"If you've ever opened up your computer to get all the pizza crumbs out, you probably noticed that there's nothing in there but a shiny green board covered with silver lines and lots of little black doodads. This class will attempt to teach you what those doodads are, how they work, and why it costs so much to fix when you spill stuff all over them."

- Bill Richardson, Former 3700 TA

CS/ECE 3700

Digital System Design

- T Th 12:25-1:45, WEB L101
- Instructor: Prof. Erik Brunvand
  - MEB 3142
  - Office hours: After class, when my door is open, or by appointment
CS/ECE 3700

- **TAs:**
  - Paymon Saebi
  - Leif Andersen

Lab Sections (start next week...)

- **All labs are in the SoC DSL (MEB 3133)**

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<td>Lab 4</td>
<td>11:50-1:10 (16)</td>
<td>Lab 6</td>
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<td>Lab 3</td>
<td>3:40-5:00 (15)</td>
<td>Lab 5</td>
<td>3:40-5:00 (4)</td>
<td>Lab 7</td>
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Move Some Lab Sections?

- Would like to make HW usually due on Wed
  - This means it would be nice to have TA hours on Mon and Tue
- Would like to have Lab demos during your lab session
  - This means we should try to cluster the labs later in the week

Lab Sections (start next week…)

- All labs are in the SoC DSL (MEB 3133)

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New Lab Sections?

- All labs are in the SoC DSL (MEB 3133)

Mon | Tue | Wed | Thu | Fri
---|---|---|---|---
Lab 2 | Lab 3' | Lab 4 | Lab 5 | Lab 6 | Lab 7
10:45-12:05 | 10:20-11:40 | 11:50-1:10 | 3:40-5:00 | 1:25-2:45 | 3:00-4:20
(15) | (?) | (16) | (4+) | (11) | (5+)

TA Hours | TA Hours

Watch out – ECE 2280-004 is Thu 2:00-5:00

CS/EE 3700

- Web Page - all sorts of information!
- http://www.eng.utah.edu/~cs3700
- Contact:
  - cs3700@cs.utah.edu
    - Goes to everyone in the class
  - teach-cs3700@cs.utah.edu
    - Goes to instructor and TAs
Class Goal: two main things…

- **Fundamental Principles of Digital Systems**
  - Boolean algebra lets us describe and understand digital systems in a formal way
  - Finite state machines are a basic way to structure controllers

- **Design of Digital Systems**
  - Start with problem description
  - Transform that into a working solution
  - *The essence of engineering!*

Detailed Class Goals

- **Learn about Digital System Design…**
  - **Fundamentals:** Boolean logic, Boolean function optimization, mapping to logic gates
  - **Arithmetic Circuits:** number representation, signed/unsigned arithmetic, FP, BCD, etc. circuits for digital arithmetic
  - **Combinational Circuits:** muxes, decoders, encoders
  - **Sequential Circuits:** flip flops, latches, registers, counters, memory
Detailed Class Goals

- More subjects….
  - Finite State Machines: digital system controllers, Mealy and Moore machines
  - Digital Systems: FSM controllers connected to datapath circuits

- Throughout we’ll use Verilog HDL in addition to schematics, Boolean algebra, etc.

The Big Picture
This Class

Physics → Electronics → VLSI → Logic Gates

FSM → RTL → Computer

MOV R1 R2
ADD R1 R3 R6
ST R5 GH12
ISA

If (x=1)
X = foo(y);
else
X = bar(x, y);
Programming Languages

OS
Compilers
Algorithms
Applications
Etc...

Textbook

- Fundamentals of Digital Logic with Verilog
- Brown & Vranesic

(2nd edition)
CAD Tools

- Xilinx WebPACK software v10.1 (SP3)
  - schematic capture
  - simulation
  - Verilog simulation
  - Verilog synthesis
  - Mapping to the Xilinx FPGA
- Free! Download from www.xilinx.com
- Also Xess tools from www.xess.com
  - Also free…

Lab Kits
Prerequisites

- Some programming background (1410/2000)
  - We’ll be programming mostly in Verilog but some software programming background is essential
- Some electronics background (Physics 2220)
  - Voltage, current, resistance, capacitance, etc.

First Assignment

- HW #1 is already on the web site…
  - Basic electronics review
  - Due on Wednesday, Jan 18th, 5:00pm
  - Put it in the HW slot outside the SoC office
  - Make sure to put your name and lab section on the front
Assignments/Grading

- Homework and Lab Assignments: 35%
- Final Lab Project: 15%
- MidTerm Exam I: 15% (Thu, Feb 23)
- MidTerm Exam II: 15% (Thu, Apr 5)
- Final Exam: 20%
  - Tuesday May 1, 10:30am – 12:30pm

Questions?