CSE 331 wrapup

CSE 331

University of Washington
CSE 331 goals

Enable students to
• manage complexity
• ensure correctness
• write modest programs
CSE 331 topics

Manage complexity:
- Abstraction
- Specification
- Modularity
- Program design & organization
  - OO design, dependences, design patterns, tradeoffs
- Subtyping
- Documentation

Ensure correctness:
- Reasoning
- Testing
- Debugging

Write programs:
- Practice and feedback
- Introduction to: tools (version control, debuggers), understanding libraries, software process, requirements, usability
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**) formally describe behavior.

**Reasoning** relies on all three to understand/fix errors.

Or to **avoid** them in the first place.
Getting it right ahead of time

Design: predicting implications
   Example: understanding interconnections, using module dependency diagram (MDD)

Understanding the strengths and weaknesses
   If you don’t understand a design, you can’t use it

Documentation matters!
Documentation

Everyone wants good documentation when using a system.

Not everyone likes writing documentation.

Documentation is often the most important part of a user interface.

What’s obvious to you may not be obvious to others.

An undocumented software system has zero commercial value.

John Chapin
CTO of Vanu, Inc.
Testing

Helps you understand what you didn’t understand while designing and implementing

A good test suite exercises each behavior

  Theory: revealing subdomains, proves correctness
  Practice: code coverage, value coverage, boundary values

  Practice: testing reveals errors, never proves correctness

A good test suite makes a developer fearless during maintenance
Maintenance

• Maintenance accounts for most of the effort spent on a successful software system — often 90% or more

• A good design enables the system to adapt to new requirements while maintaining quality — Think about the long term, but don’t prematurely optimize

• Good documentation enables others to understand the design
Correctness

In the end, only correctness matters

Near-correctness is often easy!

Correctness can be difficult

How to determine the goal?

Requirements elicitation

Design documents for the customer

How to increase the likelihood of achieving the goal?

Unlikely without use of modularity, abstraction, specification, documentation, design, ...

Doing the job right is usually justified by return on investment (ROI)

How to verify that you achieved it?

Testing

Reasoning (formal or informal) helps!

Use proofs and tools as appropriate

Returning gave a little practice
Working in a team

No one person can understand all of a realistic system
  Break the system into pieces
  Use modularity, abstraction, specification, documentation
Different points of view bring value
Work effectively with others
  Sometimes challenging, usually worth it
Manage your resources effectively
  Time, people
  Engineering is about tradeoffs
Both technical and management contributions are critical
What you have learned in CSE 331

Compare your skills today to 3 months ago
Theory: abstraction, specification, design
Practice: implementation, testing
Theory & practice: correctness
Bottom line: The problem sets 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!

Your next project can be more ambitious

Genius is 1% inspiration and 99% perspiration.
  Thomas A. Edison
What you will learn later

Your next project can be much more ambitious
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!
What comes next?

Classes
- 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

The purpose of computing is insight, not numbers.
Richard W. Hamming

*Numerical Methods for Scientists and Engineers*
Go forth and conquer

System building is fun!
   It’s even more fun when you build it successfully
Pay attention to what matters
   Use the techniques and tools of CSE 331 effectively