

Best Practice
eXensys – Production Scheduling

Exensys Software Solutions Ltd.		AA/B/CCDD V x.y
White Paper		W. E. F. dd/mm/yy

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Introduction:

Production scheduling is a significant tool for manufacturing, where it can have a major impact on the productivity of a process. The purpose of production scheduling is to meet the delivery due dates and to make the best use of available manufacturing resources. It involves establishing start & finish dates for each operation required to complete an item. To build a reliable schedule the planner should inform about routing, required & available capacity, operation lead time at each work center, competing production order. A production schedule helps to be in command over production materials and processes by authorizing production rates and levels. It also serves as a performance measure.

Overview:

Production Scheduling happens in the back end of the manufacturing system. It is a type of shop floor control. It is accountable for scheduling the actions needed to carry out the planned production. Capacity and material plans provide input for production scheduling and decide what can be scheduled.

Capacity Plans:

The significance of capacity planning for production scheduling can be explained by taking into account two different extremes. If insufficient capacity is provided, schedule will not be able to meet planned production levels and as a result backlog will increase, delivery performance will decrease, output levels will not increase. On the other hand, if additional capacity exists, costs will become higher.

There are different techniques to schedule production orders through a plant they are as follows:

Forward Scheduling:

Forward scheduling presumes that material purchase and scheduling for an end item is initiated when the order is received, irrespective of the due date, operations are scheduled forward from the date the order is received. Forward scheduling is used to calculate how long it will take to complete a task. This type of scheduling is used to give customer promise dates.

The method will be as follows:

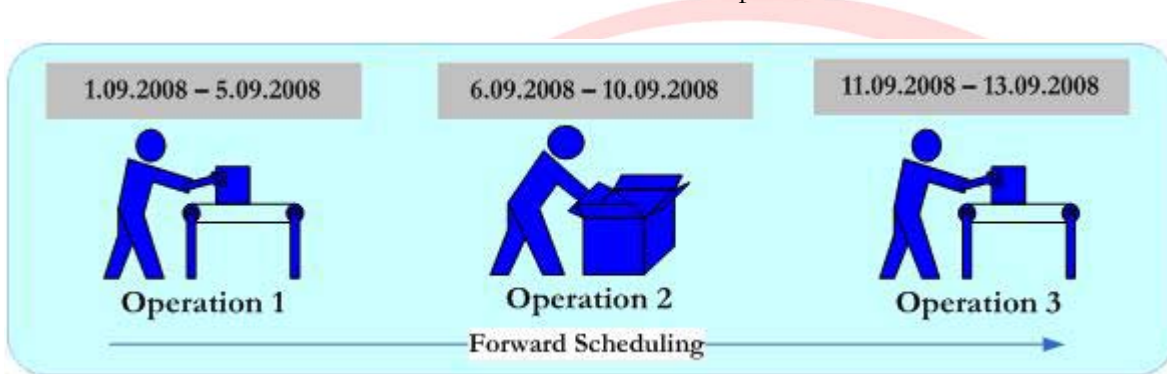
1. For each production order, the required capacity at each work center is calculated.
2. Starting with the earliest possible date, start scheduling forward to obtain the completion dates of each operation.

Let's consider an example.

ID	Production Order PO-08/09-0001	Start Date	Finish Date	Sep 2008												
				1	2	3	4	5	6	7	8	9	10	11	12	13
1	Operation 1	9/1/2008	9/5/2008	◆												
2	Operation 2	9/6/2008	9/10/2008						◆							
3	Operation 3	9/11/2008	9/13/2008											◆		

- Sales order is received with due date 15.09.2008.
- Production Order is generated for the same. There are 3 operations to be completed as mentioned in the Gantt chart.

If the planner considers forward scheduling, then production schedule will be generated from 1.09.2008 and based on the operation lead time of the respective operations the start date and the end date will be arrived for each of the three operations.



