Introduction to Computer Engineering

CS/ECE 252, Fall 2015
Computer Sciences Department
University of Wisconsin – Madison

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This Course

This course will:

• Help you understand the significance and pervasiveness of computers in today’s society and economy
• Teach you how computers really operate and how they are designed
• Introduce you to concepts that students in the Computer Sciences and Computer Engineering degree program learn in depth over four years
• Prepare and motivate you for study in this degree program
• Will count towards GCR introduction to engineering requirement
Two Big Components

• What is a computer and how to build a computer?

• How to program a computer?
Course Outline

• **Prerequisite** – none
• **Major topics in course**
  – Programming
  – Numbers and representation
  – Machine language
  – Machine encoding
  – Microarchitecture – how a computer works
  – Digital logic
Abstraction and Complexity

• Abstraction helps us manage complexity
• Complex interfaces
  – Specify what to do
  – Hide details of how

● Goal: Use abstractions yet still understand details

Scope of this course
Go Over Web Page

http://www.cs.wisc.edu/~karu/courses/cs252/fall2015/
Contact Info
Course Calendar
Texts and References
Computing
Grading
Homework
Exams
Piazza Discussion
Textbook

- discovering.cs.wisc.edu
- In-browser programming and homework submission
- Login with netid
Grading

• Homework: 30%
  – 8 equally weighted (we will drop lowest of them)
• Four mid-terms: 70%
  – Equally weighted

September 28, Monday       Midterm I (Ch. 1-3)
October 26, Monday          Midterm II (Ch. 4-5)
November 23, Monday         Midterm III (Ch. 6-7)
December 14, Monday         Midterm IV (Ch. 8)
Advice

• **Textbook** — read BEFORE corresponding lecture

• **Lecture** — attend!
  – book does NOT have all the material

• **Homework** — best completed in *study groups*
  – Will reinforce in-class coverage
  – Will help you prepare for midterm exams

• **Study Groups**
  – Groups of 2-3
  – Should meet weekly, learn from each other
  – Review material & discuss homework assignments
  – Each student should *submit* his/her own homework
Logistics

• YOU play the biggest role in your grade!
• Participate in class!
  – There are no “bad” questions or answers
• No late homework
  – Lowest of eight dropped
• Don’t come late to class
• My office hours: 11:50 to 1pm M,W,F
TAs

• Angie Lin
• Kai Zhao
• William Galliher

• Total 9 hours of office hours; use for help on material, homeworks
Lets write out first program!
from googlemaps import Client
api_key = "AIzaSyADna65ndIZRBBvx-V213ZLqHxO5KMyApY"
gmaps = Client(api_key)
origin = "1210 W. Dayton St., Madison, WI"
destination = "1605 Linden Dr, Madison, WI"
d = gmaps.directions(origin, destination)

print d.distance

for x in d.steps
    print x['html_instructions']
New materials Extend Performance of 90nm Planar Transistors

**Changes made**
- Gate
- Silicide added
- Channel
- Strained silicon

**Transistor**

**Future options**
- High-k gate dielectric
- New transistor structure
Accelerated Scaling of Planar Transistors

130nm Node
70nm Length (Production 2001)

90nm Node
50nm Length (Production in 2003)

65nm Node
30nm Prototype (Production in 2005)

45nm Node
20nm Prototype (Production in 2007)

32nm Node

15nm Prototype (Production in 2009)

Intel
Two Big Components

• What is computer and how to build a computer?

• How to program a computer?

• Main idea: Abstraction
Next Class & Announcements

• Read Chapter 1 *BEFORE* class
• Chapter 1 – overview
• HW-1 assigned; due Sep 11th.
CS/ECE 252 Lecture 1: Programming 2015 September 2

Course Introduction:
Instructors:
Professor:
   Karu Sankaralingam; CS 6367; MWF 11:50 - 1:00
TAs:
   Annie Lin; CS 6352; M 1:30-3:00; W 3:20-4:50
   William Galliher; CS 7367; MWF 2:30 - 3:30
   Kai Zhao; CS 1308; TR 12:45 - 2:15 + open office hours + appointment

This course help you understand what are computers and what computers help you do

Exposure to computer science and computer engineering
4 credits
Two big components: What is a computer? How to program a computer?
Prerequisites: none
Topics:
   Programming
   Number representation: everything is represented in 0's and 1's
   Machine encoding: how a computer represents a program
   How computers are built
   Digital logic: transistors could be on or off; transistor == boolean logic
   Abstraction: use transistor to build logic gates, use gates to build circuits, use circuits to build processors

Course Logistics:
   Book: http://discovering.cs.wisc.edu/text/box.xml
   Homework: Submit online via Learn@UW
   Piazza: https://piazza.com/class/ie0hgw9s8k623

Grades:
   30%: 8 homeworks weighted equally, lowest dropped
   70%: 4 midterms weighted equally
Advice:
Read textbook before corresponding lecture
Attend lecture
Ask questions
Form study groups

Program Example:
Get directions from googlemaps
Set up client using api key
Get directions
For loop to print turn by turn directions

Laptop connects to router
Router connects to data center
Data center has racks of computers
Computers have microprocessors
Microprocessors have transistors

Moore's law: number of transistors in an integrated circuit doubles every 1.5 years
Shrinking transistors
Can have more transistors
Faster switching
Cheaper

Assignment:
Read chapter 1 before next class, Friday Sep 4th.
Homework 1
Assign on Friday Sept 4th
Due on Friday Sept 11th