UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Formal Methods

2425-3-E3101Q121

Aims

We consider concurrent or distributed systems done by components that operate independently and interact with each other in different ways. At the end of the course, the student will have acquired the basic tools to model, at different levels of abstraction, such systems, to describe their requirements by means of a logical language; she/he will know the techniques for verifying system behavioral properties, and will be able to use some software tools for the design and analysis. These skills can be used in various application contexts such as the design of concurrent software, communication protocols, ...

Contents

A logic language will be introduced to specify behavioral properties of concurrent systems. Petri nets will be presented as useful formal tools to model concurrent systems and to analyze their properties. Algorithms and software tools for the design and analysis of such systems will be also introduced.

Detailed program

1. Survey of formal methods in the design and analysis of concurrent systems.

2. A logic language to specify behavioral properties of concurrent systems: Propositional Linear Temporal Logic (PLTL), syntax and semantics, equivalence of formulas, examples of unsatisfiable formulas in PLTL, properties of liveness, safety and fairness in PLTL. Transition systems and model checking.

3. Languages and software tools to specify and analyse concurrent systems and programs.****
4. Petri nets: conceptual foundation, applications, and analysis techniques: elementary net systems,

transition rule, case graph. Place Transition nets: incidence matrix, Parikh vector, state equation. Behavioral properties and their verification on the reachability graph. Structural analysis: S- and T-invariants; siphons and traps; rank theorems. Net subclasses: state machines, marked graphs, Free-choice nets and analysis of behavioral properties on such subclasses. Other classes of nets.

Prerequisites

Basic notions of propositional logic, basic notions of mathematical analysis and of discrete mathematics (as presented in the course of Fundamentals of Computer Science).

Teaching form

Language: Italian.
Classroom lessons and exercises, carried out in delivered mode, in person.
Laboratory activity, carried out in interactive mode, in person.

Textbook and teaching resource

Handouts, research and survey papers on the e-learning platform

Semester

Second semester

Assessment method

The assessment method consists of written and oral examination

The written exam consists of some exercises, which are similar to the ones made in class during the lectures.
The evaluation objective of the written test consists in the control of the preparation on some fundamental topics of the exam program, and in the control of disciplinary problem solving skills.

The student is admitted to the oral exam if he/she has passed the written test
In the oral exam the solution of such exercises will be discussed and some questions on the developed arguments will be done.
The objective of the oral interview is to evaluate the student's ability to present the topics of the course, and to make brief thoughts on them.

The assessment is comprehensive and is defined in the oral interview.

Office hours

On appointment

Sustainable Development Goals

QUALITY EDUCATION