CSE140: Components and Design Techniques for Digital Systems

Introduction

Prof. Tajana Simunic Rosing
Welcome to CSE 140!

- **Instructor**: Tajana Simunic Rosing
  - Email: [tajana.teach.ucsd@gmail.com](mailto:tajana.teach.ucsd@gmail.com)
  - please put CSE140 in the subject line
- **Office Hours**:
  - Tu 11:20-12:20pm, Th 5-6pm; CSE 2118
- **TAs and Tutors**
  - Shared between the two sections, office hrs will be listed on cse140 website
- **Instructor’s Assistant**: Kathleen Au
  - Office: CSE 2272
  - Phone: (858) 822-1516; Email: k6au@eng.ucsd.edu
- **Discussion sessions**:
  - Fridays 2:00p-2:50p PCYNH 109
- **Grades**: [http://ted.ucsd.edu](http://ted.ucsd.edu)
- **Announcements and online discussion**:
  - [https://piazza.com/ucsd/winter2017/cse140](https://piazza.com/ucsd/winter2017/cse140)
Class website

- https://cseweb.ucsd.edu/classes/wi17/cse140-bcd/
  - Syllabus
  - TA/Tutor office hours and locations
  - Class policies
  - Course schedule:
    - required online ZyBook exercises prior to class
    - HWs & exams
Textbooks and Recommended Readings

• Required online book:
  – Online digital design by F. Vahid
    • Exercises to complete prior to class
    • Student access instructions:
      1. Sign up at ZyBooks.com
      2. Enter ZyBook code: UCSDCSE140RosingWinter2017
      3. Select appropriate section (A or B) if available
      4. Click 'Subscribe'

• Recommended textbooks:
  – Digital Design by F. Vahid
  – Digital Design & Computer Arch.
    • by David & Sarah Harris
  – Contemporary Logic Design
    • by R. Katz & G. Borriello

• Lecture slides are derived from the slides designed for all three books
In Class We Will Use Clickers!

Vote on multiple choice questions in real time!

- Make sure to register yours with TED prior to our first Quiz, otherwise your grade for the quiz will be zero!
- freq: BB

Lets try it out:
A) Please speak louder
B) A bit quieter please
C) It is just perfect!
D) Too sleepy to know
E) None of the above
Grading

• **Standard grading scale:**
  - 90-100 = A-/A/A+;
  - 80-89.9 = B-/B/B+,
  - 70-79.9 = C-/C/C+,
  - 60-69.9 = D
  - Less than 60 = F.
  - Plusses and minuses given at the instructor's discretion.

• **Grading**
  - **Class participation 5%**
    • To get the full participation grade each session you have to respond to at least 75% of iClicker questions in class
  - **ZyBook questions 5%** (grades start with Chap 2)
    • Due before class, %completed correctly counts toward your grade
  - **Homework 10%**
  - **Midterm #1 25%**: Saturday, 1/28, 1:00p-2:20p; PETER 108
  - **Midterm #2 25%**: Saturday, 2/18, 1:00p-2:20p; PETER 108
  - **Exam#3/Final 30%**: Saturday, 3/18, 11:30-12:50; Location TBD
Some Class Policies

• Academic Honesty
  – Studying together in groups is encouraged
  – Turned-in work must be completely your own.
  – Both “giver” and “receiver” are equally culpable
  – Cheating on HW/ exams: F in the course.
  – Any instance of cheating will be referred to Academic Integrity Office

• Late:
  – No makeup for missed exams or zybook; exceptions must be documented
    • e.g. proof of the death in the family, a letter from a doctor justifying why you had to miss an exam and a permission to speak directly to your doctor
  – HWs are due at the beginning of the class
    • up to 1 day late HWs get 10% lower grade
    • More than 1 day late get no points

• Regrades
  – Request online within 24hrs of grades being posted. TAs/Tutors will review and add/subtract points as appropriate. If you are still not satisfied, contact the professor.
Abstraction:
A way to simplify by hiding details from other layers
Why Study Digital Design?

Look “under the hood” of your processors
You become a better programmer when you understand hardware your code runs on
The Scope of CSE140

- We start with Boolean algebra  \( Y = A \) and \( B \)
- We end with a hardware design of a simple CPU

- What’s next? CSE141 – more complex CPU architectures
Lets get started!

- Number representations
  - Analog vs. Digital
  - Digital representations:
    - Binary, Hexadecimal, Octal
- Switches, MOS transistors, Logic gates
  - What is a switch
  - How a transistor operates
  - Logic gates
  - Building larger functions from logic gates
- Universal gates
- Boolean algebra
  - Properties
  - How Boolean algebra can be used to design logic circuits
- Books references:
  - Online text chap 1
What Does “Digital” Mean?

- **Analog signal**
  - Infinite possible values
  - Ex: voltage on a wire created by microphone
  - Possible values: 1.00, 1.01, 2.0000009, ... infinite possibilities

- **Digital signal**
  - Finite possible values
  - Ex: button pressed on a keypad
  - Possible values: 0, 1, 2, 3, or 4.

Which is analog?
A) Wind speed
B) Radio Signal
C) Clicker response
D) A) & B)
E) All of the above

Diagram:
- Analog signal vs. Digital signal
- Possible values for each type

Possible values: 0, 1, 2, 3, or 4. That’s it.
Encoding Numbers – Base 10 & 2

- Each position represents a quantity; symbol in position means how many of that quantity
  - Base ten (decimal)
    - Ten symbols: 0, 1, 2, ..., 8, and 9
    - More than 9 -- next position
      - So each position power of 10
    - Nothing special about base 10 -- used because we have 10 fingers
  - Base two (binary)
    - Two symbols: 0 and 1
    - More than 1 -- next position
      - So each position power of 2
Bases Sixteen & Eight

- **Base sixteen**
  - Used as compact way to write binary numbers
  - Basic digits: 0-9, A-F
  - Known as *hexadecimal*, or just *hex*

- **Base eight**
  - Basic digits: 0-7
  - Known as *octal*