
CSE 331

Software Design & Implementation

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Winter 2023
Course Wrapup

Today

- Reminder: Fill out your course evaluations (!)
- Also: Nominate great TAs for the Bandes award
- Project Demos
- A look back at CSE 331
 - High-level overview of main ideas and goals
 - Connection to homeworks
 - Context
- Also:
 - Thank-yous

Final exam, etc. information

- Tuesday, 12:30-2:20, same rooms as midterm:
 - Last name A-I in GWN 201; J-Z in GWN 301
- Comprehensive but biased towards the 2nd half of the course
- Old exams on the web
 - Some questions won't apply if we didn't do similar things this quarter (swing, etc.)
- Review session Monday 4:30, JHN 102

- Daylight savings time starts this weekend – remember to move your clocks ahead one hour!
 - Don't be That Person who shows up 1 hour late for their Monday morning final exam! 😊

- Please finish submitting regrades for recent assignments now – will shut off regrades after this weekend except for hw9 and final exam

CSE 331

What was it all about?

But first....

Huge thanks to the folks who made it work

Course staff: 15 Amazing TAs:

Sparsh Binjrajka, Jaela Field, Elijah Greisz, Humza Lala,
Edison Leung, Katherine Murphy, Gargi Panatula,
Nuha Qadir, Zoey Shi, Justin Tysdal, Tanay Vakharia,
Kevin Xu, Alex Zhang, Randy Zhang, Zhennan Zhou

*This course is itself a sophisticated
(or at least really, really complicated) system
requiring savvy design and implementation*

And a big thanks to **you** for all you've done!

4 slides from Lecture 1...

What is the goal of CSE 331?

How to build harder-to-build software

- Move from intro programming exercises toward software projects you'll see in upper-level CSE courses and in industry

Specifically, how to write code of

- Higher **quality**
- Increased **complexity**

We will discuss *tools* and *techniques* to help with this

- There are *timeless principles* to both

What is high quality code?

In summary, we want our code to be:

1. Correct
2. Easy to change
3. Easy to understand
4. Easy to scale (modular)

These qualities also allow for increased complexity

What we will cover in CSE 331

- Everything we cover relates to the 4 goals
- We'll use Java but the principles apply in any setting

Correctness

1. Tools
 - Git, IntelliJ, JUnit, Javadoc, ...
 - Java libraries: equality & hashing
 - Adv. Java: generics, assertions, ...
 - debugging
2. Inspection
 - reasoning about code
 - specifications
3. Testing
 - test design
 - coverage

Changeability

- specifications, ADTs
- listeners & callbacks

Understandability

- specifications, ADTs
- Adv. Java: exceptions
- subtypes

Modularity

- module design & design patterns
- event-driven programming, MVC, GUIs

Back to Goals

- CSE 331 will teach you to how to write correct programs
- What does it mean for a program to be **correct**?
 - Specifications
- What are ways to **achieve correctness**?
 - Principled design and development
 - Abstraction and modularity
 - Documentation
- What are ways to **verify correctness**?
 - Testing
 - Reasoning and verification

Some new slides to tie the pieces together...

Divide and conquer: Modularity, abstraction, specs

No one person can understand all of a realistic system

- **Modularity** permits focusing on just one part
- **Abstraction** enables ignoring detail
- **Specifications** (and **documentation**) precisely describe behavior
- **Reasoning** relies on all three to understand/fix errors
 - Or avoid them in the first place
 - **Proving, testing, debugging**: all are intellectually challenging

How CSE 331 fits together

| | |
|----------------------|------------------------------------|
| Lectures: ideas | ⇒ Assignments: get practice |
| Specifications | ⇒ Design classes |
| Testing | ⇒ Write tests |
| Subtyping | ⇒ Write subclasses |
| Equality & identity | ⇒ Override equals, use collections |
| Generics | ⇒ Write generic classes |
| Design patterns | ⇒ Larger designs; MVC |
| Reasoning, debugging | ⇒ Correctness, testing |
| Events | ⇒ GUIs |
| Systems integration | ⇒ N/A |

What you have learned in CSE 331

Compare your skills today to 10 weeks ago

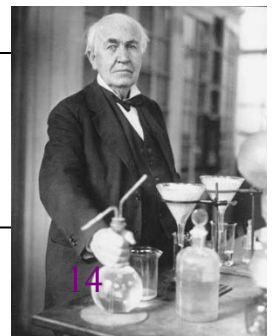
- Theory: abstraction, specification, design
- Practice: implementation, testing
- Theory & practice: correctness

Bottom line aspiration: Much of what we've done would be *easy* for you today

This is a measure of how much you have learned

There is no such thing as a “born” programmer!

Genius is 1% inspiration and 99% perspiration.
Thomas A. Edison



What you will learn later

- Your next project can be much more ambitious
 - But beware of “second system” effect
- Know your limits
 - Be humble (reality helps you with this)
- You will continue to learn
 - Building interesting systems is never easy
 - Like any worthwhile endeavor
 - Practice is a good teacher
 - Requires thoughtful introspection
 - Don't learn *only* by trial and error!
 - Voraciously consume ideas *and* tools

What comes next?

Courses

- CSE 403 Software Engineering
 - Focuses more on requirements, software lifecycle, teamwork
- Capstone projects
- Any class that requires software design and implementation

Research

- In software engineering & programming systems
- In any topic that involves software

Having an impact on the world

- Jobs (and job interviews)
- Larger programming projects

Last slide

- System building is fun!
 - It's even more fun when you're successful!!
- Pay attention to what matters
 - Take advantage of the techniques and tools you've learned (and will learn!)
- On a personal note:
 - Don't be a stranger: I love to hear how you do in CSE and beyond as alumni
 - Students are amazing; I believe in you! 😊
- Closing thoughts?



That's all Folks!