CS 5803
Introduction to High Performance Computer Architecture

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Text: Computer Organization, Design, and Architecture, 5th edition (Shiva)

Reference: *Introduction to Arithmetic for Digital Systems (Waser & Flynn)*

Outline:
1. Performance measures
2. High Speed Arithmetic Techniques

    a) Fast Adder/Subtractor
    b) Fast Multiplier/Divider
3. Memory Hierarchy, Organization and Design

    a) Virtual Memory
    b) Cache Memory
    c) Interleaved Memory
    d) Associative Memory
4. Input-Output Organization and Design

    a) I/O Channels
    b) I/O Processors
5. Study of Advanced Processor Features

    a) Uniprocessor (RISC, CISC)
    b) Stack Machines
    c) Pipelining and Pipeline Design
    d) Fine Grain Parallelism
6. Instruction Level Parallelism
7. Study of a multifunctional system
8. How to break RISC barrier/superscalar/VLIW/super pipeline
9. Study of Pentium/Power PC/Multicore architecture

    *   Administrative (no make up exam)
        *   8 Home-works   10%
        *   Project   10%
        *   Periodic Exams and quizzes   50%
        *   Final Exam   30%   (Comprehensive)

Attendance
Class attendance is highly recommended

Makeup examinations & Extensions
There will be no makeup exams/quizzes (except for documented medical reason and highly unusual unexpected events).

Exams
There will be one exam for each course module during the semester and one comprehensive final exam during final exams week.
Submission Guidelines
Hardcopy of homework assignments and project(s) are collected in class,
It is encouraged to work as a group (at most two people per group) on homework assignments/project (grouping is fixed throughout the semester).

Tentative course schedule CS5803

Major Topic	Related Text Chapter	Class notes	Date
Performance measures	Chapter 16	Module 1, page 1-31	August 25
		Module 1, page 32-52	August 27
Test Module1, Arithmetic Logic Module	Chapter 10	Module 3, page 1-24	September 1
Modular ALU		Module 3, page 25-37	September 3
Algorithms for Fast ALU operations		Module 3, page 38-53	September 8
		Module 3, page 54-69	September 10
		Module 3, page 70-96	September 15
Test Module 3, Address Accessible Memory	Chapter 9	Module 4, page 1-17	September 17
		Module 4, page 18-45	September 22
		Module 4, page 46-67	September 24
		Module 4, page 68-103	September 29
		Module 4, page 104-130	October 1
		Module 4, page 131-145	October 6
Test Module 4 Content Addressable Memory	Chapter 9	Module 5, page 1-19	October 8
		Module 5, page 20-44	October 13
Test Module 5, Concurrency	Chapter 12	Module 6, page 1-26	October 15
Pipelining		Module 6, page 27-58	October 20
Parallel Architecture		Module 6, page 59-80	October 22
Multiprocessing		Module 6, page 81-105	October 27
DSM		Module 6, page 106-127	October 29
Message Passing		Module 6, page 128-162	November 3
Test Module 6, Beyond RISC		Module 7, page 1-14	November 5
Out-of-order execution/ VLIW/ Superscalar		Module 7, page 15-39	November 10
Superpipeline/ Multi-core/ Power PC/ Pentium4		Module 7, page 40-62	November 12
		Module 7, page 63-87	November 17
		Module 7, page 88-102	November 19
No class, Thanksgiving			November 24
No class, Thanksgiving			November 26
		Module 7, page 103-118	December 1
		Module 7, page 119-135	December 3
Test Module 7			December 8
			December 10

Missouri University of Science and Technology is committed to the safety and well-being of all members of its community. US Federal Law Title IX states that no member of the university community shall, on the basis of sex, be excluded from participation in, or be denied benefits of, or be subjected to discrimination under any education program or activity. Furthermore, in accordance with Title IX guidelines from the US Office of Civil Rights, Missouri S&T requires that all faculty and staff members report, to the Missouri S&T Title IX Coordinator, any notice of sexual harassment, abuse, and/or violence (including personal relational abuse, relational/domestic violence, and stalking) disclosed through communication including but not limited to direct conversation, email, social media, classroom papers and homework exercises.

