product P1 at Level 0 are completed: they are the amounts stated in the Master Schedule we have to manufacture with their corresponding finishing dates (exact quantities and dates)

Data of the Master Schedule

P1	04-Mar	11- Mar	18- Mar	25- Mar	01-Apr	08- Apr	15- Apr	22- Apr
Gross requirements					240	220	260	200
Available stock								
Net requirements								
M.O. launches								

- The available stock is completed for each product on current date (in our case, 3 units for the week of 1st April)

- Besides, the net requirements are the addition of the **gross requirements** and the safety stock, minus the **available stock** in the warehouse.

In our case: $240 + 5 - 3 = 242$

P1	04-Mar	11- Mar	18- Mar	25- Mar	01-Apr	08- Apr	15- Apr	22- Apr
Gross requirements					240	220	260	200
Available stock					3			
Net requirements					242			
M.O. launches								

- Order launches: we calculate the exact quantity required, taking into account the % of failure in the manufacturing operation.

In our case, the number of items to be manufactured will be 245 units, (we start from a requirement of 242 units the failure % is 0 and the 5 multiple immediately above is 245)

- We determine the manufacture order launching date, which will be: Date of Requirement - manufacture or replacement term.

In our case, as the manufacture term is 1 week, the launch should be on the week of 25 March, so that the material is available by the week of 1st April.

P1	04-Mar	11- Mar	18- Mar	25- Mar	01-Apr	08- Apr	15- Apr	22- Apr
Gross requirements					240			
Available stock				M 5	3			
Net requirements					242			
M.O. launches				245				

Following the same procedure, we complete the file for the product P1, for each week, taking into account that to calculate the available inventory, we should take into account the extra we have manufactured last week, plus the safety stock.

For example, for the week of 8 April, we have 3 extra launched ($245 - 242$) + 5 of safety stock = 8 available units.

P1	04-Mar	11- Mar	18- Mar	25- Mar	01-Apr	08- Apr	15- Apr	22- Apr
Gross requirements					240	220	260	200
Available stock					3	8	8	8
Net requirements					242	217	257	197
M.O. launches				245	220	260	200	

b) Calculations at Level 1 of the Bill of Materials, which are the subassembly T1 and the component C3. We have to remember that to assemble one final product P1, it is necessary to have 2 T1 subassemblies and 3 components C3.

T1	04-Mar	11- Mar	18- Mar	25- Mar	01-Apr	08- Apr	15- Apr	22- Apr
Gross requirements								
Available stock								
Net requirements								
M.O. launches								

C3	04-Mar	11- Mar	18- Mar	25- Mar	01-Apr	08- Apr	15- Apr	22- Apr
Gross requirements								
Available stock								
Net requirements								
M.O. launches								

- We complete the gross requirements of the reference of assembly T1 level 1. In this case, according to the bill of materials, they will be the P1 launched multiplied by the two T1 assemblies required. Thus, we have:

P1	04-Mar	11- Mar	18- Mar	25- Mar	01-Apr	08- Apr	15- Apr	22- Apr
Gross requirements					240	220	260	200
Available stock					3	8	8	8
Net requirements					242	217	257	197
M.O. launches				245	220	260	200	

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 Launches of P1 x 2 = T1 required

T1	04-Mar	11- Mar	18- Mar	25- Mar	01-Apr	08- Apr	15- Apr	22- Apr
Gross requirements				490	440	520	400	
Available stock								
Net requirements								
M.O. launches								

- We complete the available stock of each product on current date (in our case for the week of 25 March) and we complete the box of the week of 25 March for available stock in the warehouse, in our case 4.
- On the other hand, the net requirements are the addition of the gross requirements and the safety stock minus the available stock in the warehouse.

In our case, $490 + 0 - 4 = 486$

T1	04-Mar	11- Mar	18- Mar	25- Mar	01-Apr	08- Apr	15- Apr	22- Apr
Gross requirements				490	440	520	400	
Available stock				4				
Net requirements				486				
M.O. launches								

- We determine the order launches: they are the exact quantity of the net requirement, in our case multiple of 10 unit lot with a 2% failures in assembly, so we have to oversize the lot 2%.

