CS-453

Concurrent algorithms

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Cursus	Sem.	Type
Computer science	MA1, MA3	Opt.
Cybersecurity	MA1, MA3	Opt.
SC master EPFL	MA1, MA3	Opt.

Language of teaching	English
Credits	5
Session	Winter
Semester	Fall
Exam	Written
Workload	150h
Weeks	14
Hours	**5 weekly**
Lecture	3 weekly
Exercises	1 weekly
Practical work	1 weekly
Number of positions	

Summary

With the advent of multiprocessors, it becomes crucial to master the underlying algorithmics of concurrency. The objective of this course is to study the foundations of concurrent algorithms and in particular the techniques that enable the construction of robust such algorithms.

Content

Model of a parallel system
A multicore architect
Processes and objects
Safety and liveliness

Parallel programming
Automatic parallelism
Mutual exclusion and locks
Non-blocking data structures

Register Implementations
Safe, regular and atomic registers
General and limited transactions
Atomic snapshots

Hierarchy of objects
The FLP impossibility
The consensus number
Universal constructions
Transactional memories
Transactional algorithms
Opacity and obstruction-freedom

Keywords

Concurrency, parallelism, algorithms, data structures

Learning Prerequisites

Required courses

ICC, Operatings systems

Recommended courses
This course is complementary to the Distributed Algorithms course.

Important concepts to start the course
Processes, threads, datas structures

Learning Outcomes
By the end of the course, the student must be able to:
- Reason in a precise manner about concurrency
- Design a concurrent algorithm
- Prove a concurrent algorithm
- Implement a concurrent system

Teaching methods
Lectures, exercises and practical work

Expected student activities
Midterm and final exam
Project

Assessment methods
With continuous control, midterm final exams and project

Supervision
Office hours	Yes
Assistants	Yes
Forum	No

Resources
Notes/Handbook
Concurrent Algorithms, R. Guerraoui and P. Kouznetsov

Websites
- http://lpd.epfl.ch/site/education