Syllabus

Descrizione corso

Titolo insegnamento	Applied Formal Methods
Codice insegnamento	71088
Titolo aggiuntivo	
Settore Scientifico-Disciplinare	INFO-01/A
Lingua	Inglese
Corso di Studio	Corso di Dottorato di ricerca in Scienze e Tecnologie informatiche
Altri Corsi di Studio (mutuati)	
Docenti	dr. Andrea Mazzullo, Andrea.Mazzullo@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/38537
Assistente	
Semestre	Primo semestre
Anno/i di corso	2026/27
CFU	2
Ore didattica frontale	20
Ore di laboratorio	0
Ore di studio individuale	50
Ore di ricevimento previste	
Sintesi contenuti	The students will develop a deep understanding of technologies based on applying formal methods for the specification and verification of hardware systems. The students will learn the most important techniques based on Model Checking to check the properties of a system. In particular, the students will be able to understand how to formally specify a hardware system by means of transition systems and how to express computation properties by means of formulas in Temporal Logic. Both Linear Temporal Logic (LTL) and Computation Tree Logics (CTL and CTL*) will be studied. A tutorial on NuSMV will introduce the students to one of

	the most successful software used in industrial applications to specify and test synchronous concurrent systems and critical software.
Argomenti dell'insegnamento	• Modeling systems as transition systems • Temporal logics: LTL, CTL, CTL* • Model checking of temporal formulas • NuSMV to model systems and perform model checking
Parole chiave	Model Checking, Transition Systems, Temporal Logics
Prerequisiti	
Insegnamenti propedeutici	A background on propositional logic is welcome.
Modalità di insegnamento	Frontal lectures
Obbligo di frequenza	Not compulsory but recommended. Non-attending students have to contact the lecturer at the start of the course to agree on the modalities of the independent study
Obiettivi formativi specifici e risultati di apprendimento attesi	Knowledge and understanding • Knowledge of model checking principles and of temporal logics used in applications. Applying knowledge and understanding • To be able to model systems and specify desired properties using transition systems and LTL/CTL formulas. • To be able to use the NuSMV model checker to specify a system and verify temporal properties. Making judgments • To be able to understand the expressivity and the limitations of the temporal formalisms. • To be able to interpret and assess the model checking outputs and counterexamples. Communication skills • To be able to present technical content (project descriptions, research articles) in advanced academic English. • To be able to synthesize knowledge from scientific and technical documentation, and to prepare reports and presentations. Learning skills

	• To be able to independently read, understand, and produce scientific and technical documentation on formal methods.
Obiettivi formativi specifici e risultati di apprendimento attesi (ulteriori info.)	
Modalità di esame	To pass the course each student should develop and present either: (A) a small project using the model checker NuSmv; or (B) a set of slides on a topic or research article relevant to the course contents.
Criteri di valutazione	The exam is assessed on a pass/fail basis and is based either on: (A) a NuSMV project delivered and presented at the end of the course; (B) a presentation of a research article or topic relevant to the course contents. The assessment considers the following criteria: - Clarity and effectiveness of communication. - Ability to summarize, critically evaluate, and establish connections between topics. - Ability to apply the tools, methods, and processes introduced during the course to specific cases. The same evaluation criteria apply to non-attending students.
Bibliografia obbligatoria	• Principles of Model Checking. Christel Baier and Joost-Pieter Katoen. MIT Press, 2008.
Bibliografia facoltativa	• Logic in Computer Science -- Modelling and Reasoning about Systems. Michael Huth and Mark Ryan. Cambridge University Press, 2004 (second edition). • Model Checking. E. Clarke, O. Grumberg, D. Kroening, D. Peled, and H. Veith. MIT Press, 2018 (second edition).
Altre informazioni	NuSMV (to be downloaded from: https://nusmv.fbk.eu/)
Obiettivi di Sviluppo Sostenibile (SDGs)	Istruzione di qualità