[CS3704] Intermediate Software Design and Engineering

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Virginia Tech
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Introduction

What is software and its engineering?
Course Overview
Responsibilities

What is software?

- Software is a set of instructions, data, or programs used to operate a computer and execute specific tasks. In simpler terms, software tells a computer how to function. [1]

- Software encompasses:
  - Executable programs
  - Data associated with these programs
  - Documents: user requirements, design documents, user/programmer guides, etc.

[Pressman]

Why is software important?

Software is eating the world! [Andreessen, 2011]

> ***"More and more major businesses and industries are being run on software and delivered as online services…"***

Hardware vs. Software

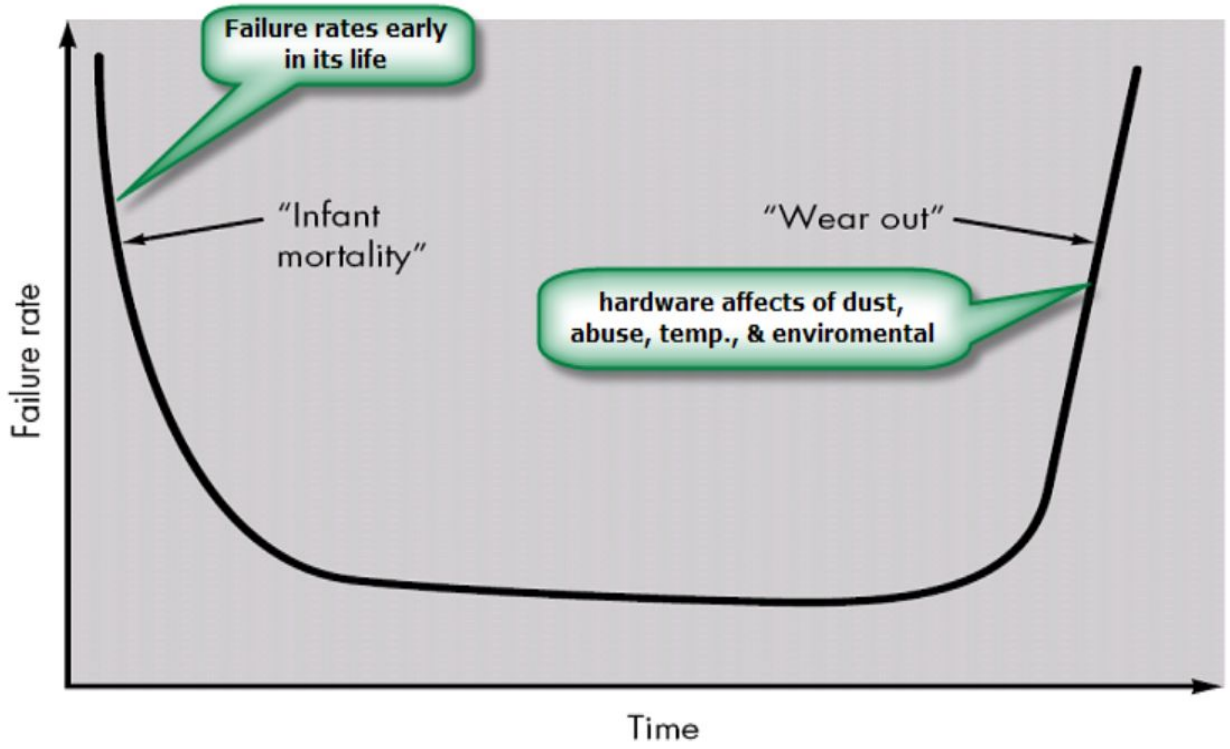
Hardware

- Manufactured
- Built using components
- Relatively simple
- Difficult or impossible to modify
- Hiring more people = more work done
- …

