CS 430 Computer Architecture
Syllabus – Spring 2016

<u>Catalog Description</u>

An introduction to the hardware design aspects of all major components of a computer system. Topics include computer arithmetic, Boolean algebra and gate networks, logic design, an introduction to IA-32/64 & MIPS assembly language programming, memory (virtual and cache), I/O devices, pipelined instruction execution, bus structures, microprogramming and RISC/CISC philosophies.

<u>Student Learning Outcomes</u>

- Describe the basic principles of computer architecture and organization and what influences the performance of the system.
- Identify the relationship between high-level abstractions and low-level hardware components.
- Identify the addressing mode of instructions.
- Demonstrate how to add and multiply integers and floating-point numbers using two's complement and IEEE floating point representation.
- Describe the operation of performance enhancements such as pipelines, dynamic scheduling, branch prediction, and caches.

<u>Topics</u>

- Overview and history of computer architecture
- Fundamental building blocks (logic gates, flip-flops, counters, registers, PLA)
- Logic expressions, minimization, sum of product forms
- Register transfer notation
- Physical considerations (gate delays, fan-in, fan-out)
- Bits, bytes, and words
- Numeric data representation and number bases
- Fixed- and floating-point systems
- Signed and twos-complement representations
- Representation of non-numeric data (character codes, graphical data)
- Representation of records and arrays
- Basic organization of the von Neumann machine
- Control unit; instruction fetch, decode, and execution
- Instruction sets and types (data manipulation, control, I/O)
- Assembly/machine language programming
- Instruction formats
- Addressing modes
- Subroutine call and return mechanisms
- I/O and interrupts
- Storage systems and their technology
- Coding, data compression, and data integrity
- Memory hierarchy
- Main memory organization and operations
- Latency, cycle time, bandwidth, and interleaving
- Cache memories (address mapping, block size, replacement and store policy)

- Virtual memory (page table, TLB)
- I/O fundamentals: handshaking, buffering, programmed I/O, interrupt-driven I/O
- Interrupt structures: vectored and prioritized, interrupt acknowledgment
- External storage, physical organization, and drives
- Buses: bus protocols, arbitration, direct-memory access (DMA)
- Implementation of simple datapaths
- Control unit: hardwired realization vs. microprogrammed realization
- Instruction pipelining
- Introduction to instruction-level parallelism (ILP)
- Introduction to SIMD, MIMD, VLIW, EPIC
- Shared memory systems
- Cache coherence
- Memory models and memory consistency
- Superscalar architecture
- Branch prediction, Prefetching, and Speculative execution

Instructor Details

Professor:	Shereen Khoja
Email:	shereen@pacificu.edu
Office:	Strain 203 C
Office Hours:	Monday, Tuesday 2:30 – 3:3pm, Wednesday 2:00 – 3:30pm

Course Details

Course Title:	CS 430 Computer Architecture
Prerequisite:	CS 300 Data Structures with a minimum grade of C
Required For:	CS Major and can satisfy the Senior Capstone prerequisite
Meeting Times:	MWF 9:15am - 10:20am
Location:	LL15

Course Website:

http://zeus.cs.pacificu.edu/shereen/cs430sp16/

Course Assessment

Grade Distribution:

Homework / Programs / Projects	35%
Unscheduled (open note) quizzes	10%
Attendance / Participation / Warmups / Summaries	5%
3 Exams (closed book / no notes or any kind)	30%
Final	20%

Grading Breakdown:

		92-100%	A	90-92%	A-
88-90%	B+	82-88%	B	80-82%	B-
78-80%	C+	72-78%	C	70-72%	C-
68-70%	D+	60-68%	D		
		0-60%	F		

Program Grading:

Successful execution	70%
Acceptable structure, style, documentation, and efficiency. You must follow the C Coding Standards.	30%

Important Dates

Tentative dates for Exams:
Exam 1:   Monday, February 29, 2016
Exam 2:   Friday, April 15, 2016

