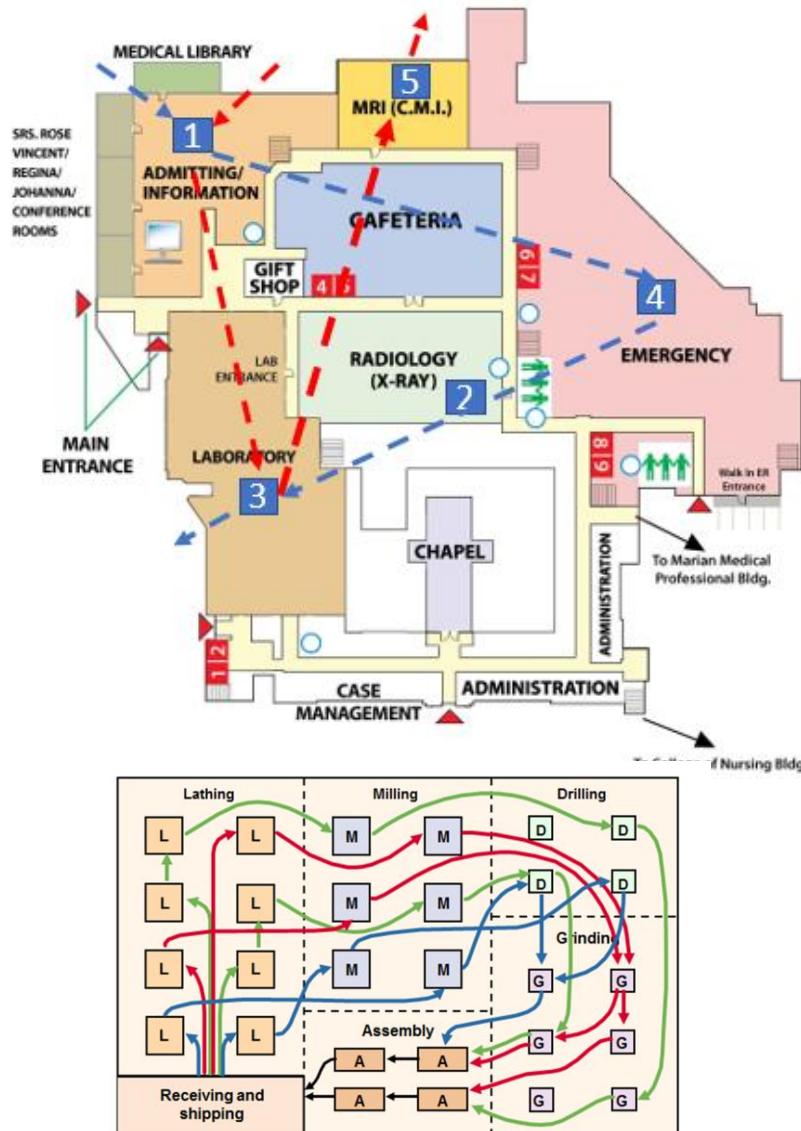


Job Shop Scheduling

Job Shop Scheduling



In Job Shop, the **machines are arranged in functional groups** (i.e., a lathe department, a milling department, a heat-treating oven, assembly stations, and so on).

Job Shop Scheduling: n jobs and m machines | Process Sequence will be differ | Processing Time will also differ