Business Performance Sustained

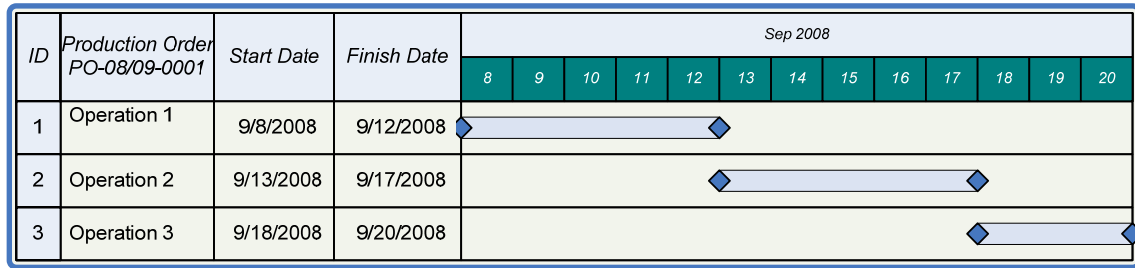
Backward Scheduling:

In backward scheduling the start time of the current operation is used as the end time of the preceding operation and scheduling is continued till all the operation on the production order have been scheduled. During Scheduling if the end of preceding operation falls at the time when the required resources are not available then automatically the end date is assigned as the nearest available date. Backward scheduling has a number of advantages. It will reduce work in process, reschedule the commitment of raw materials to specific Products, and reduces storage time of completed components.

The method will be as follows:

1. For each production order, the required capacity at each work center is calculated.
2. Starting with the completion date, start scheduling backward to obtain the completion and start dates of each operation.

Let's consider the same above example but planner follows backward scheduling.



- Sales order is received on 1.09.2008 with due date 20.09.2008.
- Production Order is generated for the same. There are 3 operations to be completed as mentioned in the Gantt chart.

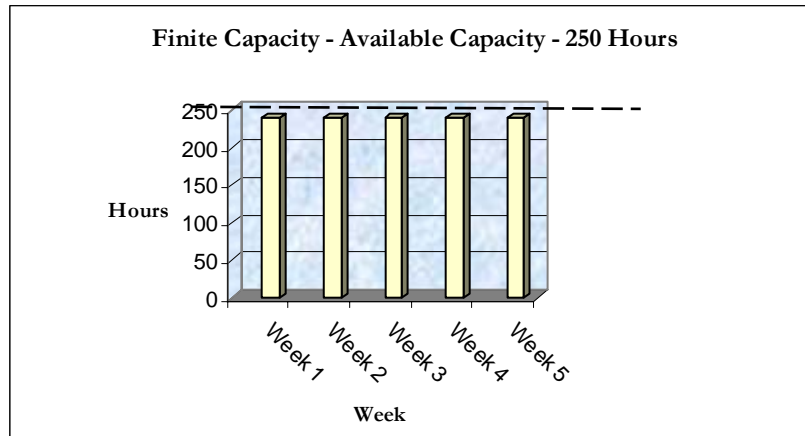
If the planner considers backward scheduling, then production order will be scheduled with 20.09.2008 as the due date and based on the operation lead time backward calculations will be done to arrive at the start & end date for the other operations.



Finite Loading:

Finite Capacity is assigning no more work to a work center that is already loaded during a given time period. Finite loading doesn't consider the due date it focuses only on the capacity that's available. If the capacity is not available for a particular period then the due date will be moved to the next period. Finite Loading takes place as follows:

- For every operation to be scheduled, available capacity is checked on the required date.
- If sufficient capacity is available then the operation is carried out on the required date.
- If there is insufficient capacity, then the operation is moved to a date when it can be processed without any capacity constrains.



Example:

PO Code	Item Code	Item Name	Due Date	Quantity
1000	3000	Car	15.09.2008	100
1001	2500	Car	15.09.2008	200
1002	3500	Car	15.09.2008	100

PO Code	Operation Code	Operation Name	Work Center Code
1000	Op - 0001	Assembly 1	WC - 0001
	Op - 0002	Assembly 2	WC - 0002
1001	Op - 0001	Assembly 1	WC - 0001
	Op - 0003	Assembly 3	WC - 0003
1002	Op - 0001	Assembly 1	WC - 0001
	Op - 0002	Assembly 2	WC - 0002

Before finite scheduling is done:

PO Code	Operation Code	Work Center Code	Start Date	End Date
1000	Op - 0001	WC - 0001	10.09.2008	12.09.2008
	Op - 0002	WC - 0002	13.09.2008	15.09.2008
1001	Op - 0001	WC - 0001	10.09.2008	12.09.2008
	Op - 0003	WC - 0003	14.09.2008	15.09.2008
1002	Op - 0001	WC - 0001	10.09.2008	12.09.2008
	Op - 0002	WC - 0002	13.09.2008	15.09.2008

After Finite scheduling is done:

PO Code	Operation Code	Work Center Code	Start Date	End Date
1000	Op - 0001	WC - 0001	10.09.2008	12.09.2008
	Op - 0002	WC - 0002	13.09.2008	15.09.2008
1001	Op - 0001	WC - 0001	13.09.2008	15.09.2008
	Op - 0003	WC - 0003	16.09.2008	17.09.2008
1002	Op - 0001	WC - 0001	16.09.2008	18.09.2008

