# Great Ideas in Computer Architecture (Machine Structures)

CS 61C at UC Berkeley with Stephan Kaminsky, Sean Farhat, Jenny Song - Summer 2020

Lecture: Online

Textbooks:

- *Computer Organization and Design RISC-V Edition, 1st ed.* by David Patterson, and John Hennessy
- *The C Programming Language, 2nd ed.* by Brian Kernighan and Dennis Ritchie
- *The Datacenter as a Computer* by Luiz André Barroso and Urs Hölzle, freely available [here](#)

| By Week | Lectures | Discussions | Labs | Homeworks | Projects | Exams |
| --- | --- | --- | --- | --- | --- | --- |

| Week 1 | Lec 1  6/22 | Lec 2  6/23 | Lec 3  6/24 | Lec 4  6/25 | Materials | Assignments |
| --- | --- | --- | --- | --- | --- | --- |
| | Intro, Number Representation [ Video ] [ Slides ] Readings: P&H; 2.4, Binary slides , Course Policies | C Intro, Pointers [ Video ] [ Slides ] Readings: K&R; Ch. 1-5, Brian Harvey's Intro to C | C Arrays, Strings [ Video ] [ Slides ] Readings: K&R; Ch. 5-6 | C Memory Management [ Video ] [ Slides ] Readings: K&R; Ch. 7.8.5, 8.7 | Discussion 1: Number Representation (Solutions, Video) | Homework 1: Number Rep Due 6/26 |
| | | | | | Lab 0: Intro and Set Up | Homework 2: C Concepts Due 6/30 |
| | | | | | Discussion 2: C Basics (Solutions, Video) | Project 1 Due 7/1 |
| | | | | | Lab 1: Number Rep, C and CGDB | |

| Week 2 | Lec 5  6/29 | Lec 6  6/30 | Lec 7  7/1 | Lec 8  7/2 | Materials | Assignments |
| --- | --- | --- | --- | --- | --- | --- |
| | Floating Point [ Video ] [ Slides ] Readings: P&H;:3.5, 3.9 , IEEE 754 Simulator | Intro to Assembly Language, RISC-V Intro [ Video ] [ Slides ] Readings: P&H;:2.1-2.3, 2.9-2.10 | RISC-V, RISC-V Functions [ Video ] [ Slides ] Readings: P&H;:2.6-2.8, 3.2 | RISC-V Instruction Formats [ Video ] [ Slides ] Readings: P&H;:2.5, 2.10 | Discussion 3: Floating Point (Solutions, Video) | Homework 3: Floating Point Due 7/2 |
| | | | | | Lab 2: Advanced C | Homework 4: RISC-V Due 7/7 |
| | | | | | Discussion 4: RISC-V Intro, RISC-V Control Flow, ISA (Solutions, Video) | Project 2 Due A: 7/8 B: 7/12 |
| | | | | | Lab 3: RISC-V Assembly | |

| Week 3 | Lec 9  7/6 | Lec 10  7/7 | Lec 11  7/8 | Midterm 1  7/9 Up to CALL | Materials | Assignments |
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| | | | | | Discussion 5: RISC-V | Homework 5: Logic, |

| | | | | | Materials | Assignments |
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Compiler, Assembler, Linker, Loader (CALL) [ Video ] [ Slides ]

Readings: P&H;:2.12

Combinational Digital Logic [ Video ] [ Slides ]

Readings: SDS Handout

Sequential Digital Logic [ Video ] [ Slides ]

Readings: P&H;:A.3-A.6 , State Handout

[ Blank ] [ Solutions ] [ Blank Full ] [ Solutions Full ]

Procedures, CALL (Solutions, Video)

Lab 4: RISCV Functions, Pointers

Discussion 6: SDS, Logic, FSM (Solutions, Video)

Timing Due 7/13

| Week 4 | Lec 12 7/13 | Lec 13 7/14 | Lec 14 7/15 | Lec 15 7/16 | Materials | Assignments |
|---|---|---|---|---|---|---|

**Lec 12** 7/13

RISC-V Datapath, Single-Cycle Control Intro [ Video ] [ Slides ]

Readings: P&H;:4.1. 4.3

**Lec 13** 7/14

RISC-V Single-Cycle Control and Pipelining [ Video ] [ Slides ]

Readings: P&H;:4.4

**Lec 14** 7/15

RISC-V 5-Stage Pipeline / Hazards [ Video ] [ Slides ]

