CSC005 – Overview of Computer Science
Course Description

- Introduction to fundamental concepts in computer hardware and software. Exploration of the history and evolution of computing, and foundational areas of current computer science research. Algorithms, program development, and problem solving. Elements and use of a high-level programming language.

- Prerequisites: None
Required Text:

Computer Science Illuminated, Second Edition

Nell Dale, Ph.D., University of Texas, Austin, John Lewis, Villanova University

ISBN 13: 9780763726263
ISBN 10: 0763726265
Price: $81.95 (Sugg. US List)
Cover: Paperback
Pages: 699
Copyright: 2004
Grading

- Several assignments
- mid-term and end-term
- Class participation
- Final project or paper
- No make-up test or extended deadlines
Point Allocation

Assignments 1-3: 5% each
Final Project: 30%
Mid-Term: 25%
End-Term: 25%
Participation: 5%
Attendance

- **Not Mandatory**, but...
- ...you’ll probably **fail**!
- **Participation** is very important
- **Let me know** if you can’t make it
## Course Schedule

<table>
<thead>
<tr>
<th>Chapter 1: The Big Picture</th>
<th>Chapter 10: Operating Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapter 2: Binary Values and Number Systems</td>
<td>Chapter 11: File Systems and Directories</td>
</tr>
<tr>
<td>Chapter 3: Data Representation</td>
<td>Chapter 12: Information Systems</td>
</tr>
<tr>
<td>Chapter 4: Gates and Circuits</td>
<td>Chapter 13: Artificial Intelligence</td>
</tr>
<tr>
<td>Chapter 5: Computing Components</td>
<td>Chapter 14: Simulation and Other Applications</td>
</tr>
<tr>
<td>Chapter 6: Problem Solving and Algorithm Design</td>
<td>Chapter 15: Networks</td>
</tr>
<tr>
<td>Chapter 7: Low-Level Programming Languages</td>
<td>Chapter 16: The World Wide Web</td>
</tr>
<tr>
<td>Chapter 8: High-Level Programming Languages</td>
<td>Chapter 17: Limitations of Computing</td>
</tr>
<tr>
<td>Chapter 9: Abstract Data Types and Algorithms</td>
<td></td>
</tr>
</tbody>
</table>
Slides, Links & News

- www.cs.hofstra.edu/~cscvjc/Fall06
Class Rules

- Assignments are to be completed individually
- Academic **honesty** taken very seriously
- Be selfless! – You are part of a community
Chapter 1

• Introduction – The Big Picture
Computing Systems

Computing systems are dynamic!

What is the difference between **hardware** and **software**?
Computing Systems

**Hardware**  The physical elements of a computing system (printer, circuit boards, wires, keyboard…)

**Software**  The programs that provide the instructions for a computer to execute
Layers of a Computing System

Communication
Application
Operating System
Programming
Hardware
Information
Abstraction

A mental model that removes complex details

This is a key concept. Abstraction will reappear throughout the text – be sure to understand it!
Early History of Computing

Abacus
An early device to record numeric values

Blaise Pascal
Mechanical device to add, subtract, divide & multiply

Joseph Jacquard
Jacquard’s Loom, the punched card

Charles Babbage
Analytical Engine
Early History of Computing

Ada Lovelace
First Programmer, the loop

Alan Turing
Turing Machine, Artificial Intelligence Testing

Harvard Mark I, ENIAC, UNIVAC I
Early computers launch new era in mathematics, physics, engineering and economics
First Generation Hardware (1951-1959)

Vacuum Tubes
Large, not very reliable, generated a lot of heat

Magnetic Drum
Memory device that rotated under a read/write head

Card Readers ➔ Magnetic Tape Drives
Sequential auxiliary storage devices
Second Generation Hardware (1959-1965)

Transistor
Replaced vacuum tube, fast, small, durable, cheap

Magnetic Cores
Replaced magnetic drums, information available instantly

Magnetic Disks
Replaced magnetic tape, data can be accessed directly
Integrated Circuits
Replaced circuit boards, smaller, cheaper, faster, more reliable.

