RICE

Welcome to 220
Fundamentals of Computer Engineering!

Overview of the Course, Syllabus, and Discussion

What is Computer Engineering?

- Computer engineering is concerned with combining the fields of **computer science** and **electrical engineering** to **design and implement** an **optimized computing system**.
- Computer engineering enjoys:
  - an **extensive theoretical base** developed over several decades,
  - an **elegant implementation technology** (semiconductor VLSI) that is highly advanced and well matched to its computational demands,
  - and **abundant applications**.
- Computer engineering is at **the heart of much of modern technology**.

Its current and future impact is difficult to overstate.

Another Perspective: This is Water

- Computer engineering influences our lives constantly:
  - Sometimes it's obvious that computers are involved: **Augmented reality**
- Sometimes it's transformative: The Anova Precision Oven
- But it goes deeper than that… 3 Ways to Cook a Smashburger with 3 Burger Experts
  - Locally, check out burger-chan, found by two Rice grads.
- A parable….

From a 2005 commencement address "This is Water" by David Foster Wallace: https://youtu.be/eC7xzavzEKY

Eric Weinstein @EricRWeinstein · Aug 5
Replying to @EricRWeinstein
As for history:

Powered Flight

Use of Atomic Weapons

Anti-Biotics

Moon Landings

The Internet

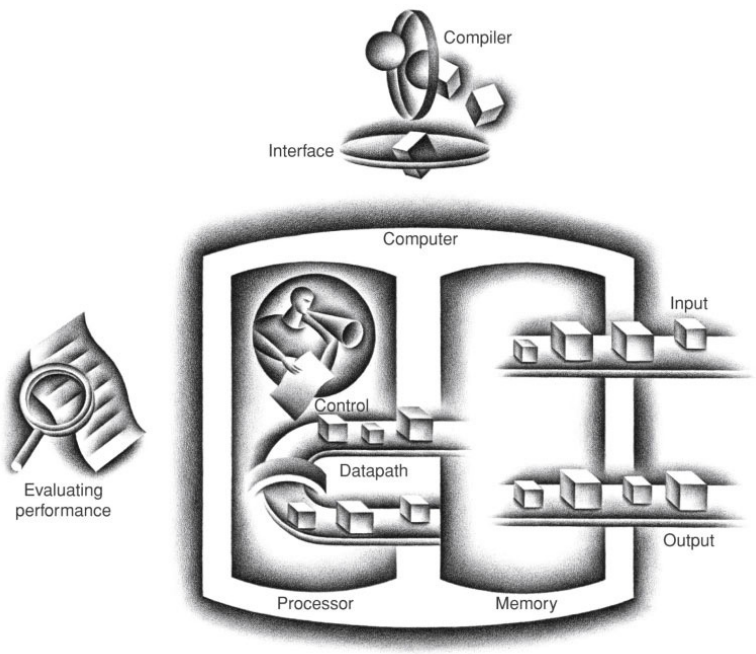
Intercontinental discovery

Gunpowder

DNA

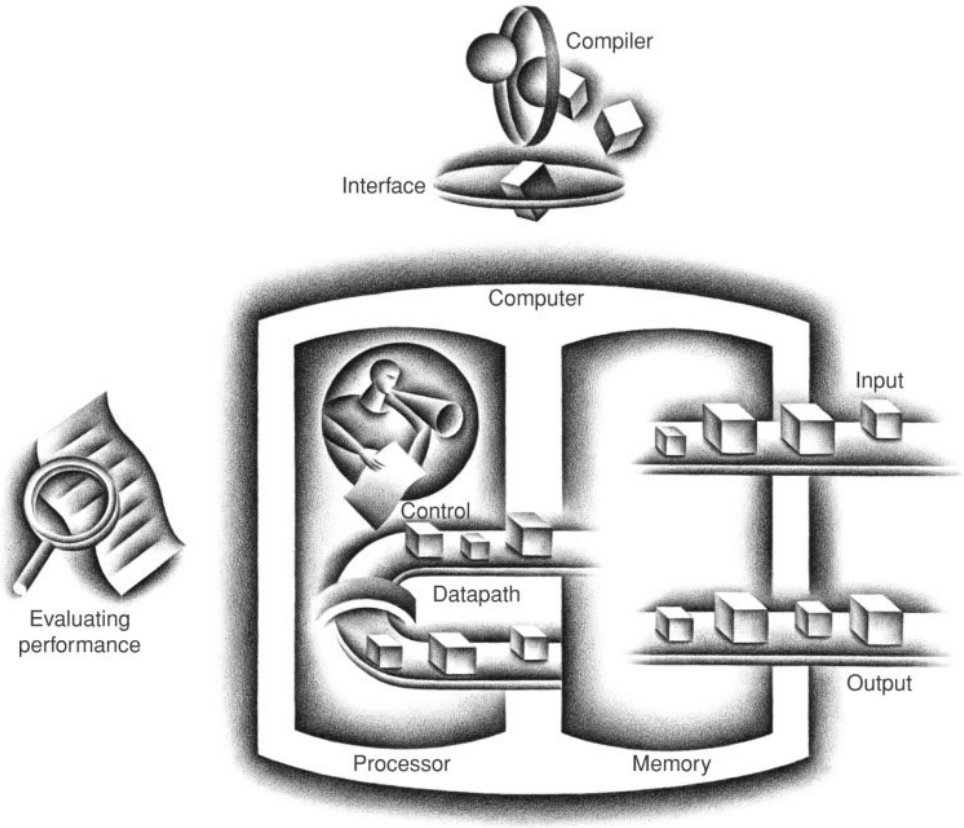
"were all unthinkable simply because there weren't direct precedents."

