

Algoritmos Avançados

2024/2025 — 1º Semestre

2nd Project — Randomized Algorithms for Combinatorial Problems

Deadline: December 3, 2024

Objectives

Design and test **randomized algorithms** to solve the **combinatorial problem** that was **assigned to you** in the **first project**.

You can both generate candidate solutions randomly and combine some degree of randomness with appropriate heuristics.

Devise and/or adapt strategies for:

- **Iterating through the generated candidate solutions and keeping the best feasible solution computed.**
- **Ensuring that no such solutions are tested more than once.**
- **Deciding when to stop testing candidate solutions of a certain size and start testing larger or smaller solutions, if that makes sense for your problem.**
- **Deciding when to stop testing altogether: e.g., after a given number of candidate solutions, or after spending a certain amount of computation time, etc.**

Graphs for the Computational Experiments

In addition to the graph instances already used in the first project, you should **run all your algorithms on example and benchmark graph instances available on the Web**.

Pointers for such graph instances will be given on the course page on E-Learning.

Performance Analysis

Afterwards, analyze the performance of the developed strategy. To accomplish that:

- a) Perform a formal computational **complexity analysis** of the randomized algorithm.
- b) Devise and carry out a sequence of **experiments, for successively larger problem instances**, to register and analyze (1) the **number of basic operations** carried out, (2) the **execution time** and (3) the **number of solutions / configurations** tested.

- c) Analyze the **accuracy of the obtained solutions** by comparing them with the solutions obtained with the algorithms of the first project.
- d) Compare the results of the **experimental** and the **formal analysis**.
- e) Determine the **largest graph** that you can process on your computer, without taking too much time.
- f) Estimate the execution time that would be required by **much larger problem instances**.
- g) Write a report (8 pages, max.).

J. Madeira, November 11, 2024