DEPARTMENT OF MATHEMATICS
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE
MAN 010: OPTIMIZATION TECHNIQUES

Tutorial 8: (Sequencing & Scheduling) Spring 2020

1. Following table shows the machine time (in hours) for 5 jobs to be processed on two machines. Passing is not allowed. Find the optimal sequence for jobs processing.

Jobs	1	2	3	4	5
Machine A	3	7	4	5	7
Machine B	6	2	7	3	4

2 Find the sequence that minimizes the total elapse time required to complete the following tasks:

Tasks	A	B	C	D	E	F	G
Time on I machine	3	8	7	4	9	8	7
Time on II machine	4	3	2	5	1	4	3
Time on III machine	6	7	5	11	5	6	12

3. Find the sequence that minimizes the total elapsed time (in hours) required to complete following jobs on three machines M_1 , M_2 and M_3 in the order M_1 , M_2 , M_3.

Tasks	A	B	C	D	E
Machine M_1	4	9	8	6	5
Machine M_2	5	6	2	3	4
Machine M_3	8	10	6	7	11

4. Use graphical method to minimize the time needed to process the following jobs on the machines as shown below. For each machine find the job which should be done first. Also calculate the total time needed to complete both the jobs.

		Machines				
Job 1	sequence	A	B	C	D	E
	Time	3	4	2	6	2
Job 2	sequence	B	C	A	D	E
	Time	5	4	3	2	6

5. Solve the following giving an optimal solution given that passing is not allowed.

	Machines				
	M_1	M_2	M_3	M_4	M_5
A	9	7	4	5	11
B	8	3	6	7	12
C	7	6	7	8	10
D	10	5	5	4	8

Answers:

1. $1 \to 3 \to 5 \to 4 \to 2$; min time = 28 hours; idle time is 2 and 6 hours for A & B
2. $A \to D \to G \to E \to B \to C \to F$; and $A \to D \to G \to B \to F \to C \to E$. Min elapsed time: 59 hours, idle time:13 for I, 37 for II and 7 for III.
3. (i) $A \to D \to E \to B \to C$; (ii)) $A \to E \to D \to B \to C$; (iii) $D \to A \to E \to B \to C$; (iv) $D \to E \to A \to B \to C$; (v) $E \to D \to A \to B \to C$; (vi)) $E \to A \to D \to B \to C$. Min time = 51 hours; idle time 9, 31 and 19 hours, resp.
4. Elapsed time = 22 hours
5. $A \to C \to B \to D$; Min time = 67 hours

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