Beyond CS240
How Computers Work

1. How Computers Work

Hardware
- Devices (transistors, etc.)
- Digital Logic
- Microarchitecture
- Instruction Set Architecture
- Operating System
- Compiler/Interpreter
- Programming Language
- Program, Application, Algorithm

Software

CS 240 in Context
Skills for Thinking and Programming

Few of you will build new HW, OS, compiler, but...

1. Effective programmers and computer scientists understand their tools and systems.
2. The skills and ideas you learn here apply everywhere.

Reason about computational models, translation.

Debug for correctness and performance (with tools to help).

Assess costs and limits of representations.

"Figure it out" via documentation, experiments, critical thinking.

Remember low-level implications of high-level choices.
4 Big Ideas in CS, Systems, and beyond

**Abstraction**
Do not start every project with transistors. Abstraction is beautiful and empowering, but real abstractions have leaks and wrinkles.

**Translation**
Between layers of abstraction. Structured computation.

**Representation**
No representation without taxation. Representations have costs.

**Performance**
Memory: clever, imperfect abstraction. Tiny code changes, huge impact.

**Security + Reliability**
Trickiest exploits & errors involve multiple layers, even hardware!

These things matter more every day.