AMPL Problems

Course: *Mathematics for Decisions*
University of Verona

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1 Lot Sizing and Production Problem

A company produces cubic meter glass fiber and would like to plan the production for the following six weeks. The production capacity is limited and this limit varies according to the considered week. Weekly demand is already known for the whole period. Production and warehousing costs also vary according to the week. Data are shown in the table below.

Week	**Capacity**	**Demand**	**Prod. Cost**	**Warehousing Cost**
1	140	100	5	0.20
2	100	120	8	0.30
3	110	100	6	0.20
4	100	90	6	0.25
5	120	120	7	0.30
6	100	110	6	0.40

Plan the production minimizing production and warehousing costs.

2 Vertex Cover

A vertex cover of an undirected graph is a subset of its vertices such that for every edge (u, v) of the graph, either u or v is in the vertex cover, covering all edges of the given graph. Given an undirected graph, the vertex cover problem is to find minimum size vertex cover.

In this case, no particular instance is given, so you are free to use the examples you prefer.

3 Triangle

Given a triangle of numbers like the following one,

7
3 8
8 1 0
2 7 4 4
4 5 2 6 5

write a program that computes the biggest sum that you can obtain, following a path that starts at the top of the triangle and ends somewhere along its basis. At every level, the path considers exactly just one number and, descending from the vertex to the base, at every step it chooses if going to the left or to the right number below the current position.

4 The Old Map

A map is divided in sections that correspond to the ones in a squared N x N chessboard, with rows and columns enumerated from 1 to N. The section in the position corresponding to row r and column c is identified with the integer couple (r,c). Sections labeled with a "1" contain mortal traps and therefore they must be avoided, whereas the others are harmless and signaled by a "0".

Starting from section (1,1), we would like to reach section (N,N), building a path through adjacent sections and moving in horizontal, vertical or diagonal way, but going only through harmless sections.
The objective is computing the shortest harmless path.

5 Pirellone

The Pirellone is a famous skyscraper in Milan, where windows are methodically arranged in M rows (floors) and N columns. Rows are enumerated from 1 to M (from the top to the bottom) and columns from 1 to N (from left to right). Not every employee turns off the light in its office, before leaving the building at the end of the day. Therefore some windows remains enlightened and it is up to the guardian to turn them off.

To make the guardian's job easier, $M+N$ special switches were prepared, with a particular mode of operation. There are M row switches and N column switches. When the guardian click on the $i-th$ row switch, every light on the $i-th$ row is turned off but, at the same time, the ones off are turned on! In a similar way, a column switch turns off every light on in that column and turns on the off ones.

Given the initial configuration of the lights, the guardian must check if it is possible turning off the lights with the special switches and, in that case, he has also to specify which specific switches to use. Otherwise, he establishes that traditional switches have to be used.

Help the guardian to decide which $M+N$ switches use, in order to turn off all the lights of the windows of Pirellone. In this case, no particular instance is given, so you are free to use the examples you prefer.