Welcome to CS220 Software Construction

October 2nd, 2018

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https://www.classes.cs.uchicago.edu/archive/2018/fall/22001-1/

Outline

- Technical stuff
  - What is software engineering
    - What are the goals & challenges
  - What is a software engineering process
    - Waterfall model
- Administrative stuff
  - Who I am
  - Components/tasks/schedule of this class
- A brief history of software engineering

My background

- Shan Lu
  - JCL 343, shanlu@cs.uchicago.edu
  - Office hours: after-class—4:15pm, Tu/Th

  – East China → Illinois → Wisconsin→Illinois

  – Research
    - Software reliability, software efficiency, etc.

  – Teaching
    - I enjoy **discussion**


Our TA / Grader

- Yuxi Chen
  - chenyuxi@uchicago.edu
  - Office hour: 4—6pm Tu/Th @ CSIL1
- Hussein Elkheshen
  - husseinelkheshen@uchicago.edu
  - TBD

Your background?

- How many programs have you written?
  - What are the sizes of your programs?
- What programming languages do you use?
- How familiar are you with O-O?

Engineering

Software ~~Construction~~

Engineering

Software ~~Construction~~

--- An engineering discipline about all aspects of software production

What do you do to produce software?

What are the aspects of S. production?

- Gathering requirements
- Design
- Development
- Testing & debugging
- Maintenance

What is the goal of S.E.?

- What are the criteria for ***good*** programmers?
- What are the criteria for ***good*** software?
- The goal of software engineering is …

What is the goal of S.E.?

- What are the criteria for ***good*** programmers?
  - Write good software
  - Be on time
- What are the criteria for ***good*** software?
  - Reliable/correct (few bugs)
  - Efficient (run fast)
  - Maintainnable
  - Good usability
  - Good security
- The goal of software engineering is
  - Produce good software, within time schedule, within resource budget

What are the challenges?

What are the challenges?

- Large code sizes
  - http://www.informationisbeautiful.net/visualizations/million-lines-of-code/
  - Linux Kernel 1.0.0 (1994) 100K+
  - Linux Kernel 2.2.0 (1999) ?
  - Hubble Space Telescope ?
  - Chrome? Firefox?
  - Boeing 787?
  - Mac OS X Tiger?
  - Car software
  - healthcare.gov
- Changing requirements
  - User, hardware, …
- Large development team (at different geo locations)

Google

- 15000+ developers in 40+ offices
- 4000+ projects under active development
- ~~5500+~~ 30000+ submissions per day on average
- Single monolithic code tree with mixed language code
- Development on one branch - submissions at head
- All builds from source
- 20+ sustained code changes per minute with 60+ peaks
- 50% of code changes monthly
- ~~75+~~ 100+ million test cases run per day

How to …?

