linfo2143

2022

Concurrent systems : models and analysis

5.00 credits	30.0 h + 15.0 h	Q1

Teacher(s)	Pecheur Charles ;
Language :	English > French-friendly
Place of the course	Louvain-la-Neuve
Main themes	This course studies the principles, formalisms and tools used to model and analyse concurrent computer systems. • Models of Concurrent Systems • Semantics of Concurrent Systems • Properties of Concurrent Systems • Verification of Concurrent Systems
Learning outcomes	**At the end of this learning unit, the student is able to :** 1 Given the learning outcomes of the "Master in Computer Science and Engineering" program, this course contributes to the development, acquisition and evaluation of the following learning outcomes: • INFO1.1-3 • INFO2.2-3, INFO2.5 • INFO5.2, INFO5.5 • INFO6.1, INFO6.4 Given the learning outcomes of the "Master [120] in Computer Science" program, this course contributes to the development, acquisition and evaluation of the following learning outcomes: • SINF1.M1, SINF1.M2 • SINF2.2-3, SINF2.5 • SINF5.2, SINF5.5 • SINF6.1, SINF6.4 Students completing successfully this course will be able to • master the mathematic concepts and tools which enable modelling and analysis of concurrent computer systems; • model an actual concurrent system in a appropriate abstract formalism; • use automated verification techniques to analyse concurrent systems. Students will have developed skills and operational methodology. In particular, they have developed their ability to • model existing software ; • thinking with abstractions and use a formalized approach to infer properties of an existing system .
Evaluation methods	• 3 assignments, 30% of the final grade. • Exercises: test at the end of term, 30% of the final grade. • Theory: oral exam, 40% of the final grade. A list of questions is provided at the end of the course. The assignments can only be presented during the quadrimester of the course. They cannot be represented in subsequent exam sessions. Following circumstances, the exam may be organized remotely.
Teaching methods	• Lectures • Exercises (theoretical exercises to master the concepts, followed by computer room session to apply these on concurrent systems) • Assignments (performed conjointly by two students) The exercise sessions are closely related to the assignments and help student using similar models and tools on other concurrent systems. Due to circumstances,all or part of the lectures and exercises may be streamed and recorded for distance learning.
Content	• Models of Concurrent Systems: processes and actions, conditions and choices, concurrency, synchronization, process algebras.

	• Semantics of Concurrent Systems: state machines and transition systems, finite and infinite traces, concurrency by interleaving, equivalences and minimization. • Properties of Concurrent Systems: invariants, safety and liveness properties, temporal logic, refinement relations. • Verification of Concurrent Systems: model checking, equivalence checking.
Inline resources	http://icampus.uclouvain.be/claroline/course/index.php?cid=ingi2143
Bibliography	Livre de référence (obligatoire) • J Magee and J Kramer, Concurrency: State Models and Java Programming (2nd Ed.), Wiley, 2006. Autres références • H Bowman and R Gomez, Concurrency Theory: Calculi and Automata for Modelling Untimed and Timed Concurrent Systems, Springer, 2006. • AW Roscoe, The Theory and Practice of Concurrency, Prentice Hall, 1998 (http://web.comlab.ox.ac.uk/oucl/work/bill.roscoe/publications/68b.pdf). • E Clarke, O Grumberg and D Peled, Model Checking, MIT Press, 1999. • B Bérard et al., Systems and Software Verification, Springer, 2001.
Faculty or entity in charge	INFO

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Computer Science and Engineering	INFO2M	5		🔍
Master [120] in Computer Science	SINF2M	5		🔍
Master [120] in Data Science Engineering	DATE2M	5		🔍
Master [120] in Data Science: Information Technology	DATI2M	5		🔍