

CSCI 2321 (Principles of Computer Design), Spring 2004

Review for Final

1 Format of the exam

The exam will be at the scheduled exam period, May 5 at 6:30pm. It will be about twice the length of the midterm and so should take about two hours, but you will have the whole three-hour exam period if you need it. You may use your textbook and any notes or papers you care to bring, but you may not use other books, *a calculator or computer*, or (of course) each other's papers.

The exam will be comprehensive but will focus on material since the midterm (approximately two-thirds of the questions/points will be about material from the second half of the course).

Most questions will be similar in form to those in the homework assignments, quizzes, and midterm.

2 Lecture topics to review

You are responsible for all material covered in class, but the following is a summary of topics I think are most important.

- (*Review*) Terminology from chapter 1; the five classic components of a computer.
- (*Review*) Defining and measuring performance; relationship among execution time, clock rate, cycle time, and cycles per instruction.
- (*Review*) Idea of “instruction set architecture” (as the interface between hardware and software).
- (*Review*) MIPS instructions described in chapter 3 — usage and binary (machine-language) representation.
- (*Review*) Compilers, assemblers, linkers, and loaders.
- (*Review*) MIPS conventions for procedure calls.
- (*Review*) Binary, decimal, and hexadecimal number systems; two's complement notation.
- (*Review*) Computer arithmetic (on integers): addition, subtraction, multiplication and division (basic ideas only, not details of algorithms), overflow.
- (*Review*) MIPS instructions for manipulating bits (`sll`, `srl`, `and`, `or`, etc.).
- (*Review*) AND and OR gates and inverters, and how to use them to implement Boolean functions.
- (*Review*) Design of an ALU.
- (*Review*) Floating-point representation and arithmetic (basic ideas only, not details).
- Combinational-logic blocks versus state elements.

- State elements and the clock cycle.
- Design of a datapath for a single-cycle implementation of our selected subset of MIPS instructions: what elements are needed, how to connect them, what control signals are needed.
- Generating control signals for our single-cycle implementation — what elements we need (two combinational-logic blocks), their inputs and outputs, how outputs depend on inputs (expressed via truth tables and/or Boolean functions).
- How the completed single-cycle implementation (datapath and control) executes example instructions.
- Why a single-cycle implementation isn't really practical.
- Design of a datapath for a multiple-cycle implementation of our selected subset of MIPS instructions — what elements are needed, how to connect them, what control signals are needed, how to break instructions down into single-cycle steps.
- Generating control signals for our multiple-cycle implementation — how to express what we want as a finite state machine, how to implement a FSM, how to express what we want in terms of microprogramming, (briefly) how to implement microprogramming.
- How the completed multiple-cycle implementation (datapath and control) executes example instructions.
- Extending the datapath and control to support exceptions (interrupts).
- A little about pipelining — how it can help, the basic idea (assembly-line analogy), what makes it tricky (the “hazards”).
- A very little about memory hierarchies (caching and virtual memory), buses and I/O, and multiple processors.

3 Reading to review

See Lecture Topics and Assignments¹ for a complete list of reading. The following is a list of sections to read more carefully and/or review.

- (*Review*) In chapter 1: 1.2.
- (*Review*) In chapter 2: 2.1, 2.2, and 2.3.
- (*Review*) In chapter 3: 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.8, and 3.9.
- (*Review*) In chapter 4: 4.1, 4.2, 4.3, 4.4, 4.10 (first two pages), 4.11.
- In chapter 5: 5.1, 5.2, 5.3 (except material on performance), 5.4 (except material on performance), 5.5, and 5.6.
- In appendix B: B.1 through B.6 (except pages B-10 through B-17 and B-27 through B-35).
- In appendix C: C.3 (up through page C-12) and C.4.
- In chapters 6 through 9: Just skim the assigned sections, skipping anything that isn't mentioned in the class notes.

¹http://www.cs.trinity.edu/~bmassing/Courses/CS2321_2004spring/schedule.html