UCLouvain

linfo2345

2023

Languages and algorithms for distributed Applications

5.00 credits	30.0 h + 15.0 h	Q1

Teacher(s)	Van Roy Peter ;
Language :	English > French-friendly
Place of the course	Louvain-la-Neuve
Main themes	• Study of the theoretical basis of distributed systems, distributed algorithms, and languages for distributed programming. • Study of the specific issues related to distributed and mobile systems : geographic distribution, management of localized and distributed resources, fault tolerance, security, interoperability, and openness. • Practical use of several representative and advanced systems and languages for programming collaborative, distributed, and mobile applications.
Learning outcomes	**At the end of this learning unit, the student is able to :** 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 • INFO2.2-4 • INFO5.4-5 • 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.M2 • SINF2.2-4 • SINF5.4-5 • SINF6.1, SINF6.4 1 Students completing successfully this course will be able to • define distributed systems and distributed algorithms with concepts they contain and the properties they give to programs. • design collaborative applications on distributed systems using rigorous models to deal with concurrency and partial failure. • implement collaborative applications on distributed systems using appropiate technics. • use some advanced tools for the development of distributed and mobile applications. Students will have developed skills and operational methodology. In particular, they have developed their ability to • think with abstractions (reason correctly about a system that consists of several layers of abstractions, and define new abstractions to simplify a problem's solution).
Evaluation methods	• Dispensatory test 25% (around week 7) • Project 25% • Final exam 50% (or 75% if redoing test part) The project is mandatory and is done during the quadrimester. It can only be done only once and it counts for the whole academic year. The optional dispensatory test and the final exam may be done in auditorium or online, depending on university requirements. The teacher reserves the right to give an oral examination to certain students.
Teaching methods	• Weekly lecture (in auditorium or online, according to university requirements) • Practical sessions in the computer room, every two weeks, to solve simplified problems using concepts explain during the lectures • Design and programming project to apply these concepts in a more complexe application
Content	• Introduction to distributed systems • Formal models of distributed systems • Specification and implementation of distributed systems (including safety and liveness) • Failure detectors

	• Reliable broadcast • Causal broadcast • Shared memory • Consensus and its applications • Large-scale systems based on gossip and peer-to-peer • Examples of large-scale systems taken from the course professor's research (for example, Internet of things, #QSD approach for system design, convergent systems based on CRDTs, and so forth).
Inline resources	LINFO2345 on Moodle: https://moodle.uclouvain.be/course/view.php?id=4947
Bibliography	Mandatory course material: • Course slides (on Moodle) Bibliography: • Rachid Guerraoui and Luis Rodrigues. "Introduction to Reliable Distributed Programming". Springer-Verlag, 2006. • Hagit Attiya and Jennifer Welch. "Distributed Computing: Fundamentals, Simulations, and Advanced Topics". McGraw-Hill, 1998.
Other infos	Background : • Mastery of at least one programming system and experience in concurrent programming are a requirement for this course. One possible way to achieve this is by the course LINFO1131, but having followed this course is not imperative.
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		🔍