CSE 403
Lecture 1

Introduction

Reading:
Rapid Development Ch. 3.3

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Software engineering

- **software engineering**: Creating and maintaining software applications by applying technologies and practices from computer science, project management, and other fields.
  - Software engineering is about people working in teams under stress to create value for their customers.
  - Software engineering has accepted as its charter, "How to program if you cannot." *-- E. Dijkstra*
  - The first step toward the management of disease was replacement of demon theories and humours theories by the germ theory. That very step, the beginning of hope, in itself dashed all hopes of magical solutions. It told workers that progress would be made stepwise, at great effort, and that a persistent, unremitting care would have to be paid to a discipline of cleanliness. So it is with software engineering today. *-- F. Brooks*

Aspects of software engr.

1. **Processes** necessary to turn a concept into a robust deliverable that can evolve over time
2. Working with **limited time and resources**
3. Satisfying a **customer**
4. Managing **risk**
5. Teamwork and **communication**

Ties to many fields

- **computer science** (algorithms, data structures, languages, tools)
- **business/management** (project mgmt, scheduling)
- **economics/marketing** (selling, niche markets, monopolies)
- **communication** (managing relations with stakeholders: customers, management, developers, testers, sales)
- **law** (patents, licenses, copyrights, reverse engineering)
- **sociology** (modern trends in societies, localization, ethics)
- **political science** (negotiations; topics at the intersection of law, economics, and global societal trends; public safety)
- **psychology** (personalities, styles, usability, what is fun)
- **art** (GUI design, what is appealing to users)

- necessarily "softer"; fewer clearly right/wrong answers

Roles of people in software

- **customer** / client: wants software built
  - often doesn't know what he/she wants
- **managers** / designers: plan software
  - difficult to foresee all problems and issues in advance
- **developers**: write code to implement software
  - it is hard to write complex code for large systems
- **testers**: perform quality assurance (QA)
  - it is impossible to test every combination of actions
- **users**: purchase and use software product
  - users can be fickle and can misunderstand the product

Projects

- you make proposals (then vote on which projects to develop)
  - start thinking about ideas today
  - ideas from previous quarters are linked from the web sites
- project development in stages
  - reflects modern methodologies for effective development
  - you get feedback from us after each stage, but also regularly during the development at each stage
- project teams need to have at least 5-6 members
  - otherwise it'd be toy development, and you'd miss on some of the most important experiences

What's in it for you

- what you'll learn
  - get exposure to software development practices in use today
  - learn how to collaborate with others toward a common goal
  - see how software is produced, from idea to ship to maintenance
  - get experience working in a large team toward a common goal
  - be able to articulate and understand ideas in a conversation
  - understand issues and tradeoffs in decisions as a manager

- tools you'll use
  - design diagram (UML) software
  - integrated development environments (IDEs)
  - test suites (JUnit) and benchmarking / profiling software
  - content management systems (CVS, Subversion)
  - performance testing (profiling) software

