
CIS 422/522

Course Overview

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

Contact Information

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 - 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 (DoD, Sharp, Sun, etc.)
- Teaching industry professionals (15+ years)
 - Oregon Master of Software Engineering
- Perspective on Software Engineering as an applied discipline (i.e., what actually works)

CIS 422 Course Format

- Single Quarter Project Course
 - Lectures, reading: theory, principles, and methods
 - Projects: learn how to apply SE concepts by doing
 - Project Meetings: learn effective teamwork
 - Project evaluations: critique and guidance
- Two project iterations
 - First for perspective on SE issues, team development
 - Second to demonstrate ability to apply lessons learned
- Two exams assess individual understanding (midterm, 2nd midterm)

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 plans
- Create the full range of work products associated with a software product
- Complete project deliverables on time
- *Key point: coding is only part of the work*

Projects

- 2 projects: 4 weeks, 6 weeks
 - Project 1: same basic requirements for everyone
 - Simple but extensible application
 - Focus on project planning and teamwork
 - Understand what can go wrong
 - Project 2: a selection of projects
 - Instructor suggested or team choice
 - Focus on disciplined development
- Technically simple, but high expectations
 - Solid freeware quality application
 - Complete documentation: requirements, design, test, user guides

Teams

- Form teams of 5-6 people from surveys
 - At least one common programming language
 - Cross-section of skills
- Project grades are a combination of group grade, individual contributions, and peer evaluation
 - Overall grade for project
 - Evaluation of individual contributions
 - Peer evaluation by teammates
 - Record of contributions from Developer Log

Grading

- 60% Projects (20+40)
 - Includes presentations, intermediate deliverables
- 30% Exams (15+15)
 - Test for understanding of lectures & reading
- 10% Class Participation: includes but is not limited to...
 - Attendance at class, team meetings
 - Participation in class discussions, interactive questions
 - Appropriate behavior in the classroom (i.e. no cell phones, beepers, trolling web)

Class Website

- Use class website to track class events
- Schedule page **most important**
 - Lecture schedule, link to slides
 - Readings due for each lecture
 - Project due dates
 - Examples of work products
- Home page: announcements
- Project page: project description, constraints
- Project grading: how work will be evaluated

Additional Resources

- Top Hat: interactive questions in class, additional source for class materials
 - Use is experimental this quarter
 - Your feedback will help
- Piazza: forum for discussion, questions (including anonymous)

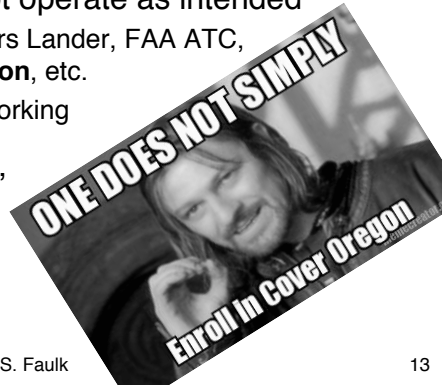
What is Software Engineering?

The “Software Crisis”

- Have been in “crisis” since the advent of “big” software (roughly 1965)
- What we want for software development
 - Low risk, predictability (time, cost, functionality, quality)
 - 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 project overshoots schedule by 50%, large project often do much worse
- 75% of large systems do not operate as intended
 - E.g., Ariane 5, Therac 25, Mars Lander, FAA ATC, Universal Credit, **Cover Oregon**, etc.
 - Many fail to deliver a single working line of code
- Really the “state of practice”



