UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Thory of Computation

2122-1-F1801Q132-F1801Q133M

Aims

Theory of Computation deals with the acquisition of basic theoretical tools that allow to understand the computational complexity of problems, how they are classified according to their complexity and then how they can be solved by algorithmic methodologies. The course provides skills on the use and design of novel data structures that are relevant in dealing with modern applications (web, complex networks, massive data, and so on).

Contents

Basic notions of theory of computation (decidability, intractability). Classification of problems with respect to their computational complexity. Approximation complexity. Modern approaches to indexing, compression of large data sets by using novel data structures and algorithmic techniques. Indexing data structures (suffix tree, trie, hashing, FM-index), pattern matching, the shift-and paradigm, data compression. Applications to the WEB (complex networks).

Detailed program

1. Basic notions of theory of computation (decidability, intractability, reductions). Classification of problems with respect to their computational complexity. Approximation complexity.

2. Modern approaches to indexing, compression of massive data sets by using novel data structures and algorithmic techniques.

3. Indexing data structures (bloom filters, hashing), pattern matching, the shift-and paradigm, data compression, succinct data structures.

4. Applications to the analysis of massive data.

Prerequisites

None

Teaching form

Lectures and practice exercises.

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.

Textbook and teaching resource

Slides and written notes.

Semester

First semester.

Assessment method

Oral exam. The written exam consists of a list of exercises whose solution requires the acquisition of skills related to the main topics of the course syllabus.

Office hours

By appointment.