In our case, the requirements are 486 units, plus 2% due to the failures we have in the manufacture process, which are calculated dividing the net requirements by the amount per one of correct parts, that is 0.98 correct. Therefore, the launches will be $486/0.98 = 496$ units, but as they should be multiple of 10, we have to launch a lot of 500 units of T1 to manufacture.

- We determine the launching date for the manufacture orders, which will be: Requirement Date - Manufacture or replacement term.

In our case, two weeks before, the requirement date is on 25 March and, as the manufacture term is two weeks, the launch will be on 11 March.

T1	04-Mar	11- Mar	18- Mar	25- Mar	01-Apr	08- Apr	15- Apr	22- Apr
Gross requirements				490				
Available stock				4				
Net requirements				486				
M.O. launches		500						

multiple of 10 lot and 2% failure.

Manufacture term 2 weeks

Following the same procedure, we complete the file for product T1, and taking into account that the available stock is what we have manufactured exceeding the previous two weeks, minus the failures, plus the safety stock. That is: $500 - 10 \text{ failures } (500 \times 0,02) = 490$ correct, minus 486 net requirements, plus 0 safety stock = 4 available stock on the 1 April week.

T1	04-Mar	11- Mar	18- Mar	25- Mar	01-Apr	08- Apr	15- Apr	22- Apr
Gross requirements				490	440	520	400	
Available stock				4	4	5	4	5
Net requirements				486	436	515	396	
M.O. launches		500	450	530	410			

- We complete the Gross Requirements of the reference of component C3 level 1. In this case and, according to the structure, they will be the P1 launches multiplied by the three units of C3 required and, as component C3 is sold as a spare part, we have to add the amounts of this component that appear in the production plan. Thus, we have.

P1	04-Mar	11- Mar	18- Mar	25- Mar	01-Apr	08- Apr	15- Apr	22- Apr
Gross requirements					240	220	260	200
Available stock					3	8	8	8
Net requirements					242	217	257	197
M.O. launches				245	220	260	200	

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Launches of P1 x 3 + C3 Master Production Schedule = Gross requirements of C3

C3	04-Mar	11- Mar	18- Mar	25- Mar	01-Apr	08- Apr	15- Apr	22- Apr
Gross requirements				735	910	1000	870	310
Available stock								
Net requirements								
M.O. launches								

- We complete the available stock of each product on current date (in our case for the 25 March week). We fill in the box of the 25 March week for the available stock on store, in our case, 12.
- Besides, the net requirements are the addition of the gross requirements plus the safety stock, minus the available stock.

In our case, $735 + 9 - 12 = 732$

C3	04-Mar	11- Mar	18- Mar	25- Mar	01-Apr	08- Apr	15- Apr	22- Apr
Gross requirements				735	910	1000	870	310
Available stock				12				
Net requirements				732				
M.O. launches								

- We determine the order launches: from the accurate quantity of the net requirement, we consider that the lots are multiple of 25 units and that we have 4% failures in manufacture, so we have to manufacture 4% more of the lot.

In our case, it will be 732, with 4% failure units, calculated by dividing the net requirements by the amount per one of correct parts; that is 0.96 correct. Therefore, the launches will be $732/0.96 = 763$ units, but, as they have to be multiple of 25, we have to launch 775 units of C3 to manufacture.

- We determine the launch date for the manufacture orders, which is: Requirement Date - Manufacture or Replacement Date.

In our case, one week before. The Requirement date is on 25 March and, as the manufacture lasts one week, the launch will be on 18 March.

C3	04-Mar	11- Mar	18- Mar	25- Mar	01-Apr	08- Apr	15- Apr	22- Apr
Gross requirements				735				
Available stock				12				
Net requirements				732				
M.O. launches			775					

Multiple of 25 lots and 4% failures



Manufacture term 1 week

Following the same procedure, we complete the file for the product C3 and, taking into account that the available stock on the week of 1 April is what we have manufactured spare on the two previous weeks, minus the failures and plus the safety stock. That is, $775 - 31$ failures (775×0.04) = 744 correct, minus the 732 net requirements and plus 9 of safety stock = 21 available stock on the week of 1 April.

