
**PLANNING OF MATERIAL FLOWS**
**IN THE SUPPLY CHAIN**
**BASED ON ALGORITHMS OF ERP SYSTEMS**

**THEORY, CASE STUDIES, WORKSHOP**

POZNAN SCHOOL OF LOGISTICS

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**PART 1**
**DISTRIBUTION REQUIREMENTS PLANNING**
**DRP I**
**THEORY, CASE STUDIES, WORKSHOP**

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## THEORY





**Distribution requirements planning - DRP I**

**is adapts the material requirements planning method (MRP I)**

**to meet the demands of the flow of goods**

**in multi-level distribution networks.**

**There is a special procedure to be put to use**

**only in the and supply chain distribution.**





**The following input data is used in distribution requirements planning:**
**- gross requirements,**
**- the structure of distribution channels (distribution structure),**
**- free inventory,**
**- delivery size,**
**- delivery cycles.**

Gross requirement for a given product (orders, forecasts) at the specific level of distribution channel is calculated based on the structure of the distribution.

The distribution channel should be understood as a concrete path a product travels in the distribution network.

Stock quantity (records) is defined by disposable stock.

Delivery lot size is determined using one of the lot sizing models.

Delivery lead time is the period of time between order placement and delivery.





**The following output data can be determined based on input data:**
**- net requirements,**
**- delivery planning,**
**- order planning.**

Net requirements denote real requirements of the distribution network link less the available stock level.

Planned deliveries determine delivery lead times and sizes required to meet net requirements.

Planned orders determine delivery lead times and sizes required to meet net requirements.

## PURPOSE

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The purpose of DRP I is **to eliminate all stocks in the network**
- as understood in inventory management,
**namely safety stock and cycle stock at all levels of the distribution network, outside points of sale**.

**Safety stock is created for each product at the points of sale level**
to counter the risk of demand fluctuations.

Safety stock ensures that the requirements are met continuously
if the demand exceeds disposable stock levels
(even though the level of disposable stock is zero,
the demand can be still met from the safety stock).

In such cases safety stock must be replenished as soon as possible.



## MECHANISM AND ESSENCE OF THE DRP I

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**MECHANISM**

- Requirement forecast is prepared for each final point of sale.

- This requirement forecast provides a basis for drawing up a delivery schedule for each final point of sale.

- Order schedule is developed for each final point of sale based on the requirement forecast.

- Order schedule for the lower link in the supply chain automatically becomes a requirement forecast for a higher link it is supplied by in the distribution network.

- This situation is repeated at subsequent (higher) levels of the distribution network.
The entire distribution network can be controlled by one shared planning mechanism.

**ESSENCE**

**The orders from lower distribution links**
**constitute requirement forecasts for higher distribution links.**



## DRP I PRINCIPLES

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**ORDER NETTING PRINCIPLE**

A product sales forecast is equal to the requirement for this product.
**Net requirement is calculated by comparing the amount of inventory in stock and in in orders with the sales forecast - by subtracting stock quantity from sales forecast.**
Net requirements provide a basis for further sales forecasting in the distribution network.

**TIME PHASING PRINCIPLE**

Time phasing means the total forecast is spread over particular distribution network links over a time scale.
**Time phasing, assuming the familiarity with order lead time (delivery cycle) allows for defining the exact moment in which sales forecasts will occur at specific levels of the distribution network.**



## DRP I PRINCIPLES

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**TIME BUCKETS**

There are two time buckets:
**- short - man hour, shift, workday,**
**- long - work week, decade, month.**

**STOCK CALCULATION MOMENT**

There are two stock calculation models:
**- at the opening of the day,**
**- at the closing of the day.**

Stock sizing based on all-time stock is recommended for short time buckets.

There are no specific recommendations for stock calculation for long time buckets.



## DRP I PRINCIPLES

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**Stock calculation at the opening of the day**
- stock calculated in period n is the result of subtracting sales forecast and stock level in period m, increased by deliveries which have arrived in delivery period m - e.g. stock (20) less sales forecast (10) in the first period = stock (10) in the second period (opening stock)

| Time buckets | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Sales forecast | 10 | 5 | 15 | 20 | 5 |
| Disposable stock | 20 | 10 | 5 | 10 | 10 |
| Net requirements | | | 10 | 10 | |
| Planned delivery | | | 20 | 20 | |
| Planned orders | | 20 | 20 | | |



## DRP I PRINCIPLES

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**Stock calculation at the closing of the day**
- stock calculated in period n is the result of subtracting sales forecast and stock level in period n, including the deliveries which have arrived in delivery period n - e.g. stock (20) less sales forecast in the second period (5) = stock (15) in the second period (all-time stock).

| Time buckets | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Sales forecast | 10 | 5 | 15 | 20 | 5 |
| Disposable stock | 20 | 15 | 0 | 0 | 0 |
| Net requirements | | | | 20 | 5 |
| Planned delivery | | | | 20 | 20 |
| Planned orders | | | 20 | 20 | |

PART 1.2

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# CASE STUDIES



RETAIL - WHOLESALE PLANNING
DESCRIPTION

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**The distribution network is composed by two retailers (R1 and R2)**

**who stock up at the same wholesaler (W).** Other data:

- sales forecasts for R1 and R2 have been included in the table

- stock: for R1 = 40 units, for R2 = 30 units, for W = 120 units

- delivery quantity: for R1 = 20 units, for R2 = 25 units, for W = 40 units

- delivery cycle: R1 = 2 weeks, for R2 = 1 week, for W = 2 weeks.