Missouri S&T's Title IX Coordinator is Vice Chancellor Shenethia Manuel. Contact her directly (manuels@mst.edu; (573) 341-4920; 113 Centennial Hall) to report Title IX violations. To learn more about Title IX resources and reporting options (confidential and non-confidential) available to Missouri S&T students, staff, and faculty, please visit http://titleix.mst.edu.

- **Academic Alert System** http://academicalert.mst.edu

The purpose of the Academic Alert System is to improve the overall academic success of students by improving communication among students, instructors and advisors; reducing the time required for students to be informed of their academic status; and informing students of actions necessary by them in order to meet the academic requirements in their courses.

- **Disabilities** http://dss.mst.edu

If you have a documented disability and anticipate needing accommodations in this course, you are strongly encouraged to meet with the instructor as early as possible in the semester. You will need to request that the Disability Support Services staff send a letter to the instructor verifying your disability and specifying the accommodation you will need before the instructor can arrange your accommodation. Disability Support Services is located in 204 Norwood Hall, their phone number is 341-4211, and their E-mail is dss@mst.edu.

- **A Student Honor Code and Academic Integrity**

The Honor Code can be found at this link: http://stuco.mst.edu/about/honor.shtml. Please read and reflect upon the Honor code and its emphasis on HONESTY and RESPECT.
Page 30 of the Student Academic Regulations handbook describes the student standard of conduct relative to the University of Missouri System's Collected Rules and Regulations section 200.010, and offers descriptions of academic dishonesty including cheating, plagiarism or sabotage (http://registrar.mst.edu/academicregs/index.html).
Incidences of Academic Dishonesty will typically result in zero grades for the respective course components, notification of the student's advisor, the student's department chair, and the campus undergraduate studies office, and further academic sanctions may be imposed as well in accordance with the regulations. Note that those who allow others to copy their work are just as guilty of plagiarism and will be treated in the same manner.

- **S&Tconnect**: https://blackboard.mst.edu/ (S&Tconnect tab)

Coming fall 2014, Missouri S&T is implementing a new advising system as part of the four UM campuses Comprehensive Retention Initiative called S&Tconnect. S&Tconnect provides an enhanced system that allows students to request appointments with their instructors and advisors via the S&Tconnect calendar, which syncs with the faculty or staff member's Outlook Exchange calendar. S&Tconnect will also facilitate better communication overall to help build student academic success and increase studentretention. S&Tconnect Early Alert will replace the Academic Alert system used by Missouri S&T. However, Academic Alert will continue to run in parallel with Early Alert until the end of the fall 2014 semester. Training will be provided beginning opening week of fall 2014 semester.

- **Classroom Egress Maps:**

Please familiarize yourself with the classroom egress maps posted on-line at: http://registrar.mst.edu/links/egress/.

- **LEAD Learning Assistance** http://lead.mst.edu

The Learning Enhancement Across Disciplines Program (LEAD) sponsors free learning assistance in a wide range of courses for students who wish to increase their understanding, improve their skills, and validate their mastery of concepts and content in order to achieve their full potential. LEAD assistance starts no later than the third week of classes. Check out the online schedule at http://lead.mst.edu/assist, using zoom buttons to enlarge the view. Look to see what courses you are taking have collaborative LEAD learning centers (bottom half of schedule) and/or Individualized LEAD tutoring (top half of the schedule). For more information, contact the LEAD office at 341-7276 or email lead@mst.edu.

- **The Burns & McDonnell Student Success Center**

The Student Success Center is a centralized location designed for students to visit and feel comfortable about utilizing the campus resources available. The Student Success Center was developed as a campus wide initiative to foster a sense of responsibility and self-directedness to all S&T students by providing peer mentors, caring staff, and approachable faculty and administrators who are student centered and supportive of student success. Visit the B&MSSC at 198 Toomey Hall; 573-341-7596; success@mst.edu; facebook: www.facebook.com/mstssc; web: www.studentsuccess.com.