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Winter term 2017/2018

Concepts and Algorithms of Optimization – Series 6

www.math.uni-magdeburg.de/institute/imo/teaching/wise17/cao/

November 28 and December 1, 2017

Exercise 1

Solve the office assignment problem (Series 4 Exercise 2) by applying the perfect matching model in AMPL.

Exercise 2

Set up a particular model to find perfect matchings in <u>bipartite</u> graphs.

(a) Solve the job assignment problem (Series 4 Exercise 1) again.

(b) Consider the problems given in Series 2. Which of these problems can be modeled using a similar structure? Give the necessary changes in the model and solve it.

Exercise 3

In the shop floor of the *H2O Chemicals Corp.*, there are several tasks to be operated and scheduled for the next day. Each of these tasks has a duration of 1 hour and some of them cannot be operated simultaneously.
The tasks are: unloading (U) and loading a truck (L), storing test tubes (S), picking (I) and packing (A) orders, mixing pesticides (M), heating (H), cooling (C) and vaporization (V) of other chemicals.
Since there is only one loading dock, the processes unloading and loading cannot take place at the same time. The mixing machine is located next to the loading dock, so that it cannot be used while any process is operated there. Storing and picking tasks involve the same vehicle, so they can only be executed after another. There are two employees working in the storage and dispatching area, each of which can only do one task at a time. One employee is responsible for unloading and storing items, while the other employee is in charge of picking and loading processes. Furthermore, cooling and heating require the same workplace, so that these tasks cannot be done simultaneously. Vaporization is one of the most dangerous processes in the shop floor. Therefore, the loading dock and the mixing workplace are the only areas, which may be used during this process.

Considering the given restrictions, the shop floor manager is willing to know, what is the maximum number of tasks, which can be operated simultaneously.

Additionally, the CEO of the *H2O Chemicals Corp.* is highly interested in optimal workflow and minimum working time. What is the minimum amount of time needed to finish all the given tasks?

State the underlying graph-based problems regarding the questions of the shop floor manager and the CEO. Give the corresponding linear programming formulations and solve the problems by using AMPL and a suitable solver.