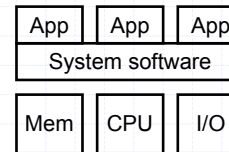


CSE 371

Computer Organization and Design

Midterm Review

Midterm Review



- Introduction
- ISAs
- Digital logic & single-cycle datapath
- Performance
- Integer & floating point arithmetic
- Pipelining

- Resources:
 - Homework solutions
 - Past exams

- Note: cheat sheet, calculator

Introduction

- Binary tree motivating example
 - Average lookup time vs size of tree
 - Distribution of repeated lookups of each leaf in tree
- Abstraction & the hardware/software interface
- Analogy with building architecture
 - Technology, Design Constraints/Goals, Applications/Domains
- Moore's law
 - Rapid technology change

ISAs

- ISA as hardware/software interface
- Sequential (fetch/execute) model
- Comparative ISAs
 - LC3 vs P37X vs MIPS vs x86 vs ...
- Performance
 - $\text{instruction/program} * \text{cycles/instruction} * \text{seconds/cycle}$
- Impact/role of the compiler
- CISC vs RISC
- ISA choices
 - Data types, registers, memory, addressing modes, branching types, instruction encoding
- Virtual ISAs, micro-operations

Digital Logic & Single-Cycle Datapath

- Digital logic review
 - Common structures (mux, decoder, PLAs, etc.)
 - Register file
- Simple datapath (single-cycle)
 - Implementing control

Performance

- Latency vs bandwidth (throughput)
- Comparing performance
 - Benchmarks
- Amdahl's Law
- Clock frequency vs CPI

Integer & Floating Point Arithmetic

- Integer
 - Addition (ripple carry)
 - Addition (carry select)
 - Shift and rotation
 - Multiplication (multi-cycle & tree based)
 - Division (software & hardware)
 - Latency of the above
- Floating point
 - Basic idea (scientific notation)
 - Addition, multiplication, division
 - Range, precision, accuracy
 - Latency of above (and vs integer)

Pipelining

- Pipelining
 - Basic pipelining vs multi-cycle vs single-cycle
 - Pipeline diagrams
 - Performance calculations
 - Structural hazards (& ways to deal with them)
 - Data dependences (& ways to deal with them)
 - Bypassing
 - Load-use delay
 - Multi-cycle operations (multiply)
 - Control dependencies (branches & branch prediction)
 - Pipeline depth
- Superscalar
 - Basic idea of multiple issue (CPI < 1)