CSE 403

Software Engineering

Winter 2023

Course introduction

Today

- The CSE 403 team
- Logistics and resources
- What is Software Engineering
- Course overview and expectations

The CSE 403 team

Instructor

- René Just (rjust@cs.washington.edu)
- Office hours: After class and by appointment

Teaching assistants/project managers

- Jesse Hu
- Ben Kushigian
- Edward Misback
- Reshabh Sharma
- Apollo Zhu

Logistics: meetings

- **Lectures**: M/W/F 12:30pm – 1:20pm (G10)
- **Team meetings**: Tue 1:30pm – 2:20pm (ECE 125)
- **Project meetings**: Thu 1:30pm – 2:20pm (G10)

This Thursday only:
Work on project proposal with your assigned partner.

Logistics: resources

- **Course website**: https://homes.cs.washington.edu/~rjust/courses/CSE403 (cs.uw.edu/403)
- Submission of assignments via **Canvas**: https://canvas.uw.edu
- Discussions on **Slack**: https://cse403-wi23.slack.com

Logistics: communication

Communication guidelines

- We use Slack for all **non-sensitive** communication.
- See the Slack guidelines for this course.

Resources

- The go-to page for this course is the course web site.
- All relevant information is on the website, or linked from it.
- Canvas for assignments and non-public materials.

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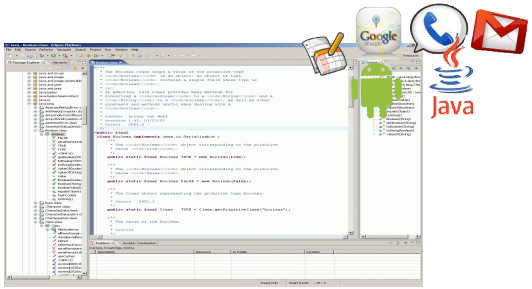
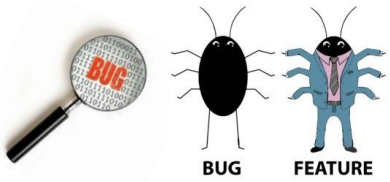
What is Software Engineering?

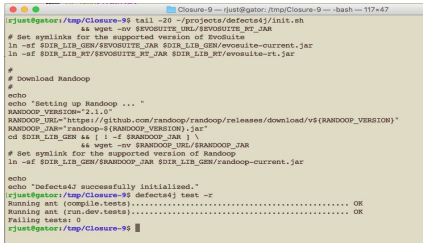
- Developing in an IDE and software ecosystem?



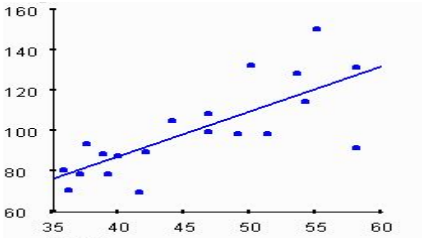
- Debugging and maintaining a software system?



- Deploying and running a software system?



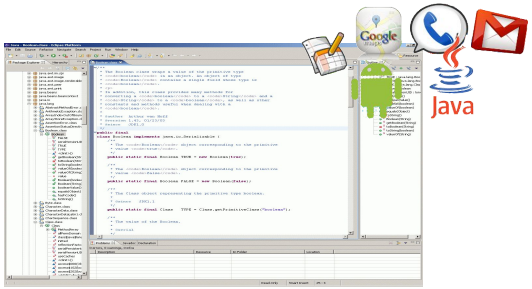
- Empirically evaluating a software system?



- Writing (design) docs?

What is Software Engineering?

- Developing in an IDE and software ecosystem?



