IE 303 Modelling and Methods in Optimization
Fall 2021
First Project Assignment to be completed individually or in groups of two, due date: 24.10.2021, 22:00 hours, send your reports to the TAs by email.
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1. Warm-up:

Power generators of four different types are available to satisfy the daily electricity demands of (in megawatts) of the city of **Schweinerei**, listed in the table below. We consider a sliding time horizon: the period 10pm-12am of day d is followed by the period 0am-6am of day $d+1$.

Per.	0am-6am	6am-9am	9am-12pm	12pm-2pm	2pm-6pm	6pm-10pm	10pm-12am
Dem.	12000	32000	25000	36000	25000	30000	18000

The power generators of the same type have a maximum capacity and may be connected to the network starting from a certain minimal power output. They have a start-up cost, a fixed hourly cost for working at minimal power, and an hourly cost per additional megawatt for anything beyond the minimal output. These data are given in the following table. Costs are in Euro/hour. Output and capacity are in megawatts.

	Avail. number	Min. output	Max. Cap.	Fix cost	Add MW cost	Start-up cost
Type 1	10	750	1750	2250	2.7	5000
Type 2	4	1000	1500	1800	2.2	1600
Type 3	8	1200	2000	3750	1.8	2400
Type 4	3	1800	3500	4800	3.8	1200

A power generator can only be started or stopped at the beginning of a time period. As opposed to the start, stopping a power plant does not incur a cost. At any moment, the working power generators must be able to cope with a surge of 20% of the demand forecast.

1. Give a Linear Integer Programming Model for the problem of deciding which power generators should be used in every period to minimize the total daily cost for Schweinerei.

2. Code and solve your model in XPRESS-MP. Attach a brief output with your XPRESS-MP model results.

2. SUDOKU

This problem entails a playful activity. Everyone knows the Sudoku puzzle: a 9×9 square checker board is given with 81 cells. The board is divided into 9 sub-boards of 3×3, and it is partially filled with numbers from 1 to 9. The rule of the game is to fill up the entire checker board (you figure out which number to assign to the empty cells, that is you do not touch the cells already filled with given numbers) with numbers from 1 to 9 so that any number appears exactly once in every column, every row and every sub-board.

In this assignment you are asked to formulate the solution of the puzzle as the result of an integer programming model. You are expected to solve the following two Sudoku puzzles with your model in XPRESS-MP and report the result:

6					3	7	8	
	1				5		9	
		8					3	1
			1					
		2		3			6	
					8			9
7								
			6	2	9			
1	9					6		

Puzzle I

		9	1					
6		3			9		7	
				8				4
	2		5		7			8
		5				4		
9			6		3		5	
				6				
	5		9			7		1
		2			4	9		

Puzzle II

Send your XPRESS-MP model and a summary of your result to the TAs.

In case you find the model on the web or another source you have to give reference to that source. However, even if you do, recall that there may be a question or two about this assignment in the quizzes and exams to come. Hence, google at your own risk!

P.S. These are really hard instances, so solving them by hand is quite difficult. Too bad that this year Bilkent News does not feature Sudoku puzzles with prizes!