

Fundamentals of Computer Systems

Review for the Final

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The Final

3 hours

8–10 problems

Closed book

Simple calculators are OK, but unnecessary

One double-sided $8.5 \times 11''$ sheet of your own notes

Much like homework assignments

- ▶ Number Representation
 - ▶ Binary, Octal, Hex
 - ▶ One's, Two's Comp.
 - ▶ Fixed-point, BCD
- ▶ Boolean Logic
 - ▶ Axioms, Simplification
 - ▶ Implicants, Minterms
 - ▶ De Morgan's Theorem
 - ▶ Karnaugh Maps
- ▶ Combinational Logic
 - ▶ Decoders
 - ▶ Multiplexers
 - ▶ Timing and Glitches
 - ▶ Adders
- ▶ Sequential Logic
 - ▶ Bistables; SR, D Latches
 - ▶ D Flip-Flops
 - ▶ Synchronous Logic
 - ▶ Shift Registers
 - ▶ Counters
- ▶ Finite State Machines
 - ▶ Moore and Mealy Machines
 - ▶ The Snail Example
 - ▶ The TLC: One-Hot Encoding
- ▶ CMOS Logic Gates
 - ▶ The Inverter
 - ▶ The CMOS NAND Gate
 - ▶ The CMOS NOR Gate
 - ▶ A CMOS AND-OR-INVERT Gate
 - ▶ General Static CMOS Gates
- ▶ Memories
 - ▶ ROMs, EPROMs, FLASH
 - ▶ The SRAM Cell
 - ▶ Dynamic RAM Cell
 - ▶ PLAs and FPGAs

- ▶ MIPS Architecture/Assembly programming
 - ▶ Computational, Load/Store, & Control-flow Instrs.
 - ▶ Instruction Encoding
 - ▶ Pseudoinstructions
 - ▶ Calling Conventions
 - ▶ Higher-level constructs; subroutines and recursion
- ▶ MIPS Microarchitecture/Datapaths
 - ▶ Single-Cycle
 - ▶ The datapath for lw, sw, R-type, and branch
 - ▶ The controller: instruction decoding
 - ▶ Processor Performance
 - ▶ Multi-cycle
 - ▶ Constructing the datapath
 - ▶ The FSM controller
 - ▶ Performance Analysis
 - ▶ Pipelined
 - ▶ Basic pipelined datapath and control
 - ▶ Hazards: forwarding, stalling, and flushing
 - ▶ Performance Analysis

- ▶ The Memory Hierarchy: Caches
 - ▶ Memory hierarchy to make it fast & cheap
 - ▶ Temporal and Spatial Locality
 - ▶ Memory performance; hit rate
 - ▶ Direct-mapped caches
 - ▶ n -way set associative caches
 - ▶ Fully associative caches