

INTRODUCTION AND LOGISTICS

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Assistant Professor

School of Computing

University of Utah

Overview

- This lecture
 - ▣ Instructor
 - ▣ Teaching assistants
 - ▣ Course resources and requirements
 - ▣ Academic integrity
 - ▣ Computer architecture
 - ▣ Trends and challenges

Instructor

- Mahdi Nazm Bojnordi
 - ▣ Assistant Professor of School of Computing
 - ▣ PhD degree in Electrical Engineering
 - ▣ Personal webpage: <http://www.cs.utah.edu/~bojnordi/>
- Research in Computer Architecture
 - ▣ Novel Memory Technologies
 - ▣ Energy-Efficient Hardware Accelerators
 - ▣ Research Lab. (MEB 3383)
 - Opening positions are available!
- Office Hours (MEB 3418)
 - ▣ Please email me for an appointment
- Class webpage: <http://www.cs.utah.edu/~bojnordi/classes/6810/s18/>

Teaching Assistants

- Payal Guha Nandy

- ▣ Email: payalgn@cs.utah.edu

- ▣ Office Hours: Thu. 12:00-2:00 PM

- ▣ MEB 3115



- Yomi Karthik Rupesh

- ▣ Email: yomikarthik@gmail.com

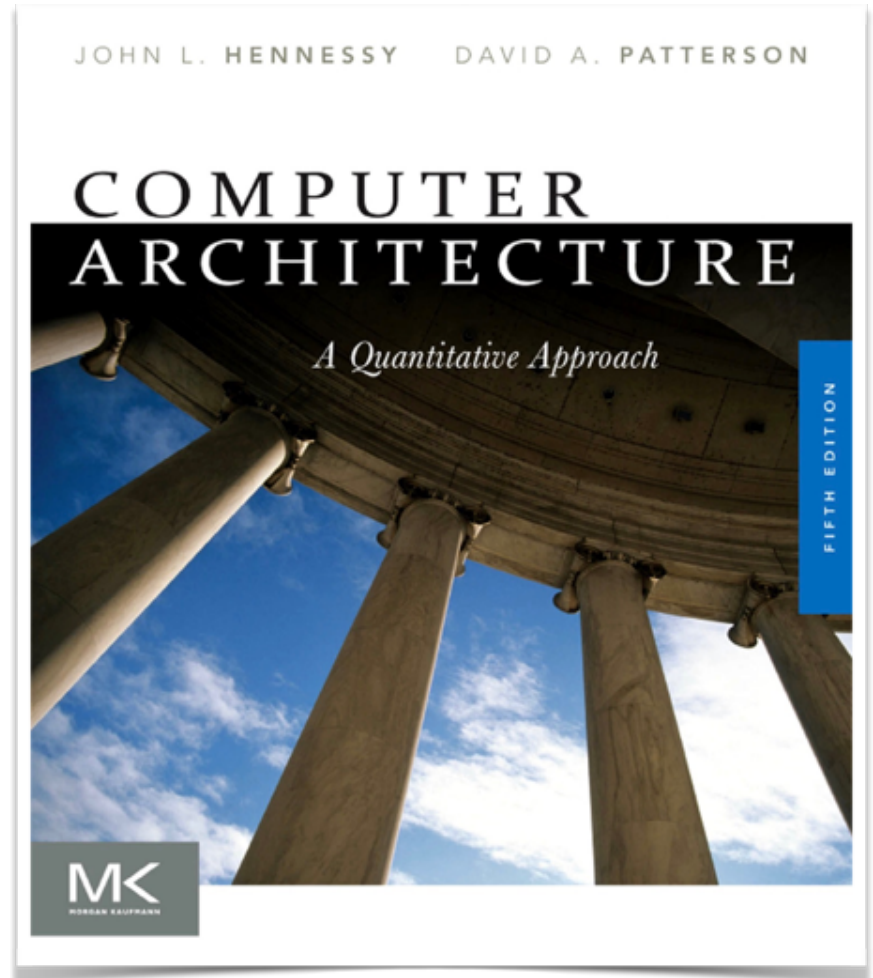
- ▣ Office Hours: Tue. 11:30-1:30 PM

- ▣ MEB 3115



Resources and Requirements

- Textbook: Computer Architecture A Quantitative Approach - 5th Edition, John Hennessy and David Patterson
- Pre-requisite: CS/ECE 3810 or equivalent



