COS116: Computational Universe Spring 2006

Tentative Course Plan

Week	Lecture Topic	Lab topic
1	Intro: Computer science, a new way of looking at the world. (CS ≠ Programming!)	Creating and understanding a weblog. (To be used in later assignments.)
	Telling a robot how to behave.	
2	Telling a computer how to behave. (Via pseudocode).	Understanding a simple robot and the determinants of its behavior. (Each student gets a robot for the rest of the semester.)
	"Everything's a number." (Simulation. Creating new worlds. Games and Life.)	
3	"It ain't no good if it ain't snappy enough." (Efficiency in computations.)	Modifying the robot's behavior.
	"It sure is clever, but can it swing?" (Computer music.)	
4	How the computer raises its IQ. ("Intelligent" programs and how they view the world.)	Computer Music.
	What is a computation? Can we make a fundamentally different computer?	
5	What computers just cannot do. The fluid boundary between program and data. Implications for computational technologies.	Robotic fine art (drawing, painting, music, dance, or maybe something else?)
	Bioinformatics. The parallels between molecular basis of life and the computer. How computers enable the study of life.	
6	Logic: How the Greeks and medieval philosophers tried to formalize thought.	*No lab session.* Instead, students write an analytical article on their blogs.
	Boolean logic and Boolean circuits: the basis of computational hardware.	
7	How a Boolean circuit (and the computer) acquires memory: the importance of feedback.	Understanding properties of elementary gates and circuits.
	Clocked circuits and finite state machines.	
8	How to juggle the various demands of life. (Multitasking and operating systems.)	Understanding finite state machines.

	What do computers talk about when they talk? (Networking and the internet.)	
9	Physics of the silicon chip.	Strategies for congestion control on the internet.
	What can computers not do efficiently? And is that good or bad?	
10	Secrets and Lies, Knowledge and Trust. (Modern cryptography.)	More about congestion control. Fairness, quality of service, etc. Network phenomena.
	Viruses, worms, zombies, and other beasties.	
11	How do search engines work?	Study of Virus propagation in networks. Implications for epidemiology.
	What is intelligence? (What is your computer's Turing Quotient?)	
12	Can computers think?	Dissecting a computer.

Some memorable quotes:

This `telephone' has too many shortcomings to be seriously considered as a means of communication. The device is inherently of no value to us.
-- Western Union internal memo, 1876

I think there is a world market for maybe five computers.
-- Thomas Watson, chairman of IBM, 1943

Computers in the future may weigh no more than 1.5 tons.
-- Popular Mechanics, forecasting the relentless march of science, 1949

I have traveled the length and breadth of this country and talked with the best people, and I can assure you that data processing is a fad that won't last out the year.
-- The editor in charge of business books for Prentice Hall, 1957

But what ... is it good for?
-- Engineer at the Advanced Computing Systems Division of IBM,1968, commenting on the microchip

There is no reason anyone would want a computer in their home.
-- Ken Olson, president, chairman and founder of Digital Equipment Corp., 1977

There has been a great deal said about a 3,000-mile high-angle rocket. In my opinion, such a thing is impossible today and will be impossible for many years [...]
-- Vannevar Bush, author of *As We May Think*, Director of the Office of Scientific Research and Development, as stated before the Special Senate Committee on Atomic Energy [http://www.hq.nasa.gov/office/pao/History/SP-4404/ch3-7.htm, http://www.hq.nasa.gov/office/pao/History/SP-4201/ch1-4.htm]