CS 310: 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 pretty darn cool!

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

Lectures  MW 3:30pm, WAG 101
Lecturers  Prof. Fussell
TAs  Bert Maher, Dong Li
Discussions  Th 10-11 – RAS 211A
            Th 1-2 – RAS 211A
            Th 10-11 – JES A207A
            Th 2-3 – RAS 313A
## More Logistics

### Grading:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-class Quizzes</td>
<td>30% (15% each for 2 highest)</td>
</tr>
<tr>
<td>Quiz 1</td>
<td>Wednesday, Feb. 25</td>
</tr>
<tr>
<td>Quiz 2</td>
<td>Wednesday, April 8</td>
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<tr>
<td>Quiz 3</td>
<td>Wednesday, May 6</td>
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<tr>
<td>Final Exam</td>
<td>35%, Exam week</td>
</tr>
<tr>
<td>Homework/Pgms</td>
<td>25%</td>
</tr>
<tr>
<td>Participation</td>
<td>10% (discussion section)</td>
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</tbody>
</table>

### Textbooks:

- *Course Reader*
URL:
www.cs.utexas.edu/users/fussell/cs310

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

newsgroup: utexas.csclass.cs310
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
- Mem bus
- DISK
- Keyboard
- Monitor
- Modem
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!

(a)

This sample was "stained" to delineate levels.
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
  - Maccabe 1.1, 1.2, 2.1