

CS-471

Advanced multiprocessor architecture

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Cursus	Sem.	Type
Computational science and Engineering	MA1, MA3	Opt.
Computational science and engineering minor	H	Opt.
Computer and Communication Sciences		Opt.
Computer science	MA1, MA3	Opt.
Cybersecurity	MA1, MA3	Opt.
Electrical and Electronical Engineering	MA1, MA3	Opt.
SC master EPFL	MA1, MA3	Opt.

Language of teaching	English
Credits	8
Session	Winter
Semester	Fall
Exam	During the semester
Workload	240h
Weeks	14
Hours	12 weekly
Courses	4 weekly
Project	8 weekly
Number of positions	

Summary

Multiprocessors are basic building blocks for all computer systems. This course covers the architecture and organization of modern multiprocessors, prevalent accelerators (e.g., GPU, TPU), and datacenters. It includes a research project on multiprocessors and post-Moore era datacenters.

Content

- Introduction
- Metrics and methodologies
- Parallel programming models
- Communication models
- Applications and Workloads
- Cache hierarchies & memory models
- Memory & storage hierarchies
- Interconnects
- GPUs
- AI/ML/Analytic accelerators
- Near-memory computing
- Datacenters & cloud Computing
- Cloud-native CPU
- Cloud-native memory hierarchies
- Sustainable architecture

Learning Prerequisites**Recommended courses**

- Advanced computer architecture
- Systems for data management and data science

Learning Outcomes

- Explore the development trend of computation systems and datacenters
- Establish the basic model to analyze the performance and characteristics of foundational workloads operating in cloud environments.
- Classify and describe the components of modern parallel systems, including multiple processors, cache hierarchies, memory systems, interconnects, and accelerators, and their roles in handling emerging workloads
- Define and clarify research questions and opportunities
- Interpret and critique research papers and extract insights for research questions
- Plan and conduct a research project
- Present research contributions

Teaching methods

Lecture, research paper retrieval, and a research project

Assessment methods

- Homework: 10%
- Research project (in group): 40%
- Midterm exam: 20%
- Final exam: 30%

Resources

Websites

- <https://parsa.epfl.ch/course-info/cs471/>