

Program 1

Nedialko B. Dimitrov

1. You own a machining company and you would like to expand your operations. It is currently year zero and you own zero machines. You want to purchase more machines over time. For each of the following six years, you would like to have a minimum number of machines as follows.

Year	1	2	3	4	5	6
Minimum number of machines required	1	2	4	6	7	8

But, the cost of purchasing new machines changes over time. The cost for a single new machine varies from year to year as follows:

Year	1	2	3	4	5	6
Cost of a single new machine	\$4	\$6	\$8	\$7	\$5	\$2

In addition, you can buy no more than three machines per year.

Formulate the problem of finding the minimum cost expansion plan as a shortest path problem. Be sure to describe what are the nodes in your graph, what are the edges, how you compute the edge costs, and what are the start and end nodes for your shortest path problem.

In addition, obtain a solution for this problem using Python, networkx, and pyomo.

For this assignment, turn in the following things:

- A description of how you formulated the network. (nodes, edges, costs, etc.) A picture is also helpful.
- A print out of the Python code you used to solve the problem. Remember that you can use the solution previous programming homework as a starting point. Specifically, you shouldn't need to write *anything* in terms of pyomo... you should be able to re-use the function from the previous assignment. On the other hand, you will have to create input files that contain the data for the problem, and code to construct a network for the problem.

Please highlight or underline the lines of code you wrote. Also, please provide a printout of the output your program produces that tells you the solution of the problem. If you'd like to understand pyomo slightly better, try switching the solver between cplex and glpk. Also try adding constraints that say $y_{ij} \leq 1 \forall ij \in E$. These constraints should not change the resulting solution, they will just give you practice with editing pyomo code.