UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Analisi e Progetto di Algoritmi

2122-3-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.

We introduce the NP-complexity and approximation algorithms.

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, minimum spanning trees construction, Shortest path problems will be presented.

Detailed program

1. Mathematical tools

    - Growth of functions, asymptotic notations
    - Execution time of iterative algorithms
    - Recurrence equations and Execution times of recursive algorithms
    - Dichotomic Search, height of a binary tree

2. Algorithmic Techniques: Dynamic Programming (DP)

- Introductory examples
- Main features - Recursion
- Implementation with matrices

3. Algorithmic Techniques: Greedy method

- Introductory examples
- Huffman Codes
- Matroids
- Rado Theorem

4. Graph Algorithms

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

5. Minimum spanning trees

- Kruskal algorithm
- Prim algorithm

5. Shortest path problems

- Dijkstra Algorithm
- Bellman-Ford Algorithm
- Floyd-Warshall Algorithm

6. Maximum flow problems

- Ford-Fulkerson Algorithm

7. NP completeness and reducibility. Approximation.

Approximation of Vertex-cover.

Prerequisites

Basic notions of programming, algorithms and data structures

Teaching form

In case of restrictions related to Covid-19 emergency, lectures and practice exercises could be done by means of recorded or online video, with specific non-recorded online meetings for discussing and answering possible questions from students.

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 slides and exercises are available through the e-learning website.

Semester

First semester

Assessment method

Written examination: the total score is 30/30. The exam consists of two parts, relative to two parts of the course and consisting in:

- exercises related to the main arguments

- open questions on the theoretical aspects of the arguments discussed 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 during the course

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