UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Design and Analysis of Algorithms

2324-3-E3101Q113

Aims

Students will acquire knowledge of the main techniques for the design and analysis of algorithms and the ability to identify the most appropriate algorithmic techniques to efficiently solve specific computational problems.

Contents

The course will introduce the main algorithmic techniques (dynamic programming, greedy), with particular attention to the efficiency of the algorithms, with the main analysis methods. The main algorithms for graph search and several combinatorial optimization problems, including minimum spanning trees construction amd shortest path problems will be presented.

Detailed program

1. Mathematical tools (review)

- Growth of functions, asymptotic notations
- Execution time of iterative algorithms
- Recursion and recursive algorithms
- Recurrence equations and Execution times of recursive algorithms

2. Algorithmic Techniques: Dynamic Programming (DP)

- Introductory examples
- Main features - Recursion

- Implementation with matrices
- Combinatorial optimization problems over sequences and sets

3. Algorithmic Techniques: Greedy method

- Introductory examples
- Matroids
- Rado Theorem

4. Disjoint-set data structure

- Definitions and operations
- Linked list representation and forest representation

5. Minimum spanning trees

- Kruskal algorithm
- Prim algorithm

5. Shortest path problems

- Dijkstra Algorithm
- Floyd-Warshall Algorithm

6. Graph Algorithms

- Representations of graphs.
- Breadth first visit of graphs
- Depth first visit of graphs

Prerequisites

Basic notions of programming, algorithms and data structures

Teaching form

Lectures, practice exercises, and classroom laboratory exercises. The course is in Italian.

Textbook and teaching resource

T.H. Cormen, C.E. Leiserson, R.L. Rivest, C. Stein, Introduzione agli Algoritmi e Strutture dati, Ed. Mc. Graw Hill

Further material and exercises are available through the e-learning website.

Semester

First semester

Assessment method

Written examination: the total score is 30/30. It consitsts of

- exercises related to the main topics

- open questions on the theoretical aspects of the topics explained in the course

2 additional points may be assigned if the exercises are perfectly solved

Partial written examinations:
The written exam can be substituted by two partial written examinations in the middle and at the end of the course.

Each partial written examination is about the topics of the corresponding part of the course and it consists of exercises to the main topics and open questions on the related theoretical aspects.

Each partial written examination has a maximum score of 15/15: the final score of the exam is the sum of the two partial scores. 2 additional points may be assigned if the exercises are perfectly solved

Office hours

By appointment

Sustainable Development Goals