CS 310H: Computer Organization and Programming

Lecture 1: Overview
Goals

- Understand the fundamental components of computer systems
  - Hardware
  - Machine language
  - Assemblers
  - Compilers
  - Operating Systems

- Learn to program the machine at its most basic level
  - Why? Can’t we just use a high level language?
  - SW design decisions are driven by the HW
  - Understand program performance
  - It’s cool!

- Without this knowledge, it’s kind of like being an architect without knowing anything about construction
Logistics

Lectures     MWF 10:00am, RLM 6.116
Lecturers    Prof. Fussell
TA           Aditya Rawal
Discussions  Th 9-10 – GAR 1.134
             Th 11-12 – PAR 204
More Logistics

**Grading:**

- **In-class Quizzes**: 30% (15% each for 2 highest)
- **Final Exam**: 30%, Exam week
- **Homework/Pgms**: 30%
- **Participation**: 10% (discussion section)

**Textbooks:**  
*Introduction to Computing Systems: From Bits and Gates to C and Beyond, by Patt and Patel, 2nd edition*
CS310 Online

URL:  
www.cs.utexas.edu/users/fussell/cs310h

Email List: for class announcements  
(see web page to sign up)
My Favorite Program

\[ a[0] = 1; \]
\[ a[1] = 1; \]
\[
\text{for}(i=2; \ i<100; \ i++) \ \{ \\
\quad a[i] = a[i-1] + a[i-2]; \\
\}
\]

1, 1, 2, 3, 5, 8, 13, 21, ...
Your Computer

- **CPU**
- **DRAM**
- **I/O bus**
- **Keyboard**
- **Monitor**
- **Modem**
- **DISK**
Layers of Abstraction

Specification
compute the fibonacci sequence

Program
for(i=2; i<100; i++) {
    a[i] = a[i-1]+a[i-2];
}

ISA (Instruction Set Architecture)
load r1, a[i];
add r2, r2, r1;

microArchitecture

Logic

Transistors

Physics/Chemistry
The Mighty Transistor!
Intel 4004 - 1971

- The first microprocessor
- 2,300 transistors
- 108 KHz
- 10μm process
Intel 8086 - 1978

- IBM PC processor
- 29,000 transistors
- 10 MHz
- 3µm process
Intel Pentium - 1993

- First Intel processor to execute more than one instruction per cycle
- 3.1 million transistors
- 66 MHz
- 0.8µm process
Intel Pentium IV - 2001

- 42 million transistors
- 2GHz
- 0.13µm process

Could fit ~15,000 4004s on this chip!
AMD Opteron - 2004

- 106 million transistors
- 2.4 GHz
- 0.13µm process
IBM Power 5 - 2004

- 276 million transistors
- 1.9 GHz
- 0.13µm process
- 2 processors
Next Time

- Basic (simple) electronics

- Reading assignment:
  - P&P Chapters 1, 2.1, 2.2, 3.1-3.2