COMP 411 — MACHINE ORGANIZATION

Fall 2016

Lecture
MW 1:25p – 2:40p HO 0115 (Fuchs)
TTh 2:00p – 3:15p Sitterson 014 (Lastra)

Lab
F 1:25p – 2:40p HO 0115 (Fuchs)
Th 5:00p – 5:50p Sitterson 014 (Lastra)

Henry Fuchs *fuchs@cs.unc.edu*
Anselmo Lastra *lastra@unc.edu*
http://comp411f16.web.unc.edu

READ THIS HANDOUT CAREFULLY. YOU ARE RESPONSIBLE FOR KNOWING THE GROUND-RULES FOR THIS COURSE!

Course Overview

This course is an introduction to computer organization. Topics include digital logic, basic circuit components, data and instruction representation, computer architecture and implementation, and assembly language programming. Additionally, we will provide an introduction to programming in C.

Prerequisite

COMP 401 ("Foundation of Programming").

Course Information

Instructor:	Henry Fuchs fuchs@cs.unc.edu Brooks 216, 590-6211	Anselmo Lastra lastra@cs.unc.edu Brooks 212, 590-6058
Instructor Office Hours:	TBA – we'll decide the first week of the semester by polling for your availability. Look on Sakai	
Teaching Assistants:	Office hours and phone numbers will be announced when the TAs are assigned.	
Meetings:	See above.	
Texts:	Computer Organization and Design: The Hardware/Software Interface Patterson and Hennessy 5th ed. ISBN 9780124077263 eBook available C Programming Absolute Beginner's Guide Greg Perry and Dean Miller 3rd ed ISBN 9780789751980 eBook available	

Software: We will be using a MIPS assembler and simulator. More on this in class.

Web page The course web page (just basic information) is at

http://comp411f16.web.unc.edu/

The contents are mostly this document and contact info. ***Course materials will be distributed on Sakai (sakai.unc.edu).*** It should appear on your workspace.

Exams: There will be one in-class mid-term exam and a final exam, plus some quizzes.

The final exams are scheduled on Saturday December 10 at noon for the TTh 2:00 section and on Monday, December 12 at noon for the MW 1:25 section.

Grading: Problem Sets (5-7): 25%

Quizzes (4-6): 15%

Midterm Exam: 15%

Final Exam: 20%

Labs: 25%

Notes:

- There will be 5-7 problem sets.
- There will be 4-6 in-class quizzes, about 15 minutes in duration. The dates of these quizzes will be announced in advance.
- There will be a midterm and a final exam. The dates of these exams will be announced in advance.
- There will be approximately 10-12 lab assignments, including a final project.

Late policy: There will be several graded assignments. Each assignment will have a specific day and time deadline; late assignments will be penalized as follows:

1 day late (up to 24 hours after due date and time): 10% deduction

2 days late (24-48 hours after the due date/time): 25% deduction

3 days late (48-72 hours after the due date/time): 40% deduction

4+ days late (more than 72 hours after the due date/time):

No assurance that assignment will be graded

90% deduction if submitted before the assignment solution is discussed in class

no credit if submitted after the assignment solution is discussed in class

It is always better to turn in something, even if it is very late, than to turn in nothing. However, it is far better to work on the current assignment than to work on a past-due assignment.

Honor Code See http://honor.unc.edu

The Honor Code is in effect in this class, as in all others at the University. The Honor System's "Honor in the Syllabus" page includes the following suggested "affirmation of the Honor Code":

The University of North Carolina at Chapel Hill has had a student-administered honor system and judicial system for over 100 years. The system is the responsibility of students and is regulated and governed by them, but faculty share the responsibility. If you have questions about your responsibility under the honor code, please bring them to your instructor or consult with the office of the Dean of Students or the Instrument of Student Judicial Governance. This document, adopted by the Chancellor, the Faculty Council, and the Student Congress, contains all policies and procedures pertaining to the student honor system. Your full participation and observance of the honor code is expected.

We are very serious about the honor code. While it's easy to cheat in this course, it's also very easy for us to detect plagiarism. So don't do it! You are encouraged to work together for better understanding of the course material and assignment requirements, but **do the actual coding by yourself**. Too much reliance on others can be disastrous at exam time.

You are free to use any code that was presented in class, in recitation or other help sessions, with attribution (in the comments). You may NOT use code that you found on the web, or material from previous offerings of this course.

Important Incompletes will be given only in dire emergencies such as illness or a family emergency. Documentation will be required.

Course Contents

- Introduction (0.5 week)
- Performance (1 week)
  - Latency and Throughput
  - Amdahl's Law
- Representing Data and Instructions (3 weeks)
  - Information Encoding
  - Instruction Sets
  - Addressing Modes
- Programming in Assembly Language (2 weeks)
  - Assembly Language
  - Function/Procedure Calls and Stacks
  - Assemblers and Compilers
- Basics of Logic Implementation (1 week)
  - Transistors
  - Basic Logic Gates
  - Truth Tables and Boolean Synthesis
- Arithmetic Circuits (3 weeks)
  - Addition and Subtraction
  - Shifting and Logical Operations
  - A Complete ALU
  - Multiplication and Division
  - Floating-Point Arithmetic
- Control and Execution (2 week)
  - Finite State Machines
  - Five Stages of Execution
  - A Complete CPU
- Memory (1 week)
  - RAM/ROM Organization
  - Memory Hierarchy
  - Caches and Virtual Memory
- Pipelining (1 week)
  - Pipeline Basics
  - Two-, Four-, and Five-Stage Processor Pipelines
  - Structural, Data, and Branch Hazards
  - Performance Impact
- Operating System and I/O (0.5 week)
  - Basics of OS and I/O