Chapter 1: Fundamentals of Computer Design (Part 1)

What is computer architecture?
Why study computer architecture?
Common principles
What is Computer Architecture?
Instruction set architectures

Most ISAs today are general-purpose register based

Operands may be registers or memory locations

Register-memory vs. load-store

Addressing modes

Register, immediate, displacement, …

Operand sizes

8 bits, 16 bits, 32 bits, 64 bits, SP and DP FP

Operations: Arithmetic, memory, control flow, floating point

Encoding: fixed vs. variable length

Action no longer in ISA

But not always the case: CISC vs. RISC – what happened?

Our main focus: organization
Goals of the Computer Architect
Why Study Computer Architecture? - Historical Trends

- Performance (vs. VAX-11/780)

- Intel Xeon 6 cores, 3.3 GHz (boost to 3.6 GHz)
- Intel Xeon 4 cores, 3.3 GHz (boost to 3.6 GHz)
- Intel Core i7 Extreme 4 cores, 3.2 GHz (boost to 3.5 GHz)
- Intel Core Duo Extreme 2 cores, 3.0 GHz
- Intel Core 2 Extreme 2 cores, 2.9 GHz
- AMD Athlon 64, 2.8 GHz
- Intel Xeon EE 3.2 GHz
- AMD Athlon, 2.6 GHz
- Intel VC820 motherboard, 1.0 GHz Pentium III processor
- IBM Power4, 1.3 GHz
- IBM POWERstation 100, 150 MHz
- Digital AlphaStation 5/200, 300 MHz
- Digital AlphaStation 5/466, 266 MHz
- IBM RS/6000/540, 30 MHz
- VAX 8700, 22 MHz
- VAX-11/780, 5 MHz

- 25%/year
- 52%/year
- 22%/year
Why Study Computer Architecture?
Relationship to Prerequisites

Prerequisite
  How to design a uniprocessor?

This course
  How to design a uniprocessor WELL?
    Emphasis on Quantitative vs. Qualitative
  How to design a multiprocessor?

Be sure to check the handout for details on the prerequisites