

CS-453

Concurrent algorithms

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Cursus	Sem.	Type
Computer science	MA1, MA3	Opt.
Cybersecurity	MA1, MA3	Opt.
Data Science	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
Courses	3 weekly
Exercises	1 weekly
TP	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 liveness

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, data 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>