Calculate DRP schedule for the period January - February



RETAIL - WHOLESALE PLANNING
INPUT DATA

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After input data has been entered DRP schedule has the following form (table).
The sales forecast line displays weekly forecasts for both retailers.
In order to facilitate the calculations for each link the following data has been entered: disposable stock quantity (S), delivery quantity (DQ) and delivery cycle (DC).
The first forecast week displays disposable stock levels for each link.

| | | January | | | | February | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Time buckets | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| R1 | Sales forecast | 15 | 20 | 15 | 25 | 20 | 15 | 25 | 20 |
| | Disposable stock | 40 | | | | | | | |
| S = 40 | Net requirements | | | | | | | | |
| DQ = 20 | Planned delivery | | | | | | | | |
| DC = 2 | Planned orders | | | | | | | | |
| R2 | Sales forecast | 25 | 30 | 30 | 25 | 35 | 35 | 20 | 35 |
| | Disposable stock | 30 | | | | | | | |
| S = 30 | Net requirements | | | | | | | | |
| DQ = 25 | Planned delivery | | | | | | | | |
| DC = 1 | Planned orders | | | | | | | | |
| W | Sales forecast | | | | | | | | |
| | Disposable stock | 120 | | | | | | | |
| S = 120 | Net requirements | | | | | | | | |
| DQ = 40 | Planned delivery | | | | | | | | |
| DC = 2 | Planned orders | | | | | | | | |



RETAIL - WHOLESALE PLANNING
CALCULATIONS

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Schedule calculations for R1 and R2 have been completed accordingly (table for R1 and R2).
With the use of DRP I method we can move orders from lower distribution links (planning retailer orders R1 and R2) on higher link requirement forecasts in the distribution network (wholesaler W sales forecast).
Schedule calculations for W are performed using the same model.

| | | January | | | | February | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Time buckets | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| R1 | Sales forecast | 15 | 20 | 15 | 25 | 20 | 15 | 25 | 20 |
| | Disposable stock | 40 | 25 | 5 | 10 | 5 | 5 | 10 | 5 |
| S = 40 | Net requirements | | | 10 | 15 | 15 | 10 | 15 | 15 |
| DQ = 20 | Planned delivery | | | 20 | 20 | 20 | 20 | 20 | 20 |
| DC = 2 | Planned orders | 20 | 20 | 20 | 20 | 20 | 20 | | |
| R2 | Sales forecast | 25 | 30 | 30 | 25 | 35 | 35 | 20 | 35 |
| | Disposable stock | 30 | 5 | 0 | 20 | 20 | 10 | 0 | 5 |
| S = 30 | Net requirements | | 25 | 30 | 5 | 15 | 25 | 20 | 30 |
| DQ = 25 | Planned delivery | | 25 | 50 | 25 | 25 | 25 | 25 | 50 |
| DC = 1 | Planned orders | 25 | 50 | 25 | 25 | 25 | 25 | 50 | |
| W | Sales forecast | 45 | 70 | 45 | 45 | 45 | 45 | 50 | 0 |
| | Disposable stock | 120 | | | | | | | |
| S = 120 | Net requirements | | | | | | | | |
| DQ = 40 | Planned delivery | | | | | | | | |
| DC = 2 | Planned orders | | | | | | | | |



RETAIL - WHOLESALE PLANNING
RESULTS

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| | | January | | | | February | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Time buckets | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| R1 | Sales forecast | 15 | 20 | 15 | 25 | 20 | 15 | 25 | 20 |
| | Disposable stock | 40 | 25 | 5 | 10 | 5 | 5 | 10 | 5 |
| S = 40 | Net requirements | | | 10 | 15 | 15 | 10 | 15 | 15 |
| DQ = 20 | Planned delivery | | | 20 | 20 | 20 | 20 | 20 | 20 |
| DC = 2 | Planned orders | 20 | 20 | 20 | 20 | 20 | 20 | | |
| R2 | Sales forecast | 25 | 30 | 30 | 25 | 35 | 35 | 20 | 35 |
| | Disposable stock | 30 | 5 | 0 | 20 | 20 | 10 | 0 | 5 |
| S = 30 | Net requirements | | 25 | 30 | 5 | 15 | 25 | 20 | 30 |
| DQ = 25 | Planned delivery | | 25 | 50 | 25 | 25 | 25 | 25 | 50 |
| DC = 1 | Planned orders | 25 | 50 | 25 | 25 | 25 | 25 | 50 | |
| W | Sales forecast | 45 | 70 | 45 | 45 | 45 | 45 | 50 | 0 |
| | Disposable stock | 120 | 75 | 5 | 0 | 35 | 30 | 25 | 15 |
| S = 120 | Net requirements | | | 40 | 45 | 10 | 15 | 25 | |
| DQ = 40 | Planned delivery | | | 40 | 80 | 40 | 40 | 40 | |
| DC = 2 | Planned orders | 40 | 80 | 40 | 40 | 40 | | | |