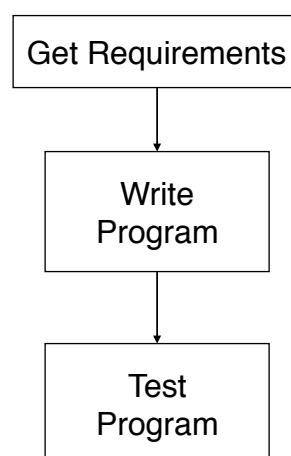
Discussion Context

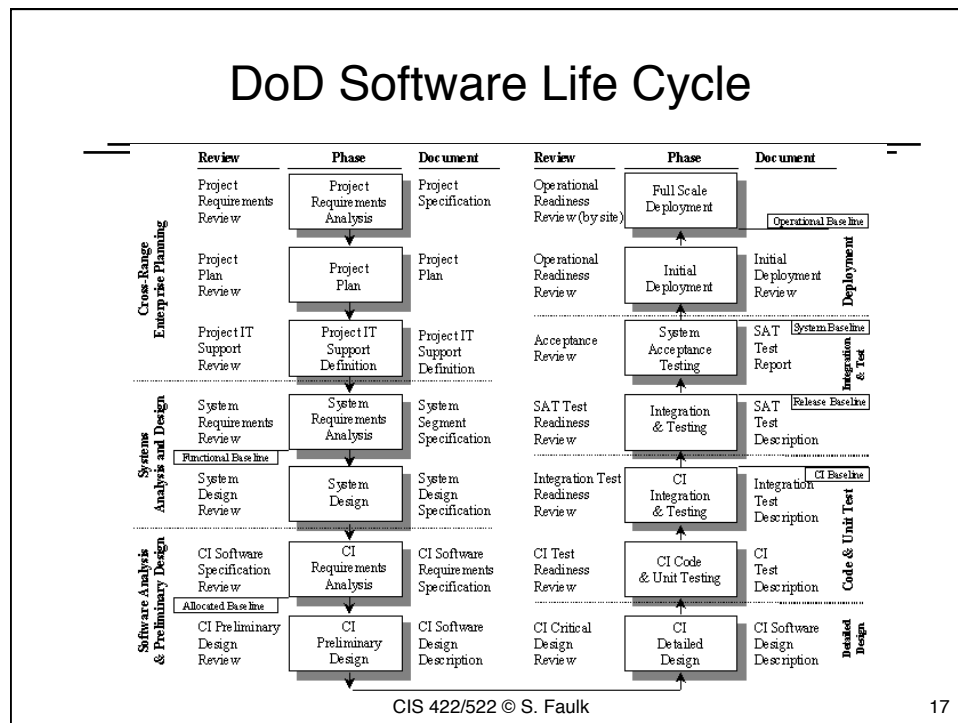
- Focus on large, complex systems
 - Multi-person: many developers, many stakeholders
 - Multi-version: intentional and unintentional evolution
- *Quantitatively* distinct from small developments
 - Software complexity grows non-linearly with size
 - Communication complexity grows exponentially
- *Qualitatively* distinct from small developments
 - Multi-person implies need for organizational functions (management, accounting, etc.), policies, oversight, etc.
 - More stakeholders and more kinds of stakeholders
- Rule of thumb: project starts to be “large” development team 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
 - Problem understanding, managing complexity, communication, coordination, etc.
 - Projects fail when these issues are inadequately addressed
- Key Lesson #1: **programming \neq 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





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”
- Desire for software development to be more like mature engineering disciplines
 - Analytical, predictable, manageable
 - But, stated as an aspiration, not the state of practice

What has 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 software processes
- But the problems have also changed
 - Improved capabilities often overcome by larger problems, greater complexity
 - Orders of magnitude more code, faster pace of technology, accelerated delivery schedules, etc.

What has not changed?

- Still not an engineering discipline in classic sense
 - Lack of applied mathematics and systematic methods to develop and assess product properties
 - Not taught, licensed, or regulated as an engineering discipline (most of USA)
- Worse, practitioners often don't apply what we know
 - Existing SE methods, models often not understood or used in industry
 - Little attention is given to processes or products other than code
 - Upshot: 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!

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 practical methods for acquiring and maintaining control of software projects
- Intellectual control
 - Methods for software requirements, architecture, design, test
 - Modeling methods and notations
 - What to produce, how to make decisions, how verified?
- Managerial control
 - Planning and controlling development
 - Process models addressing development
 - People management and team organization
 - When, who, how much?
- Caveat: we can only simulate the problems of large developments

Assignments

- Return consent form
- Forward your emails from xxx@uoregon.edu
- Review class web pages
 - Project: Understand basic project requirements
 - Read *Team Roles* consider what you would like to do
 - Look at *Schedule* page to understand how to get lecture notes, assignments, etc.
- Memorize definition of Software Engineering from lecture

Questions?