Topics for the First Midterm

CS 315-01

Spring, 2016

The following topics may be covered on the first midterm.

• Chapter 1 and Related Material
  – Why knowledge of computer architecture is important for software developers.
  – Interpretations of performance: execution time, throughput, power consumption.
  – Hardware components: I/O, memory, datapath, control
  – Relation between high-level language, assembly language, and machine language.
  – Compiler, assembler.
  – Instruction set architecture
  – Application binary interface
  – Performance is the reciprocal of execution time, or execution time per program.
  – Wall clock vs CPU time.
  – Clock frequency vs. clock period.
  – The classic cpu performance equation:

\[
\text{CPU time} = \frac{\text{Instruction Count} \times \text{CPI}}{\text{Clock Frequency}}.
\]
- CPI
- Prefixes used for very large and very small values (e.g., tera, giga, ..., micro, nano, pico)
- Growth in processor performance since the 1980’s. Its relation to power consumption. Why designers switched to multicore architectures.
- Consequences of parallelism for performance improvements
- Moore’s law
- Speedup
- Amdahl’s law
- Relation between power consumption and CPU utilization.

**Chapter 2**
- MIPS registers and conventions for their usage.
- MIPS memory layout: stack, heap, static data, program text.
- Manipulation of stack pointer, return address.
- MIPS core instructions
- Basic use of Mars/Spim simulators
- Register usage and conventions
- Scope of registers, memory
- Instructions vs pseudoinstructions
- Use of syscall
- .text, .globl, .data, .asciiz
- Branches and loops in MIPS
- Function calls/returns in MIPS
- Words vs. bytes
- Array element addressing
- Allocating memory on the stack
- Program break, **sbrk** system call, allocating memory on the heap
- Recursion
– Reading the green sheet
– Representation of unsigned numbers: binary, octal, hexadecimal, decimal.
– Converting between representations.
– Representation of signed numbers: sign-magnitude, one’s complement, two’s complement
– Range of $n$-bit two’s complement integers.