

Production Planning Solution Techniques Part 1 MRP, MRP-II

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Overview

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- MRP is called a push system since it pushes items in the production chain.

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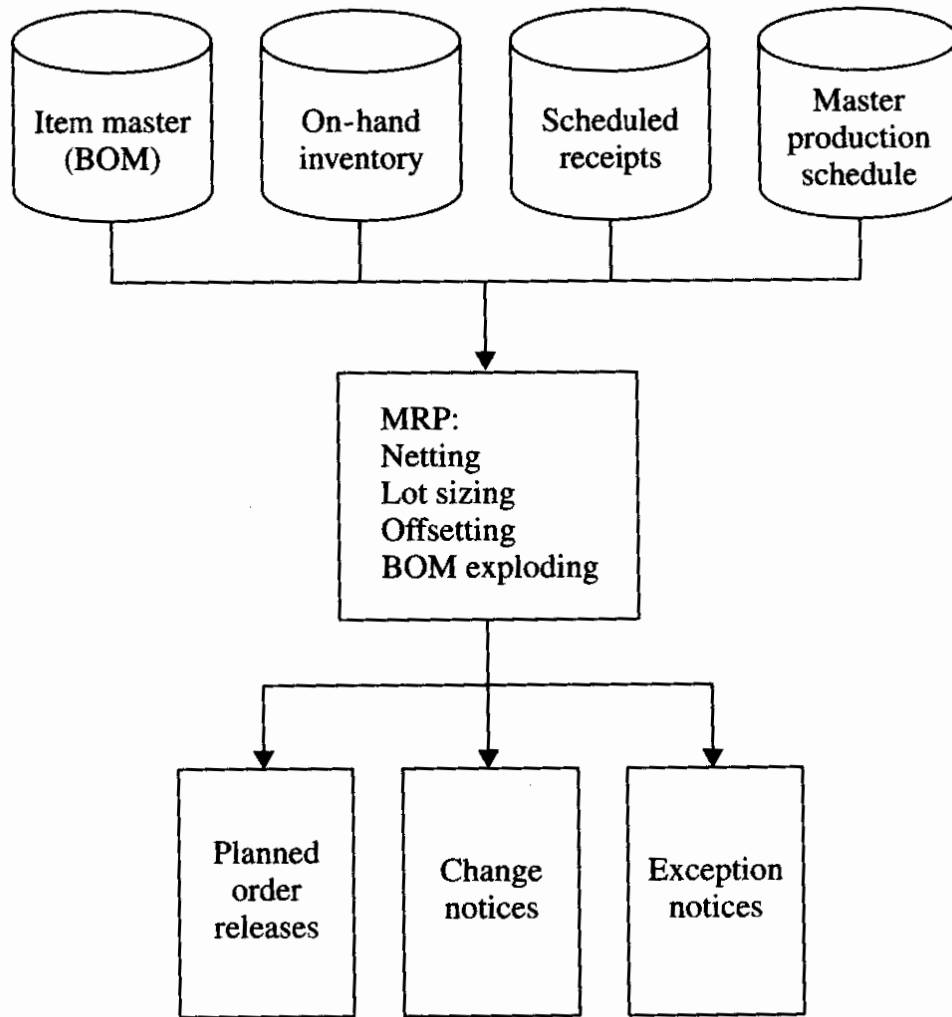
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Schematic of MRP



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- MRP outputs: Planned order release, Change notices and Exception reports.

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Net requirement follows as:

$$N_t = \begin{cases} 0 & t < t^* \\ -I_t & t = t^* \\ D_t & t > t^* \end{cases}$$

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Scheduled receipts		10	10		
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- Bom Explosion. Netting and lot sizing is done for each sub item.

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- System Nervousness. Plans that are feasible can become infeasible.

Questions or comments to MRP

Are there any questions or comments ?

