CS 413/513 Concurrent Systems

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Class hours - Idaho Falls: MW 5:30pm - 6:45pm
Class hours - Moscow: MW 4:30pm - 5:45pm
Office hours: TBA
Classroom: CHE 301
Textbooks: In class notes.

Recommended Reference Textbook:


Course Description: This course will examine the structure of high-performance computer systems (supercomputers, high-end processors) and their influence on programming paradigms and automatic optimization techniques available in all modern day compilers. The interdependence between concurrent system architectures and advanced programming strategies to extract program performance will be examined in detail. Notions such as vector chaining, loop interchange and loop unrolling, code motion, out-of-order execution, and operand pre-fetching will be introduced and related to the organization of concurrent systems through selected examples. The development of wide-instruction words and concurrent execution of multiple instructions will also be covered. The development of vector computers, RISC instruction sets, hierarchical memory architectures, and the evolution to multiprocessor and multi-core systems will be examined using the principles of spatial- and temporal-locality. Emphasis is placed upon the complexity of the basic architectural
building blocks of concurrent systems and the trade-offs in attaining optimal performance. Finally, the study of multi-core and graphics processing unit (GPU) processors will be examine from an architectural and performance based perspective.

**Topics:**

- Principles of spatial- and temporal-locality
- The complexity of the basic architectural building blocks and the trade-offs in attaining optimal performance
- Vector chaining, loop interchange and unrolling, code motion, operand pre-fetching, etc.
- Symmetric multiprocessors and distributed memory processing systems
- Hierarchical memory architectures
- GPU architecture and programming issues
- Dual- and multi-core systems and programming issues

**Prerequisites:** CS 150 Computer Organization and Architecture and CS 240 Computer Operating Systems or consent of the instructor.

**Class requirements:** Course grades will be determined by weekly written assignments, a midterm, and project. Graduate students will be required to complete a project of greater difficulty.

**GRADING:**

- Homework (45%).
- One midterm examination (30%).
- Research project (45%)

**EXAMINATION SCHEDULE:** TBA