**Ch 2 Instructions**

Book Sections 2.1 - 2.7 (up to p80), 2.9

- **Types of Instructions**
  - arithmetic/logical
  - load and store
  - control (branch/jump)
  - instructions with immediate operand (i.e. addi)

- **Instruction Formats**
  - Know all 3 formats
    - The meaning of each field, number of bits in each field
  - Know the format for each instruction.

- **Memory Access**
  - load/store operations only
  - alignment restriction
  - Base addressing
  - PC-relative addressing
  - Pseudoindirect addressing

- **Types of Operands**
  - register addressing
  - memory addresses (load/store only)
    - base, offset
  - labels (branch/jump instructions)
  - immediate addressing

- **Machine Code**
  - Know what an assembler does
  - Be able convert MIPS assembly to machine code by hand
  - (given tables with opcodes and register codes)
  - Be able to convert machine code to assembly code by hand
  - (Except for addresses)

**Ch. 3 Numbers**

Book Sections 3.1- 3.4, 3.6 (up to p202)

- 2's complement
  - conversion to/from sign magnitude
  - subtraction in 2's complement
• Sign Extension
• Overflow
  - interrupts
  - non-overflow instructions
• Multiplication
  - basic algorithm (2 positive numbers)
  - simple datapath
• Floating Point
  - normalization, biasing
  - addition/subtraction
  - adder/subtractor datapath

Ch. 4 Performance

Book Sections 4.1 - 4.3

• Fundamentals
  o Response Time (latency)
  o Throughput
• Execution Time
  o Elapsed time, CPU time, system time, user time
  o Performance, speedup ("X times faster")
  o Clock frequency, cycle time
  o Execution time = cycles/program * cycle time