CIS 422/522
Course Overview

Admin: Projects and Schedule
Grading

Lecture/Disc: What is Software Engineering?

Contact Information

- Instructor contact

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- Office Hours: 11:00 – 12:00 class days, by appointment, or any time 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 (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...
    - Required attendance at class, team meetings
    - Participation in class discussions, interactive questions
    - Appropriate behavior in the classroom (i.e. no cell phones, beepers, trolling web)

Grading Constraints

To pass the course you must meet all of these criteria:

- 65 or better on the project
- 65 or better average on the exams
- Appropriate team interactions (i.e., appropriate language, civil, professional, etc.)

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

- Assembla: team online collaboration sites
- Piazza: forum for discussion, questions (including anonymous)
- Provide summaries of lectures
- Video lectures: in place of in-class lectures for some classes; links provided as needed

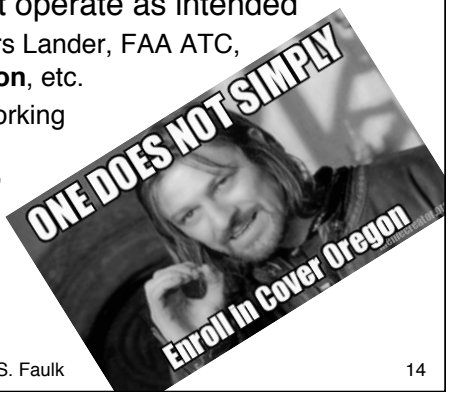
What is Software Engineering?

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
  - Inconsistent 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"



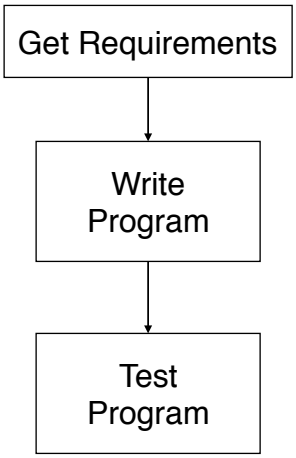
Discussion Context

- 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,), 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.

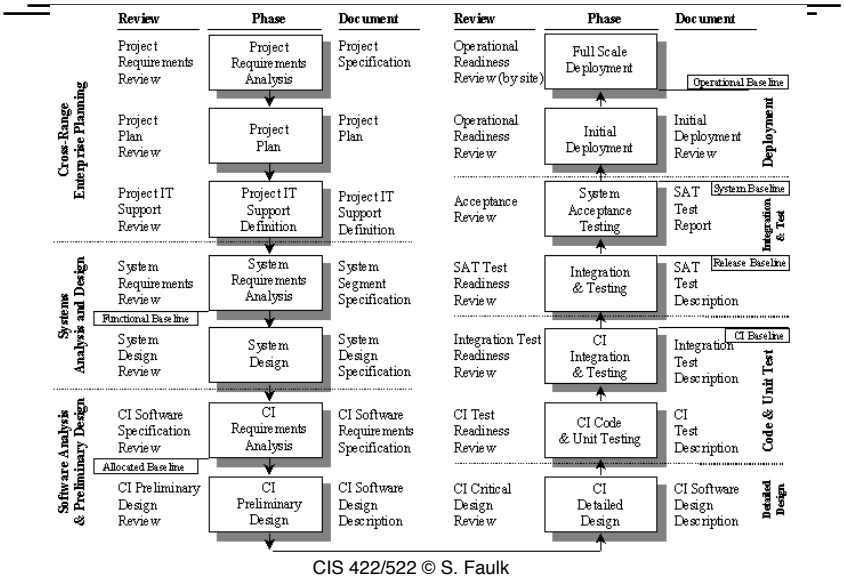
Implications

- 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 ≠ 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



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”
- 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 to check correctness
- Managerial control
  - Planning and controlling development
  - Process models addressing development
  - People management and team organization
- Caveat: we can only simulate the problems of large developments

Assignments

- Read through the class web site
  - Make sure you understand what is expected of you and how the course is graded
  - Understand how the schedule page works, this should be checked before class
- Read the project description
- Read through the Team Roles page and consider which roles interest you
- Read the Process Models reference before next class

Questions?