

Week 16 - Metaheuristics

Flowshop

MENGM0032
Manufacturing Systems

Cyberdyne runs a production line with 8 machines M_1 to M_8 . The products that go on this line require processing by all 8 machines in sequence (i.e. starting on M_1 then processing on M_2 and onwards through the rest of the machines until they finish processing on M_8) but the time that each product requires on each machines varies. The company has received an order for 30 jobs (see table 1 - an Excel copy is also available on Blackboard).

1. Create a computer tool to calculate the time of the end of the final job on the last machine, given a sorted list of jobs. Assume that jobs cannot overtake one another in the line.
2. Use the sum of time that the job requires on all machines as a heuristic. Order the jobs in an ascending and descending order and calculate the total makespan of the resulting job sequence (the time that it takes to complete all 8 processes on all jobs).
3. Use the sum of the time of the first four jobs and the sum of the time of the last four jobs and use Johnson's rule ¹ to schedule the jobs. Compute the makespan and compare with the previous ones.
4. Use a metaheuristic method to find a good schedule and compare with the results of the previous sections.
5. Create a mathematical programming model for the problem and try to optimally solve it. If completed, compare the solution to the previous sections.

¹https://en.wikipedia.org/wiki/Johnson%27s_rule

Table 1: Orders received and the time they require on each machine.

Job	M_1	M_2	M_3	M_4	M_5	M_6	M_7	M_8
1	9	3	6	10	8	5	3	2
2	2	4	4	1	1	5	5	3
3	5	9	8	2	9	8	1	10
4	3	5	10	6	8	9	1	2
5	2	2	7	9	7	8	8	1
6	1	5	7	6	6	5	2	10
7	8	1	2	1	6	6	4	2
8	9	3	2	4	6	3	6	10
9	4	4	2	3	7	7	10	8
10	1	4	3	2	3	10	9	6
11	2	8	8	8	3	4	7	10
12	6	8	10	8	10	3	6	7
13	6	2	7	1	10	1	10	7
14	9	7	5	4	8	1	2	2
15	3	1	10	4	10	2	8	3
16	9	2	1	1	4	3	7	4
17	7	1	7	6	6	3	6	7
18	8	5	5	10	5	9	2	4
19	6	1	6	1	1	7	5	2
20	7	1	5	9	7	1	8	2
21	2	8	5	2	3	4	6	10
22	1	8	9	9	7	1	10	8
23	10	3	3	10	6	7	2	4
24	7	1	6	2	4	4	9	2
25	5	8	9	6	10	2	5	4
26	9	3	5	1	8	6	9	1
27	1	9	5	9	7	1	7	1
28	9	8	3	3	4	8	10	4
29	2	4	7	3	3	1	10	1
30	6	10	9	1	10	1	4	5