

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 $GAP \leq 1\%$. (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.