Readings: P&H;:4.6-4.10

**Lec 15** 7/16

Memory Hierarchy, Fully Associative Caches [ Video ] [ Slides ]

Readings: P&H;:5.1-4, 5.8-5.9, 5.13 , Cache Flowchart

Discussion 7: Single-Cycle Datapath (Solutions, Video)

Lab 5: Logisim

Discussion 8: Pipelining and Hazards (Solutions, Video)

Lab 6: Pipelining and CPU, Mid Semester Survey

Homework 6: RISC-V Datapath Due 7/17

Homework 7: Caches Due 7/22

Project 3 Due A: 7/16 B: 7/24

| Week 5 | Lec 16 7/20 | Lec 17 7/21 | Lec 18 7/22 | Lec 19 7/23 | Materials | Assignments |
|---|---|---|---|---|---|---|

**Lec 16** 7/20

Caches–Direct-mapped, set-associative [ Video ] [ Slides ]

Readings: P&H;:5.1-5.4, 5.8-5.9, 5.13 , Cache Flowchart

**Lec 17** 7/21

Mutilevel Caches, Cache Questions [ Video ] [ Slides ]

Readings: P&H;:5.1-5.4, 5.8-5.9, 5.13 , Cache Flowchart

**Lec 18** 7/22

Operating Systems & Virtual Memory [ Video ] [ Slides ]

**Lec 19** 7/23

Virtual Memory [ Video ] [ Slides ]

Readings: P&H;:5.7-5.8

Discussion 9: Caches (Solutions, Video)

Lab 7: Caches

Discussion 10: I/O, OS (Solutions, Video)

Lab 8: Virtual Memory

Homework 8: OS and I/O Due 7/28

Homework 9: Virtual Memory Due 7/28

Project 4 Due 8/6

| Week 6 | Lec 20 7/27 | Lec 21 7/28 | Midterm 2 | Lec 22 7/30 | Materials | Assignments |
|---|---|---|---|---|---|---|

**Lec 20** 7/27

Virtual Memory and I/O

**Lec 21** 7/28

Flynn Taxonomy, Data-Level

**Midterm 2**
7/29
Up to Virtual Memory

**Lec 22** 7/30

Amdahl's Law, Thread-level

Discussion 11: Virtual Memory

Homework 10: Performance

[ Video ]
[ Slides ]

Parallelism
[ Video ]
[ Slides ]

Readings:
P&H;:2.11,
4.10, 5.10,
6.5

[ Blank ]
[ Solutions ]
[ Blank Full ]
[ Solutions Full ]

Parallelism, OpenMP Introduction
[ Video ]
[ Slides ]

Readings:
P&H;:2.11,
4.10, 5.10,
6.5 ,
OpenMP Summary Card

(Solutions, Video)

Lab 9: SIMD Instructions

Programming and Dependability
Due 8/10

| Week 7 | Lec 23    8/3 | Lec 24    8/4 | Lec 25    8/5 | Materials | Assignments |
|---|---|---|---|---|---|
| | Multithreading Issues, Cache Coherency [ Video ] [ Slides ] Readings: The Datacenter as a Computer:Ch 1, Ch 2.4, Ch 3, 5.1-5.3 , P&H;:6.7 | Warehouse Scale Computing, MapReduce (Spark) [ Video ] [ Slides ] Readings: The Datacenter as a Computer:Ch 1, Ch 2.4, Ch 3, 5.1-5.3 , P&H;:6.7 | Dependability and Redundancy [ Video ] [ Slides ] Readings: P&H; 5.2, 5.5, 5.11 | Discussion 12: AMAT, Data-level Parallelism (Solutions, Video) Lab 10: Thread Level Parallelism Discussion 13: Coherency and Atomic, Parallelism (Solutions, Video) Lab 11: Spark / Dependability | Homework 11: ECC, Parity & Potpourri Due 8/10 |
| Week 8 | Lec 26    8/10 | Lec    8/12 | Final    8/13 | Materials | Assignments |
| | Summary [ Video ] [ Slides ] | Using Buffer Overflows to Speedrun Super Mario Bros. 3 Readings: Optional lecture from CS161 from 5-6pm PT | Covers all material [ Blank ] [ Solutions ] [ Blank Full ] [ Solutions Full ] | Discussion 14: WSC, RAID, (Spark, Map Reduce), Parity & ECC (Solutions, Video) | |

CS 61C    Calendar    Staff    Policies    Piazza    Venus    Resources    Semesters    Back to top