Homework 3

In the lecture, we introduced DC Load Flow as a method to include physical flows in the dispatch model. The goal of this Homework is to implement DC Load Flow Constraints in a template of the Ehrenmann & Smeers model.

Task 1: The Model:
The goal of this task is to get familiar with the model structure and its results.

a) From line 14 in the template you find the PTDF matrix of the network. Explain what the PTDF matrix does, what assumptions and information is used to derive it.

b) Describe the Objective function of the problem and distinguish the different subsets of nodes.

c) State the problem type and find an available solver to solve it[1].

d) The model formulation in the template is different to formulation in the paper. Explain why both formulations are equivalent and describe possible benefits of either.

e) How is the market price defined in the model and how are supply nodes distinguished from demand nodes?

f) Use the result Dictionary to get access the model results and return all values which are used in the result table in the paper plus the price by dual as a reference.

g) Run the template. To which result from the paper does this problem formulation correspond?

Task 2: Equations and Results:

a) Based on the results of the template model, will this market price be equal to the dual on the Energy Balance. Explain possible differences in terms of the formulation or optimization problems in general.

b) Implement two constraints which enforce upper- and lower limits in line flows. Make sure this constraint only applies to the lines "1-6" and "2-5". This should correspond to the results from Table 4. Explain why the market- and dual price are now equivalent.

c) Implement a constraint that forces the market prices to be equal to a variable price for all nodes within a price zone. You can use a similar approach as in the plants-in-zone dictionary from the transport model.

[1] Use `https://www.juliaopt.org/` as a reference of available solvers.

d) Use this constraint to implement configurations 2.1 and 2.2 from the paper. Confirm the results with Tables 11 and 12. Compare the resulting prices from the definition and the ones by the dual.

Please sent your results to riw@wip.tu-berlin.de until July 4th 2018.