Unique aspects of course

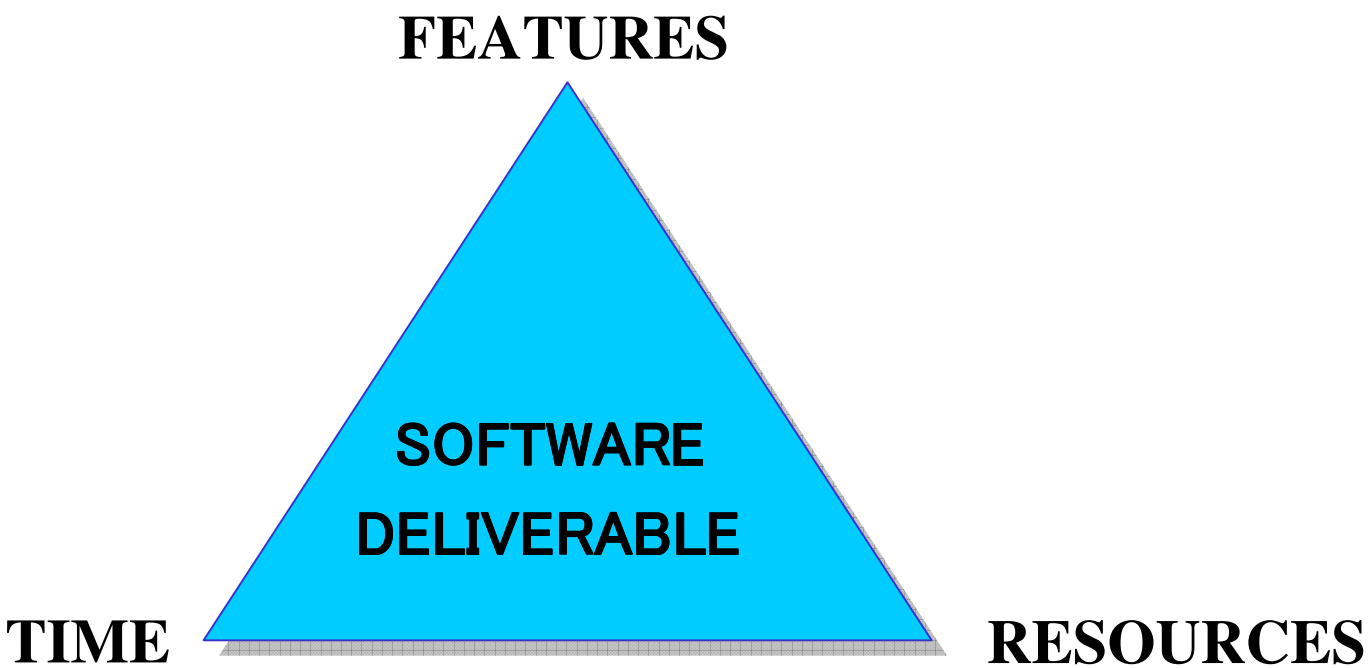
- cross-disciplinary nature of the subject
- larger-size teams
- opportunity to propose and work on your own ideas
- instructors and TAs in the "coach" role
- (some) mistakes along the way are encouraged, not penalized
- few clearly right/wrong answers
- plans always change
- content: software design, testing, project management, etc.

Advice from past students

- "**Work together** (in the same place) as much as possible."
- "Well-run and consistently scheduled **meetings** help a lot."
- "We often underestimated tasks. If we had spent more time analyzing each task and **breaking it down** into smaller chunks, our estimated times would have been more accurate."
- "Don't underestimate the difficulty of **learning** new programming languages, frameworks and tools."
- "Make small, **frequent updates** and commits to your source repository. Failing to do this results in merges that can be a nightmare."

What is a software project?

- "Good, fast, cheap ... Choose 2"



Making software is hard

- Historically, ~ 85% of software projects "fail." Why?
  - management sets unrealistic expectations; devs don't correct them
  - overestimating the positive impact of shiny new tools and hardware
  - hired developers based on availability despite warning signs
  - personality conflicts between developers
  - changes in rate structure requirements in middle of work
  - one delay causes another (dev delay leads to test delay, etc.)
  - hacks and shortcuts
  - developers end up working "death marches" (6-day, 10-hour weeks)
  - overestimating how nearly done you are ("I'm 90% there!")
  - software written doesn't match the spec
  - developer time taken away by other tasks
  - tons of bugs come out in testing
  - developers don't listen to testers; ignore severity of bugs reported
  - management breaking promises (bonuses, time off, etc.)

Kinds of mistakes made

People	Process	Product	Technology
• Undermined motivation • Weak personnel • Uncontrolled problem employees • Heroics • Adding people to a late software project • Noisy, crowded offices • Friction between developers and customers • Unrealistic expectations • Lack of effective project sponsorship • Lack of stakeholder buy-in • Lack of user input • Politics placed over substance • Wishful thinking	• Overly optimistic schedules • Insufficient risk management • Contractor failure • Insufficient planning • Abandonment of planning under pressure • Wasted time during the "fuzzy front end" • Shortchanged upstream activities • Inadequate design • Shortchanged quality assurance • Insufficient management controls • Premature or overly frequent convergence • Omitting necessary tasks from estimates • Planning to catch up later • Code-like-hell programming	• Requirements gold-plating • Feature creep • Developer gold-plating • Push-me, pull-me negotiation • Research-oriented development	• Silver-bullet syndrome • Overestimated savings from new tools or methods • Switching tools in the middle of a project • Lack of automated source-code control

Is SWE different?

Are the problems faced in software any different than those faced in other engineering fields? Arguments in favor:

- testing software quality is hard (example: Halting Problem)
- lower barrier to entry
- immaturity of the discipline
- customer expectations: quality, delivery timeline, etc.
- fast pace of technological change
- software is easier to copy

- Arguments against:
  - software isn't always "soft"
    - change is not easy, yet requirements do change
    - change often forces a rewriting of major parts of the software
  - developers still need to plan, execute, test, and sell
  - the discipline is still in its infancy