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Handout: 8.10.2018
Turnin by: 18.10.2018

Tutorials

Optimisation

2018

Exercise Sheet 2

(accounts for **5 %** of your final mark)

Exercise 3 is for the tutorial session. Exercise 4 is homework (and will be marked).

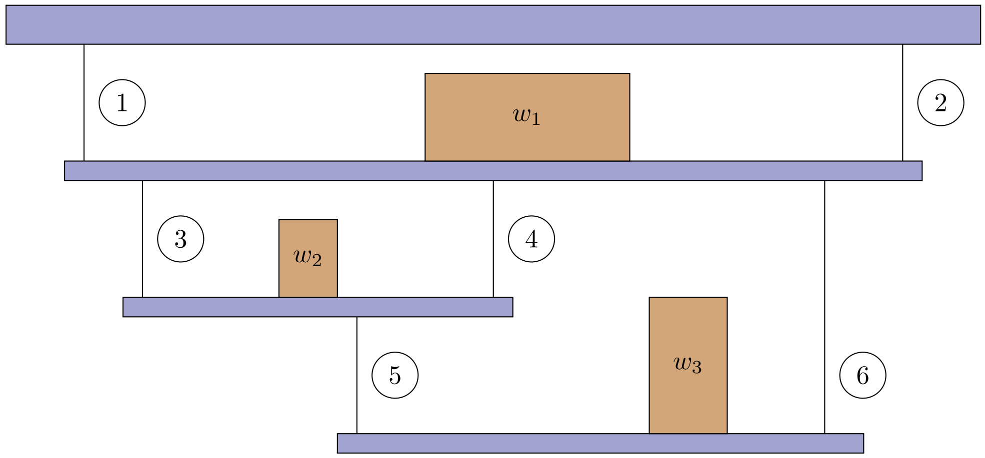
Exercise 3:
A manager of a tiny oil refinery has 800 barrels of crude oil A and 500 barrels of crude oil B allocated for production during the coming month. These resources can be used to make either gasoline, which sells for £38 per barrel, or home heating oil, which sells for £33 per barrel. There are three production processes with the following characteristics:

	Process 1	Process 2	Process 3
Input crude A	14	3	24
Input crude B	24	3	14
Output gasoline	19	3	14
Output heating oil	14	3	19
Cost	£184	£33	£109

All quantities are in barrels. For example, with the first process, 14 barrels of crude A and 24 barrels of crude B are used to produce 19 barrels of gasoline and 14 barrels of heating oil. The costs in this table refer to variable and allocated overhead costs, and there are no separate cost items for the cost of the crudes. Formulate a linear programming problem that would help the manager maximize net revenue over the next month.

Solve the LP by using Gurobi.

Exercise 4 (5 marks)**:**
Consider the following scaffolding that consists of three platforms connected in the shown way, hanging at a fixed ceiling.



The connections 1 to 6 are realized by wires. There has to be at least one wire at each connection, but there can also be more, in which case the carrying capacity of the connection increases linearly. However, every platform must have the same number of wires on both sides. The weight capacity of one wire is 40 kg, independent of its length. For simplicity we ignore the weight of the wires themselves. Each connection has a length of 1m, except connection 6, which is 2 m long. There is a total of 60 m of wire available to implement all connections. Finally, there is the weight of the three platforms, which is 10 kg each. The problem is to maximize the total weight that can be loaded onto the construction. For stability reasons it has to be ensured that the weight on the upper platform (w_1) does not exceed the sum of the weights on the two other platforms ($w_2 + w_3$); accordingly, the weight on the lower platform (w_3) may also not exceed the sum of the weights on the others ($w_1 + w_2$). Assume that it makes no difference where the weights are positioned on the respective platforms; more precisely, for each platform assume that both upward connections have to hold the same weight.

a) Set up a mixed integer linear program (MIP) that models the problem. The weights can be non-negative real numbers and the number of wires at each connection should be non-negative integers. Rewrite the problem as an LP file and name it "platforms.lp".

b) Use Gurobi to find an optimal solution for platforms.lp. Put the output of m.getVars() into a text-file named "output.txt". In your own words, state the solution of this LP (values of variables and objective function) and add this to the end of the text-file.

Submit the LP file platforms.lp and the output file output.txt by **Thursday, 18 October 2018, 5pm** by using the link that corresponds to your module code. No late submission accepted.

- `https://sam.csc.liv.ac.uk/COMP/Submissions.pl?module=comp331`
- `https://sam.csc.liv.ac.uk/COMP/Submissions.pl?module=comp557`