Production and Operations Management

Scheduling

Scheduling Definitions

- **Routing:** The operations to be performed, their sequence, the work centers, & the time standards
- **Bottleneck:** A resource whose capacity is less than the demand placed on it
- **Due date:** When the job is supposed to be finished
- **Slack:** The time that a job can be delayed & still finish by its due date
- **Queue:** A waiting line

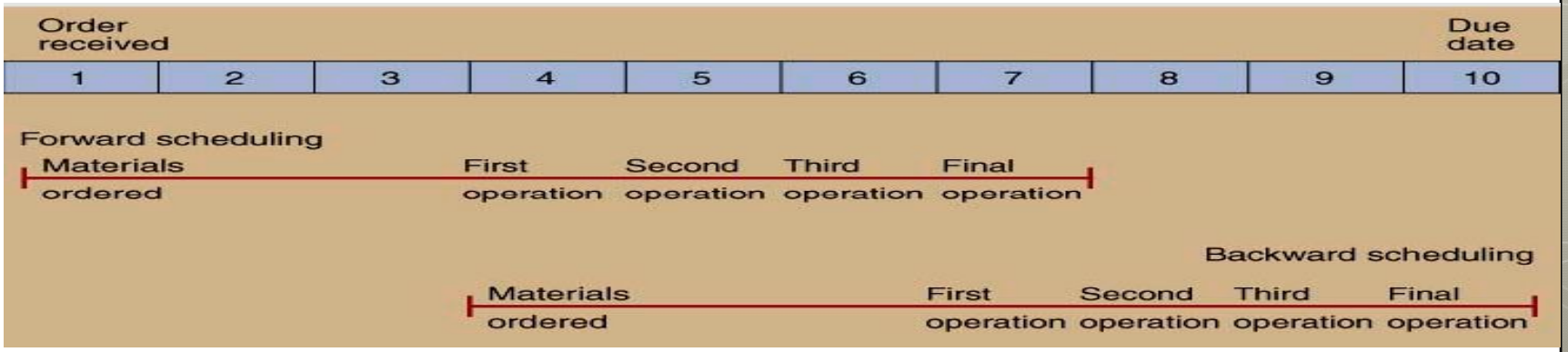
Scheduling

- *Manufacturing lead-time = Setup time, Run time (Wait time + Process time), Move time, Queue time.*
- *Cycle time – length of time from when material enters a production facility until it exits.*
- *Forward Scheduling and Backward Scheduling*
- *Finite Loading and Infinite Loading*

Manufacturing Lead Time	
Division	Subdivision
Set-up Time	
Run Time	Process Time
	Wait Time
Move Time	
Queue Time	

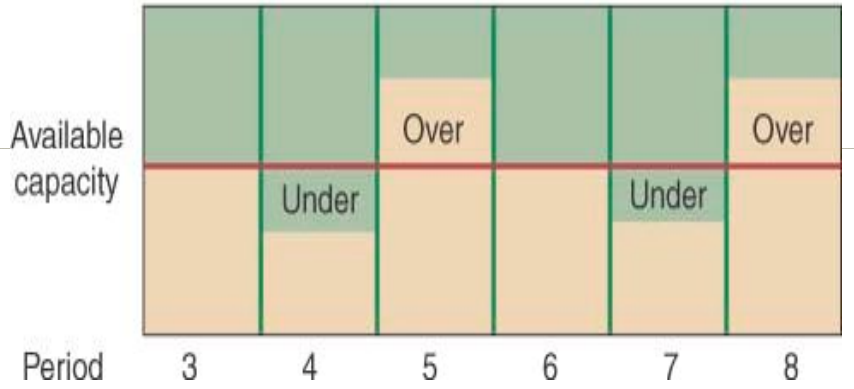
Other Scheduling Techniques

- **Forward Scheduling** – starts processing when a job is received
- **Backward Scheduling** – begin scheduling the job's last activity so that the job is finished on due date



Scheduling Work - Work Loading

- ***Infinite loading:***
  - Ignores capacity constraints, but helps identify bottlenecks in a proposed schedule to enable proactive management

