CS 58003: Parallel Computer Architecture

Subject: CS Faculty: Faculty of Engineering and Natural Sciences
SU Credit: 3 , ECTS Credit: 10.00 / 10.00 ECTS
Instructor(s): Kubilay Atasu
Language of Instruction: English
Level of Course: Graduate
Planned Learning Activities: Discussion based learning, Task based learning

CONTENTS (Tentative)

This course focuses on the design principles of parallel computer architectures. The course covers the following topics:
- Instruction-Level Parallelism: Superscalar Architectures, Speculative Execution
- Multicore-/Multiprocessor-Architectures, Interconnection Networks
- Caches in Shared Memory Architectures, Cache-Coherency
- Shared Memory Architectures and Memory Consistency
- Quantitative Principles of Computer Architectures
- Vector Architectures, Systolic Arrays, GPUs
- Case Studies and Emerging Trends

Reference book: *Computer Architecture: A Quantitative Approach, Fifth Edition* by John L. Hennessy & David A. Patterson (online access via Information Center)

Simulation projects: The gem5 Simulator for Computer Architecture Research

OBJECTIVE

This course aims to provide the students with a deep understanding of parallel computer architectures, including their history, the current developments, and the future trends.

LEARNING OUTCOME

Describe various forms of parallelism available in modern computer architectures.
Exploit these different forms of parallelism to achieve high performance.
Demonstrate knowledge of long-lived, recurring standard architectural design patterns.
Show ability to build on these patterns to architect efficient parallel computer systems.
Evaluate tradeoffs between cost and performance.
Understand architectural principles behind the fastest supercomputers and AI chips.

ASSESSMENT METHODS AND GRADING (Tentative)

	Percentage (%)
Final	30 (Written, oral, or both)
Midterm	20 (Written, oral, or both)
Homeworks (bi-weekly)	20
Projects	30