INTRODUCTION

Description: Introduction to the fundamental and newly developing hardware and software topics in parallel computer architecture including concepts, models, methods, metrics, systems, and applications. Parallel computer architecture has recently become one of the most challenging and important areas of ECE, and is now a dominant theme throughout computer architecture, systems, and programming, from embedded systems to supercomputing systems, featuring fixed-logic (e.g., CPU, DSP, GPU), reconfigurable-logic (e.g., FPGA), and/or hybrid forms of multicore and manycore processing devices.

Prerequisites: Passing grade (i.e., B or better) in EEL5764 Computer Architecture, CDA5155 (CS equivalent), or consent of the professor.

Time and Place: 4th period (10:40-11:30am) MWF, NEB Room 102.

Course Objective: Students will gain fundamental knowledge and understanding of principles and practice in parallel computer architecture and computing, emphasizing both hardware and software challenges and the interactions between them, as well as exposure to research challenges in this field, through class lectures and discussions, reading assignments, homework exercises, and a major research project.

Sakai: Click here for e-learning support services

Prerequisites by Topic: All topics covered in EEL5764 Computer Architecture, which include: fundamentals of computer design; instruction-set principles and examples; basic and intermediate concepts in pipelining; instruction-level parallelism and its exploitation; superscalar and VLIW multi-issue constructs; limits on instruction-level parallelism; memory hierarchy concepts and design; and storage and I/O subsystems.

Required Textbooks:


Professor:

- Dr. Alan D. George, Professor of Electrical and Computer Engineering.
- Founder & Director of the NSF Center for High-Performance Reconfigurable Computing (CHREC).
- Office: 327 Larsen Hall, Telephone: (352)392-5225, Email: here, Office Hours: MWF period 3 (i.e., 9:35-10:25am) or by appointment.

Teaching Assistant:
Mr. Ruoyu Huang, Location: TBA, Office Hours: TBA

Suggested Reference Textbooks:


General Topics:

- Basic concepts in PCA
- Design concepts, methodologies, and strategies
- Message-passing and shared-memory programming paradigms
- Parallel programming languages and tools
- Fixed and reconfigurable device architectures and options
- Parallel algorithmic complexity
- Performance prediction and evaluation and tools
- Shared-memory architectures
- Distributed-memory architectures
- Cache coherency and consistency
- Interconnection networks
- Research challenges and opportunities
- Case studies and special topics

Engineering Applications: Parallel computer architecture, software, and system design and analysis; high-performance computing; high-performance embedded computing; reconfigurable computing; parallel processing applications.

Project: A major research project will be assigned in order to explore fundamental issues in parallel computer architectures, systems, and applications. This project will span most of the semester, and it will provide students the opportunity to more deeply explore fundamental issues in PCA. Students will form teams of two or three persons and propose then conduct an experimental research project on a topic in PCA of their choosing (subject to professor approval). Each project will involve elements of both hardware and software in parallel computing, although the balance need not necessarily be 50-50. Facilities and tools to support these projects will be provided as needed and available via special resources in the professor's research laboratory. The culmination of each project will be a clear and concise technical report suitable for potential publication discussing project concepts, development, experiments,
results, and analyses. The most important outcome of each project will be the research results that are achieved, analyses rendered, and conclusions drawn with demonstrable insight.

POLICIES

Grading Policy:

- 25% from Exam #1 (covers first half of semester)
- 25% from Exam #2 (covers second half of semester)
- 45% from Class Research Project (working in pairs or sets; consists of formal proposal, progress reports, and final report)
- 05% from Homework (working alone or in pairs as stipulated with each assignment)
- Final Grade: Overall scores in the course will be sorted and converted into letter grades via a roughly Gaussian or bell-shaped curve, where scores in the upper half equate to a B+ or better.

Graduate students, in order to graduate, must have an overall GPA of 3.0 or better (B or better). Note: a B- average is equivalent to a GPA of 2.67, and therefore, it does not satisfy this graduation requirement. Undergraduate students, in order to graduate, must have an overall GPA and an upper-division GPA of 2.0 or better (C or better). Note: a C- average is equivalent to a GPA of 1.67, and therefore, it does not satisfy this graduation requirement. For more information on grades and grading policies, see here.

