Additional Content

By: Ashok Basnet

Flow-shop scheduling

- Flow-shop scheduling is an optimization problem in computer science and operations research.
- It is a variant of optimal job scheduling.
- In a general job-scheduling problem, we are given n jobs J_1, J_2, ..., J_n of varying processing times, which need to be scheduled on m machines with varying processing power, while trying to minimize the makespan – the total length of the schedule (that is, when all the jobs have finished processing).
- In the specific variant known as flow-shop scheduling, each job contains exactly m operations.

Flow-shop scheduling

- There are m machines and n jobs.
- Each job contains exactly m operations.
- The i-th operation of the job must be executed on the i-th machine.
- No machine can perform more than one operation simultaneously.
- For each operation of each job, execution time is specified.
- Operations within one job must be performed in the specified order.
- The first operation gets executed on the first machine, then (as the first operation is finished) the second operation on the second machine, and so on until the m-th operation.

Flow-shop scheduling - Johnson's Algorithm

In a factory, there are 6 jobs to perform, each of which should go through 2 machines A and B, in the order AB. The processing timings (in hours) for the jobs are given below:

Job	**J1**	**J2**	**J3**	**J4**	**J5**	**J6**
Machine A	1	3	8	5	6	3
Machine B	5	6	3	2	2	10

You are required to determine the sequence for performing the jobs that would minimize the total elapsed time T. What is the value of T?

Flow-shop scheduling - Johnson's Algorithm

Johnson's rule is:

- if the shortest time is for the 1st machine, do that job first
- if the shortest time is for the 2nd machine, do that job last
- if there is a tie in the processing time, then we will choose that job for which the difference in the processing time is large between the machines and enter in the location depending on the machine.

Based on this, we will proceed as follows:

Job sequence will be:

Flow-shop scheduling - Johnson's Algorithm

Job	**Machine A**		**Machine B**		**Idle Time Machine A**	**Idle Time Machine B**
	In	Out	In	Out		
J1	0	1	1	6	-	1
J6	1	4	6	16	-	-
J2	4	7	16	22	-	-
J3	7	15	22	25	-	-
J4	15	20	25	27	-	-
J5	20	26	27	29	29-26 = 3	-