Welcome to CMPE 12
Computing Systems and
Assembly Language Programming
Winter 2011
Joel Ferguson

Based on slides from
Cyrus Bazeghi and (especially) Andrea Di Blas
Thank you to both!
The team:

Instructor: F. Joel Ferguson fjf@
Office Hours: Wed 3:30 to 4:30 E2 Rm. 329
and by appointment 459-2411

TAs: Aimen Al-Rafai aalrefai@
     Ian Lee ianlee1521@
     Jonathon Loh jeloh@

8 Undergraduate Lab Tutors

MSI tutor: Evan Wegley ewegley@
Outline of CMPE12

• Beginning logic design
• Interface between software and hardware
• Assembly language programming (two languages).
The website:

http://www.soe.ucsc.edu/classes/cmpe012/Winter11
(under development)

The forum:

http://forums.soe.ucsc.edu/
The schedule:

<table>
<thead>
<tr>
<th>MON</th>
<th>TUE</th>
<th>WED</th>
<th>THU</th>
<th>FRI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab 01</td>
<td>Lab 04</td>
<td>Lab 01</td>
<td>Lab 04</td>
<td></td>
</tr>
<tr>
<td>9:30-11:30</td>
<td>9:00-11:00</td>
<td>9:30-11:30</td>
<td>9:00-11:00</td>
<td></td>
</tr>
<tr>
<td>Lab 02</td>
<td></td>
<td>Lab 02</td>
<td></td>
<td>Extra Lab</td>
</tr>
<tr>
<td>11:30-1:30</td>
<td></td>
<td>11:30-1:30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class</td>
<td>Lab 05</td>
<td>Class</td>
<td>Lab 05</td>
<td>Class</td>
</tr>
<tr>
<td>2:00-3:10</td>
<td>2:00-4:00</td>
<td>2:00-3:10</td>
<td>2:00-4:00</td>
<td>2:00-3:10</td>
</tr>
<tr>
<td>Lab 06</td>
<td></td>
<td>Lab 06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4:00-6:00</td>
<td></td>
<td>4:00-6:00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lab 03</td>
<td></td>
<td>Lab 03</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5:00-7:00</td>
<td></td>
<td>5:00-7:00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All labs are in BE109, class is... Here: Baskin 152
What we will cover in this class

Part 1: introduction and logic design

- Computing Systems and Abstraction (Ch 1)
- Number Bases and Arithmetic (Ch 2.1)
- Logic Functions and Gates (Ch 3)
What we will cover in this class

Part 2: The LC-3 computer system

- LC-3 Architecture (Ch 4)
- LC-3 Instruction Set Architecture (Ch 5)
  - Integers and Bit Operations (Ch 2.2-2.6)
- LC-3 Machine Language Programming (Ch 6)
- LC-3 Assembly Language Programming (Ch 7)
- LC-3 Input and Output (Ch 8)
- LC-3 TRAPS and subroutines (Ch 9)
- LC-3 Stack (Ch 10)
What we will cover in this class

Part 3: The 68HC11 microcontroller (all on notes and Motorola manuals)

- Microcontrollers and embedded systems
- HC11 microcontroller
- HC11 assembly
- HC11 I/O and interrupts
What we will cover in this class

Part 4: The C programming language
- Fixed- and floating-point numbers and arithmetic (Ch 2.6-2.7)
- Intro to the C programming language (Ch 11)
- C variables (Ch 12)
- C control structures (Ch 13)
- C functions (Ch 14)

*If we have time:*
- C pointers and arrays (Ch 15, 16)
Extended Course Description

Required skills to pass the course.

1. Number representations, including
   a. arbitrary base conversion    b. binary, hex, decimal, 2’s C
   c. bitwise operators           d. Binary fixed point numbers
   e. single-precision floating-point format
2. Binary Arithmetic, including
   a. Signed magnitude add/sub    b. Unsigned add/sub/mul
   c. Two’s complement add/sub/mul d. IEEE floating point add/sub/mul
3. Computing Systems
   a. Basic logic gates (and, or, not, xor)
   b. Determining the function of simple combinational circuits
   c. Adder and mux logic blocks
4. Assembly language programming
   a. Arithmetic and bitwise operations  b. Procedure calls
   c. Stack & memory operations
   d. Assembly implementation of C control structures
5. An understanding of acceptable and unacceptable collaboration, the need to ensure permission to collaborate in a class, and an automatic urge to acknowledge collaborators and others who have assisted in a project.
Extended Course Description

Core topics (must be taught)