Deadline Policy: Much as you will often experience in your career after graduation, all assignments in this course will be given with a strict deadline, and students are required to submit their assignments on or before that deadline. In case of extenuating circumstances, students are advised to contact the professor immediately or as soon as practical. Late assignments and makeup exams will only be permitted in the case of documented medical emergencies.

Attendance Policy: Although attendance will not be taken regularly in class, students are advised to attend all lectures and take good notes. Tardiness for lectures found to be disruptive will NOT be tolerated. Use of cell phones is strictly prohibited.

Conduct Policy: We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity. All assignments are to be considered an individual effort unless otherwise specified by the instructor.

Academic Honesty: All work submitted in this course must be your own and produced exclusively for this course. The use of sources (ideas, quotations, paraphrases) must be properly acknowledged and documented. Your professor in this course requires the utmost degree of academic honesty and thus any violations will be treated and handled very seriously. All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a student at the University of Florida and to be completely honest in all assignments and exams in this and all courses. If at any time questions arise regarding what is or is not appropriate, the student should ask the professor for guidance or clarification before proceeding. For a copy of the UF Honor Code and consequences of academic dishonesty, please refer here.

Accommodation for Students with Disabilities: Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation.

UF Counseling Services: Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include: (1) UF Counseling & Wellness Center, 3190 Radio Rd, 392-1575, psychological and psychiatric services; and (2) Career Resource Center, Reitz Union, 392-1601, career and job search services.
Software Use: All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

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READING ASSIGNMENTS & CLASS MATERIALS TO DATE

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<tr>
<th>ASSIGNED</th>
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<th>MATERIALS</th>
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<tr>
<td>01/07/13 Monday</td>
<td>Introduction to PCA</td>
<td>Chp. 1 in PCA textbook (intro to PCA), Sections 4.1 (intro to DLP) and 5.1 (intro to TLP) in CA 5ed textbook, and on-line tutorial @ LLNL</td>
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<tr>
<td>01/09/13 Wednesday</td>
<td>Parallel Programming with MPI</td>
<td>Chp. 6 in PCA textbook, lecture notes (TBA), and on-line tutorial @ LLNL</td>
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WRITTEN ASSIGNMENTS TO DATE

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<tr>
<td>HW #1</td>
<td>01/07/13 Monday</td>
<td>01/16/13 Wednesday</td>
<td>Carefully survey the literature and then write an original, technical survey paper (single-spaced, single-column, 11-point font, about 5-6 pages) entirely in your own words that provides a concise history of &quot;supercomputing&quot; (a.k.a., high-performance computing or HPC, the high end of PCA). Craft a title to emphasize the theme of your paper, and divide content in your paper into several enumerated sections. From what you learn in your survey and analysis, end your paper with a section rendering conclusions about the future of computing and supercomputing in your opinion, followed by your list of references used. For your paper, find, leverage, and cite at least five scholarly references (i.e., refereed and published conference or journal papers or books), and cite them in the body of your paper where and in order used (i.e., first is [1]). Note: Figures from any particular source may be reused in your paper if and only if that source is properly cited, but text or other content from sources may not. All HW#1 papers are to be submitted via Sakai with TurnItIn checking. This assignment is for teams of one or two students each.</td>
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NOTE: Each assignment is due at the beginning of class on the designated date in the manner specified (e.g., via Sakai).

EXAM SCHEDULE

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<tr>
<td>2/25/13 Monday</td>
<td>Exam #1</td>
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NOTE: Remote EDGE students are expected to arrange with their exam proctors to complete their exams on these dates;
those with extenuating circumstances should discuss with the professor well in advance.

Sample of Related Web Sites

- Introduction to Parallel Computing by LLNL
- Introduction to Parallel Programming by MHPCC
- Introduction to MPI Programming by ANL
- Top500 Supercomputer Sites
- NSF CHREC Center
- University HPC Center
- National Lambda Rail
- Florida Lambda Rail