WHOLESALE - REGIONAL WAREHOUSE PLANNING
DESCRIPTION

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**The distribution network is created by two wholesalers (W1 and W2)**

**who stock up at the same regional warehouse (RW).** Other data:

- sales forecasts for W1 and W2 (retail orders) have been presented in the table

- stock: for W1 = 120 units, for W2 = 100 units, for RW = 250 units

- delivery quantity: for W1 = 20 units, for W2 = 50 units, for RW = 250 units

- delivery cycle: for W1 = 2 weeks, for W2 = 1 week, for RW = 2 weeks.

Wholesaler W1 is the same link, as in the example above - it has already been calculated.

It is necessary to calculate the value for the second wholesaler (W2) and regional warehouse (RM).

Calculate DRP schedule for the period January - February.

## WHOLESALE - REGIONAL WAREHOUSE PLANNING INPUT DATA, CALCULATIONS

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After input data has been entered DRP schedule has the following form (table).
The sales forecast line displays weekly forecasts for both wholesalers.
In order to facilitate the calculations for each link the following data has been entered: disposable stock quantity (S), delivery quantity (DQ) and delivery cycle (DC).
The first forecast week displays disposable stock levels for each link.

| | | January | | | | February | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Time buckets | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| **W1** | Sales forecast | **45** | **70** | **45** | **45** | **45** | **45** | **50** | **0** |
| | Disposable stock | **120** | **75** | **5** | **0** | **35** | **30** | **25** | **15** |
| S = 120 | Net requirements | | | **40** | **45** | **10** | **15** | **25** | |
| DQ = 40 | Planned delivery | | | **40** | **80** | **40** | **40** | **40** | |
| DC = 2 | Planned orders | **40** | **80** | **40** | **40** | **40** | | | |
| **W2** | Sales forecast | **50** | **35** | **35** | **70** | **55** | **50** | **20** | **0** |
| | Disposable stock | **100** | | | | | | | |
| S = 100 | Net requirements | | | | | | | | |
| DQ = 50 | Planned delivery | | | | | | | | |
| DC = 1 | Planned orders | | | | | | | | |
| **RW** | Sales forecast | | | | | | | | |
| | Disposable stock | **250** | | | | | | | |
| S = 250 | Net requirements | | | | | | | | |
| DQ = 100 | Planned delivery | | | | | | | | |
| DC = 2 | Planned orders | | | | | | | | |



## WHOLESALE - REGIONAL WAREHOUSE PLANNING RESULTS

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Schedule calculations for W1 and W2 have been completed accordingly (table for W1 and W2).
With the use of DRP I method we can move orders from lower distribution links (planning wholesaler orders W1 and W2) on higher link requirement forecasts in the distribution network (regional warehouse RW sales forecast).
Schedule calculations for RW are performed using the same model.

| | | January | | | | February | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Time buckets | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| **W1** | Sales forecast | **45** | **70** | **45** | **45** | **45** | **45** | **50** | **0** |
| | Disposable stock | **120** | **75** | **5** | **0** | **35** | **30** | **25** | **15** |
| S = 120 | Net requirements | | | **40** | **45** | **10** | **15** | **25** | |
| DQ = 40 | Planned delivery | | | **40** | **80** | **40** | **40** | **40** | |
| DC = 2 | Planned orders | **40** | **80** | **40** | **40** | **40** | | | |
| **W2** | Sales forecast | **50** | **35** | **35** | **70** | **55** | **50** | **20** | **0** |
| | Disposable stock | **100** | **50** | **15** | **30** | **10** | **5** | **5** | **35** |
| S = 100 | Net requirements | | | **20** | **40** | **45** | **45** | **15** | |
| DQ = 50 | Planned delivery | | | **50** | **50** | **50** | **50** | **50** | |
| DC = 1 | Planned orders | | **50** | **50** | **50** | **50** | **50** | | |
| **RW** | Sales forecast | **40** | **130** | **90** | **90** | **90** | **50** | **0** | **0** |
| | Disposable stock | **250** | **210** | **80** | **90** | **0** | **10** | **60** | **60** |
| S = 250 | Net requirements | | | **10** | **0** | **90** | **40** | | |
| DQ = 100 | Planned delivery | | | **100** | | **100** | **100** | | |
| DC = 2 | Planned orders | **100** | | **100** | **100** | | | | |



