

CSI 4360: Concurrent and Multicore Programming

Credits Hours: 4 credits, 3.57 contact hours/week.

Instructor: Yonghong Yan, Ph.D.

Text book: Introduction to Parallel Computing, 2nd Edition By Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar Addison-Wesley, 2003 <http://www-users.cs.umn.edu/~karypis/parbook/>

Specific course information

This course will focus on concepts, theory, design and implementation of concurrent programs for multi-core computers, multicore programming methodologies. Topics covered include mutual exclusion, memory model and thread-based parallelism, forkjoin framework, locks, parallel control flow, concurrent data structures.

Prerequisites: Senior standing

Elective course

Course Objectives: Upon successful completion of this course, students should be able to

- Describe benefits and applications of concurrent and parallel programming
- Explain key concepts in parallel computer architectures, e.g. shared memory system, distributed system, NUMA and cache coherence
- Understand principles for concurrent program design, e.g. decomposition of works, task and data parallelism, processor mapping, mutual exclusion, locks
- Write parallel program using OpenMP, Cilkplus, CUDA, MPI programming models Perform analysis of parallel program problem

List of Topics:

- OpenMP and Dense Matrix Algorithms in OpenMP
- Parallel algorithm design
- Parallel program measurement and analysis
- Cilk practice and performance analysis
- PThread and mutual exclusion
- Parallel architecture
- Memory optimization practice
- Manycore and GPU/CUDA
- Distributed memory systems
- MPI
- Parallel algorithms