



ECE4680
Computer Organization & Architecture
Midterm Review

Effective learning requires reading the textbook, attending classes, looking at my class materials, adding your own notes to the class materials, doing large amount of exercises.

ECE 4680 Midterm Test

I have neither given nor received unauthorized assistance on this quiz.

Signed: _____ Date: _____

Do not open without the permission from instructor.

Read the following rules before you start to answer:

This test is open-book and open-notes.

- 1) You may use calculator.**
- 2) You are allowed 100 minutes from 5:30PM to 7:10PM.**
- 3) Write your answer on the exam pages. No additional pages are provided. It is your responsibility to compress your answer into allowed space. You may use back pages for scratch purpose.**
- 4) Do not ask any questions during the whole examination.**

Wayne State University

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Chapter 2 Performance Evaluation

- Many measures: execution time, throughput, cost, MIPS, ...
- Time is the most important measure.
 - Time = program length \times instruction length \times cycle length
 - Program length = instructions / program
 - Instruction length or CPI = cycles / instruction = Weighted Arithmetic Mean
 - Cycle length = seconds / cycle = $1 / F$
 - Speed = F / CPI
 - How to use such formulae?
- Amdahl's Law
 - Meaning: speed is limited by unimproved part of program.
 - How to use Amdahl's Law
- Benchmarks
 - Why benchmarking?
 - Average Performance: AM, GM, HM. Which mean should be used?

Chapter 3 ISA

- Concepts:
 - Different IS architectures: Stack, accumulator, register-memory, register-only (load/store)
 - Byte addressing, word address,
 - word alignment: big endian and little endian.
 - Base address and offset/displacement
 - RISC and CISC
- MIPS
 - Addressing mode: register, immediate, displacement
 - Instruction format: R-format, I-format, J-format
 - Basic instructions: see inner back cover of the textbook
 - Write the instructions in decimal form?
 - Given an assembly program, what is the meaning?
 - Given a requirement or a C program, write the corresponding assembly program.

Chapter 4 ALU Design

- Number representation
 - Integer Number
 - BASE: Decimal number, binary number, octal number and hexadecimal number. **How to convert between different base?**
 - REPRESENTATION: Unsigned number, sign and magnitude, and 2's complement. **How to represent a given integer?**
 - Floating Pointer Number
 - Range and precision
 - Excess M or Bias M
 - Normalized form
 - IEEE 754 standard: single precision and double precision.
 - Rounding
 - special values for NaN, Infinity
 - **How to represent a floating point number?**
 - **How to add, multiply FP numbers?**
 - For N bits, **what is the range of one representation?**

Chapter 4 ALU Design (Continue)

- Adder Design
 - Design Process: requirement → truth table → logical equation → logical diagram or Gate circuit.
 - Ripple carry and carry lookahead: advantages and disadvantages.
- ALU Design
 - Capable of executing typical instructions such as add, subtract, compare and branch, logical operations, shift.
 - Overflow
- Multiply and Divide
 - From 3 versions of multiply to see successive refinement.
 - Either left-shift multiplicand or right-shift product.
 - Use the same hardware of adder for multiply and divide.
 - 3 versions of divide: similar to multiply.
- Booth Algorithm
 - Motivation behind Booth Algorithm.
 - **How to multiply by Booth Algorithm?**

Good Luck