Certified in Planning and Inventory Management

MRP-Based Scheduling

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MRP-Based Scheduling

1. Principles of MRP-Based Scheduling

MRP-based scheduling focuses on planning material and capacity requirements by using time-phased logic derived from the master production schedule. It ensures that components are available exactly when needed, avoiding early or late orders. Unlike traditional scheduling, which may rely on fixed lead times, MRP-based scheduling ties material releases to planned start dates. Understanding how planned, firm, and open orders work in relation to dependent demand is essential. This concept underpins all subsequent techniques, including finite scheduling, capacity validation, and synchronized flow.

2. Forward and Backward Scheduling

Forward scheduling starts from a known start date and calculates when an order will be completed. Backward scheduling begins from a required due date and determines the latest start date. In MRP-based scheduling, backward scheduling is commonly used to minimize inventory and ensure just-in-time availability of components. CPIM candidates must understand when each method is appropriate, how MRP systems apply lead times, and how deviations such as capacity overloads or material shortages require schedule adjustments.

3. Lead-Time Offsetting and Time-Phasing

MRP scheduling depends on exploding requirements through BOMs and offsetting them by cumulative lead times. Time-phasing ensures that planned order releases occur at the right time to satisfy the need dates.

Understanding processing lead times, queue time, setup time, waiting time, and move time is essential to correctly calculate release schedules. Improper lead-time parameters result in early orders, late orders, excess WIP, or production delays, making accurate lead-time management a core CPIM competency.

4. Scheduling Using Low-Level Codes

Low-level codes (LLCs) ensure that requirements for components appearing at multiple levels of a BOM are planned at the lowest level in which they appear. This prevents duplicate or premature requirement calculations. In MRP-based scheduling, LLCs ensure proper sequencing of planned order releases and accurate time-phasing. Misassigned LLCs can cause incorrect pegging and schedule errors across the system. Mastery of LLC management is essential for accurate material explosion.

5. Finite vs. Infinite Scheduling

Infinite scheduling assumes unlimited capacity and is typical of standard MRP systems. Finite scheduling respects actual capacity limits at work centers. Understanding when and how to use each method is critical for CPIM preparation. While infinite scheduling supports planning simplicity, finite scheduling gives realistic production timelines and prevents overload conditions. Many modern MRP systems combine both, beginning with infinite-material planning and overlaying finite-capacity adjustments.

6. Work Center Load Scheduling

Work center scheduling determines when operations should begin based on available capacity, setup requirements, and order priorities. MRP-based scheduling uses routing data—such as standard times and operation sequences—to calculate capacity loads. Effective scheduling prevents bottlenecks, smooths resource utilization, and ensures reliable delivery performance. Mastery of work center load leveling and dispatching rules is essential for operational execution.

7. Priority Planning and Dispatching Rules

Dispatching rules guide sequencing of jobs within a work center. Common methods include earliest due date (EDD), shortest processing time (SPT), first-come-first-served (FCFS), and critical ratio (CR). MRP-based scheduling generates planned orders, but dispatching rules determine real-time execution priority. Understanding how to evaluate order importance and minimize lateness improves scheduling performance and aligns execution with MRP priorities.

8. Operation Overlapping and Splitting

To accelerate lead times, manufacturing may overlap operations (starting a subsequent operation before the prior one finishes) or split lots into smaller batches processed simultaneously. MRP-based scheduling must account for these methods to avoid inaccurate load calculations. Overlapping reduces queue time, while splitting reduces bottlenecks and increases throughput. CPIM candidates must understand when these techniques improve flow versus when they complicate control.

9. Queue and Wait Time Management
Queue time often contributes the largest portion of total lead time. MRP-based scheduling requires accurate estimates of queue and wait times to ensure correct start dates and resource planning. Reducing queue time improves schedule reliability and reduces WIP. CPIM concepts like Little's Law can also help analyze flow. Queue-time mismanagement leads to schedule slippage and missed due dates.

