* OR Case Study *

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Sequencing Problem.

- Sequencing deals with the selection of an optimum order for the number of jobs to be performed with a finite number of facilities.
The objective of sequencing is to determine the sequen of performing jobs such that the total cost / time is minimized.

- Terminology:

Total Elapsed time: (T)
It is the time interval between starting the first job and completing the last job including the idle time (if any) in a particular order by the given set of machines.

Idle Time:
It is the time for which a machine j does not have a job to process, i.e., idle time from the end of job (i-1) to the start of job i.

Processing Time:
It is the time required by a job i on each machine j.

Example:

Q. A machine operator has to perform three operations – turning, threading and knurling – on a number of different jobs. The time required to perform these operations (in minutes) for each job is given below table. Determine the order in which the jobs should be processed in order to minimize the total time required to perform all the jobs. Also find the minimum elapsed time.

Jobs	Turning [M1]	Threading [M2]	Knurling [M3]
1	3	8	13
2	12	6	14
3	5	4	9
4	2	6	12
5	9	3	8
6	11	1	13

Soln: Check the condition for,

Minimum time for M1 ≥ Maximum time M2

i.e. $2 \geq 8$

∴ does not satisfy the condition.

(OR)

Minimum time for M3 ≥ Maximum time on M2

i.e. $8 \geq 8$

∴ satisfies the condition.

Since either one of the conditions is satisfied, the problem can now be converted into two machine type.

Assume Imaginary machines as M4 and M5
where, M4 = M1 + M2
M5 = M2 + M3

Jobs	M4	M5
1	3+8 = 11	8+13 = 21
2	12+6 = 18	6+14 = 20
3	5+4 = 9	4+9 = 13
4	2+6 = 8	6+12 = 18
5	9+3 = 12	3+8 = 11
6	11+1 = 12	1+13 = 14

optimal sequence:

4	3	1	6	2	5

Jobs sequence	M1 IN	M1 OUT	M2 IN	M2 OUT	M3 IN	M3 OUT	Idle Time A	Idle Time B	Idle Time C
4	0	2	2	8	8	20	0	2	8
3	2	7	8	12	20	29	0	0	0
1	7	10	12	20	29	42	0	0	0
6	10	21	21	22	42	55	0	1	0
2	21	33	33	39	55	69	0	11	0
5	33	42	42	45	69	77	0	3	0

∴ Total elapsed time = 77 min.

elapsed time for machine M1 = 42 min.
elapsed time for machine M2 = (45 - 2) = 43 min.
elapsed time for machine M3 = (77 - 8) = 69 min

idle time for machine M1 = 77 - 42
= 35 min.

idle time for machine M2 = 2 + 1 + 11 + 3 + (77 - 45)
= 49 min

idle time for machine M3 = 8 min