Spring Break:
Monday, March 21, 2016 through Sunday, March 27, 2016 (No Classes)

Senior Projects Day:
Wednesday, April 27, 2016

Date of Final:
Monday, May 16, 2016, 3:00 pm - 5:30 pm

Academic Calendar:
http://www.pacificu.edu/as/calendar/

Course Policies

Attendance and Participation: Attendance at every class is critical to your success in this course. I expect you to be on time and ready to go once it is 9:15am and that you stay until the end of class. You will not be allowed into the classroom once I close the door and start teaching. Any missed lecture is your responsibility to make up; just remember that if you fall behind, it may be very difficult for you to catch up.

- I reserve the right to raise or lower your grade based on class participation and attendance. Specifically, I may lower your grade or may officially withdraw you from the course through the tenth week of the semester for poor attendance or participation. Further, your final grade may be lowered by 1/3 of your final course grade for each day (or portion thereof) of class missed. Please notify me PRIOR to class if you must miss class for any reason.

- No early or late exams/final will be given. No incompletes will be given.

- **Warmups:** Assigned readings will be accompanied by a short set of questions ("warmups"). The warmups will address concepts covered by the reading, and are intended to get you thinking about what you've read and to determine what topics need more attention. Warmups are due at midnight before the class period for which the reading is assigned.

Assignments: Assignments will take the form of hand-written answers to problems, assembly programming, Boolean algebra, using various other computer architecture hardware.

- Assignments can be turned in up to 24 hours late with a penalty of 10% of the grade. Anything turned in later than 24 hours of the assignment deadline will NOT be accepted.

- A program that does not successfully compile or produces no output loses 70% of the assignment grade.

- All code in any form generated from this course becomes the intellectual property of Pacific University. You may not share this code with anyone without obtaining written permission from Pacific University.

- Neither computer failure, software failure, nor lack of computer access are accepted as excuses for late programs; therefore, start work on the programs as soon as they are assigned, and don't put them off until the last minute. Further, corruption of programs due to bad disk media is also not accepted as an excuse for late programs; therefore, always keep a current backup of all programs on a separate disk. Please note that the Computer Science departmental servers are not backed up.

Learning Support Services for Students with Disabilities: If you have documented challenges that will impede your learning in any way, please contact our LSS office in Scott Hall (ext.2107). The Director will meet with students, review the documentation of their disabilities, and discuss the services that Pacific offers and any appropriate ADA accommodations for specific courses.

Academic Dishonesty: Pacific University has no tolerance for academic misconduct/dishonesty. It is university policy that all acts of misconduct and dishonesty be reported to the Associate Dean for Student Academic Affairs. Sanctions that may be imposed for such misconduct range from an "F" for the assignment, an "F" for the course, and suspension or dismissal from the university. Forms of academic misconduct include but are not limited to plagiarism, fabrication, cheating, tampering with grades, forging signatures, and using electronic information resources in violation of acceptable use policies.

- For programming assignments, plagiarism takes the form of, *but is not limited to* copying code from someone else, whether copying files, glancing at someone else's code, typing from someone else's notes, typing from someone's description of a solution (written or verbal) or typing while they dictate. The source can be a classmate, former student, website, program listing found in the trash, or anything else. Furthermore, plagiarism even on a small part of the program is cheating.

- You should also note that aiding someone else's cheating also constitutes cheating. You should never leave your code or problem set solution where someone else could have access to it, such as staying logged onto a machine or placing solutions in the recycling bin where another student may take it.

- Sanctions that may be imposed for academic dishonesty are:
    - First offense for cheating: 12% subtracted from your final course grade
    - Second offense for cheating of any kind: `F' in the course

Other:

- You may be asked to leave the class if you are causing a distraction e.g. cell phone ringing, talking, etc.

- If you have a complaint regarding a grade on an assignment or exam, write a one paragraph description of why you feel the grade is incorrect and deliver it to the instructor within five working days (M-F are considered working days) of when the graded material was returned to you. I will not consider any grade changes later than five working days after the graded material was returned.