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Hands-on Tutorial on Optimization

Exercise Sheet: Maintenance Scheduling of a Fleet of Trucks (extra)

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.

The Happy Truckers company wants to have at least 75 trucks available during each week.

Exercise 1

Due to transportation laws each truck requires routine maintenance every 15 weeks. If a truck had its last routine maintenance performed more than 15 weeks ago, it is not allowed on the streets. (That is, there cannot be 15 consecutive weeks during which a truck is not maintained.) Routine maintenance takes half a week and costs € 250. And the maintenance station of the Happy Truckers company has space and time to do at most 6 routine maintenances every week. (That is, there can be at most 12 maintenances that only take half a week.)

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. You may relax the half week maintenance duration by assuming that a truck undergoing routine maintenance satisfies availability as half a truck during the whole week.

Exercise 2

In reality, transportation laws require that each truck undergoes 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 takes two weeks and 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 (this includes trucks still under maintenance from previous weeks):

Work the new constraints into your model of Exercise 1. You may still assume that a truck undergoing routine maintenance satisfies availability as half a truck during the whole

Maintenance	capacity per week
Routine	6
Transmission	1
Engine	2

Table 1: Capacities for each maintenance type

week. 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. Pay attention to 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?