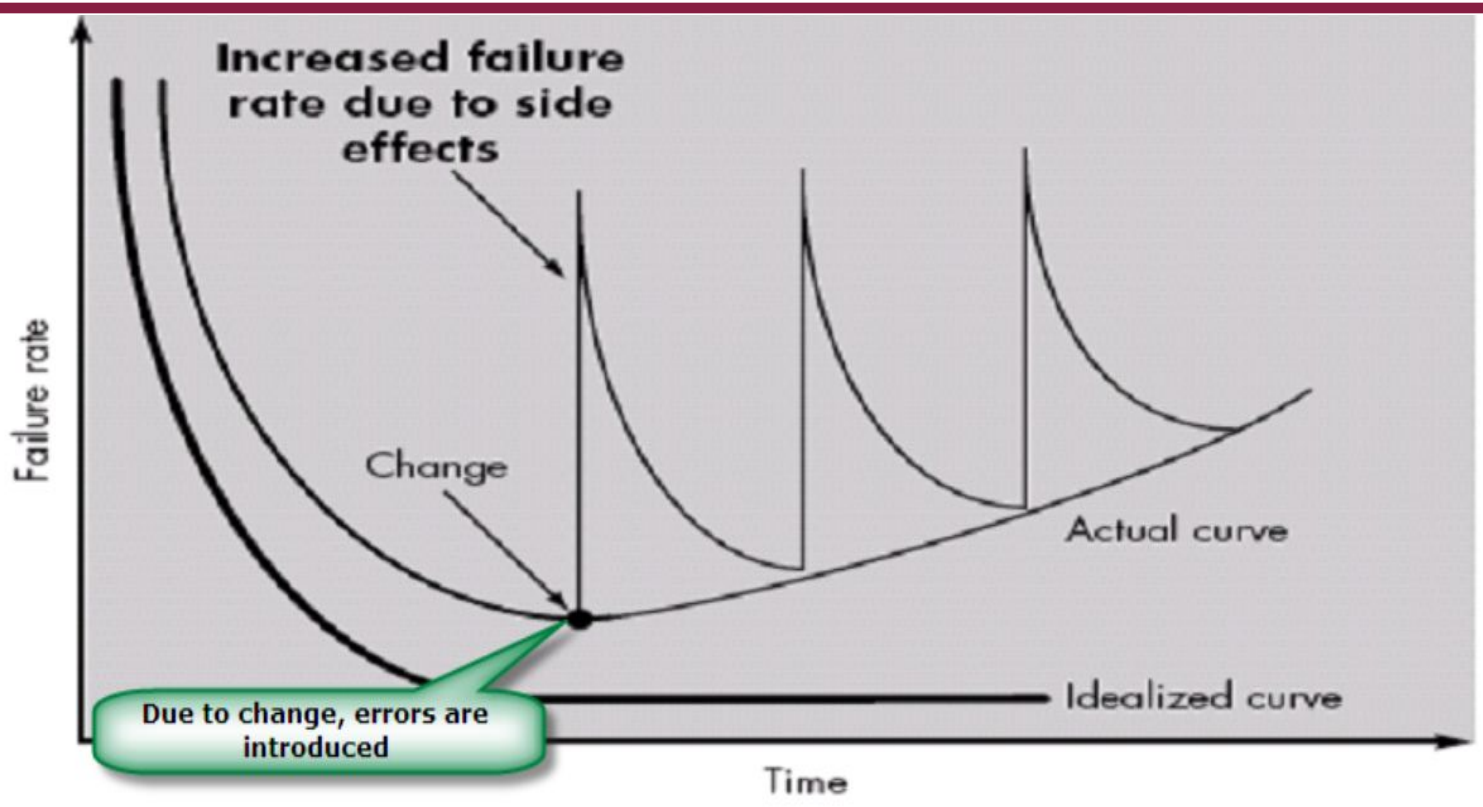
Software

- Developed
- Custom built?
- Complex
- Routinely modified and updated
- More people ***!=*** more productivity
- …

Hardware “wears out” over time



So does software!



What is software engineering?

A discipline that encompasses:

- the ***process*** of software development;
- ***methods*** for software analysis, design, construction, testing, and maintenance; and
- ***tools*** that support the processes and the methods.

[Pressman]

What is this class?

- CS3704: Intermediate Software Design and Engineering (Undergraduate SE course)

Explores the principles of software design in detail, with an emphasis on software engineering aspects. Includes exposure of software lifecycle activities including design, coding, testing, debugging, and maintenance, highlighting how design affects these activities. Peer reviews, designing for software reuse, CASE tools, and writing software to specifications are also covered.