Course Expectation

- We use Canvas for homework submissions, grades, and homework announcements.
- Grading

	Fraction	Notes
Assignments	40%	homework assignments
Midterm Exam	30%	In-class, Monday, March 5th
Final Exam	30%	Thursday, April 26th
Class Participation	--%	Questions and answers in class

Homework Assignments

- Homework assignments will be released on Canvas; all submissions must be made through Canvas.
- Only those submissions made before midnight will be accepted.
- Any late submission will be considered as no submission.

	Release Date	Submission Deadline
Homework 1	January 17th	January 30th
Homework 2	January 31st	February 13th
Homework 3	February 14th	February 25th
Homework 4	March 14th	March 27th
Homework 5	March 28th	April 10th
Homework 6	April 11th	April 18th

Academic Integrity

- Do NOT cheat!!
 - ▣ Please read the Policy Statement on Academic Misconduct, carefully.
 - ▣ We have no tolerance for cheating
- Also, read to the College of Engineering Guidelines for disabilities, add, drop, appeals, etc.

Important Policies

Please refer to the [College of Engineering Guidelines](#) for disabilities, add, drop, appeals, etc. Notice that we have zero tolerance for cheating; as a result, please read the [Policy Statement on Academic Misconduct](#), carefully. Also, you should be aware of the [SoC Policies and Guidelines](#).

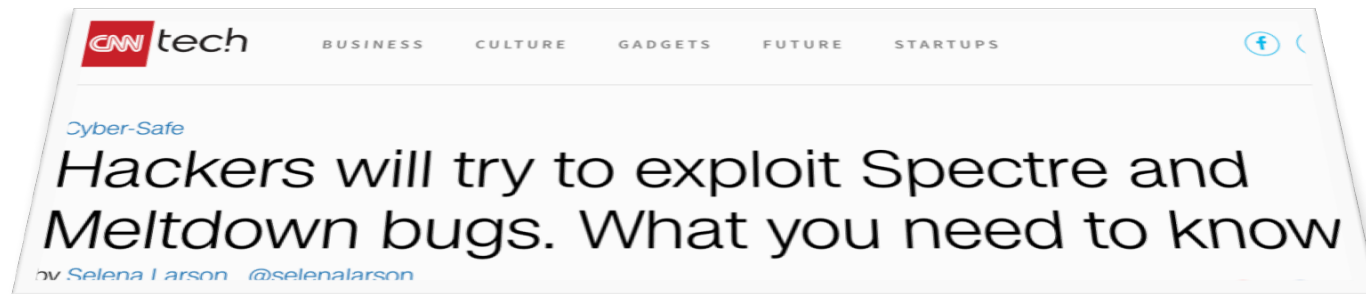
Class rosters are provided to the instructor with the student's legal name as well as "Preferred first name" (if previously entered by you in the Student Profile section of your CIS account). While CIS refers to this as merely a preference, I will honor you by referring to you with the name and pronoun that feels best for you in class, on papers, exams, group projects, etc. Please advise me of any name or pronoun changes (and please update CIS) so I can help create a learning environment in which you, your name, and your pronoun will be respected.

Why CS/ECE 6810?

- ☐ Need another qualifier/graduation requirement?
- ☐ You plan to become a Computer Architect?
- ☐ Understand what is inside a modern processor?
- ☐ Want to use the knowledge from this course in your own field of study?
- ☐ Understand the technology trends and recent developments for future computing?
- ☐ ...