C3	04-Mar	11- Mar	18- Mar	25- Mar	01-Apr	08- Apr	15- Apr	22- Apr
Gross requirements				735	910	1000	870	310
Available stock				12	21	23	31	25
Net requirements				732	896	986	848	294
M.O. launches			775	950	1050	900	325	

- c) Level 2 calculations of Bill of Material, which are the components C1 and C2, taking into account that to assemble a subassembly T1, it is necessary to have 2 components C1 and 1 component C2.

Proceeding as in the previous cases, and taking into account the relation between them in the bill of materials, we will determine the gross requirements of C1 as the product of the launches of T1 by 2.

T1	04-March	11-March	18-March	25-March	01-Apr	08- Apr	15- Apr	22- Apr
Gross requirements				490	440	520	400	
Available stock				4	4	5	4	5
Net requirements				486	436	515	396	
M.O. launches		500	450	530	410			



Launches of T1 x 2 = gross requirements of C1

C1	04-Mar	11- Mar	18- Mar	25- Mar	01-Apr	08- Apr	15- Apr	22- Apr
Gross requirements		1000	900	1060	820			
Available stock								
Net requirements								
M.O. launches								

- We complete the available stock of each product on current date (in our case for the week of 11 March), we complete the box of the week of 11 March for available stock, in our case, 9.
- Besides, the net requirements are the addition of the gross requirements plus the safety stock, minus the available stock.

In our case $1000 + 6 - 9 = 997$

C1	04-Mar	11- Mar	18- Mar	25- Mar	01-Apr	08- Apr	15- Apr	22- Apr
Gross requirements		1000	900	1060	820			
Available stock		9						
Net requirements		997						
M.O. launches								

- We determine the order launches: from the accurate quantity of the net requirement, we consider that the lots are multiple of 50 units and that we have 5% failures in manufacture, so we have to manufacture 5% more of the lot.

In our case, it will be 997, with 5% failure units, calculated by dividing the net requirements by the amount per one of correct parts; that is 0.95 correct. Therefore, the launches will be $997/0.95 = 1049.4$ units, but, as they have to be multiple of 50, we have to launch 1050 units of C3 to manufacture.

- We determine the launch date for the manufacture orders, which is: Requirement Date - Manufacture or Renewal Date.

In our case, one week before. The Requirement date is on 11 March and, as the manufacture lasts one week, the launch will be on 4 March.

C1	04-Mar	11- Mar	18- Mar	25- Mar	01-Apr	08- Apr	15- Apr	22- Apr
Gross requirements		1000	900	1060	820			
Available stock		9						
Net requirements		997						
M.O. launches	1050							

Multiple of 50 lots and 5% failures.

Manufacture term 1 week

Following the same procedure, we complete the file for the product C1 and, taking into account that the available stock is what we have manufactured spare on the week before, minus the failures and plus the safety stock. That is, $1050 - 53$ failures (1050×0.05) = 997 correct, minus the 997 net requirements and plus 6 of safety stock = 6 available stock on the week of 1 April.

C1	04-Mar	11- Mar	18- Mar	25- Mar	01-Apr	08- Apr	15- Apr	22- Apr
Gross requirements		1000	900	1060	820			
Available stock		9	6	8	40			
Net requirements		997	900	1058	786			
M.O. launches	1050	950	1150	850				

We go on the same and calculate the file for component C2

C2	04-Mar	11- Mar	18- Mar	25- Mar	01-Apr	08- Apr	15- Apr	22- Apr
Gross requirements		500	450	530	410			
Available stock		12	29	25	12			
Net requirements		496	429	513	406			
M.O. launches	530	475	550	450				

After completing the files, we will be able to indicate the dates to launch the manufacture orders, as well as, knowing the delivery term for each raw material, the date of the required orders to meet the manufacture orders.