Today’s Topics

Computer Science 1
Review

Upcoming
Final Exam: Thursday, 06/30, 2:00pm, Room 229 Social Sciences (here)

Reading
Great Ideas, Chapter 1 - 11
4. Top-Down Programming, Subroutines, and a Database Application

- Functions using Functions
- Getting Information In and Out of Functions
- Class Data: known within class.
- Formal Parameters/Arguments
- Syntax: Using a Function
- Functions that Return Values
- Syntax: Defining a Function
- Larger Problems: How to Deal with the Complexity
  - Divide and Conquer
  - Design: Stepwise Refinement
  - Top-Down Implementation
4. Top-Down Programming, Subroutines, and a Database Application

- "Parallel" Arrays or "Corresponding" Arrays
  - Model Phone Book Capability
  - Typical Access by Name
  - Access by other Fields (other arrays)
- Extend Idea to Database
- Basic Data Base Functions
- Wild Card Retrieval
- Used Car Database
- Relational Data Bases
4. Top-Down Programming, Subroutines, and a Database Application

- **Recursion**
  - Factorial \((N!\))
  - Iterative Approach for Factorial
  - Exponentiation \((X^N)\)
5. Graphics, Classes, and Objects

❖ Basic Stuff
  ❖ Canvas class, Graphics class, pixels, Coordinates

❖ Graphics Methods
  ❖ void drawLine(int x1, int y1, int x2, int y2)
  ❖ void drawRect(int x, int y, int width, int height)
  ❖ void drawOval(int x, int y, int width, int height)
  ❖ void setColor(Color c)

❖ Example: (Using Recursion) Serpinsky.java
5. Graphics, Classes, and Objects

- Writing a Class
  - Header
  - Contents of a class definition
  - The Constructor
  - The Serp Class to draw Serpinsky Gasket

- Simple-Minded Animation
  - Draw and Erase
6. Simulation

- Simulation: Motivation
- Optimization, Simulation: Biggest Dog Lot
- How Could We Automate Process?
- Other Roles For Simulations
  - Economy, Policy (e.g. birth control), Marketing
  - Camera Lenses, UNC CS Walkthrough, Virtual Reality
- Simulation in Microelectronics
  - Logic, Layout, Circuit, Process
- Design and Manufacturing
7. Software Engineering

- Engineering a Program - Programming in the Large
- What is Good Software?
- Program Life Cycle, Feedback Cycles
- Understanding Problem / Specifications
- Debugging
- Correctness, Proofs?
- Documentation
- Testing
- Bottom Line: Productivity: 15 LINES OF CODE/DAY
- Many People? The "Committee": Interaction
- Organizational Schemes: e.g. Chief Programmer Team
7. Software Engineering

- Killer Robot Scenario
  - Development Models
    - Waterfall
    - Prototyping
  - Testing
  - User Interface

- Ethics
8. Machine Architecture

- Architecture (definition)
- Hardware / Software
- Basic Computer very primitive
- Architectural Features
  - Memory
  - CPU: AX, IP, IR, CF
- Fetch/Execute Cycles
- Need to handle IF and WHILE situations
- Tracing (often the only way to understand)
- Loop Example: Factorial Example
- Handling Lists or Arrays (Self Modifying Code)
- Fancier Architecture
9. Language Translation

- Importance of language
- Goal: Translate Java To Assembler
- Revise Syntactic Production Rules (seen before)
- Use Rules to Modify Strings
- Add Semantic ("meaning") Components to our Rules
- Use Syntactic Derivation to Generate Semantic Rules;
  Use Semantic rules to Generate Code
- Rules for Looping
- Important: Everything done by simple substitution
- Everything "adds up"
11. Security, Privacy and Wishful Thinking

- Billions in Losses
- Possible Traps in Public Systems
  - Trojan Horse, Onlooker, Digital camera
- Good Passwords and Cracking
  - Briefcase combination lock
  - Analysis of brute force methods
  - Password on a Computer
  - Dictionary Attacks
- Encryption
  - Monoalphabetic Substitution
  - Polyalphabetic Substitution
11. Security, Privacy and Wishful Thinking

- Cypher Reuse: BAD
- One Time Pads: Can be Absolutely Secure
- The Key Exchange Problem
  - Using your "secure" channel (bad)
  - A Padlock Analogy
- Public Key Encryption
  - A Padlock Analogy
  - Rivest, Shamir, and Adleman (RSA) Encryption
    - Using Public Key and Private Key
    - Primes and Factoring
  - Breaking the Code: *Factoring*
11. Security, Privacy and Wishful Thinking

- Public Key Encryption
  - Digital Signatures
    - Using Private Key and Public Key
    - Need for Time Stamps
- Other Attacks (Buzz Words)
  - Many Leave No Trace
  - Password Hacking, IP Spoofing, Replay Attack
  - Man in the Middle, Denial of Service
- Whom Can You Trust?
  - Viruses, Trapdoors, Trojan Horses, Common Sense
- The Strong Encryption Trap
10. Virtual Environments for Computing

- The Raw Machine Provides a Hostile Environment
- Early Years Had Major Theme: CPU Time Precious
- Later Years: Cheaper and Cheaper Hardware
- What Does an Operating System Do?
  - Processor Management (Multiprogramming)
  - I/O Systems
  - Memory Management
  - Software Environments
- Memory Management
  - Memory Hierarchies, Paging, Protection
10. Virtual Environments for Computing

- **I/O Systems**
  - Files Systems, Communications/Networking
  - Graphical User Interfaces (GUI)

- **Processor Management**
  - True Parallel Processes vs. Simulated
  - Synchronization
    - Race condition
    - Deadlock