Transistors
Now used for memory construction

Terminal
An input/output device with a keyboard and screen
Fourth Generation Hardware (1971-?)

Large-scale Integration
Great advances in chip technology

PCs, the Commercial Market, Workstations
Personal Computers were developed as new companies like Apple and Atari came into being. Workstations emerged.
Parallel Computing
Computers rely on interconnected central processing units that increase processing speed.

Networking
With the Ethernet small computers could be connected and share resources. A file server connected PCs in the late 1980s.

ARPANET and LANs ➔ Internet
First Generation Software (1951-1959)

**Machine Language**
Computer programs were written in binary (1s and 0s)

**Assembly Languages and translators**
Programs were written in artificial programming languages and were then translated into machine language

**Programmer Changes**
Programmers divide into application programmers and systems programmers
High Level Languages
Use English-like statements and make programming easier. Fortran, COBOL, Lisp are examples.
Third Generation Software (1965-1971)

• **Systems Software**
  - utility programs,
  - language translators,
  - and the operating system, which decides which programs to run and when.

• **Separation between Users and Hardware**
  Computer programmers began to write programs to be used by people who did not know how to program
Third Generation Software (1965-1971)

- Application Package
- Systems Software
- High-Level Languages
- Assembly Language
- Machine Language
Structured Programming
Pascal, C, C++

New Application Software for Users
Spreadsheets, word processors, database management systems
Fifth Generation Software (1990-present)

**Microsoft**
The Windows operating system, and other Microsoft application programs dominate the market

**Object-Oriented Design**
Based on a hierarchy of data objects (i.e. Java)

**World Wide Web**
Allows easy global communication through the Internet

**New Users**
Today’s user needs no computer knowledge
Computing as a Tool

Programmer / User

- Systems Programmer (builds tools)
- Applications Programmer (uses tools)

Domain-Specific Programs

User with No Computer Background
Computing as a Discipline

• **What can be (efficiently) automated?**

• **Four Necessary Skills**
  1. Algorithmic Thinking
  2. Representation
  3. Programming
  4. Design
Computing as a Discipline

What do you think?

Is Computer Science a mathematical, scientific, or engineering discipline?
Systems Areas of Computer Science

- Algorithms and Data Structures
- Programming Languages
- Architecture
- Operating Systems
- Software Methodology and Engineering
- Human-Computer Communication
Application Areas of Computer Science

- Numerical and Symbolic Computation
- Databases and Information Retrieval
- Artificial Intelligence and Robotics
- Graphics
- Organizational Informatics
- Bioinformatics
Social Networking

- **Social Networking** - Bringing People Together Through Collaboration, Content Syndication, Folksonomy, Web Service, Web 2.0
- Jabber/XMPP - Open Alternative To Instant Messaging
- Tools - Collaboration With Wiki's, Joomla, del.icio.us, Protopage, GooglePages
- Social Sites – Flickr, MySpace, YouTube
The Long Tail

- Coined by Chris Anderson in Oct, 2004 Wired article
- XY: Popularity vs Inventory
- Total volume of low popularity items exceeds the volume of high popularity items
- Key factor: cost of inventory storage and distribution
- It can be economically viable to sell relatively unpopular products
The Long Tail

Sales for any given product group

- Top sellers
- “non-popular” products

Few thousand products

50%

Millions of products

50%

Coined by Chris Anderson in Wired
Making A Difference

[Apple Advertisement, 10/13] “It’s unfolded before your eyes. The revolution that is iPod first took the music scene by storm. Further spiced things up with full-color photos. Added a full complement of podcasts to the mix.

And now iPod has turned the world topsy-turvy once again with video, letting you carry up to 150 hours of video wherever you go. Imagine: With iPod, you can play the DJ one minute. Rock with the latest Madonna or U2 music videos the next. Then get lost with “Lost”—or any of the other TV shows or short films now available for purchase and download from the iTunes Music Store. “

The Long Tail is becoming reality!!!
Social Networking
Have A Good Week