10. Bottleneck Scheduling and Theory of Constraints (TOC)
MRP-based scheduling must identify and account for bottlenecks—resources with limited capacity relative to demand. The Theory of Constraints guides prioritizing work at bottlenecks, ensuring that the entire system's throughput is maximized. Scheduling around bottlenecks may require drum-buffer-rope methods, strategic buffers, and careful sequencing. CPIM candidates must understand how bottlenecks impact due dates and planned order releases.

11. Backflushing and Simplified Reporting
Backflushing automatically deducts components from inventory when the finished product is completed rather than when components are physically issued. When used with MRP-based scheduling, it reduces labor for transaction reporting. It is best suited for repetitive environments with stable BOMs. However, it requires accurate BOM data and scrap reporting. Misuse can distort inventory balances and cause schedule disruptions.

12. Time Fences and Schedule Freezing

Time fences protect the stability of the production schedule. In the demand time fence (DTF), changes are highly restricted; in the planning time fence (PTF), the system allows controlled modifications. MRP-based scheduling relies on these fences to avoid constant rescheduling that destabilizes capacity and material plans. Understanding how and when to freeze schedules is crucial for CPIM planning accuracy.

13. Pegging and Allocation for Scheduling

Pegging links planned orders to specific demands, enabling planners to determine the impact of schedule changes. Material allocation reserves inventory or future supply for specific orders. In MRP-based scheduling, pegging helps track the ripple effect of rescheduled operations, part shortages, or BOM changes. It aids effective priority planning and customer service management.

14. Planned Order Release Management

Scheduled planned order releases must be reviewed and firmed appropriately. MRP-based scheduling uses these releases to coordinate procurement, production, and capacity plans. Firm planned orders prevent system nervousness and keep shop-floor schedules stable. Understanding overrides, exceptional cases, and release timing is essential for balancing responsiveness with control.

15. Flow Control and Material Synchronization

Flow control ensures material moves through operations at the appropriate rate. MRP-based scheduling synchronizes flow using time-phased requirements and capacity alignment. Poor flow control results in starvation and congestion, affecting throughput and schedule adherence. Mastering synchronization principles helps maintain predictable lead times and reliable output.

16. Cumulative Lead-Time Calculation

Cumulative lead time includes all manufacturing levels and sequential processes necessary to produce a finished product. MRP-based scheduling uses cumulative lead time to determine feasibility of due dates and required start dates for lower-level components. Incorrect cumulative lead-time parameters cause unrealistic delivery commitments and scheduling errors.

17. Lot Sizing Impact on Scheduling

Lot-sizing rules—such as lot-for-lot (L4L), economic order quantity (EOQ), and period order quantity (POQ)—influence capacity loads, setup frequency, and WIP levels. MRP-based scheduling must consider how lot sizing affects flow and resource utilization. Incorrect lot sizes can create bottlenecks or excess inventory. CPIM candidates must understand how to select lot-sizing methods based on cost, stability, and flexibility objectives.

18. Schedule Stability and Nervousness Control

MRP systems can become “nervous,” producing frequent changes in planned orders due to volatile demand or inaccurate inputs. Techniques to reduce nervousness include firm planned orders, lot-sizing adjustments, time fences, and demand smoothing. A stable schedule improves supplier reliability, internal efficiency, and customer service.

Mastery of stability strategies is essential in CPIM scheduling.

19. Coordination with Execution Systems (MES/Shop Floor Control)

MRP-based scheduling creates planned start and completion dates, but actual execution is managed through MES or shop-floor control systems. Understanding how these systems integrate helps planners identify discrepancies, update order status, and adjust schedules based on real-time feedback. This linkage improves accuracy, supports continuous improvement, and enhances schedule reliability.

20. Performance Metrics for Scheduling

Key metrics include adherence to schedule, throughput, on-time completion, queue length, WIP levels, and load vs. capacity accuracy. MRP-based scheduling success is evaluated by how well planned dates match actual shop-floor performance. Understanding these metrics helps identify inefficiencies, improve accuracy, and align MRP logic with operational reality.

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