Why CS/ECE 6810?

- Better understanding of today's computing problems
 - ▣ Security flaw: Spectre and Meltdown



- ▣ How to fix?



Estimated Class Schedule

- Processor Core
 - ▣ Introduction and Performance Metrics
 - ▣ Instruction Set Architecture and Pipelining
 - ▣ Instruction-Level Parallelism
 - ▣ Compiler Optimization
 - ▣ Dynamic Instruction Scheduling
- Memory System
 - ▣ Cache Architecture
 - ▣ Virtual Memory
 - ▣ Main Memory and DRAM
 - ▣ Data Parallel Processors

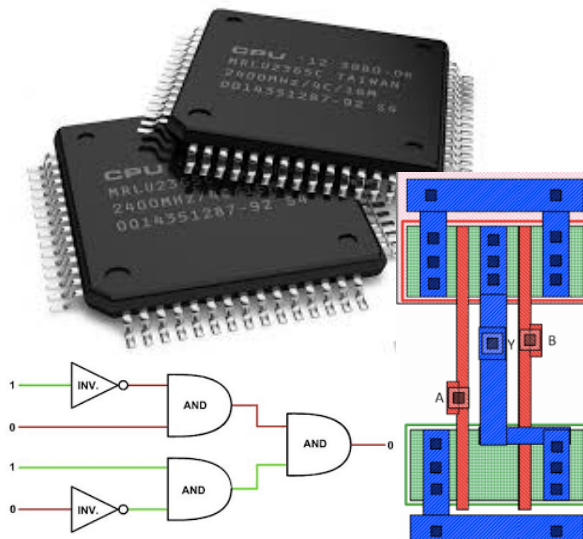
What is Computer Architecture?

- Computer systems are everywhere ...

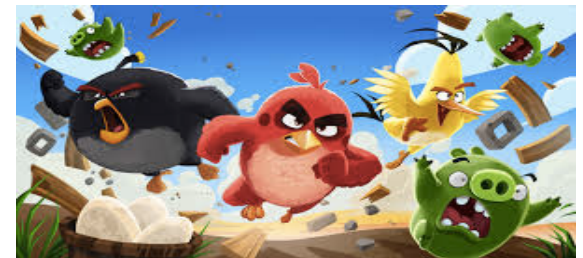


What is Computer Architecture?

- What is inside modern processors ...



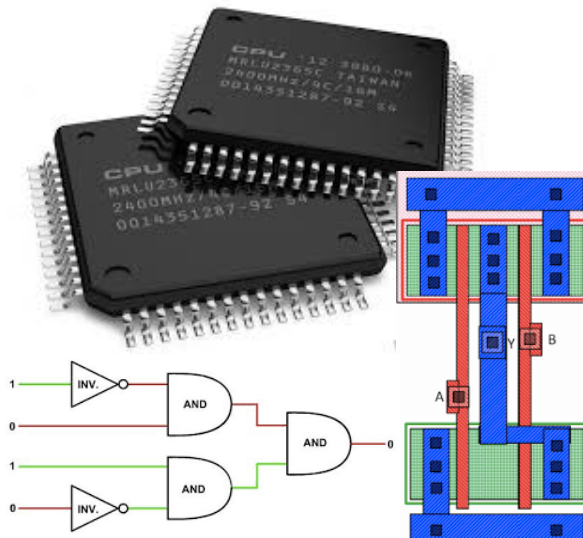
VLSI Circuits
Hardware Implementation



Software Applications
OS and Compiler

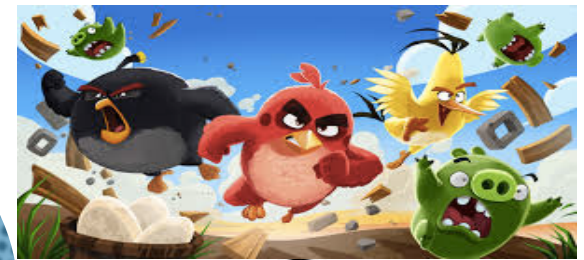
What is Computer Architecture?

