1. Algorithms: Introduction

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Algorithms (CC4010) 2024/2025

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https://fm-dcc.github.io/alg2425





Algorithms (CC4010)

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An algorithm in CS is:

- a method for solving a (computational) problem
 - given some input
 - must produce some output
- independent of programming languages, computational machines, etc.

Sorting Problem

Input: a sequence

 a_1, a_2, \ldots, a_n

Output: a sorted

permutation

 $a_1' \leq a_2' \leq \ldots \leq a_n'$

Instance

Input: 4, 1, 5, 3, 7

Output: 1, 3, 4, 5, 7

Algorithm

Contents of the module

Contents of the module



How well can we solve a problem:

- is there an algorithm guaranteed to solve it in finite time? (Decidable)
- if so, is it really solving the problem? (Correct)
- if so, how well does it work in practice? (Feasible)

We will be formal

- precisely formulate concepts
- proof correctness
- calculate how fast
- pen-and-paper (no tool support)

We will see examples

- Some well known algorithms
- Understand how to reason about them

Syllabus



- Algorithm Correctness
- Complexity: worst/best-case analysis
- Asymptotic analysis
- Recursive algorithms
- Average-case and randomized algorithms

- Amortized analysis
- Lower bounds
- Data structures
- Fundamentals of NP-completeness

Logistics

Useful information



Relevant class material and announcements will be posted on the website periodically

Lecturers

- José Proença https://jose.proenca.org
- jose.proenca@fc.up.pt
- office hours: Thursday afternoon

- Pedro Ribeiro (small part)
 https://www.dcc.fc.up.pt/~pribeiro/
- pribeiro@fc.up.pt
- office hours: tbd

Office hours (please send an email the day before if you wish to meet):

Assessment



Assessment will consist of

- 30% (IT) an individual intermediate test in the middle of the semester (≥ 5.5);
- **70%** (FT) a final test at the end, during the normal exam period (≥ 5.5);
- 100% (RE) a global exam at the end, during the recovery (recurso) exam period (≥ 9.5);

There will be possible evaluation periods:

Normal period:

$$IT * 0.3 + FT * 0.7 \ (\geq 9.5)$$

• Recovery period (recurso):

RE
$$(\geq 9.5)$$