CIS 422/522 Overview

Admin:  Projects and Teams
Schedule
Grading
Lecture/Disc.: What is Software Engineering?

Contact Information

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• Office Hours: Deschutes 354, after class, by appointment, or when my door is open
  – I respond most quickly to email

Instructor Background

• Real World Experience (20+ years)
  – R&D U.S. Naval Research Lab
  – R&D Aerospace industry
  – Consulting (various)

• Teaching industry professionals (15+ years)
  – Developed and taught in Oregon Master of Software Engineering (industry professionals)

• Potential weaknesses
  – Do not use many current programming technologies (so I cannot help with technology)

CIS 422 Course Format

• Single Quarter Project Course
  – Lectures, reading: Foundations and background
  – Projects: Learn how to apply SE concepts by doing
  – Project Meetings: Learn teamwork
  – Project Reviews and Presentations: Critique and guidance

• Two project iterations
  – First for perspective on SE issues
  – Second to demonstrate learning and ability

• Two exams (midterm, final) address individual understanding
Emphasis is on Life-Cycle Management and Teamwork

- Participate in collaborative design
- Work as a member of a project team, assuming various roles
- Create and follow project and test plans
- Create the full range of documents associated with a software product
- Complete project deliverables on time
- Key point: the focus is not on coding!

Projects

- 2 projects: 4 weeks, 5 weeks
  - Project 1: two choices
    - Same basic requirements for everyone
  - Project 2: TBD
    - Extend Project 1 (may also propose projects)
- Technically simple, but high expectations
  - Solid freeware quality
  - Complete product includes internal and external documentation, tests

Teams

- Form teams of 5-6 people
  - Project 1: Instructor chooses teams
  - Project 2: May re-form teams
- Project grades are a combination of group grade, individual contribution, and peer evaluation
  - Overall grade for project
  - Evaluate individual contributions
  - Group Member Evaluation (GME) by teammates may significantly raise or lower grade

Grading

- 55% Projects (20+40)
  - Includes presentations, intermediate deliverables
  - Weighted toward non-code products
- 35% Exams (15+15)
  - Two midterms; no final exam
- 10% Class Participation
  - Includes but is not limited to...
    - Attendance (required)
    - Contributing the discussions, class exercises
    - Appropriate behavior in the classroom (i.e. no cell phones, beepers, trolling web)
What is Software Engineering?

The “Software Crisis”

- Have been in “crisis” since the advent of “big” software (roughly 1965)
- What we want for software development
  - Low risk, predictability
  - Lower costs and proportionate costs
  - Faster turnaround
- What we have:
  - High risk, high failure rate
  - Poor delivered quality
  - Unpredictable schedule, cost, effort
- Characterized by lack of control (inability plan the work, work the plan)

Symptoms of the “Crisis”

- One of every four large software project is cancelled
- Average projects overshoot schedule by 50%, large project tend to do much worse
- 75% of large systems are failures in the sense that they do not operate as intended
- 60% of them fail to deliver a single working line of code
- E.g., Ariane 5, Therac 25, Mars Lander, DFW Airport, FAA ATC etc., etc. (See examples in Text)
- Really the “state of practice”

Discussion Context

- Focus large, complex systems
  - Multi-person: many developers, many stakeholders
  - Multi-version: intentional and unintentional evolution
- Quantitatively distinct from small developments
  - Complexity of software (e.g., rises non-linearly with size)
  - Complexity of communication rises exponentially
- Qualitatively distinct from small developments
  - Multi-person introduces need for organizational functions (management, accounting, marketing), policies, oversight, etc.
  - More stakeholders and more kinds of stakeholders
- Rule of thumb: project starts to be “large” when group developing a single product can’t fit around a table.
**Implications**

- Small system development is driven by technical issues (i.e., programming, technical understanding)
- Large system development is dominated by organizational issues
  - Managing complexity, communication, coordination, etc.
  - Projects fail when these issues are inadequately addressed
- Lesson #1: **programming ≠ software engineering**
  - Techniques that work for small systems fail utterly when scaled up
  - Programming skills alone won’t get you through real developments or even this course

**Programming View**

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Get Requirements

Write Program

Test Program
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**DoD Software Life Cycle**

**Origins of SE**

- Term “software engineering” was coined at 1968 NATO conference:
  “Software engineering is the establishment and use of sound engineering principles in order to obtain economically software that is reliable and works efficiently on real machines.”
- Response to “software crisis”
  - Failed developments
  - Lack of critical qualities (e.g., performance, safety, reliability, maintainability)
  - Budget and schedule overruns
- Desire for SE to be more like other engineering disciplines
  - Analytical, predictable, manageable
  - Stated as an aspiration, not of existing condition
Has anything changed since ‘68?

- Incorrect to conclude that no progress has been made
  - Better understanding of issues
  - Substantial improvements in programming languages, tools
  - Better understanding and control of processes
- But the problems have also changed
  - Large developments now are orders of magnitude more code than in 1968
  - Improved capabilities are overcome by larger problems, greater complexity

What hasn’t changed?

- Still not an engineering discipline in classic sense
  - Lack of applied mathematics and systematic methods to develop and assess product properties
    - These tools are immature where they exist at all
  - Not taught, licensed, regulated, or recognized as an engineering discipline
- But we often don’t apply what we know
  - Existing methods, models often not understood or used in industry
  - Little attention is given to process or products other than code
  - Quality of products depends on qualities of the individuals rather than qualities of engineering practices
- Development continues to be characterized by lack of control

View of SE in this Course

- The purpose of software engineering is to gain and maintain intellectual and managerial control over the products and processes of software development.
  - “Intellectual control” means that we are able make rational choices based on an understanding of the downstream effects of those choices (e.g., on system properties).
  - Managerial control similarly means we are able to make rational choices about development resources (budget, schedule, personnel).
- Memorize this!

Control is the Goal

- Both are necessary for success!
- Intellectual control implies
  - We understand what we are trying to achieve
  - Can distinguish good choices from bad
  - We can reliably and predictably build to our goals
    - Functional behavior
    - Software Qualities (reliability, security, usability, etc.)
- Managerial control implies
  - We make accurate estimations
  - We deliver on schedule and within budget
- Assertion: managerial control is not really possible without intellectual control (no matter what the Harvard School of Business says)
Course Approach

- Will learn methods for acquiring and maintaining control of software projects
- Intellectual control
  - Methods for software requirements, architecture, design, test
  - Modeling methods and notations
- Managerial control
  - Planning and controlling development
  - Process models addressing development issues (e.g. risk, time to market)
  - People management and team organization
- Caveat: we can really only scratch the surface in 10 weeks (but it’s important)

Questions?

Assignment

- Fill out and return the team member survey
- Review web site (syllabus, etc.)
  - Read the project descriptions
  - Do readings specified in the schedule for Wednesday

Questionnaire

- Purpose
  - Formation of balanced project 1 teams
  - Beginnings of grade database
- Fill in
  - Name (family, given), What you would like to be called
  - Proficiencies
    - 1 low, 3 average, 5 high