MAN-010 (Optimization Techniques)

Ex. 10 **Instructor:** Dr. S. K. Gupta

1. We have five jobs, each of which must be processed on the two machines A and B in the order AB. Processing times in hours are given in the table below:

Job	: 1	2	3	4	5
Machine A	: 5	1	9	3	10
Machine B	: 2	6	7	8	4

   Determine a sequence for the five jobs that will minimize the elapsed time T.

2. A book binder has one printing press, one binding machine, and manuscripts of a number of books. The time required performing the printing and binding operations on each book are shown below. The binder wishes to determine the order in which the books should be processed, so that the total time required to process all books is minimized.

Book	: 1	2	3	4	5	6
Printing time (Hours)	: 30	120	50	20	90	110
Binding time (Hours)	: 80	100	90	60	30	10

3. Five jobs are performed, first on machine X and then on machine Y. The time taken, in hours by each job on each machine is given below:

Job	: A	B	C	D	E
Time on machine X	: 12	4	20	14	22
Time on machine Y	: 6	14	16	18	10

   Determine the optimum sequence of jobs that minimizes the total elapsed time to complete the jobs. Also compute the minimum time.

4. Following table shows the machine time (in hours) for5 jobs to be processed on two different machines:

Job	: 1	2	3	4	5
Machine A	: 3	7	4	5	7
Machine B	: 6	2	7	3	4

   Passing is not allowed. Find the optimal sequence in which jobs should be processed.

5. We have five jobs each of which must go through two machines in the order AB. Processing times are given below:

Job	: 1	2	3	4	5
Machine A	: 10	2	18	6	20
Machine B	: 4	12	14	16	18

6. We have six jobs, each of which must go through machines A, B and C in the order ABC. Processing time(in hours) are given in the following table:

Job	: 1	2	3	4	5	6
Machine A	: 8	3	7	2	5	1
Machine B	: 3	4	5	2	1	6
Machine C	: 8	7	6	9	10	9

   Determine a sequence for the five jobs that will minimize the elapsed time t.

7. Determine the optimal sequence of jobs that minimize the total elapsed time based on the following information. Processing time on machines is given in hours and passing is not allowed.

Job	: A	B	C	D	E	F	G
Machine (M_1)	: 3	8	7	4	9	8	7
Machine (M_2)	: 4	3	2	5	1	4	3
Machine (M_3)	: 6	7	5	11	5	6	12

8. We have five jobs each of which must go through the machines A,B and C in the order ABC. Processing times(in hours) is as follows:

Job	: 1	2	3	4	5
Machine A	: 5	7	6	9	5
Machine B	: 2	1	4	5	3
Machine C	: 3	7	5	6	7

Determine the sequence for the jobs that will minimize the total elapsed time.

9. Use the graphical method to find the minimum elapsed total time sequence of 2 jobs and 5 machines, when we are given the following information.

			Machines				
Job 1	Sequence	:	A	B	C	D	E
	Time (hrs)	:	2	3	4	6	2
Job 2	Sequence	:	C	A	D	E	B
	Time (hrs)	:	4	5	3	2	6

Answers:

1. Optimal sequence: 2-4-3-5-1; Elapsed time=30hours.Idle time for machine A=2 hours, and for machine B=3 hours.
2. Optimal sequence: 4-1-3-2-5-6; Elapsed time=430 hours. Idle time for printing machine=10 hours, and for binding machine=40 hours.
3. Optimal sequence: B-D-C-E-A; Elapsed time=48 hours. Idle time is 12 hours for machines X and Y each.
4. Optimal sequence: 1-3-5-4-2; Elapsed time= 28 hours. Idle time for machine A=2 hours, and for machine B=3 hours.
5. Optimal sequence: 2-4-3-5-1; Elapsed time=60 hours.
6. Optimal sequence: (i) 4-5-2-6-1-3, (ii) 4-5-2-6-1-3; Elapsed time= 53 hours. Idle time for machine A=27 hours; for machine B=32 hours, and for machine C=4 hours.
7. Optimal sequence: D-G-F-B-C-E; Elapsed time= 59 hours. Idle time for machine M_1=13 hours; for machine M_2=37 hours, and for machine M_3=7 hours.
8. Optimal sequence: (i) 2-5-4-3-1, (ii) 5-4-3-2-1, (iii) 5-2-4-3-1. Elapsed time= 40 hours. Idle time for machine A=8 hours; for machine B=25 hours, and for machine C=12 hours
9. Idle time is 3 hours for job 1 and zero hour for job 2.Elapsed time for job 1 is 17+3=20 hours