Introduction to System Programming Course

2015 Spring
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Overview

- What this course is about
- Who teaches this course
- Why you have to take this course
- What you will learn in this course
- What you will earn in this course
- How to succeed in this course
What This Course is About

- **System Programming**
  - Information representation
  - Assembly language
  - Processor architecture
  - Compilers, linkers, and loaders
Administrative Information

- **Course Code**
  - SWE 2001

- **Class Hour**
  - Tuesday and Thursday
  - 10:30 AM ~ 11:45 AM

- **Lecture Room**
  - #330110 (located on 1F in Semiconductor Building)
Textbook

- Computer Systems: A Programmer’s Perspective (2nd Ed.)
  - Randal E. Bryant and David R. O’Hallaron
  - 2011 Prentice-Hall
  - Authors’ site: http://csapp.cs.cmu.edu
Course Components

- Lectures
  - Concepts
  - Backgrounds

- Projects
  - Mostly on assembly programming
  - Design, implementation, measurement and optimization
Course Web Page

- http://csl.skku.edu/SWE2001S15
- Check the web site regularly
- Class material, project information and other useful things will be posted
Grading

- Proportion of Activities
  - Participation 10%
  - Projects 30%
  - Midterm 30%
  - Final 30%
- If you miss any exam, you will fail
- No lateness is allowed
- Up to four absences will be tolerated
Project

- You will work on each project alone
- The submission status will be posted on the course web page
- Only the assignments submitted before the deadline will receive full credit
- 25% of the credit will be deducted for every single day delay
Ethical Code

- No academic misconduct will be tolerated
  - Zero-tolerance policy
  - One who is found guilty will be kicked out of my class immediately
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Why You Have to Take This

- Abstraction is Good, But Don’t Forget Reality
  - Most CSE courses emphasize abstraction
    - Abstract data types
    - Asymptotic analysis
  - These abstractions have limitation
    - In performance optimization
    - In detection and elimination of bugs
Great Reality

- **Ints are not Integers, Floats are not Reals**
  - **Example 1: Is x^2 >= 0?**
    - Float’s: Yes!
    - Int’s:
      » 40000 * 40000 = 1600000000
      » 50000 * 50000 = ??
  - **Example 2: Is ( x + y ) + z = x + (y + z)?**
    - Unsigned & signed Int’s: Yes!
    - Float’s:
      » (1e20 + -1e20) + 3.14 = 3.14
      » 1e20 + (-1e20 + 3.14) = ??
Great Reality

- When you measure the required time to execute a part of your code, what can you do?
  - Measuring time in clock cycle accuracy is necessary

- Time Stamp Counter
  - A special 64-bit register in Intel-compatible machines
  - Incremented every clock cycle
  - Read with rdtsc instruction
  - Why couldn’t it be possible with a C-function?
What You Will Learn

- A little bit of computer organization
- A little bit of processor internals
- Assembly language
- Code optimization techniques
- A little bit of system software
  - Compiler, linker, loader, OSs and so on
What You Will Learn

Software

Operating Systems

Application

Architecture

Hardware

CPU
Mem
I/O Devices
<table>
<thead>
<tr>
<th>Application programs</th>
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<tbody>
<tr>
<td>Data structures &amp; algorithms</td>
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<tr>
<td>Programming languages &amp; compilers</td>
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<tr>
<td>Operating System</td>
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<tr>
<td>Architecture</td>
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<td>Microarchitecture</td>
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<td>Hardware Description Languages</td>
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<td>Digital logic</td>
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<tr>
<td>VLSI layout</td>
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<td>Processing, Fabrication</td>
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<td>Chemistry, Physics</td>
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What You Will Earn

- You will become more effective programmers
  - Able to find and eliminate bugs efficiently
  - Able to understand and tune for program performance

- You will be prepared for later “systems” classes in CSE
  - Compilers, Operating Systems, Computer Architecture, Embedded Systems and etc.
Keys to Success

- Think with your butt, not with your brain
- Invest as many hours as possible
- There’s no royal road to become a hacker