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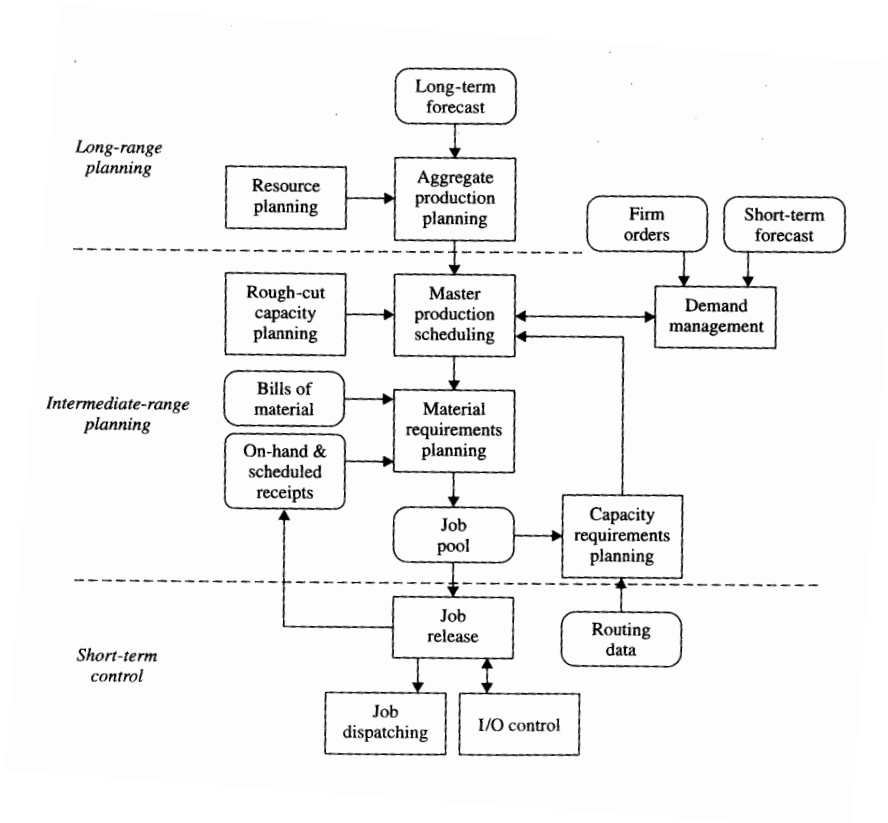
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- Capacity Requirements Planning Does not preform actual capacity check. CRP assumes infinite capacity on resources. Basically it just calculates finish dates based on fixed lead times.

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 - Least slack per remaining operation Divide slack with number of operation remaining on routing.

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- $\frac{1}{p_j}$ is the maximum fraction of a job that can be completed in a week.

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Mathematical Model

$$\min \quad \sum_{t=1}^T \sum_{k=1}^K c_{kt} U_{kt}$$

subject to

$$\begin{aligned} \sum_{t=r_j}^{d_j} x_{jt} &= 1 & 1 \leq j \leq n \\ x_{jt} &\leq \frac{1}{p_j} & 1 \leq j \leq n, 1 \leq t \leq T \\ \sum_{j=1}^n q_{jk} x_{jt} - U_{kt} &\leq 0 & 1 \leq j \leq n, 1 \leq t \leq T \\ x_{jt}, U_{kt} &\geq 0 & 1 \leq j \leq n, 1 \leq t \leq T \end{aligned}$$

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A set \mathcal{S} of ATW windows is feasible if:

Controlling feasibility

Allowed To Work window for job J_j is defined as $[S_j, C_j]$.

Job J_j cannot start before S_j or after C_j

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A set \mathcal{S} of ATW windows is feasible if:

1. Every ATW window is feasible
2. $S_j > C_i$ if $J_i \rightarrow J_j$

Mathematical Model ATW windows

$$s_{jt} = \begin{cases} 1 & S_j \leq t \leq C_j \\ 0 & \textit{otherwise} \end{cases}$$

(P_S) min $\sum_{t=1}^T \sum_{k=1}^K c_{kt} U_{kt}$
subject to

$$\begin{aligned} \sum_{t=r_j}^{d_j} x_{jt} &= 1 & 1 \leq j \leq n \\ x_{jt} &\leq \frac{s_j}{p_j} & 1 \leq j \leq n, 1 \leq t \leq T \\ \sum_{j=1}^n q_{jk} x_{jt} - U_{kt} &\leq 0 & 1 \leq j \leq n, 1 \leq t \leq T \\ x_{jt}, U_{kt} &\geq 0 & 1 \leq j \leq n, 1 \leq t \leq T \end{aligned}$$

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Have I forgotten an important assumption ?

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A critical path is maximal if for all J_l :

- $\{J_{i_1}, J_{i_2}, \dots, J_{i_k}, J_{i_l}\}$ is critical
- $\{J_{i_l}, J_{i_1}, J_{i_2}, \dots, J_{i_k}\}$ is critical

(H_{CPM}) continued

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- Change to $C_{i_k} = S_{i_{k+1}} - 1$

H_{CPM} example

	1	2	3	4
S	0	5	15	20
C	10	15	25	30
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$$C_1 = S_2 - 1 = 5, C_2 = 11, C_3 = 23$$

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- Neighbourhood can be ordered after the greedy choice or the steepest edge rule.

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 - Ex 2.3 Describe a heuristic for the resource driven RCCP. The heuristic should include a constructive heuristic and a improvement heuristic.