UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Fundamentals of Computer Science

2324-1-E3101Q102

Aims

The main aim of the course is to introduce formal, theoretical, and technical foundations of computer science. The main issues to be presented will give students the necessary abstraction level to understand the theoretical and computational bases of computer science through the learning of the basic formal notions to tackle required higher levels of complexity required by the discipline.

Contents

This course introduces the formal mathematical bases of theoretical computer science; namely, basic mathematical notions (set theory, relations, and functions), abstract conceptualization instruments (graphs, trees, and algebraic structures), and basics of logics (propositional and predicative).

Detailed program

1. Sets: extensional and intensinal definitions, sub-sets and power sets, union, intersection, complementation, difference and symmetric difference, partitions, Cartesian product, sequences, pairs and ordered n-tuples, relations, functions and operations, inverted function, function composition, set cardinality, diagonalization (introduction), multi-sets, notions of combinatorics.
2. Relational structures, graphs and sorting: properties of relations,boolean matrixes and related operations, graphs, relations of equivalence, composition of relations, transitive closure, ordinal and grids, monotonic functions on ordered sets, hasse diagrams, fixed-point theorem (introduction).
3. Boolean algebra: introduction to semigroups, monoids and groups, Boolean algebra)
4. Induction: principles of mathematical induction, proofs by induction, induction and recursion on arbitrary sets, strings, well-formed formulas.

5. Logic - propositional language: language and semantics, deduction, syntax and semantics of propositional logics, logical equivalence, models, decidability, completeness of set of connectives.
6. Logic - propositional deductive systems: truth tables, tableaux for propositional logic, completeness and correctness.
7. Logic - predicative languages: syntax of predicative logics, free and bound variables, interpretations and models, semantic equivalence, connectives and set operator, first order theories.
8. Logic - predicative deductive systems: tableaux for first order logic, completeness and correctness in the predicate calculus.
9. Introduction to formal language theory: finite state automata.

Prerequisites

Basic mathematical knowledge from high school programs.

Teaching form

Active lectures and exercises both in person. Moodle e-learning platform. Course language italian.

Textbook and teaching resource

Luigia Carlucci Aiello, Fiora Pirri, “Strutture, logica, linguaggi” (Pearson, 2005).

The textbook is in Italian. Alternative books in English can be suggested upon request.

Semester

1st Semester

Assessment method

Final exam (without intermediate tests) that consists of two separate tests: written test and oral test.

The **written test** includes ten questions on all the topics addressed in the course and is evaluated with a mark ranging from 0 to 30. Each question includes three sub-questions, each belonging to one of the following types of exercises: open questions on a topic, questions that require reasoning and deduction, resolution of exercises requiring calculation or development of a solution to an assigned problem, with prevalence of exercises of the third type .

The **oral test** consists in the evaluation of the knowledge acquired about the course topics through open questions, possibly related to the mistakes made during the written test.

Those who have taken a sufficient mark, that is, greater than or equal to 18/30, are admitted to the oral test or, under the circumstances specified below, can register their mark. Those who have been marked below or equal to 21/30 in the written test must necessarily take the oral test. Those who have obtained a mark equal or larger to 22/30 can take the oral exam or ask for their vote to be registered. The oral test consists in the evaluation of the knowledge acquired about the course topics through open questions, possibly related to the mistakes made during the written test.

Office hours

On demand.

Sustainable Development Goals