

Hands-on Tutorial on Optimization

Exercise Sheet: Crude Oil Processing

Two processes are available to refine 10 barrels of crude oil

Process	cost per barrel	output per 10 barrels
1	3€	2 barrels heavy oil 2 barrels medium heavy oil 1 barrel light oil
2	5€	1 barrel heavy oil 2 barrels medium heavy oil 4 barrels light oil

Any amount of crude oil can be refined using any of the two processes above, including fractions of barrels. The minimum required amounts of the three categories of refined oil are as follows:

heavy oil:	3 barrels
medium heavy oil:	5 barrels
light oil:	4 barrels

Compute the minimal cost of producing the above amounts of refined oil. Determine the amount of crude oil that should be processed using the first and the second of the available processes, respectively.

Exercise 1 (Basic Structure)

Build a model of the above problem and solve it using CPLEX. Proceed as follows:

- (a) Model the problem as LP.
- (b) Implement the basic structure of your model in CPLEX. This should include the declaration of the model variables.
- (c) Define the objective function and compute a minimal solution at the end of your model.
- (d) Now, add the constraints to your model.
- (e) Complete your program by adding text output. Display the optimal objective function value as well as the values of your model variables.

Exercise 2 (Add Flexibility)

In a first step to increase the flexibility of your model, make the following changes to your program:

- Define a set `oil_type` for the different categories of refined oil, as well as a set `process` that contains the different refinement processes.
- Define a array `demand` containing the demand for different categories of refined oil and a parameter `process_cost` that maps every process to the cost of refining a unit of 10 barrel using that process.
- Define an array `production` that holds the production of every type of refined oil for each process.
- Use loops and aggregators to define constraints and objective function of your model. If necessary, adapt your text output as well.

Exercise 3 (Data Input)

Separate your model from the data in the following way:

- Move the data from the sets and parameters defined in Exercise 2 to a data file.
- Create a new running configuration including the new model and the data file.
- Test your model on the alternative data provided on our homepage.