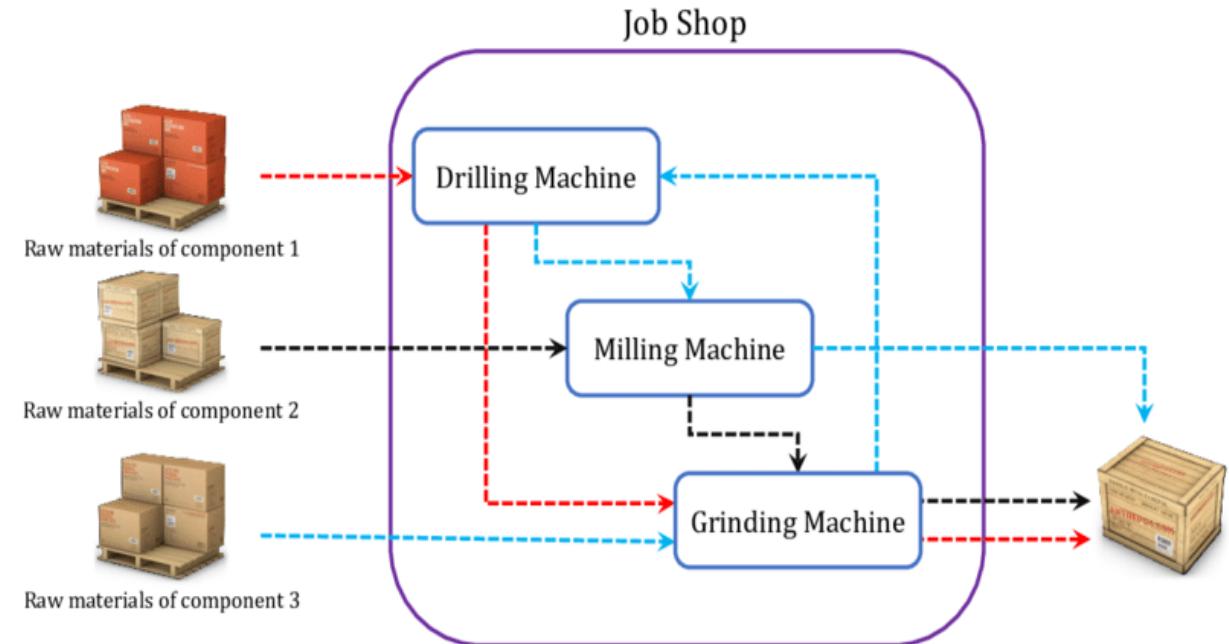


Job Shop is a Complex Scheduling Process

Each component has its processing steps.

Processing sequence may be different for every component, although often there are groups of components that have a similar sequence.

Some operations have to be done before or after other operations, while other operations are more flexible and the sequence can be varied.



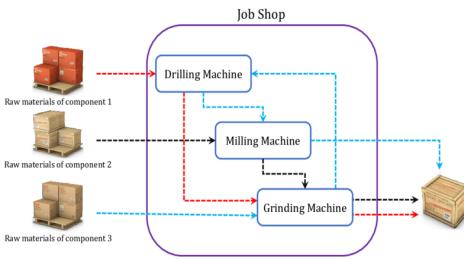
BEGNEAUD Manufacturing Ltd

- <https://www.youtube.com/watch?v=gJWMCUMdO4Q>

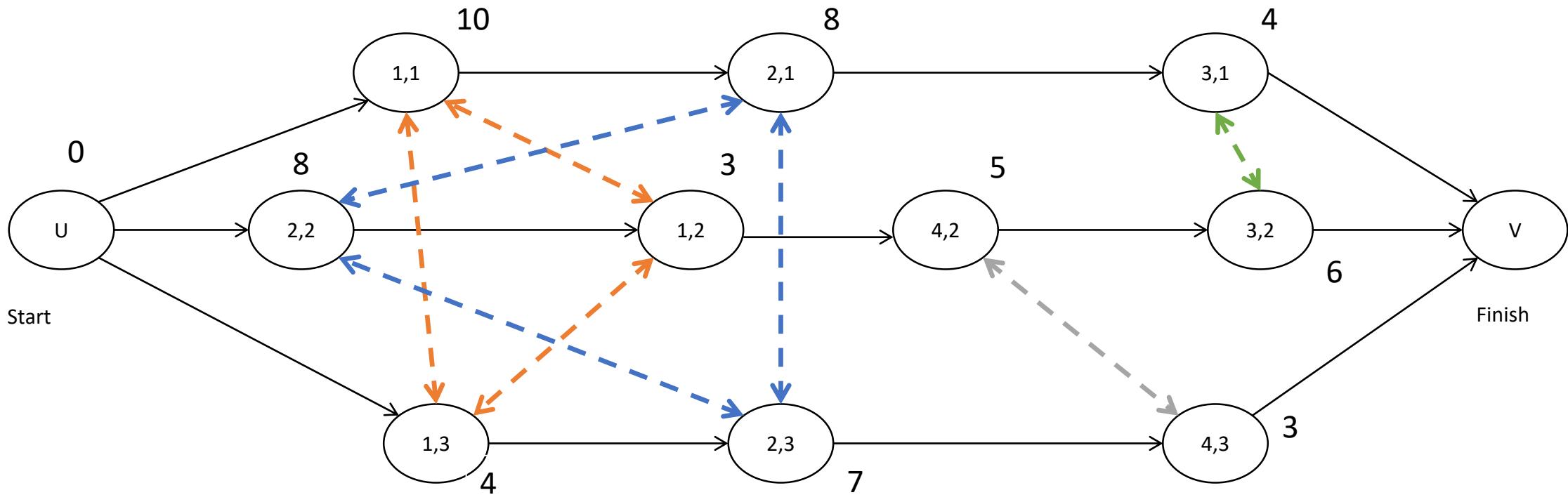
A factory consists of m machines M_1, \dots, M_m , and needs to process n jobs every day. Job j needs to be processed once by each machine in the order $(M_j(1), \dots, M_j(m))$. Machine M takes time to process job j . **A machine can process one job at a time, once a job is started on any machine, it must be processed to completion.** The objective is to minimize makespan.