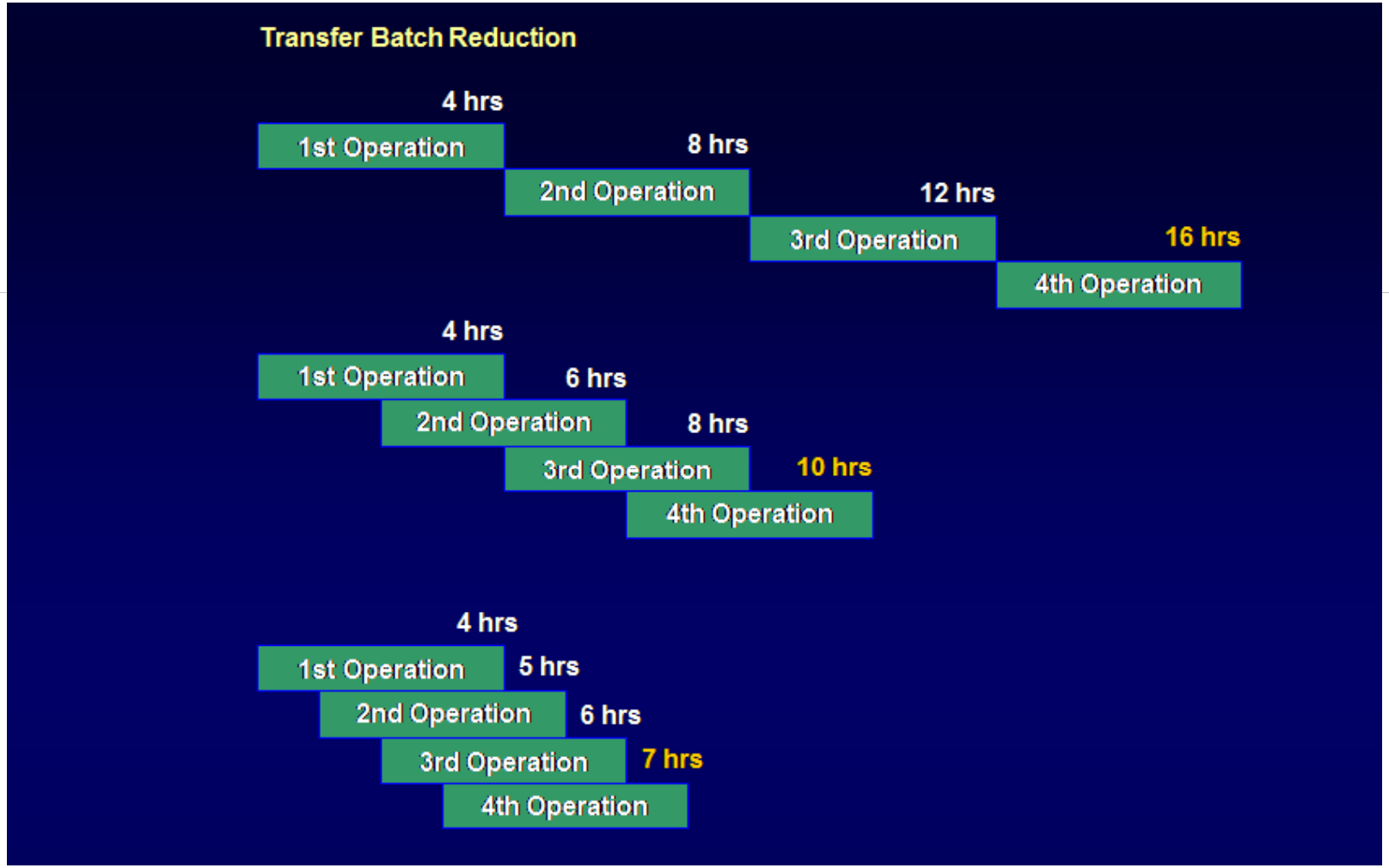


- ***Finite loading:***
  - Allows only as much work to be assigned as can be done with available capacity – but doesn't prepare for inevitable slippage

