Course Overview

15-413: Introduction to Software Engineering

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How is SE in industry different from coding assignments?

- Some of my answers:
  - Requirements ambiguous
  - Requirements change during development
  - Scale is larger
    - Requires different design skills
    - Requires teamwork
    - Software must be changed after development is complete
  - Failure is more expensive
  - Business-critical
  - Safety-critical

Assignment 1

- Read a software engineering case study
  - Several options, from SE Ph.D. students’ experiences
- Write your reaction to the study
  - What did you find surprising?
  - Was there anything you could relate to your own experience?
- 1 page (at least 500 words)
- Due Friday

What is Software Engineering?

- Involves whole development cycle
- Implementation of a process that guarantees good results
- Break down problems and solve them
  - Test, revise and try
  - Design, create, test, iterate
  - Design for errors & compensate

What is Software Engineering?

- One definition (Mary Shaw)
  - Software Engineering is the branch of computer science that creates practical, cost-effective solutions to computing and information processing problems, preferentially by applying scientific knowledge and developing software systems in the service of mankind.
How does Software differ from other engineering disciplines?

• Student comments
  • Newer discipline
  • Easier to revisions
  • Innovation/pace of change
  • Not physical – more ways it can break
  • Laws underneath are more complex
  • Can have many purposes, and can change
  • Not as much time spent testing
  • Not required to be as robust
  • Management difficult because hard to measure quality/intangible

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Course Goals

• You will leave the course:
  • Understanding the role of software in systems
    • How software differs from other engineering materials

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How does Software differ from other engineering disciplines?

• Some of my answers:
  • Software is designed, not manufactured
  • Production cost is paid up front
  • Little re-use achieved in practice
  • Software is based on discrete math
  • Butterfly effect: small errors can have big consequences
  • Overengineering does not work well
  • Software is malleable
  • Can apply to huge variety of problems
  • Software doesn’t wear out
  • All problems are “designed in”

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Course Goals

• You will leave the course:
  • Understanding the role of software in systems
  • Understanding why SE practices are important
    • Reading and analyzing historical SE failures
    • Being exposed to situations that require good SE practices
    • Using SE practices enough to see value in them
    • Reflecting on influence of SE practices in course project

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Course Goals

• You will leave the course:
  • Understanding the role of software in systems
  • Understanding why SE practices are important
  • Knowing good basic SE practices
  • Able to make simple engineering tradeoffs
    • Exposure to multiple techniques with benefits/drawbacks
    • Making decisions in practice and reflecting on consequences
    • Evaluation of tradeoffs in historical SE projects and in peer class projects

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Course Goals

- You will leave the course:
  - Understanding the role of software in systems
  - Understanding why SE practices are important
  - Knowing good basic SE practices
  - Able to make simple engineering tradeoffs
  - **Possessing basic skills using SE tools and practices**
  - Exposure to tools: Debuggers, version control, configuration management, unit tests, modeling tools, analysis tools
  - Skills for working within frameworks and large systems
  - Skills to report and document software life

Course Goals

- You will leave the course:
  - Understanding the role of software in systems
  - Understanding why SE practices are important
  - Knowing good basic SE practices
  - Able to make simple engineering tradeoffs
  - **Possessing basic skills using SE tools and practices**
  - Exposure to tools: Debuggers, version control, configuration management, unit tests, modeling tools, analysis tools
  - Skills for working within frameworks and large systems
  - **Having applied those skills in a structured setting with realistic challenges**

Course Emphasis

- Technical content
  - Design
  - Analysis
  - Quality assurance
- Management
  - Teamwork
  - Working for clients
  - Project Planning
- Experience
  - Real project for a CMU client
  - Homework exercises

Project

- Real, internal CMU client
  - Provides interesting problem, realistic pressures, unclear/changing requirements, etc.
  - Lower overhead and pressure than external client
  - Small, 3-4 member teams
- Emphasis on good SE practices
  - Homeworks and deliverables tied to project
  - Grading: practices more important than end result

Evaluation

- Homework
- Project deliverables
- Class presentations
- Client assessment
- 360-degree peer evaluations
  - You will evaluate your team members and yourself

Textbook

- Optional text
  - Roger S. Pressman, Software Engineering, A Practitioner's Approach
- Readings from the literature
- Other resources
  - Brooks, Mythical Man-Month
  - Sommerville, Software Engineering
  - Glass, Software Runaways
  - Design Patterns
Course Outline
- Weeks 1-3: Process, Planning, Estimation, Risk Management
- Week 4: Requirements
- Week 5: Architecture
- Weeks 6-7: Design
- Week 8: Formal Methods
- Week 9: Coding
- Week 10-11: Quality Assurance
- Week 12: Analysis
- Week 13: Responsibilities of an Engineer
- Week 14: Software Evolution
- Week 15: process improvement, wrapup

Project Outline
- Week 1: Form teams & bid for project
- Weeks 2-3: Planning, Requirements
- Weeks 4-6: Requirements, Prototyping
- Week 7: Architecture
- Week 8: Design
- Week 9-10: Formal modeling assignment
- Week 11: Test Plan
- Week 12: Code review assignment
- Week 13-14: Analysis assignment
- Week 15/Finals: Final Report

A reminder on plagiarism
- Do not copy material (code, homework) without attribution
- Plagiarism is cheating; the minimum penalty will be a zero for the assignment
- Your work should be your own
- If you have any questions, ask the instructor or a TA

Questions?