

Math 441

Scheduling jobs in a machine shop.

Consider a machine shop with 5 equivalent machines each with a startup cost of \$1000. There are 18 jobs to be scheduled. Let d_i denote the duration of job i (units are days):

d_1	d_2	d_3	d_4	d_5	d_6	d_7	d_8	d_9	d_{10}	d_{11}	d_{12}	d_{13}	d_{14}	d_{15}	d_{16}	d_{17}	d_{18}
20	19	17	16	16	16	12	11	9	9	9	5	4	4	4	4	2	1

- a) Formulate as an integer linear program the problem of scheduling the jobs while minimizing startup costs. All jobs must be completed in 45 days. A job must be performed on only one machine; it cannot be split up.
- b) How could you specify in your model that job 1 and job 2 cannot be run on the same machine? How could you specify that job 1 and job 2 must be run on the same machine?
- c) Starting with the problem as in a), add the additional constraint that at least every 20 days (after ≤ 20 days of use) the machines must be serviced for one day at a cost of \$900. Servicing would ruin any partially completed job. Provide an integer linear programming formulation.
- d) Would it make sense to introduce individual startup times and costs for each job?