

CS-453

Concurrent computing

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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	6
Session	Winter
Semester	Fall
Exam	Written
Workload	180h
Weeks	14
Hours	5 weekly
Lecture	2 weekly
Exercises	1 weekly
Practical work	2 weekly
Number of positions	

Summary

With the advent of modern architectures, 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**

Multicore and multiprocessors architecture

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

Counters General and limited operations

Atomic counters and snapshots

Hierarchy of objects

The FLP impossibility

The consensus number

Universal constructions

Transactional memories

Transactional algorithms

Opacity and obstruction-freedom

Anonymous computing**Fault-tolerant shared-memory computing****Keywords**

Concurrency, parallelism, algorithms, data structures

Learning Prerequisites

Required courses

ICC, Operating 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

Final exam
Project

Assessment methods

Final exam (theory) and project (practice)

Resources

Notes/Handbook

Algorithms for Concurrent Systems, R. Guerraoui and P. Kouznetsov

Moodle Link

- <https://go.epfl.ch/CS-453>