CS121: Software Development

Today

- Overview
  - What is "software development?"
  - What is this course about?
- LAC computers/accounts
- Graphics lab computers/accounts

"Software Development"

Key Processes

- Requirement specification/analysis
- Design
- Implementation
- Testing

Why study software development?

- Society has become increasingly dependent on software systems.

"Software Development"

- Requirement specification/analysis
- Design
- Implementation (focus of CS70)
- Testing
Why study software development?

- Society has become increasingly dependent on software systems.
- Failures in software systems can be dangerous and costly.

Therac-25

- Linear accelerators create high-energy beams that can destroy tumors with minimal impact on the surrounding healthy tissue.
- Therac-25 was the first linear accelerator with dosage controlled solely by software (as opposed to hardware).

1983: Pre-release Safety Analysis

- Programming errors have been reduced by extensive testing on a hardware simulator and under field conditions on teletherapy units. Any residual software errors are not included in the analysis.
- Program software does not degrade due to wear, fatigue, or reproduction process.
- Computer execution errors are caused by faulty hardware components and by “soft” (random) errors induced by alpha particles and electromagnetic noise.

and then ...

- 1983: First Therac 25 installed
- 1985-1987: Six massive-overdose accidents due to “software error” are reported. Overdoses caused severe burns and death.
- 1987: Recalled for extensive design changes, including hardware to safeguard against software errors in dosage.
Therac-25 Software Errors

- Bugs in program modules
- System errors due to misinterpretations of module interfaces
- Errors in users’ guide

Why study software development?

- Society has become increasingly dependent on software systems.
- Failures in software systems can be dangerous and costly
- Software design/development is a hard problem

FAA

- 1981: FAA announced plans to modernize air-traffic control.
- 1985: IBM awarded contract. System estimate to have 1.5 million lines of code, cost $2.5 billion, and be deployed by 1991.
- 1994: FAA decided that the project would never be completed, and cancelled it. Net loss $1.5 billion

Stats on software projects

- 31.1% are canceled before they are finished
- 52.7% overrun their cost estimates by at least 189%
- 33.3% overrun their time estimates by 100%-200%
- 94% of all projects do a "restart"

Large vs. Small Steps: Productivity

- "[there are] no silver bullets" ... that will do for software productivity, reliability, and simplicity what electronics, transistors, and large-scale integration did for computer hardware
- Frederick J. Brooks, Jr.
The Mythical Man-Month
“Wicked problems are problems that are fully understood only after they are solved the first time.”
Rittel and Webber, Dilemmas in a general theory of planning, 1983

Software is a wicked problem...

Is there hope?
Software engineering: tools, techniques, and principles to promote software quality
software engineering is an evolving field

Objectives of CS121
• Understand the problems
• Understand the tools, techniques, and principles that can help
• Practice

Major Topics
• Software Development
  - managing key processes
  - artifacts
• Software Design
  - principles
  - patterns
  - artifacts

Software Design & Development Practice
You’ll develop three software projects in this class
  - arcade game
  - miniature golf game
  - computer game of your design
Why games?

Games involve a range of problems that rarely show up in a single software project
- User interface design
- Computer graphics and sound
- Simulation and modeling
- Lots of mathematics
- Real-time
- Other possibilities: AI, networking, etc.

What about graphics

- You'll learn some basic OpenGL that will be more than adequate for your games.
- Yes, you can do a few all-nighters and figure out some cool effects, but that is not required. That is not even recommended.
- This is not a graphics course. If you want to do cool effects, take the graphics course.

Software Design & Development Practice

You'll develop three software projects in this class
- Arcade game
  - Focus: Software development cycle, processes (particularly requirements elicitation/analysis), artifacts of development process
- Miniature golf game
  - Focus: Software design process, design principles & patterns, communication, artifacts
- Computer game of your design
  - Focus: Putting it all together

Grades, Texts, etc.

see the course web page

My info

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- My schedule is available on my web page: www.cs.hmc.edu/~z