## REGIONAL WAREHOUSE - CENTRAL WAREHOUSE PLANNING DESCRIPTION

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**The distribution network is created by two regional warehouses (RW1 and RW2)**

**which stock up at the same central warehouse (CW).** Other data:

- sales forecasts for RW1 and RW2 (wholesale orders) have been presented in the table

- stock: for RW1 = 250 units, for RW2 = 250 units, for CW = 500 units

- delivery quantity: for RW1 = 100 units, for RW2 = 150 units, for CW = 250 units

- delivery cycle: for RW1 = 2 weeks, for RW2 = 2 weeks, for CW = 3 weeks.

Regional warehouse RW1 is the same link, as in the example above - it has already been calculated.

It is necessary to calculate the value for the second regional warehouse (RW2) and central warehouse (CW).

Calculate the DRP schedule for the period January - February.



## REGIONAL WAREHOUSE - CENTRAL WAREHOUSE PLANNING INPUT DATA, CALCULATIONS

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After input data has been entered DRP schedule has the following form (table).
The sales forecast line displays weekly forecasts for both regional warehouses .
In order to facilitate the calculations for each link the following data has been entered: disposable stock quantity (S), delivery quantity (DQ) and delivery cycle (DC).
The first forecast week displays disposable stock levels for each link.

| | | January | | | | February | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Time buckets | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| **RW1** | Sales forecast | **40** | **130** | **90** | **90** | **90** | **50** | **0** | **0** |
| | Disposable stock | **250** | **210** | **80** | **90** | **0** | **10** | **60** | **60** |
| S = 250 | Net requirements | | | **10** | **0** | **90** | **40** | | |
| DQ = 100 | Planned delivery | | | **100** | | **100** | **100** | | |
| DC = 2 | Planned orders | **100** | | **100** | **100** | | | | |
| **RW2** | Sales forecast | **100** | **100** | **100** | **100** | **100** | **160** | **0** | **0** |
| | Disposable stock | **250** | | | | | | | |
| S = 250 | Net requirements | | | | | | | | |
| DQ = 150 | Planned delivery | | | | | | | | |
| DC = 2 | Planned orders | | | | | | | | |
| **CW** | Sales forecast | | | | | | | | |
| | Disposable stock | **500** | | | | | | | |
| S = 500 | Net requirements | | | | | | | | |
| DQ = 250 | Planned delivery | | | | | | | | |
| DC = 3 | Planned orders | | | | | | | | |



## REGIONAL WAREHOUSE - CENTRAL WAREHOUSE PLANNING RESULTS

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Schedule calculations for RW1 and RW2 have been completed accordingly (table for RW1 and RW2).
With the use of DRP I method we can move orders from lower distribution links (planning regional warehouses orders RW1 and RW2) on higher link requirement forecasts in the distribution network (central warehouse CW sales forecast).
Schedule calculations for CW are performed using the same model.

| | | January | | | | February | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Time buckets | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| **RW1** | Sales forecast | **40** | **130** | **90** | **90** | **90** | **50** | **0** | **0** |
| | Disposable stock | **250** | **210** | **80** | **90** | **0** | **10** | **60** | **60** |
| S = 250 | Net requirements | | | **10** | **0** | **90** | **40** | | |
| DQ = 100 | Planned delivery | | | **100** | | **100** | **100** | | |
| DC = 2 | Planned orders | **100** | | **100** | **100** | | | | |
| **RW2** | Sales forecast | **100** | **100** | **100** | **100** | **100** | **160** | **0** | **0** |
| | Disposable stock | **250** | **150** | **50** | **100** | **0** | **50** | **40** | **40** |
| S = 250 | Net requirements | | | **50** | **0** | **100** | **110** | | |
| DQ = 150 | Planned delivery | | | **150** | | **150** | **150** | | |
| DC = 2 | Planned orders | **150** | | **150** | **150** | | | | |
| **CW** | Sales forecast | **250** | **0** | **250** | **250** | **0** | **0** | **0** | **0** |
| | Disposable stock | **500** | **250** | **250** | **0** | **0** | **0** | **0** | **0** |
| S = 500 | Net requirements | | | **0** | **250** | | | | |
| DQ = 250 | Planned delivery | | | | **250** | | | | |
| DC = 3 | Planned orders | **250** | | | | | | | |



## DISTRIBUTION REQUIREMENTS PLANNING – DRP I SUMMARY – COMPREHENSIVE EXAMPLE

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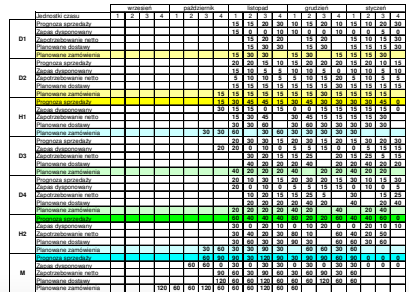