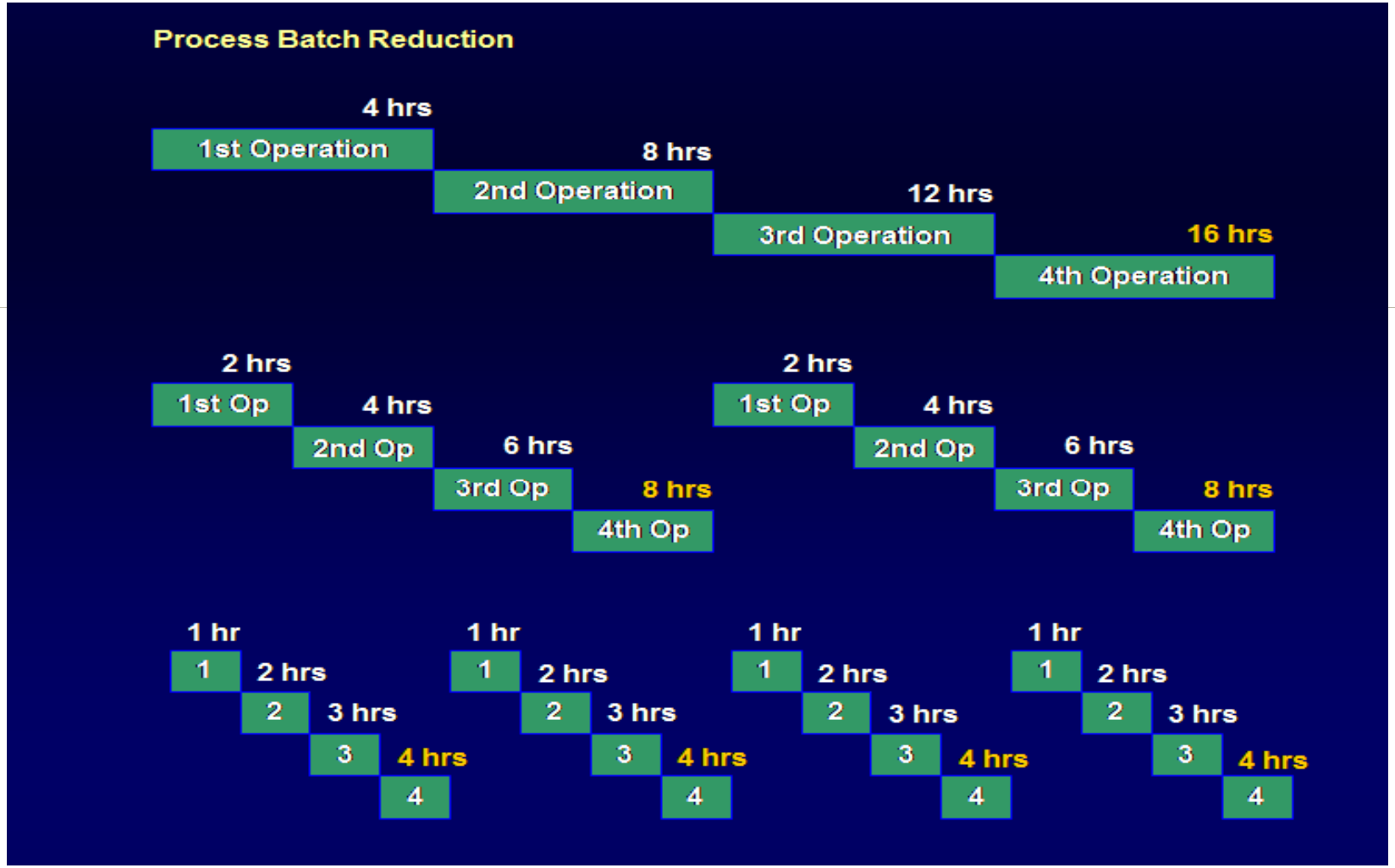
Scheduling Bottlenecks

- It is a facility, function, department, or resource whose capacity is equal to or less than the demand placed upon it.
- **Throughput** is the total volume of production passing through a facility. It is the Quantity of finished goods that can be sold.
- ***Transfer Batch***: number of parts produced in a sequence
- ***Process Batch***: Quantity produced at a resource before switching to another product

Transfer Batch Reduction



Process Batch Reduction



How to Sequence Jobs

Which of several jobs should be scheduled first?

- Techniques are available to do short-term planning of jobs based on available capacity & priorities
- ***Priority rules:***
  - ***Decision rules***: to allocate the relative priority of jobs at a work center
    - ***Local priority rules***: determines priority based only on jobs at that workstation
    - ***Global priority rules***: also considers the remaining workstations a job must pass through

Commonly Used Priorities Rules

- First come, first served (FCFS)
- Last come, first served (LCFS)
- Earliest due date (EDD)
- Shortest processing time (SPT)
- Longest processing time (LPT)
- Critical ratio (CR):
  - (Time until due date)/(processing time)
- Slack per remaining Operations (S/RO)
  - Slack /(number of remaining operations)

How to Use Priority Rules

1. Decide which priority rule to use
2. List all jobs waiting to be processed with their job time
3. Using priority rule determine which job has highest priority then second, third and so on

Example Using SPT, EDD

Example Using SPT and EDD at Jill's Machine Shop-Work		
Job Number	Job Time (includes Setup & Run Time)	Days to Due Date
AZK111	3 days	3
BRU872	2 days	6
CUF373	5 days	8
DBR664	4 days	5
EZE101	1day	4
FID448	4 days	9

Example Using SPT, EDD

Example Using SPT and EDD at Jill's Machine Shop-Work Center 101				
	Job Time	Days to	SPT Rule	EDD Rule
Job Number	(includes Setup & Run Time)	Due Date	Sequence	Sequence
AZK111	3 days	3	EZE101	AZK111
BRU872	2 days	6	BRU872	EZE101
CUF373	5 days	8	AZK111	DBR664
DBR664	4 days	5	DBR664	BRU872
EZE101	1day	4	FID448	CUF373
FID448	4 days	9	CUF373	FID448

Example Using Slack Ratio

Slack is the difference between the time remaining until a job's due date and the total shop time remaining, including that of the operation being scheduled.

$$S/RO = \frac{(\text{Due date} - \text{Today's date}) - \text{Total shop time remaining}}{\text{Number of operations remaining}}$$

Critical ratio

$$CR = \frac{Due\ Date - Today's\ Date}{Total\ Lead\ Time\ Remaining}$$