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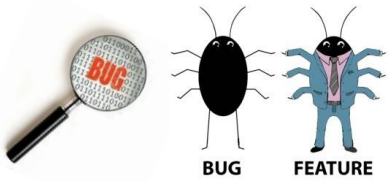

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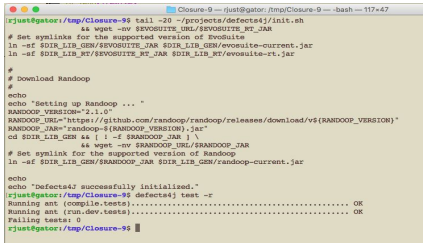

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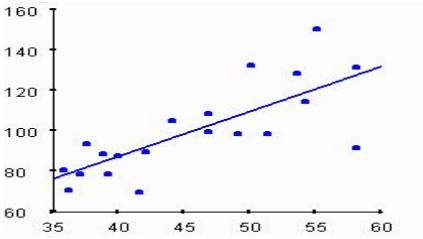


- Writing (design) docs?

All of the above and much more!

What is Software Engineering?

More than just writing code

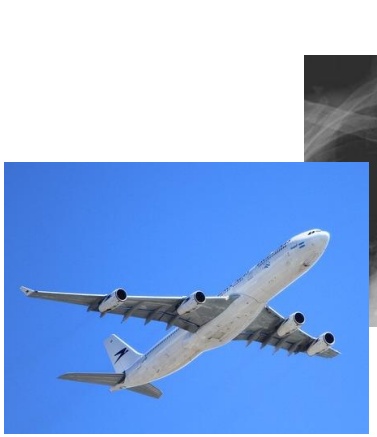
The complete process of specifying, designing, developing, analyzing, deploying, and maintaining a software system.

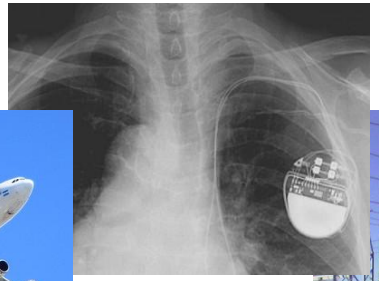
- Common Software Engineering tasks include:
  - Requirements engineering
  - Specification writing and documentation
  - Software architecture and design
  - Programming
  - Software testing and debugging
  - Maintenance and refactoring

Just one out of many important tasks!

Why is Software Engineering important?

Software is eating the world!





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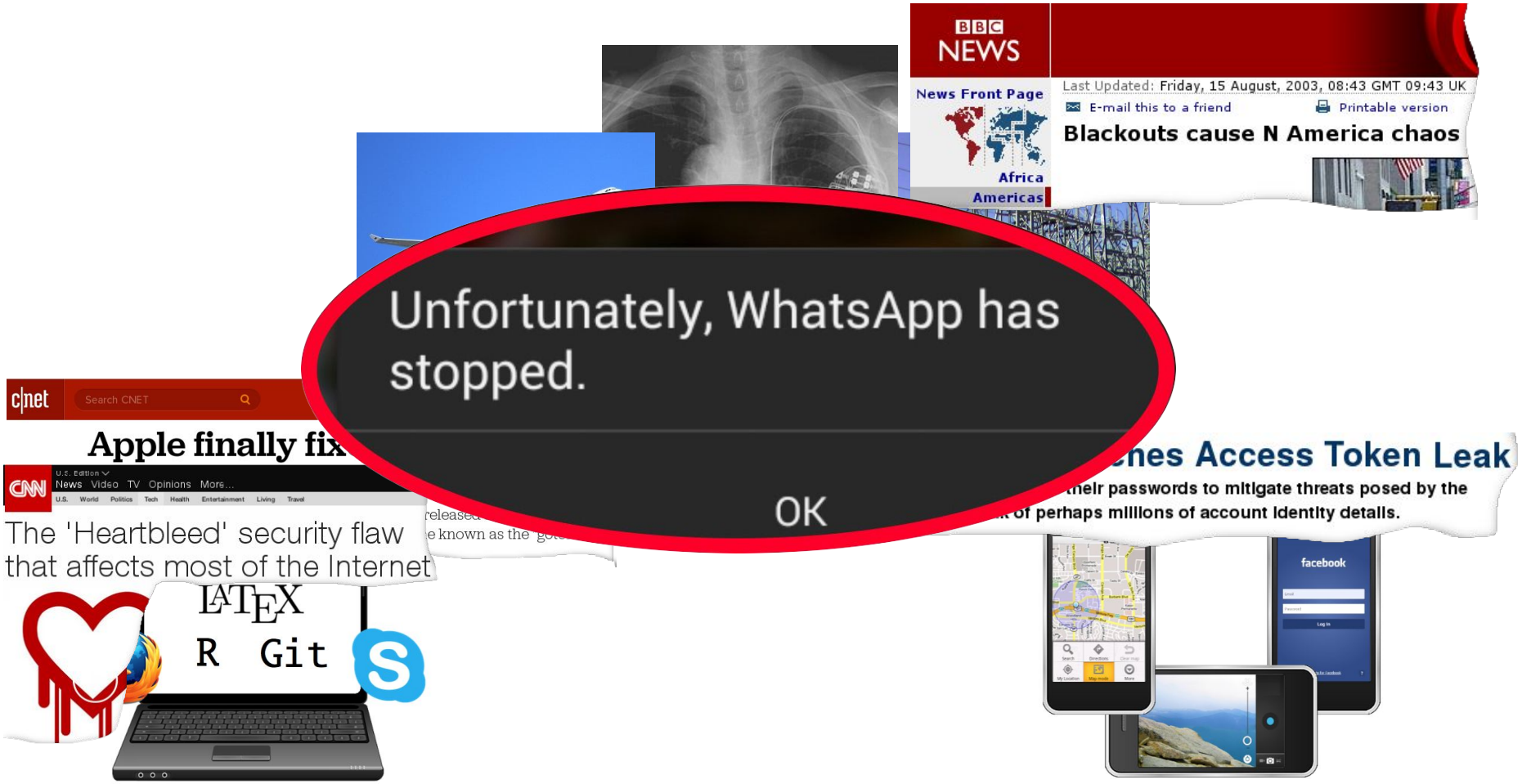