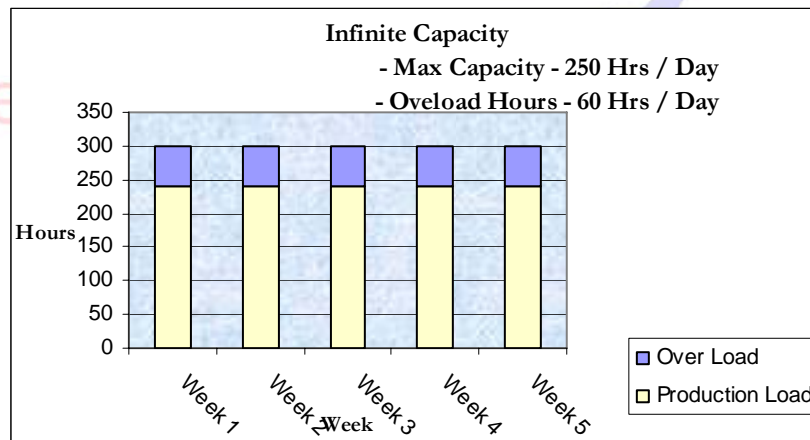
	Op - 0002	WC - 0002	19.09.2008	20.09.2008
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Here operation (OP-0001) which is being executed on WC-0001 has to be carried out for all the production orders. So until and unless the op- 0001 is finished for the first PO the execution will not start for the rest of the Production Order. As and when the remaining the op – 0001 is completed for a particular PO the execution of the same operation will be started for the subsequent PO. i.e as shown in the table(Scheduling Details – After Scheduling) op- 0001 will be completed only on 12.09.2008 till then PO 1001 will not be started. In the similar way rest of the executions will be completed.

Infinite Loading:

Infinite Capacity is assigning more work to a work center that is already loaded during a given time period. While using Infinite Capacity system calculates the capacity required at work centers in the time periods required regardless of the capacity available to perform this work. The main focus incase of infinite loading will be on the due date. Even if the capacity is not available the work center's will be loaded. Infinite Loading takes place as follows:

- For every operation to be scheduled, available capacity is checked on the required date.
- If sufficient capacity is available then the operation is carried out on the required date.
- If there is insufficient capacity, then the operation is still carried out by adding extra capacity in the form of overtime, extra shifts etc.



How scheduling is carried out in eXensys Application:

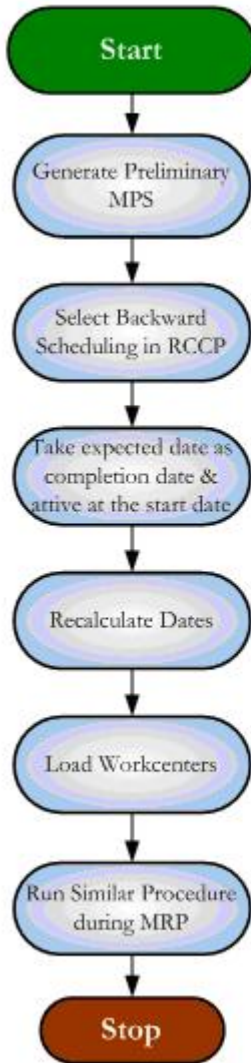
Backward / Forward Scheduling:

To carry out Backward / Forward scheduling the following information are required:

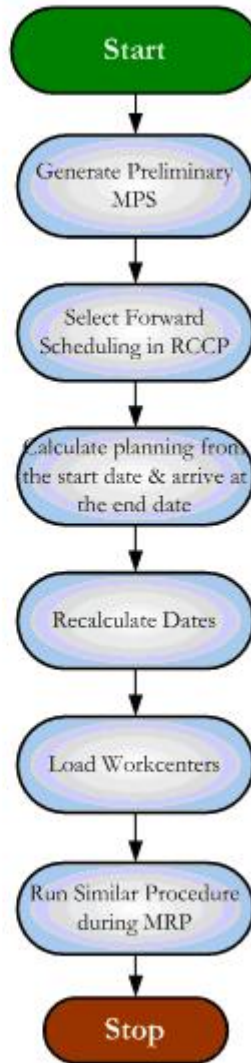
- The Quantity and due date.
- Sequence of operations and work centers needed.
- Setup and run times for each operation.

- Queue, wait and move times.
- Work centers capacity available (Rated or Demonstrated).

