

Advanced Algorithms

First Programming Project 2025/26

DI – NOVA FCT

The first programming project is done in teams of **two** students and consists of a theoretical and experimental comparative study of alternative approximation algorithms for **one** optimization problem. Each group must choose the optimization problem to study and at least two approximation algorithms for the chosen problem. The report should contain the following topics:

- **Problem:** Define the problem and indicate the complexity class of the corresponding decision problem (the proof is not required).
- **Algorithms:** For each (chosen) approximation algorithm, describe the algorithm, analyse its time and space complexities, and specify its approximation ratio. (The proof of the approximation ratio is not needed, but give a reference for it.)
- **Tests:** Characterise the instances used in the experiments (specifying if they come from available benchmarks or if they have been created by you).
- **Test Results:** Present and analyse the experimental results (comparing the implemented approximation algorithms).

Send the report, the source code and the input files with the instances used in the experiments to Margarida Mamede (mm@fct.unl.pt). The **deadline** is **October 26th** (Sunday).

Here are some possible optimization problems (for which there are approximation algorithms):

- Min. Bin Packing
- Min. Dominating Set
- Min. k-Clustering
- Min. (Weighted) Edge Cover
- Max. Independent Set
- Knapsack
- Min. Load Balancing
- Min. (Weighted) Set Cover
- Min. (Metric) Steiner Trees
- Max. Subset Sum
- Metric Travelling Salesman
- Min. (Weighted) Vertex Cover