Summary: Software Engineering

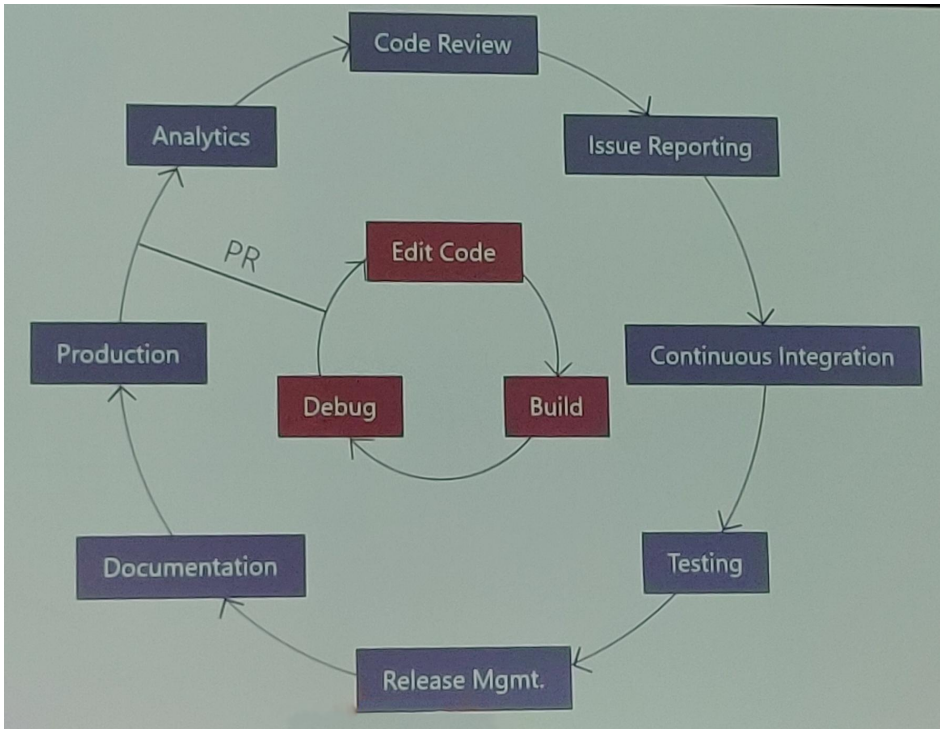
What is Software Engineering?