- Computer architecture is the glue between software and VLSI implementation



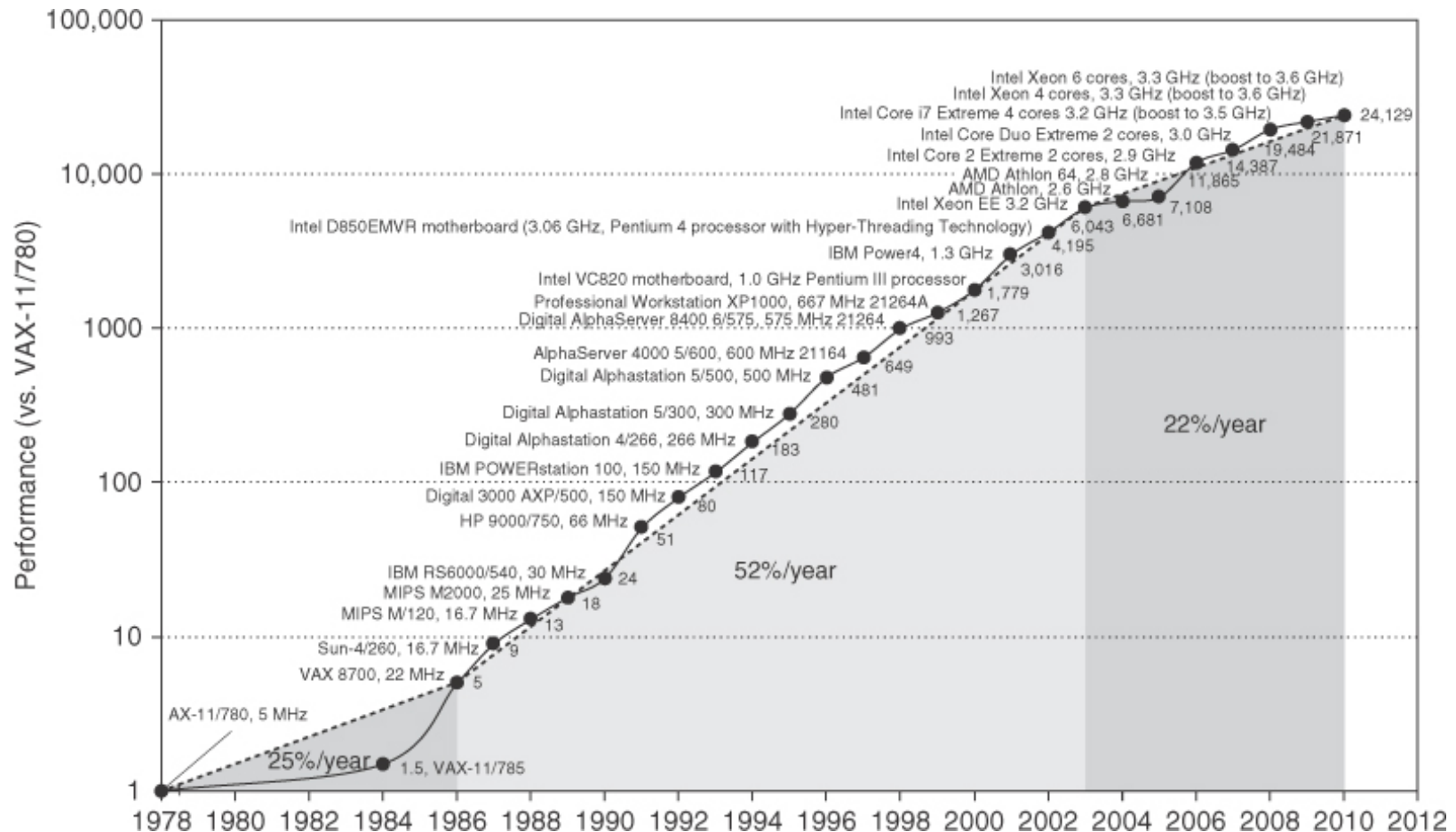
VLSI Circuits
Hardware Implementation

ISA,
 μ architecture
, system
Architecture



Software Applications
OS and Compiler

Growth in Processor Performance



Source: Hennesy & Patterson Textbook

Growth in Processor Performance

- Main sources of the performance improvement
 - ▣ Enhanced underlying technology (semiconductor)
 - Faster and smaller transistors (Moore's Law)
 - ▣ Improvements in computer architecture
 - How to better utilize the additional resources to gain more power savings, functionalities, and processing speed.