	Machine number (Processing Time)	Machine number (Processing Time)	Machine number (Processing Time)	Machine number (Processing Time)
Job 1	1 (10)	2 (8)	3 (4)	
Job 2	2 (8)	1 (3)	4 (5)	3 (6)
Job 3	1 (4)	2 (7)	4 (3)	

Graph Representation



	Machine number (Processing Time)	Machine number (Processing Time)	Machine number (Processing Time)	Machine number (Processing Time)
Job 1	1 (10)	2 (8)	3 (4)	
Job 2	2 (8)	1 (3)	4 (5)	3 (6)
Job 3	1 (4)	2 (7)	4 (3)	



Local Shifting Bottleneck Heuristic

Step 1: Identify the bottleneck machine based on the processing time of ‘job sequence for a machine’.

	Machine number (Processing Time)	Machine number (Processing Time)	Machine number (Processing Time)	Machine number (Processing Time)
Job 1	1 (10)	2 (8)	3 (4)	
Job 2	2 (8)	1 (3)	4 (5)	3 (6)
Job 3	1 (4)	2 (7)	4 (3)	

	Job 1	Job 2	Job 3	Total Process time
Machine 1	10	3	4	17
Machine 2	8	8	7	23
Machine 3	4	6	0	10
Machine 4	0	5	3	8

Step 2: Select the machine with highest processing time

Machine 2 is selected Processing time is 23

	Machine number (Processing Time)	Machine number (Processing Time)	Machine number (Processing Time)	Machine number (Processing Time)
Job 1	1 (10)	2 (8)	3 (4)	
Job 2	2 (8)	1 (3)	4 (5)	3 (6)
Job 3	1 (4)	2 (7)	4 (3)	

Machine 2	Job 1	Job 2	Job 3	
Job Processing Time	8	8	7	
Job Release Time	10	0	4	
Due Date	19	9	20	

Sequence M2 (EDD)

Job 2 – Job 1 – Job 3

Step 3 Select the height processing from the remaining machine

Machine 1 = 17 Processing Time

	Machine number (Processing Time)	Machine number (Processing Time)	Machine number (Processing Time)	Machine number (Processing Time)
Job 1	1 (10)	2 (8)	3 (4)	
Job 2	2 (8)	1 (3)	4 (5)	3 (6)
Job 3	1 (4)	2 (7)	4 (3)	

Machine 1	Job 1	Job 2	Job 3	
Job Processing Time	10	3	4	
Job Release Time	0	8	0	
Dude Date	5	6	7	

Sequence M1

Job 1 – Job 2 – Job 3

Step 4 Select Next height machine processing

Machine 3 = 10 Processing Time

	Machine number (Processing Time)	Machine number (Processing Time)	Machine number (Processing Time)	Machine number (Processing Time)
Job 1	1 (10)	2 (8)	3 (4)	
Job 2	2 (8)	1 (3)	4 (5)	3 (6)
Job 3	1 (4)	2 (7)	4 (3)	

