Advanced Computer Architecture

Course Description
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.

Prerequisite
COSC 5331 (Survey of Computer System Software). If you do not have the prerequisites (or equivalents from another university) shown on your TAMUCC records, you may be dropped from class at any time.

Learning Objectives
Upon completion of this course, students will be able to:
1. Understand the classes of computers, and new trends and developments in computer architecture
2. Understand pipelining, instruction set architectures, memory addressing.
3. Understand the performance metrics of microprocessors, memory, networks, and disks
4. Understand the various techniques to enhance a processors ability to exploit Instruction-level parallelism (ILP), and its challenges.
5. Understand exploiting ILP using dynamic scheduling, multiple issue, and speculation.
6. Understand multithreading by using ILP and supporting thread-level parallelism (TLP).
7. Understand the performance and efficiency in advanced multiple-issue processors.
9. Understand multiprocessor cache coherence using the directory based and snooping class of protocols.
10. Understand the various models to achieve memory consistency.
11. Understand the performance of multicore processors using SPEC benchmarks.
12. Understand the several advanced optimizations to achieve cache performance.
13. Understand virtual memory and virtual machines

Major Course Requirements
This is a high-level core course. This is a difficult course that demands all students attend all classes! Regular completion of all reading, homework, and other outside assignments, are absolutely essential for success in this course.
Assignments. Approximately 5-6 assignments will be given. Partial credit will be given for incomplete assignments. Assignments will significantly be based on the material from the lectures and other material considered essential for the successful completion of this course. Hard copies of assignments will be handed out in the class during the lecture sessions. The submission details will be provided to you along with each assignment.

Paper. All students are required to write a research or survey paper. The topic for the paper must be approved by the instructor. An in-class presentation is also required. Additional details on the research paper or survey report will be available later.

Exams. There will be three exams. The first exam will be given on September 26, 2012, and the second exam will be given on October 31, 2012, and the third exam will be given on November 28, 2012.

Semester grades will be based on the following weights:
- Three Exams 60%
- Assignments 25%
- Paper 15%

Required or Recommended Readings


Website: TBD

List of Supplies: None

Course Policies

Attendance/Tardiness

You must attend all classes. You are responsible for any materials covered or handed out or announcements made for the tests, quizzes, and homework assignments in your absence. Records of your attendance will be maintained and reported to the university. Students found missing classes without the instructor's permission will be automatically withdrawn from the course. Students are responsible for all materials covered in class and assigned. Should a student be absent from class, it is his/her responsibility to get the notes, etc. for that missed class. More important, should there be assignments, it is the student’s responsibility to obtain such assignments. No excuse will be accepted for assignments not turned in because the student was absent when it was due.
Late Work and Make-up Exams

All the assignments are due at the beginning of the class on the due date. If the student is absent on the assignment due date, it is the student's responsibility to make sure that the assignment is submitted on the designated date. An assignment that is turned in after the class on the due date is considered one day late. There is a penalty for late submissions. Late assignments will be counted 20% off for each day after the due time. No credit will be given if an assignment is submitted after 5 days. If you have not completed your assignment by the due date, you should submit the work you have done for partial credit. No work will be accepted once the graded work has been returned or the solution has been disclosed to the class, except for unusual circumstances.

Exams must be taken on the hour they are scheduled. In the event, if you cannot attend the class to take the exam due to some emergency or some unavoidable situation (such as serious illness, death in the family, participation in university sports, religious observations, and so on) you must notify me as soon as possible before the exam and also you must validate your absence by providing me a document (e.g., with a letter from your doctor).

Extra Credit

None

Cell Phone/Electronic Device Usage

Set your cell phone/electronic device in silent mode when you are in 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 a score of 0 (zero) for the work or dismissal from the course and the Dean of Students office will be notified. No copying from another student's work, of any class, is allowed. It is the student's duty to allow no one to copy his or her work. Anyone found cheating in the exams will receive an automatic F for the course.

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. November 2, 2012 is the last day to drop a class with an automatic grade of “W” this term.

**Preferred methods of scholarly citations**

All referenced material used in a paper or project report must be properly acknowledged and cited. Use APA style for all scholarly citations.

**Grade Appeals**

As stated in University Rule 13.02.99.C2, Student Grade Appeals, 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 Rule 13.02.99.C2, Student Grade Appeals, and University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules Web site at http://www.tamucc.edu/provost/university_rules/index.html. For assistance and/or guidance in the grade appeal process, students may contact the Office of Student Affairs.

**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 our university disability services office.

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.

The following is a tentative list of topics that will be covered in the course. Depending on the interest and the background of the students in the class, the course instructor reserves the right to add new topics in the list or delete some topics from the list.
Course Contents (Tentative)

Chapter 1: Fundamentals of Computer Design

Appendix A: Pipelining: Basic and Intermediate Concepts, HW1

Appendix A: Pipelining: Basic and Intermediate Concepts

Appendix C: Review of Memory Hierarchy, HW2

Chapter 2: Instruction Level Parallelism and Its Exploitation

Chapter 2: Instruction Level Parallelism and Its Exploitation, Exam 1 Review

Exam 1

Chapter 3: Limits to Instruction Level Parallelism and Multithreading

Chapter 3: Limits to Instruction Level Parallelism and Multithreading, HW3

Appendix F: Vector Processors

Appendix F: Vector Processors, Topic Due for Final Paper

Chapter 4: Multiprocessors and Thread-Level Parallelism

Chapter 4: Multiprocessors and Thread-Level Parallelism, HW4

Chapter 4: Multiprocessors and Thread-Level Parallelism

Chapter 4: Multiprocessors and Thread-Level Parallelism, Exam 2 Review

Exam 2

Chapter 5: Advanced Memory Hierarchy Design

Chapter 5: Advanced Memory Hierarchy Design

Chapter 5: Advanced Memory Hierarchy Design

Chapter 5: Advanced Memory Hierarchy Design, HW5

Chapter 5: Advanced Memory Hierarchy Design

Chapter 6: Storage Systems

Chapter 6: Storage Systems

Chapter 6: Storage Systems, Exam 3 Review

Exam 3

Final paper presentations