

Hands-on Tutorial on Optimization

Exercise Sheet: Maintenance scheduling of a fleet of trucks

Trucking company *Happy Truckers* has a fleet of 85 trucks. Their trucks undergo regular maintenance, which has to be planned as far ahead as possible such that they can always have the most possible trucks on the road.

Due to transportation laws each truck has to have three types of maintenance on a regular basis. Each truck has to come in for

- routine maintenance every 15 weeks
- transmission maintenance every 50 weeks
- engine overhaul every 90 weeks

When transmission maintenance is performed on a truck, routine maintenance is performed as well. Similarly, when an engine overhaul is performed both the transmission maintenance and the routine maintenance is done as well.

Routine maintenance takes half a week and costs € 250. Transmission maintenance takes a week and costs € 2000. An engine overhaul also takes a week, but it costs € 7500. A truck that is undergoing maintenance cannot be used for the complete duration of the maintenance. For each of the maintenances, there is a maximum number of trucks that can be handled each week:

Maintenance	capacity per week
Routine	6
Transmission	1
Engine	1

Table 1: Capacities for each maintenance type

The Happy Truckers company wants to always have at least 75 trucks available during all weeks.

Exercise 1

Write and implement a model that finds a week-based maintenance schedule for the next year such that all constraints are met and the total cost of maintenance is minimized.

The beginning state of each truck can be found in the data file. A .gms-file is available that you can use to read the data file in a way that should make it easier to model. Have a look at it and figure out what the purpose of the code is. Before solving the model with CPLEX, set the solver options in such a way that the solver will stop when it finds the optimal solution or when it ran for more than 10 minutes

Exercise 2

Have a look at the output of the solver. Do you notice anything? Do you recognize some of the theory that was discussed during the course? Is your solution optimal? If you did not find an optimal solution, how could you simplify the model such that CPLEX might solve it optimally?

Exercise 3

Suppose the company does not care about cost. How many trucks can they keep on the road? What is the bottleneck?