COSC 5351 - ADVANCED COMPUTER ARCHITECTURE

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Office Hours: Mon 2:00-4:00
Office Hours: Wed 3:00-4:00
Office Hours: Thu 10:00-noon

Course website: http://sci.tamucc.edu/~sking/Courses/COSC5351/ will have the most up-to-date information as well as slides, notes, examples, etc. Please visit it often.

Course Description and Purpose

An overview of computer architecture, which stresses the underlying design principles and the impact of these principles on computer performance. General topics include design methodology, processor design, control design, memory organization, system organization, and parallel processing.

This course is required of all Computer Science MS students.

Prerequisites

- Graduate Student in Computer Science Standing. Students who are not fully admitted into the MS Computer Science program can take this course if they have met the program requirements of coursework in architecture (COSC5331)

Student Learning Outcomes

At the end of this course students should:

- know the classes of computers, and new trends and developments in computer architecture
- Understand pipelining, instruction set architectures, memory addressing.
- Understand the performance metrics of microprocessors, memory, networks, and disks
- Understand the various techniques to enhance a processors ability to exploit Instruction-level parallelism (ILP), and its challenges.
- Understand exploiting ILP using dynamic scheduling, multiple issue, and speculation.
- Understand multithreading by using ILP and supporting thread-level parallelism (TLP).
- Understand the performance and efficiency in advanced multiple-issue processors.
- Understand symmetric shared-memory architectures and their performance.
- Understand multiprocessor cache coherence using the directory based and snooping class of protocols.
- Understand the various models to achieve memory consistency.
- Understand the performance of multicore processors using SPEC benchmarks.
- Understand the several advanced optimizations to achieve cache performance.
- Understand virtual memory and virtual machines
- Understand storage systems, RAID, I/O performance, and reliability measures.

Format

This course will be a mixture of lectures, discussions, and demonstrations. The student is expected to actively participate in all class activities. The student is also expected to do outside work on assignments.

Text and References

Course Outline

- Introduction
- Chapter 1: Fundamentals of Computer Design
- Appendix A: Pipelining: Basic and Intermediate Concepts
- Exam 1
- Chapter 2: Instruction Level Parallelism and Its Exploitation
- Chapter 3: Limits to Instruction Level Parallelism and Multithreading
- Appendix F: Vector Processors
- Exam 2
- Chapter 4: Multiprocessors and Thread-Level Parallelism,
- Chapter 5: Advanced Memory Hierarchy Design
- Chapter 6: Storage Systems,
- Exam 3
- Paper presentations.

Grading Plan

Your grade will be composed of a combination of Exams, assignments, a paper, a presentation and class participation.

Exams 45% 90% A
Paper 20% 80% B
Assignments 20% 70% C
Presentation 10% 60% D
Participation 5%

Exams

There will be three in class exams, tentatively scheduled for

- 14 July
- 21 July
- 4 Aug

Assignments

There will be 9 assignments one for each chapter covered, one paper due the last day of class, and one presentation over the topic of your paper.

Course Policies

- No makeup exam without adequate doctor's excuse explaining your absence. Makeup exams will not be the same exam. If for any reason you have a conflict you must see me as soon as you know about the conflict!
- Incompletes only with documented reasons in accordance with the university policy.
- Late assignments will be marked off at a rate of: 10% for 1 day, 25% for 2 days, 60% for 3 days, 100% thereafter.
- All work must be your own, group work is CHEATING, and all group members will receive a zero.
- Unless otherwise noted, the due time for homeworks will be the beginning of class, end of class is 10% off
- Unless otherwise noted, the due time for programs will be 11:59:59PM, 12:00:01AM is 10% off.
- Turn off cell phones and pagers before class.

Academic Integrity/Plagiarism University students are expected to conduct themselves in accordance with the highest standards of academic honesty. Academic misconduct for which a student is subject to penalty includes all forms of cheating, such as illicit possession of examinations or examination materials, falsification, forgery, complicity or plagiarism. (Plagiarism is the presentation of the work of another as one's own work.) In this class, academic misconduct or complicity in an act of academic misconduct on an assignment or test will result in zero on the assignment for all those involved in the misconduct.

Dropping a Class I hope that you never find it necessary to drop this or any other class. However, events can sometimes occur that make dropping a course necessary or wise. Please consult with me before you decide to drop to be sure it is the best thing to do. Should dropping the
course be the best course of action, you must initiate the process to drop the course by going to the Student Services Center and filling out a course drop form. Just stopping attendance and participation WILL NOT automatically result in your being dropped from the class. June 20 is the last day to drop a class with an automatic grade of “W” this term.

**Classroom/professional behavior** Texas A&M University-Corpus Christi, as an academic community, requires that each individual respect the needs of others to study and learn in a peaceful atmosphere. Under Article III of the Student Code of Conduct, classroom behavior that interferes with either (a) the instructor’s ability to conduct the class or (b) the ability of other students to profit from the instructional program may be considered a breach of the peace and is subject to disciplinary sanction outlined in article VII of the Student Code of Conduct. Students engaging in unacceptable behavior may be instructed to leave the classroom. This prohibition applies to all instructional forums, including classrooms, electronic classrooms, labs, discussion groups, field trips, etc.

**Statement of Civility (can be in place of classroom/professional behavior)** Texas A&M University-Corpus Christi has a diverse student population that represents the population of the state. Our goal is to provide you with a high quality educational experience that is free from repression. You are responsible for following the rules of the University, city, state and federal government. We expect that you will behave in a manner that is dignified, respectful and courteous to all people, regardless of sex, ethnic/racial origin, religious background, sexual orientation or disability. Behaviors that infringe on the rights of another individual will not be tolerated.

**Grade Appeals (College of Science and Engineering Version)** As stated in University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures, a student who believes that he or she has not been held to appropriate academic standards as outlined in the class syllabus, equitable evaluation procedures, or appropriate grading, may appeal the final grade given in the course. The burden of proof is upon the student to demonstrate the appropriateness of the appeal. A student with a complaint about a grade is encouraged to first discuss the matter with the instructor. For complete details, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, see University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules website at http://www.tamucc.edu/provost/university_rules/index.html, and the College of Science and Engineering Grade Appeals webpage (http://sci.tamucc.edu/students/Grade/Appeal.html). For assistance and/or guidance in the grade appeal process, students may contact the chair or director of the appropriate department or school, the Office of the College of Science and Engineering Dean, or the Office of the Provost.

**Disabilities Accommodations:** The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please call or visit Disability Services at (361) 825-5816 in Driftwood 101.

If you are a returning veteran and are experiencing cognitive and/or physical access issues in the classroom or on campus, please contact the Disability Services office for assistance at (361) 825-5816.

**Statement of Academic Continuity** In the event of an unforeseen adverse event, such as a major hurricane and classes could not be held on the campus of Texas A&M University-Corpus Christi; this course would continue through the use of Blackboard and/or email. In addition, the syllabus and class activities may be modified to allow continuation of the course. Ideally, University facilities (i.e., emails, web sites, and Blackboard) will be operational within two days of the closing of the physical campus. However, students need to make certain that the course instructor has a primary and a secondary means of contacting each student.