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## WORKSHOP



EXERCISE 26

**The distribution network is composed by:**

**two retailers (R1 and R2) who stock up at the same wholesaler (W1),**

**two retailers (R3 and R4) who stock up at the same wholesaler (W2),**

**both wholesaler (W1 and W2) stock up at the same regional warehouse (RW).**

Other data:

| | R1 | R2 | R3 | R4 | W1 | W2 | RW |
|---|---|---|---|---|---|---|---|
| Stock | 30 | 20 | 40 | 30 | 50 | 60 | 120 |
| Delivery quantity | 20 | 25 | 30 | 25 | 50 | 60 | 100 |
| Delivey cycle | 1 | 2 | 2 | 1 | 3 | 2 | 1 |

Calculate DRP schedule for the period January - February




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**THANK YOU FOR YOUR ATTENTION**

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**PART 2**

**MATERIAL REQUIREMENTS PLANNING**

**MRP I**

**THEORY, CASE STUDIES, WORKSHOP**

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PART 2.1 29

## THEORY



DEFINITION 30

**Material requirements planning (MRP I)**

**is a method of planning and controlling stocks**

**to be able to meet the requirements for product components.**

**MRP schedule represents the requirements (quantities) spread over time,**

**along with component arrival times and requirement delivery times.**

## INPUT DATA

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**The following input data is used in distribution requirements planning:**
**- gross requirements,**
**- the product structure,**
**- free inventory,**
**- delivery size,**
**- delivery cycles.**

Gross requirement is the requirement for a given element (orders, forecasts) at a fixed level of product complexity, calculated based on the product structure and production program.

Product structure is a list of all assemblies, subassemblies and parts that a given product is composed of, along with the definition of the relationships between those elements and the quantities required to make one product item.

Stock quantity (records) is defined by disposable stock.

Delivery lot size is determined using one of the lot sizing models.

Delivery lead time is the period of time between order placement and delivery.



## OUTPUT DATA

32

**The following output data can be determined based on input data:**
**- net requirements,**
**- delivery planning,**
**- order planning.**

Net requirement is the requirement quantity for a given element less its quantity available in stock.

Planned deliveries determine delivery lead times and sizes required to meet net requirements.

Planned orders determine delivery lead times and sizes required to meet net requirements.



## PURPOSE

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The purpose of MRP I is, among others,

**to ensure the required level of customer service**

**at each stage of the production process,**

to balance production size and distribution

with existing constraints - bottlenecks (closed MRP loop),

to minimize the levels of stock and work in progress.



## MECHANISM AND ESSENCE OF THE MRP I

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**MECHANISM**

- A requirement forecast is prepared for each final product.

- This requirement forecast provides the basis for preparing the product receipt (delivery) schedule.

- Receipt (delivery) schedule is the basis for developing product release schedule (orders).

- Finished product release (order) schedule automatically becomes a requirement forecast for it component elements at a lower structure level.

- The same applies to subsequent (lower) levels of product structure. Thus the entire distribution network can be covered under one shared planning mechanism. It may be a point of departure for improving the functioning of the production and procurement system.

**ESSENCE**

**Element order at higher structure levels**
**constitute a requirement forecast at lower product structure levels.**



## MRP I PRINCIPLES

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**ORDER NETTING PRINCIPLE**

**Net requirement quantity is calculated by comparing and subtracting**

**the quantity of items in stock and in orders from gross requirements.**

**TIME PHASING PRINCIPLE**

**Time phasing, assuming the familiarity with order lead time (delivery cycle)**

**allows for defining the exact moment of the production launch**

**for particular components**.



## MRP I PRINCIPLES

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**TIME BUCKETS**

There are two time buckets:
**- short - man hour, shift, workday,**
**- long - work week, decade, month.**

**STOCK CALCULATION MOMENT**

There are two stock calculation models:
**- at the opening of the day,**
**- at the closing of the day.**

Stock sizing based on all-time stock is recommended for short time buckets.

There are no specific recommendations for stock calculation for long time buckets.

PART 2.2

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# CASE STUDIES



PLANNING FINISHED PRODUCT - ASSEMBLIES
DESCRIPTION

38

**Product structure is created by two assemblies (Z1 and Z2),**

**which combine directly into a finished product (W).**

**It takes 2 items of assembly Z1 and 1 item of assembly Z2**

**to manufacture finished product W.**

Other data:

- gross requirement for finished product W is shown in the table,

- W stocks = 25 units,

- W delivery size = 50 units,

- W delivery cycle = 2 weeks.

