CS121: Software Development

Today

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

"Software Development"

Customer  
Developer

"Software Development"

Customer  
Developer

Key Processes

- Requirement specification/analysis
- Design
- Implementation
- Testing

Why study software development?

- Society has become increasingly dependent on software systems.
Output reported in *The Risks Digest*  
Oct. 1, 1999

**Excerpt from Expedia Maps directions:**  
From: Laurel, Maryland  
To: Baltimore-Washington International Airport, Maryland  
Driving Distance: 5865.1 miles  
Time: 9 day(s) 3 hour(s) 22 minute(s)  

**Time (hour:minute) Instruction**  
0:00 Depart Laurel, Maryland  
1:01 Entering Delaware  
1:17 Entering New Jersey  
3:24 Entering New York  
3:51 Entering Connecticut  
5:51 Entering Massachusetts  
7:29 Entering New Hampshire  
7:44 Entering Maine  
12:20 Entering New Brunswick  
20:20 Take the North Sydney-Argentia Ferry  
34:32 Entering Newfoundland  
36:35 Turn left onto Local road(s) (4543.1 mi)  
219:22 Arrive Baltimore-Washington International Airport, Maryland

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**Why study software development?**

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

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**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).

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**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.

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**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

UNIT TEST
INTEGRATION TEST
ACCEPTANCE TEST

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"

FAQ

- 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

Large vs. Small Steps: Productivity

Project Size in KSLOC

[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

- 10% individual assignments
- 20% exams (midterm and final)
- 70% projects:
  - 15% arcade game
  - 25% miniature golf
  - 30% final project

Texts

- UML Distilled by Fowler
- Design Patterns by Gamma, Helm, Johnson, Vlissides

More course info

- The mailing list is cs-121-l.
- The grutors are Brian Bentow, Ed Heaney, and Michael Tuck-Lee.
Assignments

Reading assignments are given on the course schedule page. Other assignments will be announced in class and shown on the course schedule page.

Web page:
www.cs.hmc.edu/~courses/2004/spring/cs121
Schedule:
www.cs.hmc.edu/courses/2004/spring/cs121/schedule.html

Assignment

1. Intro survey -- due TODAY
2. Arcade game review -- due next class

My info

• My email z@cs.hmc.edu
• My office is 2341 Olin, X78360
• My office hours MTW 2:45-4:00 and by appointment