Machine 3	Job 1	Job 2	Job 3	
Job Processing Time	4	6	0	
Job Release Time	18	16	0	
Dude Date	10	10		

Sequence M3

Job 1 – Job 2

Step 5: Select the next machine with height processing time

Machine 4 = Processing time 8

	Machine number (Processing Time)	Machine number (Processing Time)	Machine number (Processing Time)	Machine number (Processing Time)
Job 1	1 (10)	2 (8)	3 (4)	
Job 2	2 (8)	1 (3)	4 (5)	3 (6)
Job 3	1 (4)	2 (7)	4 (3)	

Machine 4	Job 1	Job 2	Job 3	
Job Processing Time	0	5	3	
Job Release Time	0	11	11	
Dude Date	0	2	8	

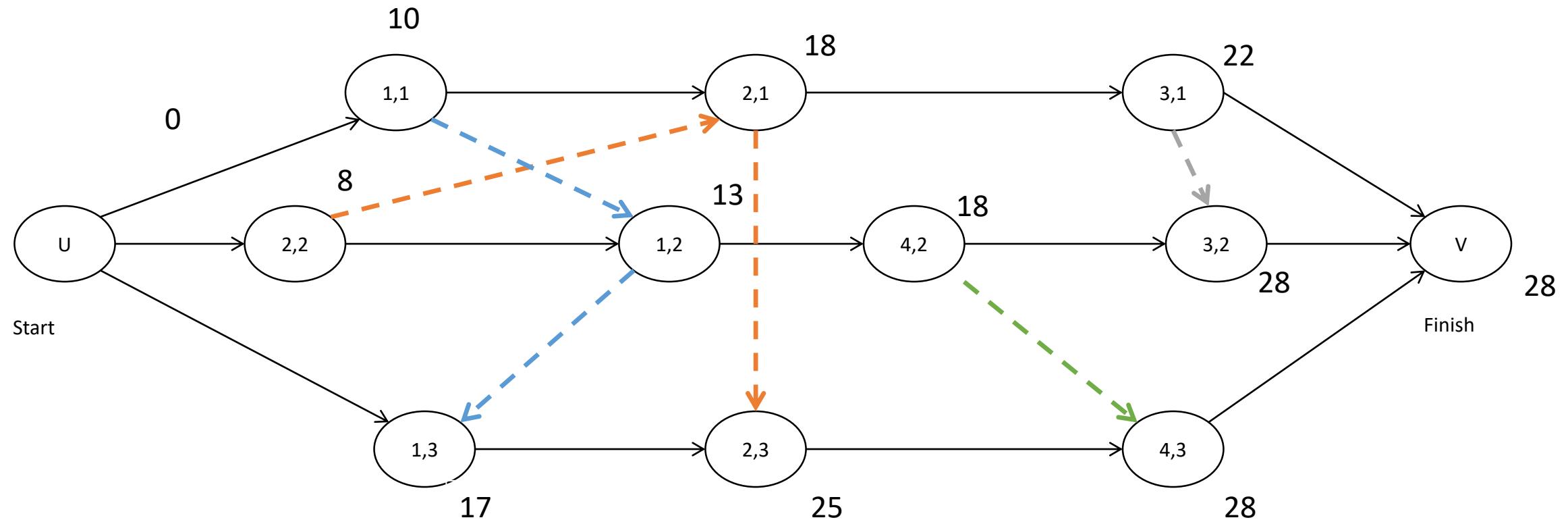
Sequence M4

Job 2 – Job 3

Make Span Calculation

	Machine number (Processing Time)	Machine number (Processing Time)	Machine number (Processing Time)	Machine number (Processing Time)
Job 1	1 (10)	2 (8)	3 (4)	
Job 2	2 (8)	1 (3)	4 (5)	3 (6)
Job 3	1 (4)	2 (7)	4 (3)	

Sequence	
Sequence Machine 2	Job 2 – Job 1 – Job 3
Sequence Machine 1	Job 1 – Job 2 – Job 3
Sequence Machine 3	Job 1 – Job 2
Sequence Machine 4	Job 2 – Job 3



Lekin