CS 2190 : COMPUTER ORGANIZATION

Semester Hours:	3.0	*Contact Hours:* 3
Coordinator:	Tianyi Song	
Text:	Computer organization and design: HW/SW Interface	
Author(s):	PATTERSON AND HENNESSY	
Year:	2014, 5th Edition	

SPECIFIC COURSE INFORMATION

Catalog Description:

Overview of computer design. Data & instruction representations. Assembly language. Logic design. Control & data flow. Introduction to Instruction-level parallelism. Memory hierarchy fundamentals. Multiple processor systems. Students cannot get credit for both CS 2170 and CS 2190. Prerequisite: Grade of C or better in CS 2010. Approved for distance education.

Course type: **REQUIRED**

SPECIFIC COURSE GOALS

- I can explain the fundamental concepts of computer organization.

- I can use different data representations.

- I can design basic circuits using logic gates and flip-flops.

- I can utilize an assembler tool to write and execute simple assembly language programs.

- I can explain the data and control hazards in designing instruction sets for pipelining.

- I can explain basic instruction-level parallelism methods.

- I can explain how the different memory units work in the memory hierarchy.

COMPUTER SCIENCE STUDENT OUTCOMES ADDRESSED BY THIS COURSE

- CS 1 Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions

- CS 2 Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline

LIST OF TOPICS COVERED

- Overview of Computer Design (0.5 weeks, ~3%)
    - Building blocks
    - Functional point of view
- Data Representations (1.5 weeks, ~11%)
    - Numeric representations
        - Codes, arithmetic, addition/subtraction, 2's complement, floating-point numbers
    - Character representations
- Assembly language (2.0 weeks, ~14%)
    - MIPS assembly language
    - Simulator
- Logic Design (2.0 week, ~14%)
    - Gates, truth tables, logic equations, don't care terms
    - Combinational logic
    - Basic arithmetic logic unit
    - Flip-flop (D flip-flop)
- Instruction Representation (1.5 weeks, ~11%)
    - Operation, operand
    - Instruction format
    - Addressing modes
    - Decision-making
    - Procedure/function calls
- Control & Data Flow (2.5 weeks, ~17%)
    - Structures
    - Control unit
    - Data path, data and control hazards
    - Forwarding, stalls, exception, interrupt
- Introduction to Instruction-level Parallelism (2.0 weeks, ~14%)
    - Multiple-Issues

- o Speculation

- o Loop Unrolling

- Memory Hierarchy Fundamentals (1.0 week, ~7%)

  - o Memory hierarchies

  - o Measuring performance

- Multiple Processor Systems (1.0 week, ~7%)

  - o Multicores, multiprocessors; clusters

COMPUTER SECURITY TOPICS

Faculty who recently offered CS 2190 have discussed and identified a list of topics related to computer security in this course. Below is a list for instructors to incorporate. (*) indicates topics that are mandatory.

Security Topic	Description	Textbook Reference[1]	Estimated Class Hours
*Math (integer) overflows	Examples: adding two positive numbers exceeds the max value causing number to become negative.	Chapter 2.4	1
*Data as instruction	Generally, computers make no distinction b/w data and instruction - an assembly language program can modify a data location and branch to that location causing the data to be interpreted as an instruction	Chapter 2.5	1
*Virtual memory	Memory hierarchy and how address translation works.	Chapter 5.7	>1

[1]Computer Organization and Design: HW/SW Interface by Patterson and Hennessy, 5th Edition.