Calculate MRP schedule for the period January - February



PLANNING FINISHED PRODUCT - ASSEMBLIES
INPUT DATA

39

After input data has been entered, the MRP schedule has the following form (table).
For a finished product, the gross requirement line displays weekly requirement.
The following data has been entered to facilitate finished product calculations:
disposable stock quantity (S), delivery quantity (DQ) and delivery cycle (DC).
Opening level of disposable stock for a finished product is displayed in schedule week 1.

| | | January | | | | February | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Time buckets | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| **W** | Gross requirement | | | | | **15** | **20** | **25** | **20** |
| S = 25 | Disposable stock | **25** | | | | | | | |
| DQ = 50 | Net requirements | | | | | | | | |
| DC = 2 | Planned delivery | | | | | | | | |
| | Planned orders | | | | | | | | |
| **Z1** (2) | Gross requirement | | | | | | | | |
| | Disposable stock | | | | | | | | |
| | Net requirements | | | | | | | | |
| | Planned delivery | | | | | | | | |
| | Planned orders | | | | | | | | |
| **Z2** (1) | Gross requirement | | | | | | | | |
| | Disposable stock | | | | | | | | |
| | Net requirements | | | | | | | | |
| | Planned delivery | | | | | | | | |
| | Planned orders | | | | | | | | |



PLANNING FINISHED PRODUCT - ASSEMBLIES
CALCULATIONS

40

Calculations should be performed according to the standard
presented in the lesson on DRP I.
The stock is calculated as of the start of day - opening stock.

| | | January | | | | February | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Time buckets | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| **W** | Gross requirement | | | | | **15** | **20** | **25** | **20** |
| S = 25 | Disposable stock | **25** | **25** | **25** | **25** | **25** | **10** | **40** | **15** |
| DQ = 50 | Net requirements | | | | | | **10** | | **5** |
| DC = 2 | Planned delivery | | | | | | **50** | | **50** |
| | Planned orders | | | | **50** | | **50** | | |
| **Z1** (2) | Gross requirement | | | | | | | | |
| | Disposable stock | | | | | | | | |
| | Net requirements | | | | | | | | |
| | Planned delivery | | | | | | | | |
| | Planned orders | | | | | | | | |
| **Z2** (1) | Gross requirement | | | | | | | | |
| | Disposable stock | | | | | | | | |
| | Net requirements | | | | | | | | |
| | Planned delivery | | | | | | | | |
| | Planned orders | | | | | | | | |



PLANNING FINISHED PRODUCT - ASSEMBLIES
RESULTS

41

Planned releases (orders) of finished product W
is created by gross requirements for its component elements - assemblies Z1 and Z2.
The requirements for Z1 = 2 items, Z2 = 1 items per each finished product
should be taken into account.
This why the requirement for this element is doubled in the case of assembly Z1.
If the finished product W is also composed of sub-assemblies and/or parts,
they should taken into account in the calculations at this level.

| | | January | | | | February | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Time buckets | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| **W** | Gross requirement | | | | | **15** | **20** | **25** | **20** |
| S = 25 | Disposable stock | **25** | **25** | **25** | **25** | **25** | **10** | **40** | **15** |
| DQ = 50 | Net requirements | | | | | | **10** | | **5** |
| DC = 2 | Planned delivery | | | | | | **50** | | **50** |
| | Planned orders | | | | **50** | | **50** | | |
| **Z1** (2) | Gross requirement | | | | **100** | | **100** | | |
| | Disposable stock | | | | | | | | |
| | Net requirements | | | | | | | | |
| | Planned delivery | | | | | | | | |
| | Planned orders | | | | | | | | |
| **Z2** (1) | Gross requirement | | | | **50** | | **50** | | |
| | Disposable stock | | | | | | | | |
| | Net requirements | | | | | | | | |
| | Planned delivery | | | | | | | | |
| | Planned orders | | | | | | | | |



PLANNING ASSEMBLIES - SUB-ASSEMBLIES
DESCRIPTION

42

**The product structure is created by two sub-assemblies (Z3 and Z4),**

**which directly combine into assembly (Z1).**

**One item of assembly Z1 requires 1 item of assembly Z3 and 2 items of assembly Z4.**

Other data:

- sales gross requirement for assembly Z1 (the result of finished product releases)
is shown in the table,

- stock for Z1 = 75 units,

- delivery quantity for Z1 = 75 units,

- delivery cycle for Z1 = 1 week.

Calculate MRP schedule for the period January - February.