1. Assembly language programming including
   a. Arithmetic and bitwise operations    b. Arrays, stacks,
   c. Procedure calls                    d. Addressing modes
   e. Both CISC and RISC architectures
2. An understanding of basic computing systems including
   a. Basic logic gates and/or/xor/not     b. Basic logic blocks (adder, mux)
   c. Registers, memory, CPU, I/O           d. Steps to execute an instruction
   e. Data structures
3. Binary arithmetic
   a. Signed magnitude add/sub            b. Unsigned add/sub/mul/div
   b. Two’s complement add/sub/mul         c. Floating point add/sub/mul
4. Number representations, including
   a. Arbitrary base conversion           b. Binary, hex, decimal, 2s Complement
   c. Bitwise operators                   d. Binary fixed point numbers
   e. Arbitrary bases (e.g., 3, 60)        f. Biased representation
   g. IEEE Floating point format
5. HLL language - basic coverage of C.
   a. Syntax                               b. Data types
   c. Procedure calls                      d. Arithmetic/bitwise operations
6. An understanding of basic system software including
   a. Assembly and compilation             b. Loading and linking
   c. The basic functions of the operating system
7. Interrupts and I/O
   a. Causes of interrupts                 b. Interrupt service routines
   c. Memory mapped I/O
Course Work and Grading

- Lectures
  - Quizzes and Participation (5%-10% extra credit)
- Weekly Homework but worst grade dropped (10% of grade)
- Midterms (25% apiece)
- Final Exam (40% of grade)
- Both homework (and solutions) and lab assignments will be posted on our web page every week
Homework

• Two parts:
  - Recommended exercises from the textbook, NOT GRADED!
  - GRADED homework will be posted on Thursday or Friday and due ON PAPER, in class, by the following Wednesday at beginning of class.
Lab Work

- Logic design with Multimedia Logic
- Programming assignments in LC-3 (using the simulator)
- Programming assignments in HC11 (using the real device)
- Programming assignments in C (maybe)

NOTE: Labs start MONDAY January 10!
Team Labs

- Program as a team (!), together at one terminal
- Reduces typos and bugs
- Improves moral and effectiveness
- Increases learning speed
- Develops engineering skills
Attendance

- Mandatory (well..) for both class and lab (some discussion times may also be mandatory)
- Use iclickers for in-class quizzes and feedback, please purchase
- Both lab sections are required until the lab is turned in
- You must pass the class to pass the lab, you can pass the class but fail the lab
Special needs

- If you qualify for classroom accommodations because of a disability, please get an Accommodation Authorization from the Disability Resource Center (DRC) and submit it to me in person outside of class (e.g., office hours) within the first two weeks of the quarter. Contact the DRC at 459-2089 (voice), 459-4806 (TTY), or http://drc.ucsc.edu for more information on the requirements and/or process.
Grades for CMPE12L

- You must turn in ALL lab assignments (working or not)
- Use `submit` to the course locker: `cmpe012-fjf.w11`
- All lab assignments have the same weight
- Read the web page about rules for late submissions and re-submissions
- Friday Lab time reserved as extra time for students in all sections.
Probable Final grades breakdown

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>96% +</td>
<td>A+</td>
</tr>
<tr>
<td>95%-91%</td>
<td>A</td>
</tr>
<tr>
<td>90%-86%</td>
<td>A-</td>
</tr>
<tr>
<td>85%-81%</td>
<td>B+</td>
</tr>
<tr>
<td>80%-76%</td>
<td>B</td>
</tr>
<tr>
<td>75%-71%</td>
<td>B-</td>
</tr>
<tr>
<td>70%-66%</td>
<td>C+</td>
</tr>
<tr>
<td>65%-61%</td>
<td>C</td>
</tr>
<tr>
<td>60%-55%</td>
<td>D</td>
</tr>
<tr>
<td>Tot% &lt; 55%</td>
<td>F</td>
</tr>
</tbody>
</table>
Academic Integrity

- What is a violation? Turning in work as your own, that is not your own.

- Consequences
  - Academic Sanction: Fail Class
  - Disciplinary Sanction: From warning to expulsion. See http://www.ucsc.edu/academics/academic_integrity/undergraduate_students/
Academic Dishonesty

- Damages trust,
- Wastes time that can be spent teaching and learning,
- Erodes value of degree and other’s work, and
- Personal integrity is weakened for future temptations.
Assignments

- Check out the **class website**: 
  www.soe.ucsc.edu/classes/cmpe012/Winter11

- Check out the **textbook’s website**: 
  www.mhhe.com/patt2

- Check out the **course discussion forum**: 
  http://forums.soe.ucsc.edu

- Read **Chapters 1 and 2.1** of the textbook by Friday.