- Practices/disciplines

- Tools

Software ~~Construction~~ *Engineering*

--- Practices and tools about
design, development, and maintenance
of software

S.E. process

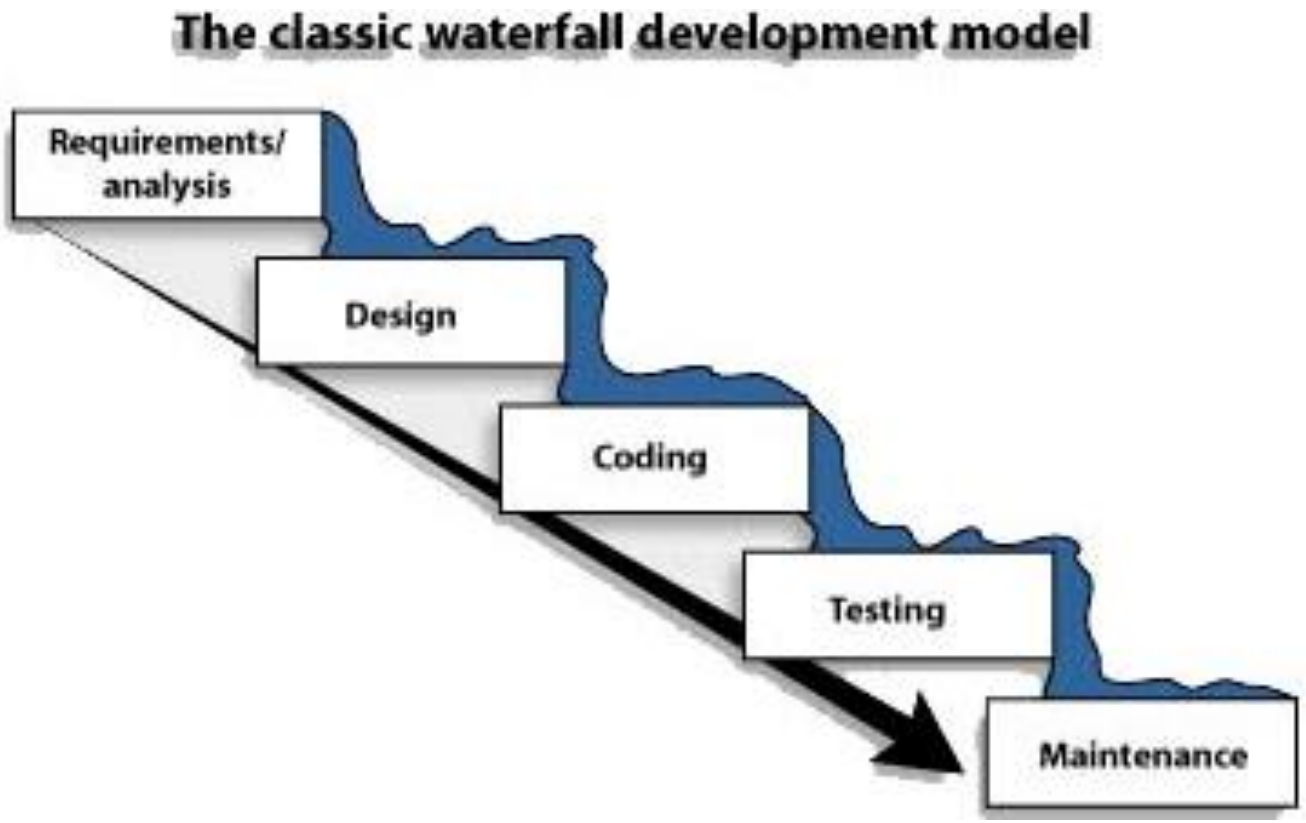
- A sequence of activities that lead to the production of a software product

- There are many processes proposed
  - Waterfall
  - RUP (Rational Unified Process)
  - Agile
    - Extreme programming

Waterfall model

- Activities ➔separate process phases

Waterfall model



Waterfall model phase I

- Requirement & analysis

- Where do we obtain the requirement?
- Should we modify or refine the requirements?
  - What should we consider?

- Output

Waterfall model phase II

- Design
- What need to be designed?
- Output

Waterfall model phase II

- Design

- What need to be designed?
  - UI
  - Module, API interface (architecture design)
  - Data structure (component design)
- Output
  - Design document