PLANNING ASSEMBLIES - SUB-ASSEMBLIES
INPUT DATA

43

| | | January | | | | February | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Time buckets | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| **Z1** | Gross requirement | | | | **100** | | **100** | | |
| S = 75 | Disposable stock | **75** | | | | | | | |
| DQ = 75 | Net requirements | | | | | | | | |
| DC = 1 | Planned delivery | | | | | | | | |
| | Planned orders | | | | | | | | |
| **Z3** (1) | Gross requirement | | | | | | | | |
| | Disposable stock | | | | | | | | |
| | Net requirements | | | | | | | | |
| | Planned delivery | | | | | | | | |
| | Planned orders | | | | | | | | |
| **Z4** (2) | Gross requirement | | | | | | | | |
| | Disposable stock | | | | | | | | |
| | Net requirements | | | | | | | | |
| | Planned delivery | | | | | | | | |
| | Planned orders | | | | | | | | |



PLANNING ASSEMBLIES - SUB-ASSEMBLIES
CALCULATIONS

44

| | | January | | | | February | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Time buckets | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| **Z1** | Gross requirement | | | | **100** | | **100** | | |
| S = 75 | Disposable stock | **75** | **75** | **75** | **75** | **50** | **50** | **25** | **25** |
| DQ = 75 | Net requirements | | | | **25** | | **50** | | |
| DC = 1 | Planned delivery | | | | **75** | | **75** | | |
| | Planned orders | | | **75** | | **75** | | | |
| **Z3** (1) | Gross requirement | | | | | | | | |
| | Disposable stock | | | | | | | | |
| | Net requirements | | | | | | | | |
| | Planned delivery | | | | | | | | |
| | Planned orders | | | | | | | | |
| **Z4** (2) | Gross requirement | | | | | | | | |
| | Disposable stock | | | | | | | | |
| | Net requirements | | | | | | | | |
| | Planned delivery | | | | | | | | |
| | Planned orders | | | | | | | | |



PLANNING ASSEMBLIES - SUB-ASSEMBLIES
RESULTS

45

Planned release (order) of assembly Z1
creates gross requirement for component elements - sub-assemblies Z3 and Z4.
The requirement should be doubled for sub-assembly Z4.
If assembly Z1 was directly composed of parts as well, they would have to be,
by way of analogy, taken into consideration in the calculations at this level.

| | | January | | | | February | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Time buckets | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| **Z1** | Gross requirement | | | | **100** | | **100** | | |
| S = 75 | Disposable stock | **75** | **75** | **75** | **75** | **50** | **50** | **25** | **25** |
| DQ = 75 | Net requirements | | | | **25** | | **50** | | |
| DC = 1 | Planned delivery | | | | **75** | | **75** | | |
| | Planned orders | | | **75** | | **75** | | | |
| **Z3** (1) | Gross requirement | | | **75** | | **75** | | | |
| | Disposable stock | | | | | | | | |
| | Net requirements | | | | | | | | |
| | Planned delivery | | | | | | | | |
| | Planned orders | | | | | | | | |
| **Z4** (2) | Gross requirement | | | **150** | | **150** | | | |
| | Disposable stock | | | | | | | | |
| | Net requirements | | | | | | | | |
| | Planned delivery | | | | | | | | |
| | Planned orders | | | | | | | | |



PLANNING SUB-ASSEMBLIES - PARTS
DESCRIPTION

46

**The product structure is created by two parts (C3 and C4),**

**which directly combine into sub-assembly (Z4).**

**One item of sub-assembly Z4 requires 2 items of part C2 and 3 items of part C4.**

Other data:

- gross requirement for sub-assembly Z4 (the result of assembly Z1 releases) is shown in the table,

- stock for Z4 = 50 units,

- delivery quantity for Z4 = 100 units,

- delivery cycle for Z4 = 1 week.

Calculate the MRP schedule for the period January - February.



PLANNING SUB-ASSEMBLIES - PARTS
INPUT DATA

47

| | | January | | | | February | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Time buckets | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| **Z4** | Gross requirement | | | **150** | | **150** | | | |
| S = 50 | Disposable stock | **50** | | | | | | | |
| DQ = 100 | Net requirements | | | | | | | | |
| DC = 1 | Planned delivery | | | | | | | | |
| | Planned orders | | | | | | | | |
| **C2** (2) | Gross requirement | | | | | | | | |
| | Disposable stock | | | | | | | | |
| | Net requirements | | | | | | | | |
| | Planned delivery | | | | | | | | |
| | Planned orders | | | | | | | | |
| **C4** (3) | Gross requirement | | | | | | | | |
| | Disposable stock | | | | | | | | |
| | Net requirements | | | | | | | | |
| | Planned delivery | | | | | | | | |
| | Planned orders | | | | | | | | |



PLANNING SUB-ASSEMBLIES - PARTS
CALCULATIONS

48

| | | January | | | | February | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Time buckets | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| **Z4** | Gross requirement | | | **150** | | **150** | | | |
| S = 50 | Disposable stock | **50** | **50** | **50** | **0** | **0** | **50** | **50** | **50** |
| DQ = 100 | Net requirements | | | **100** | | **150** | | | |
| DC = 1 | Planned delivery | | | **100** | | **200** | | | |
| | Planned orders | | **100** | | **200** | | | | |
| **C2** (2) | Gross requirement | | | | | | | | |
| | Disposable stock | | | | | | | | |
| | Net requirements | | | | | | | | |
| | Planned delivery | | | | | | | | |
| | Planned orders | | | | | | | | |
| **C4** (3) | Gross requirement | | | | | | | | |
| | Disposable stock | | | | | | | | |
| | Net requirements | | | | | | | | |
| | Planned delivery | | | | | | | | |
| | Planned orders | | | | | | | | |