Course Goals

1. Intellectual development
   – Knowledge of processes, methods, and tools to assist software development
   – Understand current techniques and problems in software engineering
2. Practical development
   – Improve development, communication, and writing skills
   – Practice various software engineering skills and processes

Course Overview

- Teaching Staff
- Course Materials
- Learning Objectives
- Class Activities
- Course Work

About Me

Education:

Duke UNIVERSITY
B.S. 2009-2013

NC STATE UNIVERSITY
M.S. 2015-2017

NC STATE UNIVERSITY
Ph.D. 2015-2021

Industry:

Bank of America
Python Developer 2013-2015

blackbaud
power your passion
Intern 2016

Red Hat
Intern 2017, 2018

Contact: dcbrown@vt.edu
Office: 4105 Gilbert
Office Hours: M/W 11:00am-12:00pm

Research

My research seeks to find ways to improve the ***behavior***, ***productivity***, and ***decision-making*** of software engineers.

About the GTA: Xiaoxiao Gan

My name is Xiaoxiao Gan, I am a PhD student in Virginia Tech.

I am interested in software engineering, particularly in automated testing, code quality improvement, software maintenance and evolution

Contact: xiaoxiaog22@vt.edu
Office Hours: Thursday 2PM-4PM

About the GTA: Hunter Leary

I’m Hunter Leary. I am a PhD student here at Tech and I am a part of Dr. Brown’s research group.

My primary research is in automated software engineering. Currently, I’m working on a tool for automated software testing using machine learning.

Contact: hunterl22@vt.edu
Office Hours: Tuesday - 11AM - 1PM

About the UTA: HyunJe Kim

I'm a senior at VT majoring in Computer Science and I'm from South Korea.

I recently got interested in application development so I've been playing around with Swift.

My hobbies are basketball and video games

Contact: k3h0j8@vt.edu

Office Hours: MWF: 9 - 11 AM

About the UTA: Brian Nguyen

I’m a Computer Science major and a junior at VT

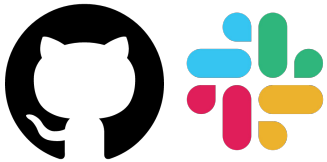
I’m interested in software development and creating applications and products for people to use in their everyday lives

Fun Fact: I have 2 dogs and a cat

Contact: briann02@vt.edu

Office Hours: Tuesday 1-3pm, Thursday 1-2pm

Course Materials



- Course materials will primarily be posted on GitHub [https://github.com/CS3704-VT/Course]
- Slack will be the primary mode of communication
  - Class updates, contact other students/teaching staff, questions, etc.
- Canvas will be mostly used for submitting assignments [https://canvas.vt.edu/courses/176246]

Course Materials (cont.)

- No textbook is required
  - FYI, lecture content will primarily use:
    - Software Engineering: A Practitioner's Approach [Pressman]
    - Building Software Together [Wilson]
    - Applying UML and Patterns: An Introduction to Object-oriented Analysis and Design [Larman]
    - Software Engineering [Somerville]
    - Head First Design Patterns [Freeman et al.]

Learning Outcomes

By the end of the course, students should be able to:

- **Understand software engineering processes and the software development life cycle**
- **Use techniques and processes to create and analyze requirements for an application**
- **Use techniques and processes to design a software system**
- **Identify processes related to phases of the software lifecycle**
- **Explain the differences between software engineering processes**
- **Discuss research questions and current topics related to software engineering**
- **Communicate about the requirements and design of software applications**

Learning Approach: Class Activities

How to achieve the learning outcomes: 📖

1. Traditional lectures
2. Workshop-style learning experiences
3. Discussion presentations

*Generally, the course will be structured with lectures on **Mondays and Wednesdays** and workshop or discussion activitie about lecture content on **Fridays**.*

Lectures

- *Why?*
  - To convey software engineering related information to students

Workshops

- Interactive tutorials, labs, mini-projects, etc.
  - Some individual and some in small groups
  - In-class activities