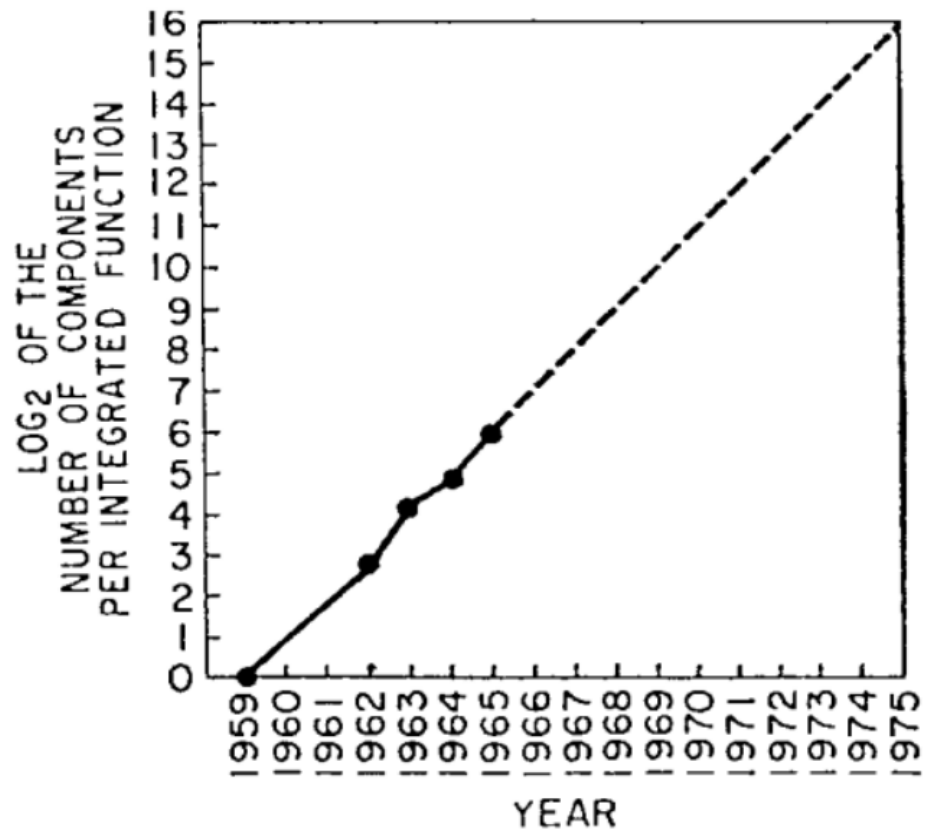
Moore's Law

- Moore's Law (1965)

- ▣ Transistor count doubles every year

- Moore's Law (1975)

- ▣ Transistor count doubles every two years



Source: G.E. Moore, "Cramming more components onto integrated circuits," 1965

What are New Challenges?

- Resources (transistors) on a processor chip?
 - ▣ Not really, billions of transistors on a single chip.
- Can we use all of the transistors?
 - ▣ Due to energy-efficiency limitations, only a fraction of the transistor can be turned on at the same time!
- Who is affected?
 - ▣ Server computers by the peak power
 - ▣ Mobile and wearables due to energy-efficiency