

EEL 6763 Parallel Computer Architecture Course Syllabus Spring 2017

Description

An introduction to parallel computer architecture (PCA) including concepts, models, methods, metrics, hardware and software systems, and applications.

Prerequisites

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

Meeting Time and Location

Time: MWF 5th (11:45-12:35)

Location: Turlington, room L005

Course Objectives

Students who successfully complete this course will understand basic principles and practices in PCA, emphasizing both hardware and software challenges and their interactions, as well as exposure to research challenges in this field, through class lectures and discussions, reading assignments, homework exercises, a major research project, and exams.

Professor

Dr. Ian A. Troxel

Office: TBD

Email: iat@ufl.edu

Phone: TBD

Office Hours: MF 4th, (10:40-11:30), in office and W 6th, (12:50-1:45), in classroom

Teacher's Assistant

None.

Required Textbook

There is no required textbook for the course because available textbooks do not provide sufficient description of modern PCA systems and software ecosystems. Rather than a required textbook, course material will be drawn from reference papers and topics available at Morgan and Claypool publishers, accessible using your GatorLink account.

Additional References

- A. Grama, A. Gupta, G. Karypis, and V. Kumar, Introduction to Parallel Computing, 2nd Edition, Pearson: Addison-Wesley, 2003. Errata is available by John Kirk.
- D. Culler and J. Singh, Parallel Computer Architecture: A Hardware/Software Approach, Morgan Kaufmann, 1999.
- P. Pacheco, An Introduction to Parallel Programming, Morgan Kaufmann, 2011.
- B. Gaster, L. Howes, D. Kaeli, P. Mistry, and D. Schaa, Heterogeneous Computing with OpenCL, Morgan Kaufmann, 2011.
- T. El-Ghazawi, W. Carlson, T. Sterling, and K. Yelik, UPC: Distributed Shared Memory Programming, Wiley, 2005.
- R. Bisseling, Parallel Scientific Computation: A Structured Approach using BSP and MPI, Oxford Univ. Press, 2004.

- H. Jordan and G. Alaghband, Fundamentals of Parallel Processing, Prentice Hall, 2003.
- T. Mattson, B. Sanders, and B. Massingill, Patterns for Parallel Programming, Addison-Wesley, 2004.
- R. Miller and L. Boxer, Algorithms Sequential and Parallel: A Unified Approach, Prentice Hall, 2000.
- V. Eijkhout, Introduction to Scientific and Technical Computing, http://tacc-web.austin.utexas.edu/veijkhout/public_html/istc/istc.html.
- D. Kirk and W. Hwu, Programming Massively Parallel Processors: A Hands-on Approach, 2/e, Newnes, 2012.

General Topics

- Basic concepts in PCA
- Design concepts, methodologies, and strategies
- Message-passing and shared-memory programming paradigms
- Parallel programming languages and tools
- Fixed, reconfigurable, and hybrid 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

Independent Research 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 provide students the opportunity to more deeply explore fundamental issues in PCA. Students will form small teams (one or two person) to propose and 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 a 50-50 split. 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.

Course Grade Determination

- 25% Mid-term Exam (covering material from the first half of the semester)
- 25% Final Exam (covering cumulative material from the course)
- 40% Class Project
- 10% Homework and class participation

Total scores in PCA will be sorted and converted into letter grades via a Gaussian curve, where scores in the upper half will equate to a B+ or better.

Note: Graduate students must maintain an overall GPA of 3.0 (B) or better to graduate. For example, a B- average, which equates to a GPA of 2.67, does not satisfy this requirement.

Deadline Policy

Deadlines are a part of life and career. Assignments in this course will be given 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

Students are expected to regularly attend classes and participate in Q&A to increase the effectiveness of lectures and in-class discussions. While some lecture materials will be posted online, others (derivations, exercises, etc.) will likely not, making attendance particularly important.

Tardiness and the use of cell phones disrupt the flow of classroom activities and will impact in-class participation grade. Please refrain from distracting your fellow students.

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 professor.

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 ethics, 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 more information on this topic and its consequences, please see the following URLs:

<http://www.dso.ufl.edu/sccr/honorcodes/conductcode.php>

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Collaboration

Although you may consult with other students and the Professor on individual assignments, you must do independent work. Consulting means “seeking opinions or advice” not receiving working programs or code snippets and then modifying them to make them your own. The latter constitutes a breach of the honor code (see above section). Working side-by-side to construct a program or design in a group constitutes cheating. Solving homework assignments is good practice for solving exams, which are also not group activities, and future work assignments in your career, even for individuals on a software development team.

Another related topic is debugging and code analysis. When asking for help on an assignment, please do not expect the Professor to be able to spend the time to de-bug your specific code. To do so for all students in the class is time-prohibitive. Also, debugging is part of the coding process and one of the skills to be learned in the class. Rather than look at specific code, we will focus on concepts and a solution’s general structure during office hour sessions. Please do not email or present source code when requesting help unless explicitly instructed.

Re-Grade Policy

If you believe an error has been made on an assignment or exam score, you must make a written request to the Professor explaining where the mis-grading or error occurred and why you think more credit is deserved. This request must be submitted immediately at the end of the class in which the assignment is returned. NO exceptions. If you choose resubmit an assignment for a re-grade, the Professor reserves the right to scrutinize and grade the entire assignment with additional scrutiny. This policy places your current score at risk and therefore this procedure is not advisable to undertake unless a blatant grading error has been made. ***Do not alter the assignment or exam in any way from the original!*** Please use a separate sheet of paper to detail what you are specifically disputing. Please return the document exactly as it was returned to you.

Technology Use

The use of cell phones (and other technology devices) is strictly prohibited during exams. All use of an electronic device during an exam will be considered a violation of the student honor code (i.e., cheating, see same-named section below). Laptop computers and tablets are welcome in class as long as they are used for class-related work. Surfing the web, checking email, making Facebook posts, etc., is strictly prohibited and will result in course grade deductions.

Time Is Money

The professor will hold office hours as outlined above or by advanced appointment in special circumstances. The professor reserves the right to defer your question to an appropriate time if asked outside of class or office hours (either in person or via email). We all are busy with external commitments and the professor will strive to respect your time by answering your questions in a timely manner (within 24 hours normally and 48 hours on holidays and weekends). Please reciprocate with the same respect. You are encouraged to use email to communicate with the professor for a more rapid response.

Accommodation for Students with Disabilities

Students requesting classroom or exam accommodations 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 Professor when requesting accommodation. For optimal consideration, you must see the Professor during the first week of class.

UF Counseling Services

Campus resources are available for students having personal problems or lacking clear career and academic goals. These resources include: (1) University Counseling & Wellness Center, 3190 Radio Rd., 392-1575, (2) psychological and psychiatric services, SHCC mental Health, Student Health Care Center, 392-1161, (3) Center for Sexual Assault/Abuse Recovery and Education (CARE), Student Health Care Center, 392-1161, and career and job search services, Career Resource Center, 392-1601.

Software Use

All faculty, staff and students of the University of Florida 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.