- *Why?*
  - To practice applicable and real-world SE skills and concepts

Discussions

- Discussions on current SE topics
  - Each student will present ***1*** paper or article in a group of six students, and lead an activity with two other groups
  - Instructor will provide papers, groups can propose content for instructor approval

- *Why?*
  - To improve critical thinking and communication skills about SE concepts

Learning Evaluation: Course Work

How you will be evaluated on the learning outcomes:

1. Homework
2. Exam
3. Project

Homework

- Mix of lecture review, application, and personal reflection questions.
- Always due Friday at 11:59pm of the week after assignment (two weeks)
  - see Course Schedule

HW0 due 11:59pm this Friday (8/25)!

Exam

- The exam will cover all course materials (lectures, workshops, and homeworks) except for discussion presentations.

- Details
  - Exam Review: 11/1
  - Exam: 11/3
  - Format: TBD

Project

- Work in teams (~4 or 5)
- Details: TBD
  - Choose from a set of given topics
  - Come up with a new project idea and get the instructor's approval
- Requirements Analysis and Design
- Project deliverables and software artifacts will be due throughout the semester (see Course Schedule).
- Two presentations

Ut Prosim

The Virginia Tech motto is Ut Prosim which means *“That I May Serve”.* To embody this as stakeholders in the VT community, part of your course grade will be determined by completing **four** service activities to the university or CS department.

- Ex.) participating in a research study, attending a department seminar, volunteer project, etc.

Grading

Assignment	Percentage
Project	35%
Exam	25%
Discussion Presentation	14%
Workshops	14%
Homework	8%
Ut Prosim	2%
Attendance & Participation	2%

Responsibilities

CS3704: Intermediate Software Design and Engineering

Adapted from slides by Dr. Brittany Johnson (GMU)

Responsibilities of the Professor

Prepare **useful** and **interesting knowledge** for you
Prepare materials **before** class
Come to class **on time**, **prepared** to teach
Offer **challenging but reasonable** homework and tests
Grade **fairly** without bias
Return graded work promptly with **helpful** comments

Goals:

- Support discussion and knowledge sharing of important concepts
- Make the class fun and engaging for everyone

Responsibilities of the Student

Come to class on time

If you miss class, **learn material** on your own

- but make an effort to attend every class

Pay attention to all instructions

Turn in assignments **on time**

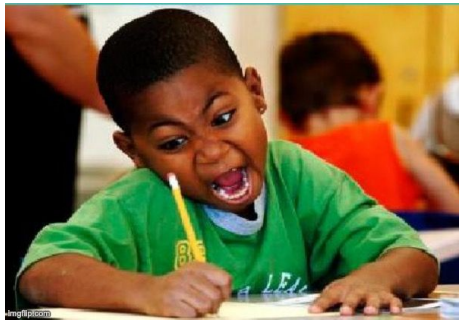
Ask for help when you're confused

Learn the material

If you disagree with me, **disagree politely**

Goals:

- Actively participate in your academic growth
- Engage with course materials and group work



Academic Integrity

- Adhere to university academic integrity and honesty policies.
- All violations will be reported to student conduct.
  - Students will receive a ***-50%*** on the assignment
- Assignments will describe individual or collaborative work.
- **Ask the instructor for clarification, any questions, or concerns before submitting an assignment.**

Other Class Policies

- Late submissions without a valid excuse will receive a -25% deduction.
- Be respectful of teaching staff and students.
- Let me know if you need accommodations.
- Attendance is ***strongly encouraged***.
- But…**do not** come to class if you are sick!

- There will be several opportunities to provide course feedback throughout the semester

Fostering an inclusive, safe space

A classroom consists of **instructors** and **students**. We *all* play a role in creating a **safe learning space**.

Everyone should feel comfortable and supported by:

- instructors (and TAs)
- fellow classmates

There is **ZERO TOLERANCE** for:

- sexism, racism, etc.
- bullying
- inappropriate comments

Questions?

Announcements

- HW0 due Friday at 11:59pm
  - Slack profile and introduction
  - Review syllabus and GitHub repo, complete survey with questions about the course
- SE Basics Workshop in class on Friday
  - Overview of software engineering topics