Algorithmic Methods for Mathematical Models (AMMM)

Lab Session 4 – Greedy + Local Search Heuristics

In this fourth session we will focus on using heuristics to solve the problem described in lab session 2 regarding assigning tasks to computers in a data center.

1. Problem statement

Recall that the *P2* problem was formally stated as follows:

Given:

- The set T of tasks. For each task t the amount of resources requested r_t is specified.
- The set C of computers. For each computer c the available capacity r_c is specified.

Find the assignment of tasks to computers subject to the following constraints:

- Each task is assigned to exactly one computer.
- The capacity of each computer cannot be exceeded.

with the *objective* to minimize the highest loaded computer.

2. Tasks

In pairs, do the following tasks and prepare a lab report using the Python code that is provided.

a) Prepare a pseudocode for the Greedy algorithm. Specify the greedy function.

b) Prepare a pseudocode for the Local search algorithm. What neighborhoods and exploration strategies are implemented?

c) Generate instances of increasing size. Store these instances as they will be used in the coming lab sessions.

d) Solve the instances previously generated using:
   - Random only
   - Greedy function only,
   - Greedy + Local search (do for all combinations)

   Plot the quality of the solutions and time to solve. Select the best combination.

e) Solve the instances previously generated using the ILP from lab session 2. Configure CPLEX to stop after 30min or GAP≤1%. (To control execution time and GAP you might need to add a settings file to your project in CPLEX

studio. Time limit is in tab: “General” and GAP is in tab “Mixed Integer Programming/Tolerances”).

f) Plot the best combination for the Greedy and the ILP in terms of quality of the solutions and time to solve.