MATLAB Tutorial and Weekly Test 11

Exercises to be posted to CANVAS are at the end of the assignment sheet. The first part in preparation for the assessment.

The parts of this tutorial that are flagged in the section header for submission are to be used for assessment purposes. The code used to generate the input for that exercise must be included in the submitted work along with the output and handed in to be marked. Please do this by publishing your work in Matlab as a pdf file and then upload onto CANVAS.

Any script or function code that *you have modified or written* must also be so included using the `type filename.m` command.

1.1 Other Integer Linear Programming Models

I this first part, we propose to discuss more models in Integer linear Programming. We propose to work on models proposed in the document `Linear models.pdf` and solve them using Matlab and/or Excel. We will discuss more particularly the example *Lucette's suitcase*.

1.2 Integer Linear Programming (to be handed in)

Example 1 *The Travelling Platypus is a backpacker hotels company already well established in Australia. The company owns some properties in various locations and have already some drafts of projects they plan to launch in the coming years on these locations. For the first phase of this expansion plan, the company plans to start, in the next four years, four of these forecasted projects. The following table gives the price of the construction (in million $) based on the type of each project and the year it starts. The company will choose a cheapest option.*

#	Location	Year 1	Year 2	Year 3	Year 4
1	Arlie Beach	150	125	175	150
2	Brisbane	145	150	200	250
3	Gold Coast	195	200	220	230
4	Melbourne	140	150	155	160
5	Sydney	125	140	180	150
6	Perth	100	125	160	180

Table 1: Construction cost in million $

These projects are interrelated and, if they start, they are subject to several constraints listed below:

- *a Gold Coast and Arlie Beach's projects cannot start on different years.*
- *b If Brisbane's project starts during the first year, then so does the Sydney's one.*
- *c The Melbourne and Sydney's projects cannot start in years 3 or 4.*
- *d The Brisbane and Perth's projects cannot start the same year.*
- *e The cost of the projects starting in year 1 cannot exceed 300 million $*

1. *Show that the problem of selecting four projects for the first four years with the objective of minimising the cost and satisfying all constraints can be formulated as an Boolean Linear Program with 24 variables, 12 inequality constraints and 6 equality constraints. Define all variables, the objective and the constraints.*

   The 6×4 *Cost matrix can be found in the Mat-file '*`data_platypus`*'.*

2. *This question aims to solve the model described at the previous question using the Matlab solver.*

   (a) *Load the variable* `Cost` *and compute a* 1×24 *vector* `CostL` *corresponding to reading* `Cost` *row-by-row using the function* `reshape` *(be careful how it works, try on examples). We then define the variables in such a way that* `CostL` *will be the objective.*

   (b) *Compute* `Aineq` *and* `Aeq`*, the inequalities and equalities matrices, respectively as well as the corresponding* `bineq` *and* `beq` *vectors. Use predefine functions and/or loops to avoid writing the matrices exhaustively. For* `Aeq` *you can use in particular the function* `repmat` *(try on simple examples to understand how it works). Display the two matrices in your published file as well as their dimension.*

   (c) *Solve the model established in Question 1 using the function* `intlinprog`*.*

   (d) *Represent the solution as a boolean* 6×4*-matrix (using the function* `reshape`*) and then, interpret the solution in a descriptive paragraph in English.*