PLANNING SUB-ASSEMBLIES - PARTS
RESULTS

49

Planned releases (orders) of sub-assembly Z4
create the gross requirement for component elements - parts C2 and C4.
The requirement should be multiplied for both parts - doubled for C2 and tripled for C4.

| | | January | | | | February | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Time buckets | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| **Z4** | Gross requirement | | | 150 | | 150 | | | |
| | Disposable stock | 50 | 50 | 50 | 0 | 0 | 50 | 50 | 50 |
| S = 50 | Net requirements | | | 100 | | 150 | | | |
| DQ = 100 | Planned delivery | | | 100 | | 200 | | | |
| DC = 1 | Planned orders | | 100 | | 200 | | | | |
| **C2** (2) | Gross requirement | | 200 | | 400 | | | | |
| | Disposable stock | | | | | | | | |
| | Net requirements | | | | | | | | |
| | Planned delivery | | | | | | | | |
| | Planned orders | | | | | | | | |
| **C4** (3) | Gross requirement | | 300 | | 600 | | | | |
| | Disposable stock | | | | | | | | |
| | Net requirements | | | | | | | | |
| | Planned delivery | | | | | | | | |
| | Planned orders | | | | | | | | |



CALCULATIONS PARTS
DESCRIPTION

50

Data:

- gross requirement for parts C2 and C4 (the result of releases of subassembly Z4) has been included in the table,

- stock: for C2 = 50 units, for C4 = 100 units,

- delivery quantity: for C2 = 200 units, for C4 = 200 units,

- delivery cycle: for C2 = 1 week, for C4 = 1 week,

Calculate the MRP schedule for the period January - February.



CALCULATIONS PARTS
INPUT DATA

51

| | | January | | | | February | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Time buckets | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| **C2** | Gross requirement | | 200 | | 400 | | | | |
| | Disposable stock | 50 | | | | | | | |
| S = 50 | Net requirements | | | | | | | | |
| DQ = 200 | Planned delivery | | | | | | | | |
| CD = 1 | Planned orders | | | | | | | | |
| **C4** | Gross requirement | | 300 | | 600 | | | | |
| | Disposable stock | 100 | | | | | | | |
| S = 100 | Net requirements | | | | | | | | |
| DQ = 200 | Planned delivery | | | | | | | | |
| CD = 1 | Planned orders | | | | | | | | |



CALCULATIONS PARTS
CALCULATIONS, RESULTS

52

In some industries there are even lower levels - raw material levels.
If needed, planned releases (orders) of parts C2 and C4
create gross requirements for component elements - raw materials for parts C2 and C4.
The calculation logic is the same.

| | | January | | | | February | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Time buckets | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| **C2** | Gross requirement | | 200 | | 400 | | | | |
| | Disposable stock | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 |
| S = 50 | Net requirements | | 150 | | 350 | | | | |
| DQ = 200 | Planned delivery | | 200 | | 400 | | | | |
| CD = 1 | Planned orders | 200 | | 400 | | | | | |
| **C4** | Gross requirement | | 300 | | 600 | | | | |
| | Disposable stock | 100 | 100 | 0 | 0 | 0 | 0 | 0 | 0 |
| S = 100 | Net requirements | | 200 | | 600 | | | | |
| DQ = 200 | Planned delivery | | 200 | | 600 | | | | |
| CD = 1 | Planned orders | 200 | | 600 | | | | | |



PART 2.3

53

# WORKSHOP



EXERCISE

54

**Product structure is created by two assemblies (Z1 and Z2) and part C1, which combine directly into a finished product (W). It takes 1 item of assembly Z1, 2 items of assembly Z2 and 4 items of C1 to manufacture finished product W.**
**Than the product structure is created by two parts (C2 and C3), which directly combine into assembly (Z1). One item of assembly Z1 requires 1 item of part C2 and 2 items of part C3.**
**Than the product structure is created by two parts (C3 and C4), which directly combine into assembly (Z2). One item of assembly Z2 requires 2 item of part C3 and 1 items of part C4.**

Other data:

| | W | Z1 | Z2 | C1 | C2 | C3 | C4 |
|---|---|---|---|---|---|---|---|
| Stock | 30 | 20 | 40 | 30 | 30 | 60 | 50 |
| Delivery quantity | 20 | 25 | 30 | 40 | 25 | 60 | 50 |
| Delivey cycle | 1 | 1 | 2 | 4 | 1 | 2 | 1 |

Calculate MRP schedule for the period January - February


POZNAN SCHOOL
OF LOGISTICS

**THANK YOU FOR YOUR ATTENTION**

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