DTC-SAP-374 Introduction to Algorithms & Models of Computation

SEMESTER: Spring
CREDITS: 6 ECTS (lecture 3 credits + laboratory 3 credits)
LANGUAGE: English
DEGREES: SAPIENS program

Course overview

This course provides a comprehensive introduction to the core concepts of algorithms and computational theory. The curriculum covers a wide range of topics, from basic algorithm design and analysis to the study of formal languages and computational complexity.

Prerequisites

- Any programming language (Python recommended).
- Data Structures.

Course contents

Theory:

- Module 1: Introduction to Algorithms
- Module 2: Languages and Regular Expressions
- Module 3: Finite automata and Touring Machines (TMs)
- Module 4: Search and Sorting Algorithms
- Module 5: Recursion, Divide and Conquer, and Backtracking
- Module 6: Dynamic Programming and Greedy algorithms
- Module 7: Basic graph algorithms
- Module 8: Complexity theory. NP-completeness

Laboratory:

- Lab 1: Implement basic algorithmic problems.
- Lab 2: Write Python scripts to validate patterns using regular expressions.
- Lab 3: Simulate deterministic finite automata (DFA) and create a simple Turing Machine in Python.
- Lab 4: Implement and compare performance of sorting algorithms.
- Lab 5: Solve problems using recursion and backtracking.
- Lab 6: Implement dynamic programming solutions for problems like knapsack and greedy algorithms for interval scheduling.
- Lab 7: Write Python code for graph traversal algorithms.

This document is a brief outline of the course and does not replace the official program of study

- Lab 8: Explore NP-completeness by implementing reductions and analyzing computational problems.

Textbook

- Introduction to Algorithms, 3rd Edition (Mit Press) 3rd Edition. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest, Clifford Stein

Grading

The following conditions must be accomplished to pass the course:
- A minimum overall grade of at least 5 over 10.
- A minimum grade in the ordinary or/and extraordinary final exam of 4 over 10.

The overall grade is obtained as follows:
- Final exam (40%)
- Final project (30%)
- Lab (20%)
- Class participation (10%)