CS:APP Chapter 4
Computer Architecture
Overview

Randal E. Bryant

Carnegie Mellon University

`http://csapp.cs.cmu.edu`

Course Outline

Background

- Instruction sets
- Logic design

Sequential Implementation

- A simple, but not very fast processor design

Pipelining

- Get more things running simultaneously

Pipelined Implementation

- Make it work

Advanced Topics

- Performance analysis
- High performance processor design

Coverage

Our Approach

- **Work through designs for particular instruction set**
  - **Y86---a simplified version of the Intel IA32 (a.k.a. x86).**
  - **If you know one, you more-or-less know them all**
- **Work at "microarchitectural" level**
  - **Assemble basic hardware blocks into overall processor structure**
    - » Memories, functional units, etc.
  - **Surround by control logic to make sure each instruction flows through properly**
- **Use simple hardware description language to describe control logic**
  - **Can extend and modify**
  - **Test via simulation**
  - **Route to design using Verilog Hardware Description Language**
    - » See Web aside ARCH:VLOG

Schedule

Week #1

- Instruction set architecture
- Logic design

Assignment: Write & test assembly code programs

Week #2

- Sequential implementation
- Pipelining and initial pipelined implementation

Assignment: Add new instructions to sequential implementation

Week #3

- Making the pipeline work
- Modern processor design

Assignment: Optimize program+pipeline for maximum performance