Critical Facts about 220



- ELEC 220 – Fundamentals of Computer Engineering
- Overall Course Objectives:
  - Understand five key components of every computer.
  - Understand and use the components of a modern digital computer system.
  - Compiler/processor interface.
  - Instruction set of a RISC style processor.
  - Logic design
  - Influence of technology (hardware and software) on architecture.
- Expected learning outcomes:
  - Be able to engineer a new computing system.
  - Use computer architectures more effectively.
  - Understand the role of computer engineering in your future.

What is a Computer?



- Every computer built has **five key components**:
  - The processor gets instructions and data from **Memory**.
  - **Input** writes data to memory.
  - **Output** reads data from memory.
  - **Control** sends the signals that determine the operations of the..
  - **…Datapath** (where we do computations), memory, input, and output.
- We will often refer to **Control** and **Datapath** together as the **Processor**
- Applications are developed with the Compiler and other programming tools.

Critical Facts

- ELEC 220 – Fundamentals of Computer Engineering
  - Will be adding to course content from last year
    - Reasons: new technical developments, student feedback, …

- Instructor: Ray Simar – Professor in the Practice
  ray.simar@rice.edu DCH 2099

- Office Hours: This is easy. Drop me a note and we'll set up time.
  Can do Zoom or on campus.

- We will get everyone into the class.
  - If you know someone who is interested, or should be interested, send them my way: ray.simar@rice.edu

Basis for Grading

• Homework	20%	- ~7 assignments - Reinforce key concepts and provide practice. - Preparation for exams. - Penalty for late turn in. - Posted on Canvas
• In-class quizzes, etc.	10%	- Short, in-class, announced quizzes, done on Canvas. - Good preparation for labs and debrief of labs - **Includes polls**
• Exams	35%	- 3 exams - Rice honor code applies to all exams. - Exams will be posted on Canvas.
• Labs	35%	~11 lab grades - Lab reports done on Canvas.

We will heavily use Canvas to provide you visibility into your grades.

Important Accommodations

- Masking policy:
  - Masks are not required in lecture or labs. You may wear a mask if you wish.
  - You can find other Covid-19 related guidelines for this fall semester here.
- Any student with a disability requiring accommodations in this class is encouraged to contact me after class or during office hours, and to contact Rice's Coordinator for Disabled Student Services in the Allen Center.
  - Website: https://drc.rice.edu
  - I'll work with you to schedule a meeting to discuss the accommodations

Lectures and Labs

- Lectures are focused on theory
  - A lot of focus on "**why**"
  - Cover key concepts
  - Examples of key concepts in use
- The lectures foreshadow the labs…
- Labs are focused on practice
  - Use the ideas discussed in class.
  - **Extend** the ideas discussed in class.
- Understanding the lectures will make the labs possible.
- No lab the next couple of weeks!
  - We are allowing time for us to get our boards and kit of parts.

We will have a few guest lecturers with special expertise.

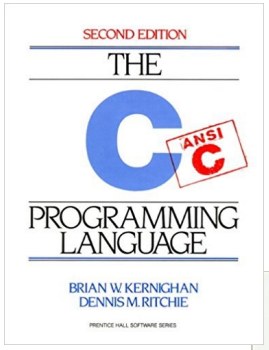
Class-taking Technique for ELEC 220

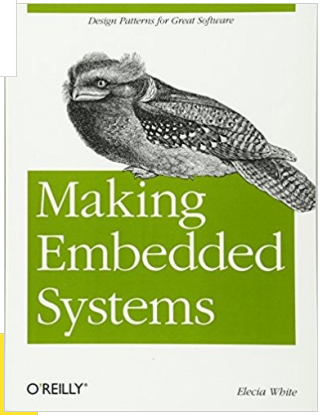
- I will use projected material extensively
  - Will endeavor to have slides on Canvas early the morning of class.
    - I will use Canvas for **announcements** and have it auto-send emails with announcements.
    - I will post **homework assignments** on Canvas and have it auto-send emails with announcements.
  - I will say more than the slides say. ☺
- Come to class
  - I welcome questions and discussion in class.
  - The exams will cover lectures, homework, and labs.
- Go to the labs
  - That is where a lot of learning will take place.
- Do the homework
  - Good practice for the tests.