- The complete process of specifying, designing, developing, analyzing, and maintaining a software system.

Why is it important?

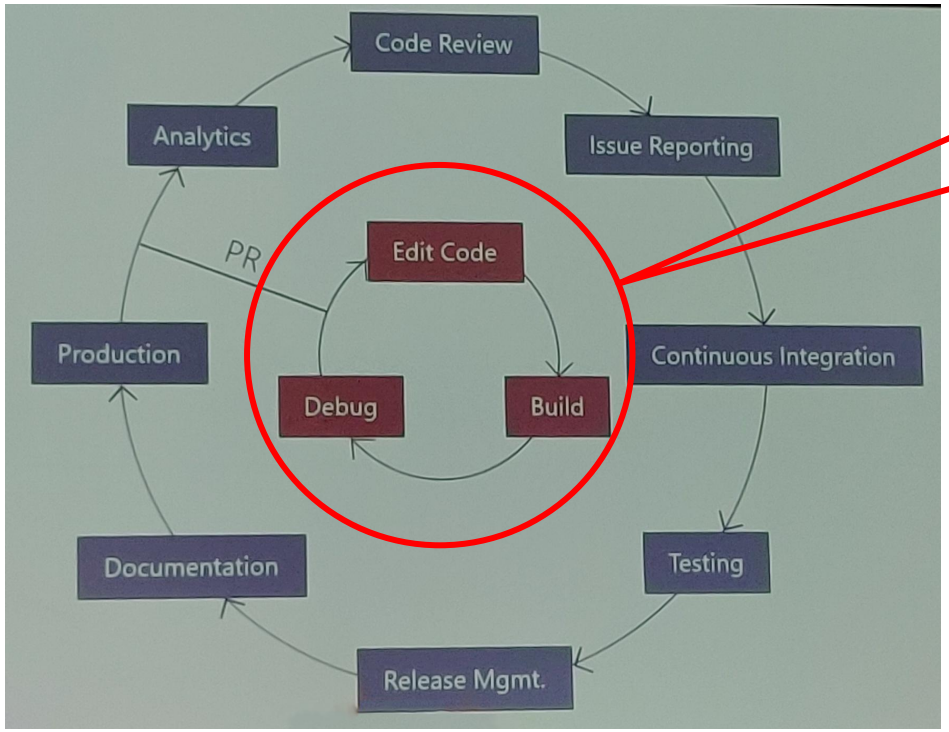
- Decomposes a complex engineering problem.
- Organizes processes and effort.
- Improves software reliability.
- Improves developer productivity.

The Role of Software Engineering in Practice



(Engineering workflow at Microsoft, Big Code summit 2019)

The Role of Software Engineering in Practice



Intro-level courses focus on the inner loop.

(Engineering workflow at Microsoft, Big Code summit 2019)

CSE 403 largely focuses on the outer loop.

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Course overview: grading

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01/09	Software development life cycle		
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Grading

- 55%: Course project
  - 70% project milestones
  - 30% final project review
- 35%: In-class exercises and individual assignments
- 10%: Participation
  - Engagement in project meetings
  - In-class discussions and activities (polls, small-group activities, etc.)
  - Slack contributions
- **No final exam!**

Course overview: workload

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Grading

- 55%: Course project
- 35%: In-class exercises and individual assignments
- 10%: Participation
- **No final exam!**

Workload

- One project assignment each week

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Grading

- 55%: Course project
- 35%: In-class exercises and individual assignments
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- **No final exam!**

