Software Engineering

CSCI 201
Principles of Software Development

Jeffrey Miller, Ph.D.
jeffrey.miller@usc.edu
Outline

• Software Engineering

Software Engineering

- Software engineering deals with the process of creating software
  - This includes more than just writing code, which is the main focus you have had in all of your programs so far
  - There is a difference between creating a program, working on a project, or building a product
  - How much longer does it take to create a software product system compared to creating a program?
    - Approximately 9 times as long! (from The Mythical Man-Month by Fred Brooks)
Software Engineering vs Computer Science

- Software engineering is an engineering discipline that is concerned with the practical aspects of developing and delivering software.
- Computer science focuses on theory and fundamentals.

Diagram:
- Venn diagram with two circles:
  - Left circle: Computer Science
  - Right circle: Software Engineering
  - Overlapping area: The intersection of Computer Science and Software Engineering
Reducing Bugs

▪ People like to criticize software engineering as being a failure because of all the buggy software in the world.
  › However, how many pieces of software work quite reliably?

▪ There are so many different types of software, and each type may require a different type of engineering.

▪ What percentage of software costs are for development compared to testing in 2015?

![Pie chart showing development and testing costs as 65% and 35% respectively.]

USC Viterbi School of Engineering
Software Failures

- What would make a manager say that a software project has failed?
  - Not functional or buggy
  - Missing critical features
  - Over schedule
  - Over budget

- What percentage of projects are either over schedule or over budget?
  - A 2004 study concluded nearly 3/4 of all IT projects were over budget
B-2 Stealth Bomber Project

- The B-2 stealth bombers had an original estimate of $929M per aircraft
- They actually cost $2.13B to build (in 1997 figures)
- 21 were built, and 20 are still in operation (one crashed in 2008)
  - The Air Force plans to operate them until 2032.
Software Failures

Why does software engineering fail?

- Bad estimate
- Each project is different in some way
- Larger systems are being created
- Technology changes rapidly
- More complex systems that may need capabilities that are not handled by existing software engineering techniques
- They don’t necessarily use formal software engineering
  - Communication may suffer within the team because of this
Software Engineering Intent

- The intent of software engineering is to support professional software development, not individual programming
- Four fundamental activities common to all software
  - Specification – define what is needed
  - Development – program what is needed
  - Validation – ensure the program is what is needed
  - Evolution – modify the program based on new requirements
ACM has a Code of Ethics and Professional Conduct (https://www.acm.org/code-of-ethics)

Preamble

- Computing professionals' actions change the world. To act responsibly, they should reflect upon the wider impacts of their work, consistently supporting the public good. The ACM Code of Ethics and Professional Conduct ("the Code") expresses the conscience of the profession.