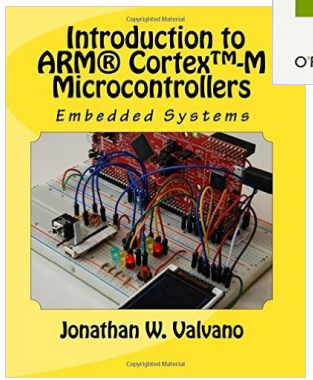
Notice: If you find that your are having difficulty i.e. falling behind in class, not turning in assignments on time, etc., please talk to me.

No required text book

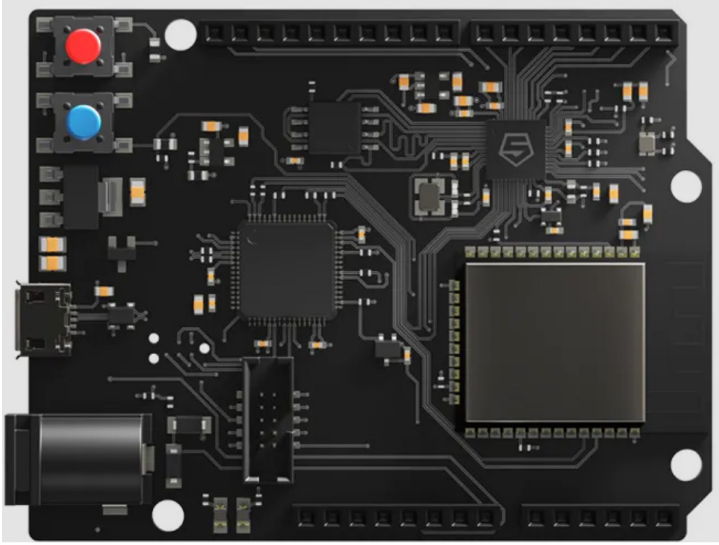
- **No required text book!**
  - A great C reference is **The C Programming Language, 2nd Edition**
    - Written by the creators of C: Brian W. Kernighan and Dennis M. Ritchie
  - A great book on programming microprocessor: **Making Embedded Systems: Design Patterns for Great Software**
    - Written by Elecia White, a very experienced computer engineer.
  - A good reference is **Introduction to ARM Cortex-M Microcontrollers**
    - Created by a great prof at UT Austin: Jon Valvano







The board (required)…



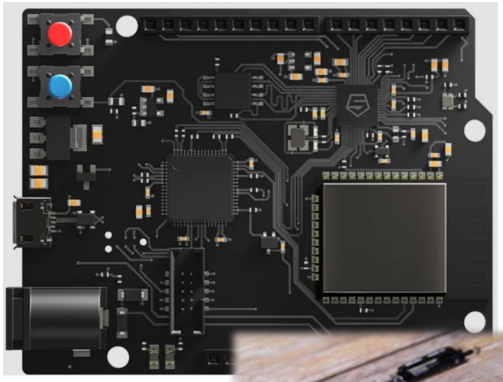
- The **HiFive1 Rev B** board is built around the Freedom E310 which supports the new RISC-V Instruction Set Architecture (ISA)
  - https://www.sifive.com/boards/hifive1-rev-b
- **Two options for buying your board:**
  - Rice bookstore: $99.99
    - They have 25 in stock and will order more
  - Mouser electronics: $64.76 link

The box (or one similar) …

- This new compact box contains everything you need to **build some nifty systems** using our HiFive board.
- **SunFounder Kit is available from Amazon: ~$24**
  - SunFounder Electronics Fun Kit

  Includes:
  - Breadboard
  - jumper wires
  - LEDs: blue, green, yellow, red, white, RGB
  - Buzzers
  - Relay
  - Servo
  - LCD display…
  - and a partridge in a pear tree.

When do I need to have my LaunchPad and SunFounder Kit?



- Everyone needs to have their own HiFive board and SunFounder Kit in their hands by:
  - **HiFive – week of Sep 5th**
  - **SunFounder Kit – week of Sep 19th**
- **HiFive**: you have a lot of options, depending upon your situation…
  - The Rice bookstore: $99.99
    - They have 25 in stock and will order more
  - Mouser electronics: $64.76 link
- **SunFounder Kit**: available from Amazon: ~$24
  - SunFounder Electronics Fun Kit
- If anyone needs assistance in purchasing, reach out to me.

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  - and **abundant applications**.
- Computer engineering is at **the heart of much of modern technology**.

Its current and future impact is difficult to overstate.

For next time, consider this idea…

- Computer engineering **can only use** the available technology of the time…

- …but it can use **any combination** of the available technologies of the time.

Thank you!