Computer Architecture

Lecture 2b: Course Info & Logistics

Prof. Onur Mutlu
ETH Zürich
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Onur Mutlu

- Full Professor @ ETH Zurich ITET (INFK), since September 2015
- Strecker Professor @ Carnegie Mellon University ECE/CS, 2009-2016, 2016-...
- PhD from UT-Austin, worked at Google, VMware, Microsoft Research, Intel, AMD
- https://people.inf.ethz.ch/omutlu/
- omutlu@gmail.com (Best way to reach me)
- https://people.inf.ethz.ch/omutlu/projects.htm

Research and Teaching in:
- Computer architecture, computer systems, hardware security, bioinformatics
- Memory and storage systems
- Hardware security, safety, predictability
- Fault tolerance
- Hardware/software cooperation
- Architectures for bioinformatics, health, medicine
- ...
Course Info: The Teaching Team

- Teaching Assistants
  - Ataberk Olgun
  - Dr. Mohammed Alser
  - João Dinis Ferreira
  - Rahul Bera
  - Geraldo F. de Oliveira Jr.
  - Can Firtina
  - Dr. Juan Gomez Luna
  - Konstantinos Kanellopoulos
  - Nika Mansouri Ghiasi
  - Giray Yaglikci
  - Dr. Mohammad Sadrosadati
  - Rakesh Nadig
  - Haocong Luo
  - Banu Cavlak
  - Aditya Manglik
  - Nisa Bostanci
  - Yahya Can Tugrul
  - Joel Lindegger

- Get to know them and their research
Some Goals of This Course

Teach/enable/empower you to:

- Understand how a computing platform works
- Understand how decisions made in hardware affect the software/programmer as well as the hardware designer
- Think critically (in solving problems)
- Think broadly across the levels of transformation
- Understand how to analyze and make tradeoffs in design
- Apply the above in several lab projects and HWs
Review: Major High-Level Goals of This Course

- Understand the principles (of design)
- Understand the precedents

Based on such understanding:
- Enable you to evaluate tradeoffs of different designs and ideas
- Enable you to develop principled designs
- Enable you to develop novel, out-of-the-box designs

The focus is on:
- Principles, precedents, and how to use them for new designs

In Computer Architecture
Why These Goals?

- Regardless of your future direction, learning the principles and methodical analysis techniques we cover will be useful to:
  - design better hardware
  - design better software
  - design better systems
  - make better tradeoffs in design
  - understand why computers behave the way they do
  - solve problems better
  - think “in parallel”
  - think critically
  - ...

...
A Note on Hardware vs. Software

- This course might seem like it is only “Computer Hardware”

- However, you will be much more capable if you master both hardware and software (and the interface between them)
  - Can develop better software if you understand the hardware
  - Can design better hardware if you understand the software
  - Can design a better computing system if you understand both
The Transformation Hierarchy

Computer Architecture (expanded view)

- Problem
- Algorithm
- Program/Language
- System Software
- SW/HW Interface
- Micro-architecture
- Logic
- Devices
- Electrons
What Do I Expect From You?

- **Required background:** Digital circuits course, programming, an open mind willing to take in many exciting concepts

- **Learn the material thoroughly**
  - attend lectures, do the readings, do the exercises, do the labs

- **Work hard:** this will be a hard, but fun & informative course

- **Ask questions, take notes, participate**

- **Perform the assigned readings**

- **Participate online (lecture, Moodle)**

- **Start early**

- **If you want feedback, come to office hours**

- **Remember “Chance favors the prepared mind.”** (Pasteur)
What Do I Expect From You?

- How you prepare and manage your time is very important

- There will be many lab and homework assignments
  - They will take time
  - Start early, work hard

- This will be a heavy course
  - However, you will learn a lot of fascinating topics and understand how a computing platform works
  - And, it will hopefully change how you look at and think about designs around you
How Will You Be Evaluated?

- Lab assignments: 50%
- Final exam (180 minutes): 30%
- Homeworks: 20%

- Many extra credit possibilities in HWs, Labs, Exam
Course Goals

- Goal 1: To familiarize those interested in computer system design with both fundamental operation principles and design tradeoffs of processor, memory, and platform architectures in today’s systems.
  - Strong emphasis on fundamentals, design tradeoffs, key current/future issues
  - Strong emphasis on looking backward, forward, up and down

- Goal 2: To provide the necessary background and experience to design, implement, and evaluate a modern processor by performing hands-on simulator implementation.
  - Strong emphasis on functionality, hands-on design & implementation, and efficiency
  - Strong emphasis on making things work, realizing ideas
Course Website

- [https://safari.ethz.ch/architecture/fall2022/](https://safari.ethz.ch/architecture/fall2022/)
- All slides, lecture videos, readings, assignments to be posted
- Plus, other useful information for the course
- Check frequently for announcements and due dates
Homework 0

- Is due Oct 10
  - [https://safari.ethz.ch/architecture/fall2022/lib/exe/fetch.php?media=hw0.pdf](https://safari.ethz.ch/architecture/fall2022/lib/exe/fetch.php?media=hw0.pdf)

- Information about yourself

- All future grading is predicated on homework 0
Heads Up

- Lab 1 is already out
  - Due in ~2 weeks after release

- HW1 will be out soon
  - Due in ~2 weeks after release

- Check the website and your email frequently for assignments and announcements
  - [https://safari.ethz.ch/architecture/fall2022/](https://safari.ethz.ch/architecture/fall2022/)

- My goal is to enable your learning and growth, so labs can be done any time until the end of the semester
  - But, please know yourself and plan accordingly
Richard Hamming
``You and Your Research''

Transcription of the
Bell Communications Research Colloquium Seminar
7 March 1986

If you really want to be a first-class scientist, you need to know yourself, your weaknesses, your strengths, and your bad faults, like my egotism. How can you convert a fault to an asset? How can you convert a situation where you haven't got enough manpower to move into a direction when that's exactly what you need to do? I say again that I have seen, as I studied the history, the successful scientist changed the viewpoint and what was a defect became an asset.

In summary, I claim that some of the reasons why so many people who have greatness within their grasp don't succeed are: they don't work on important problems, they don't become emotionally involved, they don't try and change what is difficult to some other situation which is easily done but is still important, and they keep giving themselves alibis why they don't. They keep saying that it is a matter of luck. I've told you how easy it is; furthermore I've told you how to reform. Therefore, go forth and become great scientists!
Suggested Talk on Mindset & Research

Applying to Grad School & Doing Impactful Research

Onur Mutlu
omutlu@gmail.com
https://people.inf.ethz.ch/omutlu
13 June 2020
Undergraduate Architecture Mentoring Workshop @ ISCA 2021

Panel talk at Undergraduate Architecture Mentoring Workshop at ISCA 2021
(https://sites.google.com/wisc.edu/uar...)

https://www.youtube.com/watch?v=83tlorht7Mc&list=PL5Q2soXY2Zi8D_5MGV6EnXEJHnV2YFBJl&index=54
Onur Mutlu,
"SAFARI Research Group: Introduction & Research"
Talk at ETH Future Computing Laboratory Welcome Workshop (EFCL), Virtual, 6 July 2021.
[Slides (pptx) (pdf)]