CPSC 621
PARALLEL PROCESSING

Instructor: Prof. Aaron Koehl
aaron.koehl@cnu.edu

Office Hours: MW 11am-12pm, 1-2:30pm

Meeting Times: MW 5:30-6:45

OVERVIEW

This course is intended to prepare the student for future research or industry practice by developing an understanding of parallel computation, which will be explored in the context of three major areas of computer science: architecture, operating systems, and algorithms.

OBJECTIVES

In this course, you will be exposed to contemporary topics in parallel and concurrent computing, through lectures, presentations, programming, and reading of modern research.

Upon finishing this course, it is expected that you will be able to:

- Converse intelligently about contemporary concepts in parallel computing.
- Understand the limits of instruction level parallelism provided by uniprocessors.
- Understand the complexity and function of modern parallel architectures.
- Understand when and where parallel computing is beneficial.
- Understand some of the challenges of supporting concurrency within an operating system, with respect to throughput and latency.
- Understand the various models of parallelism and parallel communication.
- Understand the scope of parallel computing research.
- Approach programming problems with new tools and a new perspective.

PREREQUISITES

CPSC 521 (Computer Architecture)

TEXTS

Grama, Gupta, Karypis, and Kumar. Introduction to Parallel Computing, 2nd Ed. Pearson Education Ltd: Essex, England. 2003.

John Hennessy and David Patterson. Computer Architecture, "A Quantitative Approach," 4th Ed., Morgan Kaufmann Publishers: San Francisco, CA. 2008.

CLASS PRESENTATIONS

Each student will be assigned two presentations throughout the semester, chosen from a list provided the first few weeks of class. The slides must be printed and handed in prior to the class presentation. Students will be allotted 25 minutes for presentation content, plus time for questions.

All students will be responsible for reading assigned research papers before the presentation day, and be able to answer questions. However, the presenter for that day must know the paper thoroughly, and be able to answer class questions.

Assessment

All written assignments must be typeset (ACM style / LaTeX preferred). There will be two partial-term tests during the semester. Homework is due at the beginning of class.

The grading breakdown is as follows:

- Coursework 35%
- Midterm Exams (x2) 20%
- Semester Project 30%
- Final Exam 15%

Grading Scale
A final score of 90 will guarantee an A-.
A final score of 80 will guarantee at least a B-.
A final score of 70 will guarantee at least a C-.
Lower scores will be considered a failing grade.

Collaboration

ALL WORK SUBMITTED FOR A GRADE MUST BE ENTIRELY YOUR OWN WORK.

Honor Policy

"*On my honor, I will maintain the highest possible standards of honesty, integrity, and personal responsibility. That means I will not lie, cheat, or steal and as a member of this academic community, I am committed to creating an environment of respect and mutual trust.*"

Disabilities

If you have a disability and need special consideration, please make an appointment with me to discuss those needs. In order to receive an accommodation for your disability, it must be on record in the Office of Career and Counseling Services (594-7192).

Tentative Schedule

	TOPIC	**Resources**
Week 1	Overview	
Week 2	Parallelism Introduction	Ch. 1, HP 1.8, HP 1.9
	Instruction Level Parallelism	HP 2, 3
Week 3	Limits of ILP	HP 3
	Shared Address Space Programming	Ch. 7
Week 4	Shared Address Space Programming	Ch. 7
	Concurrency: Deadlock	Papers
Week 5	Concurrency: Distributed Computing	Papers
	Concurrency: Multithreading	Papers
Week 6	Concurrency: Communication	Papers
	EXAM 1, 15-Feb	
Week 7	Parallel Architectures and Platforms	Ch. 2
	Parallel Architectures and Platforms	Ch. 2
Week 8	Dynamic Multithreading	CLRS 27
	Dynamic Multithreading	CLRS 27
Week 9	SPRING BREAK (Mar. 5-9)	
Week 10	Parallel Algorithm Design	Ch. 3
	Parallel Algorithm Design	Ch. 3
Week 10	Communication Patterns	Ch. 4
	Communication Patterns	Ch. 4
Week 11	Analysis of Parallel Algorithms	Ch. 5
	EXAM 2, 21-Mar	
Week 12	Parallel Topics	
	Parallel Topics	
Week 13	Parallel Topics	
	Parallel Topics	
Week 14	Parallel Search	Ch 9, 11
	Parallel Sort	
Week 15	Parallel Dynamic Programming, Graphs	Ch. 12, 10
	Parallel FFT, Dense Matrix Algorithms	Ch. 13, 8
Week 16	**FINAL EXAM, 27-APR, 5 to 7:30pm**	
	28-Apr, All papers due	

Parallel topics selected from: CUDA/GPU, Cell B/E, Parallel Functional Languages (F#), Unified Parallel C, or other contemporary topics.