Departamento de Electrónica, Telecomunicações e Informática da Universidade de Aveiro

Algoritmos Avançados

2025/2026 — 1º Semestre

2nd Project — Randomized Algorithms for Combinatorial Problems

Deadline: December 1, 2025

1 - 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.

You can also implement other strategies, if that makes sense for the problem you are solving.

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.**

2 - 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.

But you should look for appropriate, additional repositories on the Web.

3 - 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 various algorithms that you have implemented (first and second 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 10, 2025