Workload

- One project assignment each week
- 5 (+1 optional) in-class exercises

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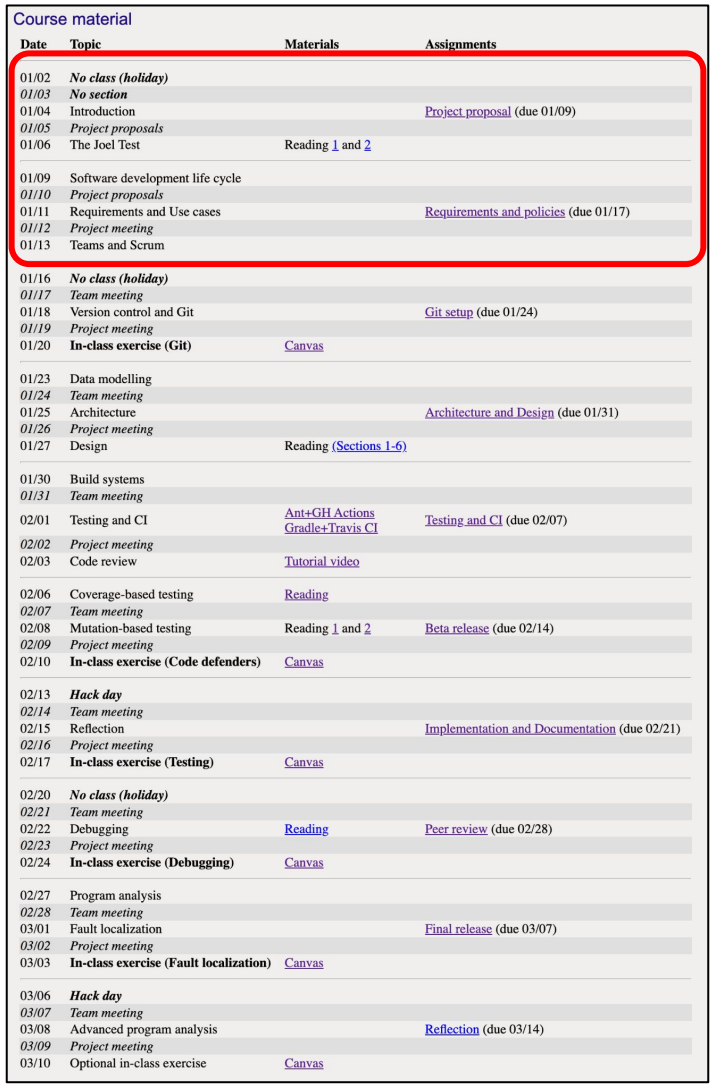
- 35%: In-class exercises and individual assignments
- 10%: Participation
- **No final exam!**

Workload

- One project assignment each week
- 5 (+1 optional) in-class exercises
- Extra time allocated for crunch time

Course overview: topics



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  - Different software development processes.
  - Precise writing (requirements and specifications).

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- **Software processes, requirements, and specification**
  - Different software development processes.
  - Precise writing (requirements and specifications).
- **Software development**
  - Decompose a complex problem and build abstractions.
  - Improve your coding skills.
  - Effectively use version control, build systems, and code review.
  - Continuous integration (CI).

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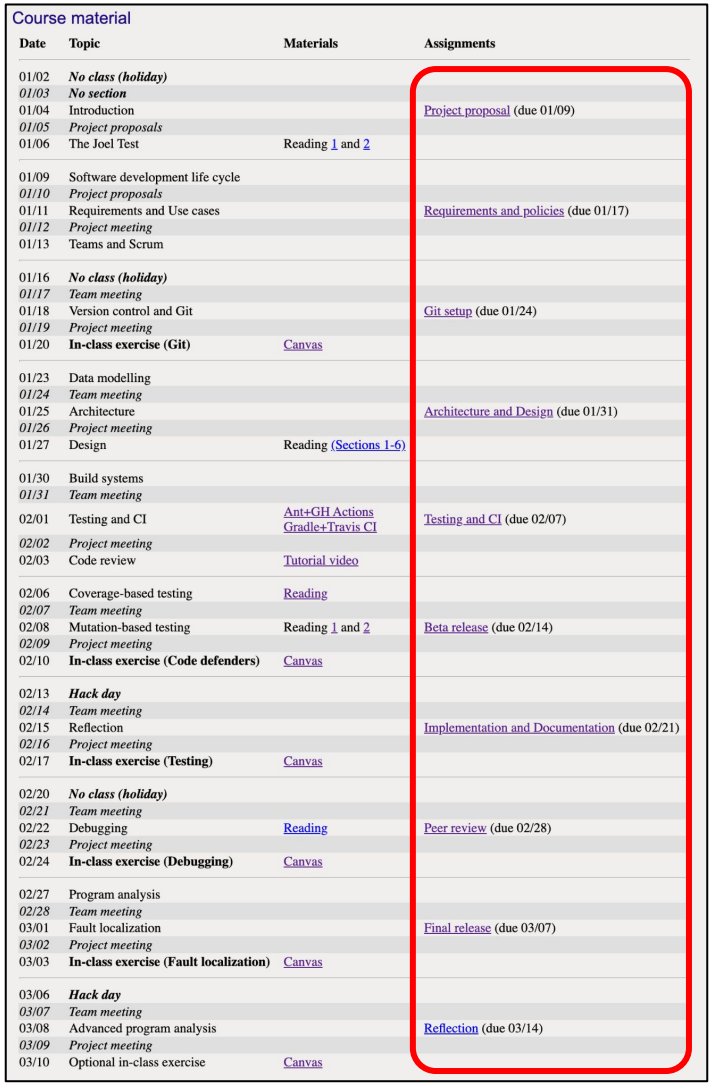
03/09	*Project meeting*		
03/10	Optional in-class exercise	Canvas	

