Digital Systems I

EEC 180A

Lecture 1

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Today

• Course details
  – Lab, Policies, Schedule (web page)
  – Course objective and strategies

• My background

• Chapter 1
  – Digital systems
  – Number systems
  – Binary (base 2) arithmetic

• Chapter 2
  – Boolean algebra
My Teaching Philosophy

• Primary goal (mine and yours):
  
  \textit{Learn digital system design well}

• Achieve this through:
  
  – Reading textbook
    • Objectives, Study Guide, Reading, Problems
    • Book is very complete, designed for self-study
  – Lectures
  – Solving problems on paper (homework)
  – Solving problems and building things in lab
  – Discussions with other students, TAs, myself
Grading Philosophy

• Grading serves two main purposes:
  – 1. Motivate you to do the work required to learn
     • Reading textbook (quizzes)
     • Lectures (quizzes)
     • Solving problems in homework (exams)
     • Solving problems in labs (lab grading, exams)
     • Discussions with others
  – 2. Give others an indication of how well you know the material
Letter Grade Assignments

• I assign a letter grade only for the final course grade
• I look at the final exams and course record of the class and assign two key dividing points: the A/A+ and D+/C- boundaries, and assign course grades from there using equally-sized intervals
  – No required numbers of any particular letter grades
  – Absolute scores are not important; the boundaries shift according to the difficulty of the exams in any quarter
  – Ignore any letter grades you might see on smartsite

(not actual grade data)
Lectures

• Ask questions at any time
  – Please raise your hand
• Be respectful of others
  – Hold conversations outside of class
  – Silence phones
  – Sit in the back if you come in late or need to leave early
Course Announcements

• In class
• Web
  – Assignments, etc.
• Email
  – Time-critical announcements only
Questions

• In class
• In lab
• Office hours
  – TBD
• After both lectures
• See me in person rather than through email
• TAs
  – Lab
  – Office hours
  – Email
Working With Others

• Collaboration
  – Asking questions and explaining principles produces better work and dramatically increases learning
  – Working with others
    • Do homework and prelabs with classmates nearby
    • Ask each other questions, help each other—regarding principles, and approaches to solving only

• Dishonesty
  – Copying produces similar work, stunts learning, is not fair to honest students, and is not allowed in this course
    • Students engaged in dishonest work will be referred to Student Judicial Affairs
    • I will try to keep in-class exams honest
    • Steps will be taken to keep out of class work honest
Course Workload

• 5 unit course
  – 18 “chapters” in 20 lectures

• New way of thinking of things will take some effort
  – Algebra: use variables
  – Calculus: no concrete solutions for indefinite integrals
  – Boolean algebra, binary math
    • Not only $a + b$, but also $a \text{ AND } b$, $a \text{ XOR } b$, …
    • $1 + 1 = 1$
    • $3 + 6 = -7$

• Passing this course requires significant effort and time
  – (Students that have already taken ECS 154A typically find the first part of the quarter very slow but later parts challenging)
Lab Items To Buy

- Four module wide protoboard
Lab Items To Buy

• Wire cutters/ strippers
  – Something like one of these two tools works fine
• Wire is provided in lab
Lab Items To Buy — Optional

• Diagonal cutters take a little more skill

• Needle-nose pliers are very helpful for inserting and removing wires
My Background

- My education
- My research
  - VLSI (chip) design
  - Processor architectures
  - Digital signal processing (DSP) algorithms
- Primary work experience
  - Mechanical engineering internships
  - Hewlett-Packard, Computer Systems Division
  - Atheros Communications
Areas of Research

- Processor architectures
  - Programmable
  - Special-purpose
- DSP algorithms
- Circuits
- VLSI design
- Software tools and applications

\[
G_c(m,n) = \alpha(m) \sum_{i=0}^{N-1} [\alpha(n) \sum_{k=0}^{N-1} g(i,k) \cos \frac{\pi(2k+1)n}{2N}] \cos \frac{\pi(2i+1)m}{2N}
\]
Current Research

- **AsAP – Asynchronous Array of simple Processors**
  - Reconfigurable mesh of high speed programmable processors
  - AsAP 1
    - 36 processors
    - 610 MHz each (2nd fastest processor designed in any university)

- **LDPC decoders**
  - Hardware, algorithms
  - Used in 10 Gbit ethernet, WiMAX, many emerging communications standards

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AsAP2
167-Processor Chip

- 65 nm CMOS, 1.2 GHz (fastest processor designed in any university)
- 3 accelerators + 3 shared memories
- New on-chip networks
- Processors choose own supply voltage and clock freq.
- Apps: JPEG, Wi-Fi TX & RX, H.264 video encoder, ultrasound
- Tools: compiler, mapping, simulators
- Undergrad research opportunities
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