Waterfall model phase III

- Implementation

- Output

Waterfall model phase IV

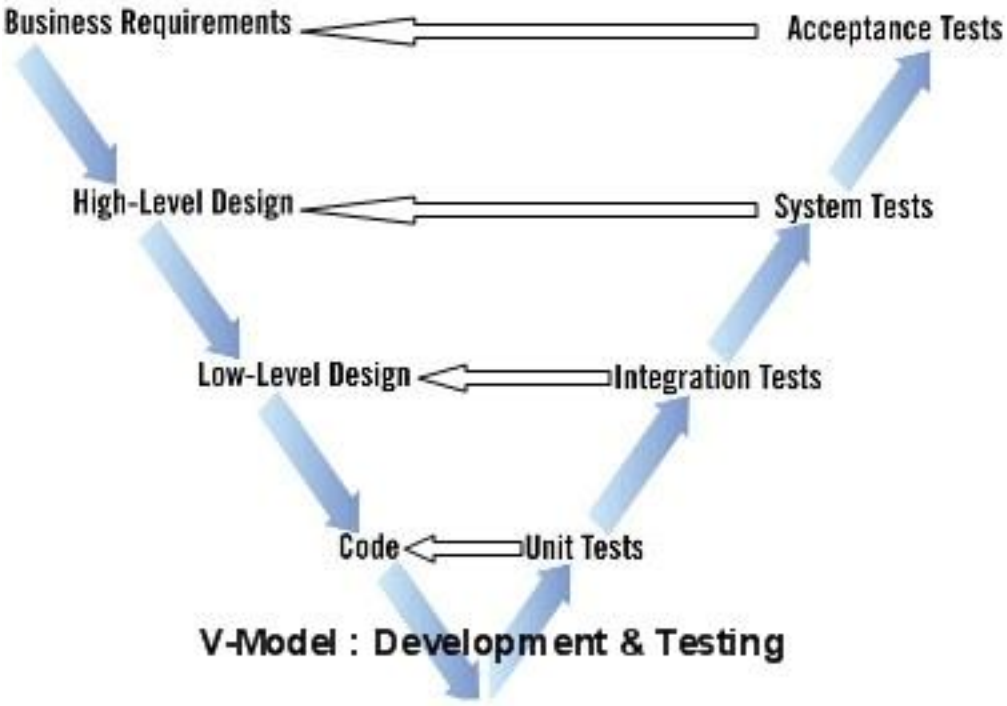
- Testing

- Output

Waterfall model phase IV

- Testing

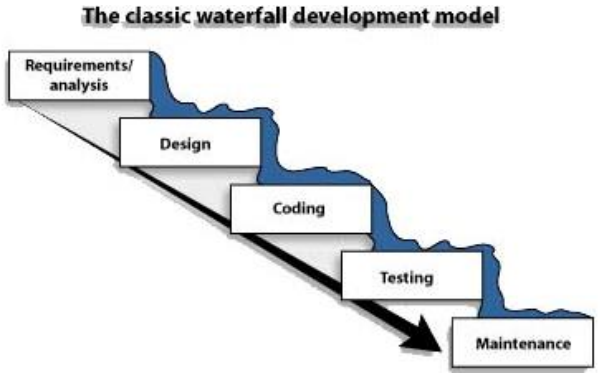
- Output



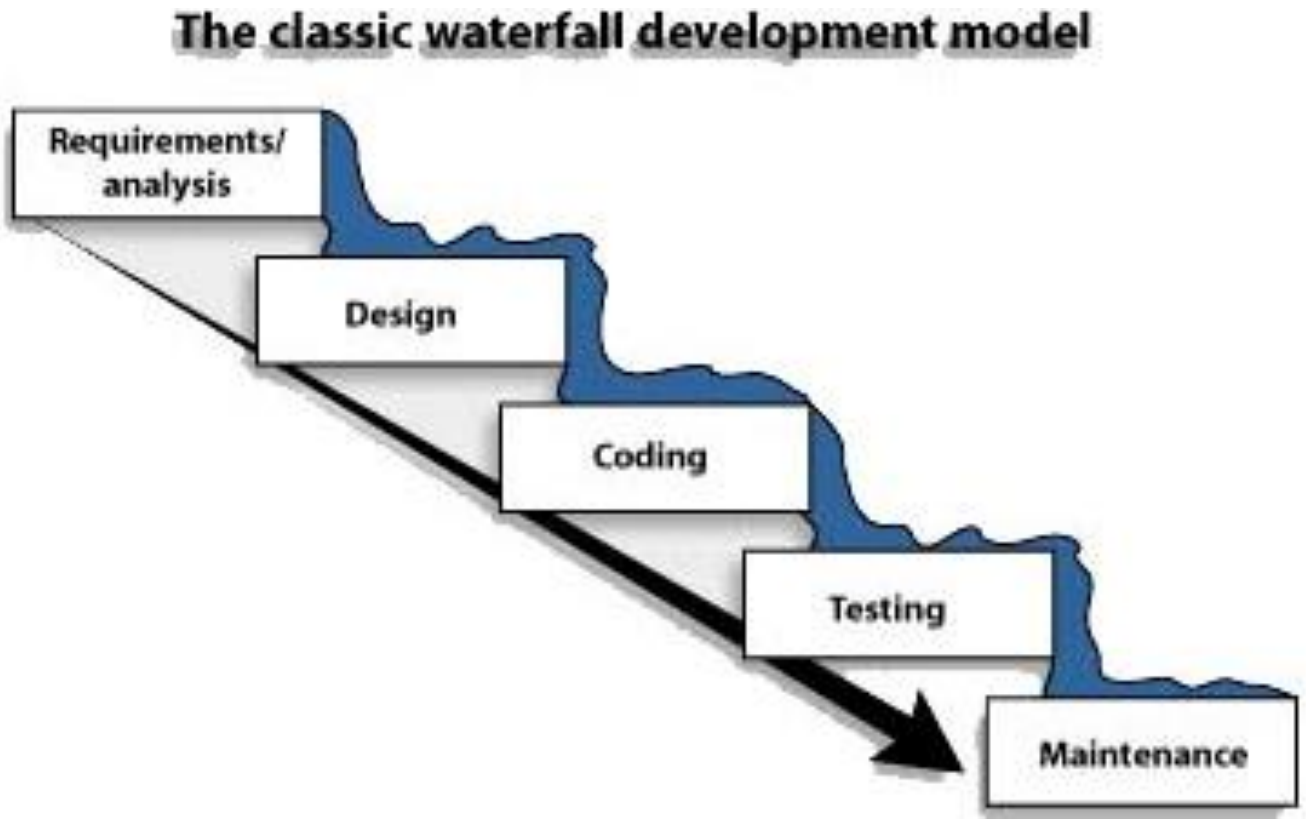
Waterfall model phase V

- Maintenance

- Ratio of cost among phases



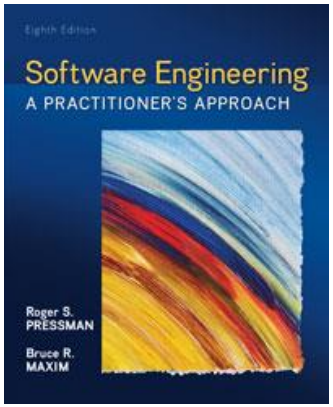
Problems with waterfall model



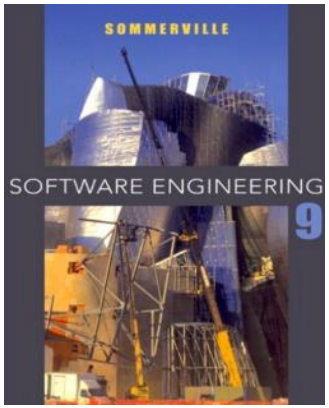
Problems with waterfall model

- Difficult to handle changes (not in model, high cost)
- Error fixing expensive
- Hard to estimate time

More information at …



- Chapter 2.0, 2.1, 2.2.0, 4.1.0, 4.1.1



- Chapter 1.1.1, 2.1.0, 2.1.1

Administrative Stuff

An overview of our schedule

10/02 Introduction, Software Processes [notes]
10/09 Project Discussion, Requirement Engineering & System Modeling I [notes]
10/16 System Modeling III [notes]
10/23 Testing 1 [notes]
10/30 Code Smell [notes]
11/06 Midterm
11/13 Design Patterns II (Composite, Interpreter) [notes]
11/20 (No Class) Happy Thanksgiving!
11/27 Bugs and Bug Detection [notes]
12/04 Project Presentation

10/04 Agile, Extreme Programming [notes]
10/11 Requirement Engineering & System Modeling II [notes]
10/18 Architectural Design [notes]
10/25 Testing 2 [notes]
11/01 Refactoring [notes]
11/08 Software Maintenance and Design Patterns I (Observer) [notes]
11/15 Design Patterns III [notes]
11/22 (No Class) Happy ThanksGiving!
11/29 Parallel Software Construction [notes]
12/06 No Class (Reading Period)

Any student graduating at the end of this quarter?