- **Software processes, requirements, and specification**
  - Different software development processes.
  - Precise writing (requirements and specifications).
- **Software development**
  - Decompose a complex problem and build abstractions.
  - Improve your coding skills.
  - Effectively use version control, build systems, and code review.
  - Continuous integration (CI).
- **Software testing and debugging**
  - Write effective (unit) tests.
  - Hands-on experience, using testing and debugging techniques.
  - (Advanced) program analysis.

Course overview: course project



Course material

Date	Topic	Materials	Assignments
01/02	***No class (holiday)***		
01/03	***No section***		
01/04	Introduction		Project proposal (due 01/09)
01/05	*Project proposals*		
01/06	The Joel Test	Reading 1 and 2	
01/09	Software development life cycle		
01/10	*Project proposals*		
01/11	Requirements and Use cases		Requirements and policies (due 01/17)
01/12	*Project meeting*		
01/13	Teams and Scrum		
01/16	***No class (holiday)***		
01/17	*Team meeting*		
01/18	Version control and Git		Git setup (due 01/24)
01/19	*Project meeting*		
01/20	**In-class exercise (Git)**	Canvas	
01/23	Data modelling		
01/24	*Team meeting*		
01/25	Architecture		Architecture and Design (due 01/31)
01/26	*Project meeting*		
01/27	Design	Reading (Sections 1-6)	
01/30	Build systems		
01/31	*Team meeting*		
02/01	Testing and CI	Ant+GH Actions Gradle+Travis CI	Testing and CI (due 02/07)
02/02	*Project meeting*		
02/03	Code review	Tutorial video	
02/06	Coverage-based testing	Reading	
02/07	*Team meeting*		
02/08	Mutation-based testing	Reading 1 and 2	Beta release (due 02/14)
02/09	*Project meeting*		
02/10	**In-class exercise (Code defenders)**	Canvas	
02/13	***Hack day***		
02/14	*Team meeting*		
02/15	Reflection		Implementation and Documentation (due 02/21)
02/16	*Project meeting*		
02/17	**In-class exercise (Testing)**	Canvas	
02/20	***No class (holiday)***		
02/21	*Team meeting*		
02/22	Debugging	Reading	Peer review (due 02/28)
02/23	*Project meeting*		
02/24	**In-class exercise (Debugging)**	Canvas	
02/27	Program analysis		
02/28	*Team meeting*		
03/01	Fault localization		Final release (due 03/07)
03/02	*Project meeting*		
03/03	**In-class exercise (Fault localization)**	Canvas	
03/06	***Hack day***		
03/07	*Team meeting*		
03/08	Advanced program analysis		Reflection (due 03/14)
03/09	*Project meeting*		
03/10	Optional in-class exercise	Canvas	

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  - Hands-on experience, using testing and debugging techniques.
  - (Advanced) program analysis.
- **Course project**
  - Apply all of the above in a group project.

