

Hands-on Tutorial on Optimization

Exercise Sheet: Final Assignment

You are responsible for planning the time tables for the studies Informatik, Wirtschaftsinformatik, Digitale Medien, and Systems Engineering at a German university. This task consists of the assignment of lectures to rooms and time slots such that certain conditions are met. The time needed per course is counted in hours in the data. For simplification, we assume that there are five time slots of two hours available, i.e., 8-10, 10-12, 12-2, 2-4, 4-6. You can scarcely use the time slot 6-8.

There are different type of courses (lectures and seminars) as well as different type of modules (Bachelor Mandatory (BM), Bachelor Basic (BB), Bachelor Advanced (BA), Master Mandatory (MM), Master Basic (MB), and Master Advanced (MA)).

For lectures, you also have to include tutorials into your timetable. The size of a course (small, medium, and large) decides in which room the lectures can be taught. A small course can be taught in any room, a medium course only in medium and large rooms, and a large course only in large rooms. The large and medium courses may split up into multiple tutorials of 25 people per tutorial (small). Up to two tutorials from the same lecture can be taught by the same tutor in one medium room at the same time. As the scheduler, you can slightly adjust the sizes of the tutorials (at most 35 per tutorial) and thereby decreasing the number.

You may assume that there are different tutors for the tutorials (i.e., lecturers do not tutor their own courses).

Some of the restrictions are

- The professors have to attend university-wide meetings each Thursday from 4pm to 6pm.
- Some of the teachers have to attend meetings on Monday morning (10am-12am) and others have meetings on Tuesday morning (8am-10am).
- The lectures of BM modules that are part of the same curriculum are not allowed to take place at the same time.
- The same holds for the MM modules.
- The university prefers to not teach BM or MM modules on Tuesday 8am-12am and on Wednesday 12am-2pm.
- No lectures on Friday 10am to 2pm.
- Some courses from one study program counts as minor course in another program.
- Some courses can take place either in the summer or in the winter semester.
- If one course uses two time slots on the same day, they have to be consecutive.

- Meetings of courses (lectures, tutorials, seminars) should be spread as evenly as possible over the whole week.
- Tutorials need to take place after the corresponding lecture.

Come up with an ILP model and implement your model in GAMS. Carefully define your sets, variables, parameters, and equations, and explain all of them in your final report.

Answer the following questions in your final report:

- Are there more (maybe obvious) restrictions you have to include in your model as well?
- Which of the above mentioned restrictions do you choose to include in your model? Explain your decision.
- Which restrictions can you incorporate in your model while still solving it?
- Can you add constraints to strengthen your model?
- Can you simplify your model? Is it still feasible for the original problem? Is it still optimal?
- Can you extend the model? Do you see a way of including more conditions, preferences, ...?