There are a **lot** of work to do

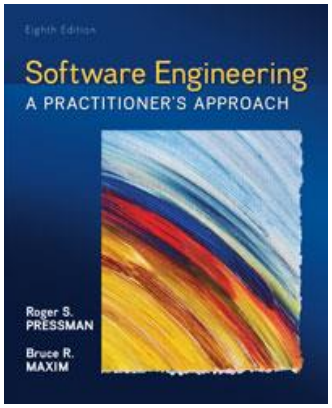
- Class

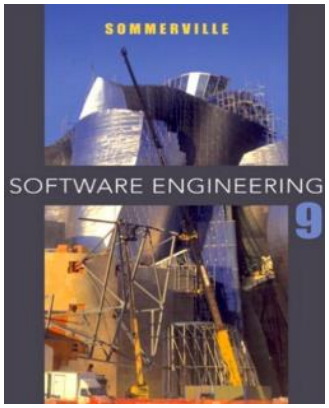
- 1 mini project (due 10/15) 8%
- 1 big programming project 40%
  - Many milestones/checkpoints
  - Proposal due 10/17
- Weekly Quiz 7%
  - First one on 10/9
- Two exams 45%

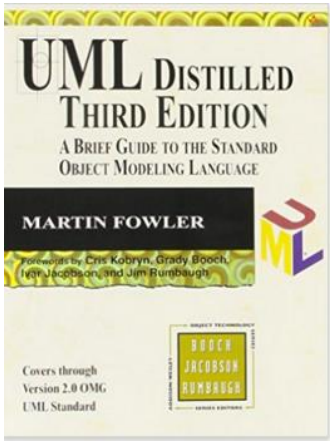
If you are going to drop this course, do it soon.

What you need to do 1: lectures & reading

- Lectures
  - Tu/Th 2—3:20 am







Links in my slides

What you need to do 2: Quizzes

- ~10 minutes @ every Tuesday lecture
- The 1st quiz is on October 9th (next Tuesday)
- Close-book, close-note
- Cover lectures and project content

- 1 point for each quiz, 7% of your overall grades

What you need to do 3: Project

- Course project
  - 7—8 people a group
  - The whole process
  - 6+ milestones

10/17	1	Proposal (2—3 students)
10/30	2	Planning (7—8 students)
11/07	3.a	Testing of 1st iteration
11/13	3.b	End of 1st iteration
11/20	4.a	Testing of 2nd iteration
11/29	4.b	End of 2nd iteration
12/04	5	System testing & documentation
12/09	6	Acceptance testing & debugging

  - 40 % of your final grade
  - **Grading criteria: 75% group + 25% individual**
  - **There will be peer evaluation**

What you need to do 4: warm-up project

- One warm-up project
  - Will be released today or tomorrow
  - Do it in a group of two people

- It is due on 10/15th

What you need to do 5: Exams

- Midterm exam
  - In the lecture on 11/06
  - 20% of your final grades
- Final exam
  - During the exam week
  - 25% of your final grades
- Cover material from class and the projects

Overall Grade

- Curved

- 2018 winter
  - A* 25; B* 5; C* 2
- 2017 winter
  - A* 19; B* 8; C* 5
- 2014 Fall
  - A* 22; B* 14; C* 4

Resources

- CSIL Labs
- TA
  - Yuxi Chen, chenyuxi@uchicago.edu
- Piazza!! (will start by the end of this week)
- Feel free to ask me questions in&off class

A brief history I

- The pioneering era
  - No S.E.
  - No way to estimate s/w development time
  - s.w. is free
- Starting 1960s
- The Software Crisis 1965--1985
  - Therac 25 1985—1987
  - Morris worm 1988

A brief history II

- 1985 – 2000
  - No silver bullet
  - **OO**, **design patterns**, formal methods, **process**
- 2000 – present
  - **Agile**
  - **Model-driven design**
  - **Tools, Program synthesis, verification, …**

Current S.E. research

Summary

- What we discussed
  - What is software engineering
  - What is s.e. process
  - Waterfall model
- What you should do/prepare to do
  - Check course webpage
  - Check piazza
  - Quiz
  - Mini-project to be released soon
  - Project proposal