Backward Scheduling

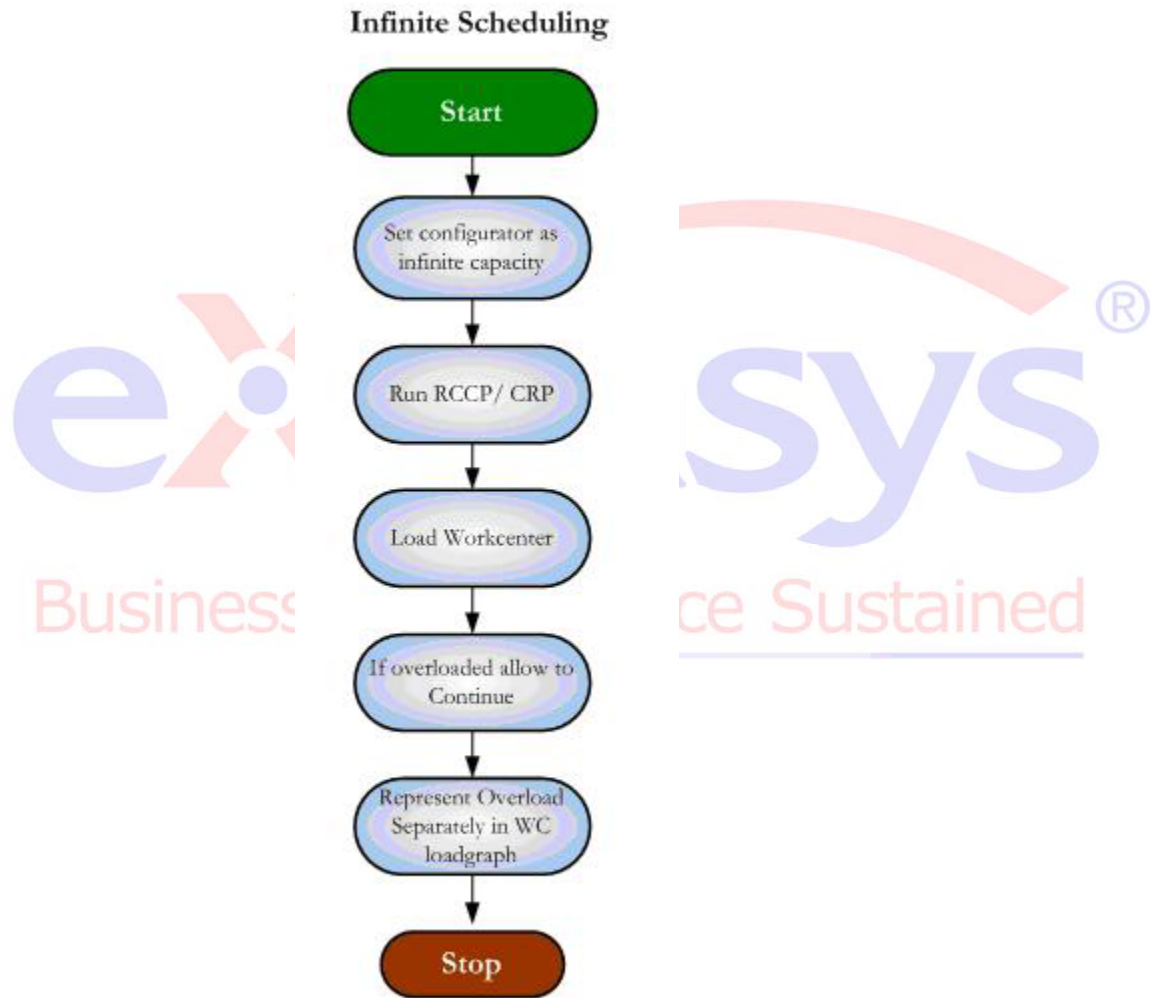


Forward Scheduling



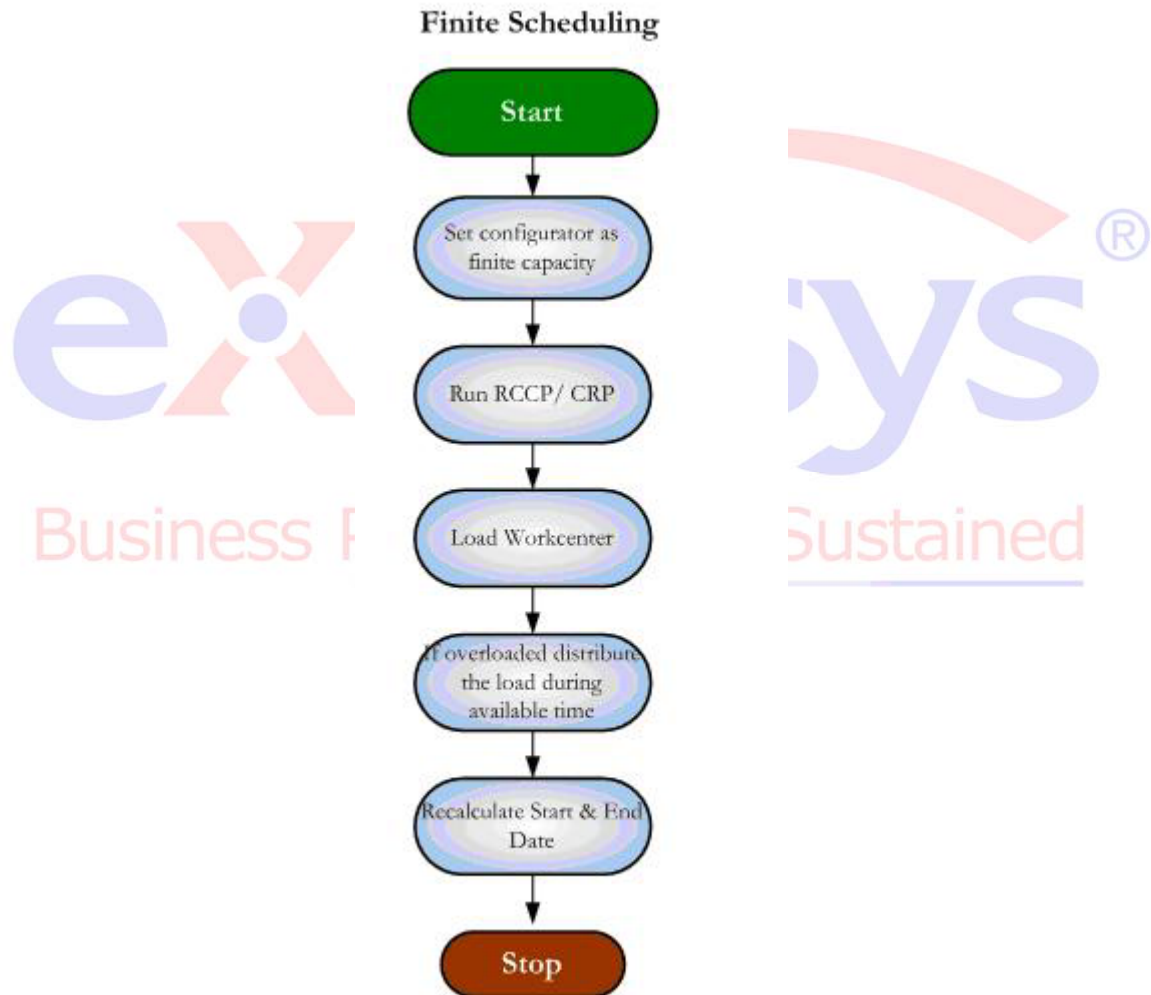
Infinite Scheduling:

Infinite capacity is initiated by setting the configuration settings as infinite capacity is required. Once the MPS and MRP establishes order due dates RCCP and CRP are run respectively to check whether the capacity is available. If capacity is available then the order due date is frozen. If there is a shortage in capacity then the work center will be overloaded that is through overtime, adding extra shifts etc. Infinite capacity focuses on completing the customer order's on time irrespective of the capacity available during the given time period.



Finite Scheduling:

Finite capacity is initiated by setting the configuration settings as finite capacity is required. Once the MPS and MRP establishes order due dates RCCP and CRP are run respectively to check whether the capacity is available. If capacity is available then the order due date is frozen. If there is a shortage in capacity then the order due date is shifted to a next date where capacity is available. Finite capacity accurately models factory capacity, including calendars, work centers, labor, and tooling resources. Accurate Finite capacity defines secondary resources like Labor, tools, materials. The result of using finite capacity method will be a set of start and finish dates for each operation at each work center. Here detailed schedules for each job through each work center based on work center capacities are established.



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Benefits:

- Helps in maintaining optimum inventory.
- Increased production efficiency.
- Maximizes the efficiency of operation and reduces costs.
- Arrives at accurate delivery dates.
- Plan production and procurement of materials.
- Real time information

Conclusion:

Production scheduling helps in gaining control over production materials and processes by determining and authorizing production rates and levels. It also serves as a performance measure.