Course project overview

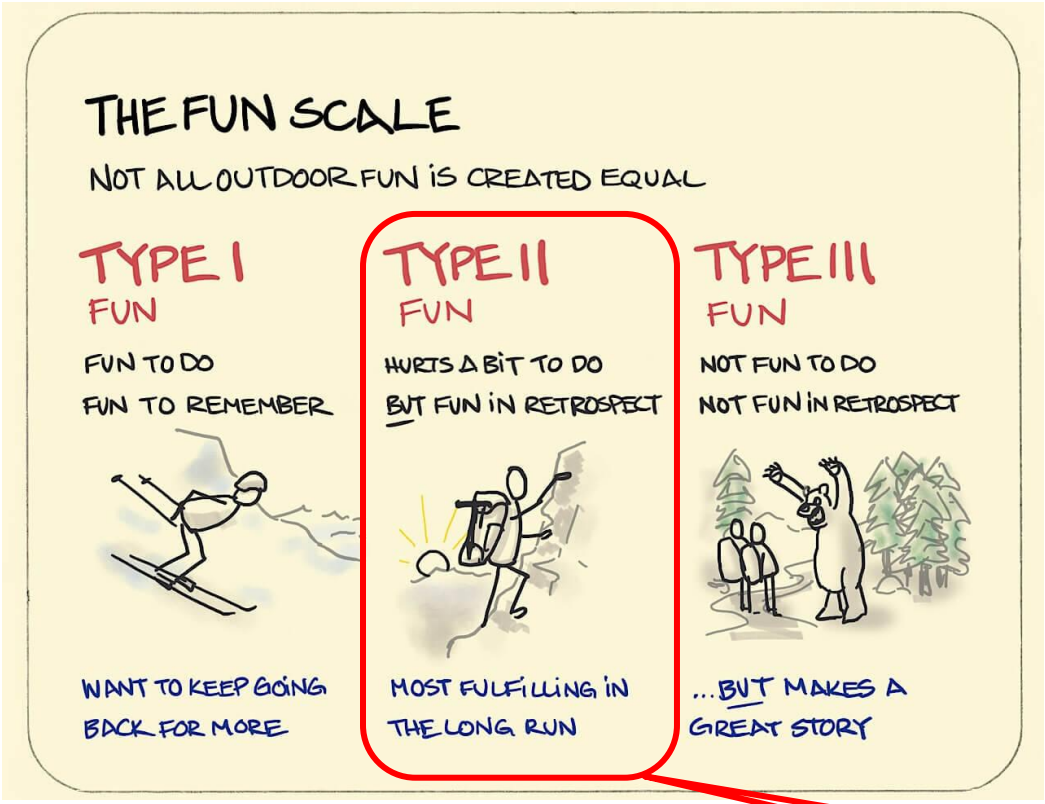
Course project proposals

Course project categories

Example categories

- Productivity and convenience apps
- Optimization problems and data science
- Gaming and making
- Extensions to open-source software
- Software Engineering research (prototypes)

CSE 403 in one picture: mostly type II fun



Sweet spot for teaching

Expectations

- Programming experience and familiarity with one programming language (Java, C++, ...).
- Active participation in discussions.
- Teamwork and communication (Slack).
- Reflecting on and improving submitted materials.

CSE 403: challenges for students

Team work

- Effective communication and coordination
- Different backgrounds, skills, and incentives

Complexity

- Tooling and technology stacks
- Scale of code base

Uncertainty

- No simple check-box grading
- Trade-offs, decisions, and justifications

CSE 403: challenges for staff

In-person vs. online education

2020: “Transition plan”

2022: “How does this work?”

Enrollment

- 2020: 40 students (2 TAs)
- 2021: 85 students (5 TAs)
- 2022: 110 students (6 TAs)
- 2023: 82 students (5 TAs)

Time

- Project duration: 9 weeks
- Lecture time: 50 minutes
- Quick turnaround times

What's next?

- *Thu: Work on project proposal (pre-assigned groups)*
- Fri: The Joel Test (or why you really should take 403)