Topic 0

Course Introduction

Instructional Support

- **Instructor:** Gang Zheng, Ph.D.
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- **Office Hours:** W 4:00-6:00pm / Th 10:00am-12:00pm, or by appointment
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- **TA Office Hours:** TBD

What will be taught?

- How computers execute programs?
- What's the correspondence between different levels of languages: C/C++, assembly, and machine language?
- How to design a processor (datapath and controller) as a digital system?
- What are the difficulties and tricks in the design of a CPU? How to resolve? How to improve?
- How memory works as part of a computer, and how is it organized?
- How processor, memory, and I/O devices work together as a computer?

What you are expected to obtain

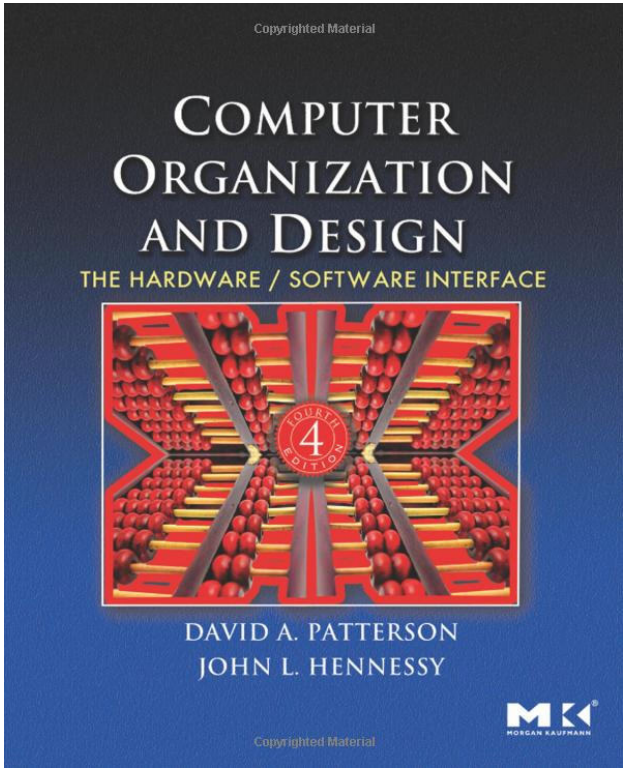
- Write an assembly language program that implements a task, translate the program into machine-level instructions, and trace the execution of the program.
- Model the computer hardware including datapath and control logic for a given instruction-set architecture by using hardware description languages (HDLs).
- Be able to identify and resolve potential data and control hazards
- Understand memory hierarchy including cache, main memory, hard disk, and how data is stored, understand memory hits and misses
- Understand the memory mapped I/O concept and how I/O devices interface the CPU
- Be able to use library and internet resources for literature search to learn the comtemporary issues, technologies, and future development trends in computing

Topics to Cover

- Introduction to computer
- Software
  - MIPS instruction set, operands, operations, assembly programming
  - Instruction encoding, addressing mode
  - Procedures, memory usage, procedure calling conventions
- Hardware – CPU
  - Single cycle processor implementation
  - Pipelined datapath and control
  - Data hazards, control hazards, exceptions
- Hardware – Memory and other peripherals
  - Cache, virtual memory, virtual machine
  - I/Os devices and interfaces
- *Advanced topics*
  - *Parallelism, Multicores, multiprocessors, clusters*

Textbook

- David Patterson and John Hennessy, *Computer Organization and Design - Hardware/Software Interface*, 4th edition, Morgan Kaufmann, 2008, ISBN 978-0-12-374493-7



Course Policies

- Honor Code
  - All students in the class are bound by the Honor Code of the Joint Institute (see the related sections in JI *Student Handbook* for details).
  - You may not seek to gain an unfair advantage over your fellow students
  - You may not consult, look at, or possess the unpublished work of another without their permission
  - You must appropriately acknowledge your use of another's work
  - Anyone violating Honor Code in an assignment/exam will receive 0 point for that assignment/exam
- Attendance
  - Attendance will be recorded randomly
  - 5% will be deducted from the final grade for each absence starting from the 4^{th} one.

Course Policies

- Evaluation methods
  - About 9 homework assignments, will not be graded, will be discussed in the classes, will be helpful for exams
  - 4 projects (on software, hardware modeling, memory modeling, literature review), reports and demonstration
  - 2 exams (paper based)
- Submission
  - project reports are due on a specified date and should be submitted electronically on Canvas.
  - No late submission will be accepted.

Course Policies

- Individual Assignments
  - Project 1 and 4
  - Literature search homework
  - Students are encouraged to discuss course topics and assignments with each other
  - However, all submissions must represent your own work. Duplicated submission is absolutely not allowed and will trigger an honor code violation investigation.
- Group Assignments
  - Project 2 and 3
  - Team of 3 students
  - The work submitted must reflect the work of the team.
  - The grade for a group assignment will be shared among the entire team equally, unless specified differently.

Grading Policy

Homework	0%
Literature search homework*	2%
Midterm Exam 1	30%
Final Exam	30%
Project 1*	5%
Project 2**	25%
Project 3**	5%
Project 4*	3%
Total	**100%**

*Individual assignments

**Group assignments

Note: final letter grades may be curved