Exam #2 review
ECE 429/629 Fall 2004

This exam will be closed-book, closed-notes.

Exam will consist of
- Short answer questions
- detailed datapath / control logic questions on a 5-cycle pipelined MIPS machine
- pipeline timing diagram question (with floating point hardware)
- miscellaneous question on static branch prediction, IEEE floating point, and/or exceptions

For the exam, students should be able to
- define the following terms: issue, execute, commit, dependence, hazard, precise exception, exact rounding
- list and describe the different types of dependences and hazards
- for a 5-stage MIPS pipelined machine,
  - explain its relationship to a single-cycle or multi-cycle machine
  - for each cycle of a given program, identify which instruction is in which pipeline register
  - list the values of the pipelined control lines for each cycle of a given program (including forwarding and hazard detection)
  - describe the extra H/W needed to resolve branches in the ID/RF stage
  - explain how the register file “forwards” data to itself by writing in the first half of the clock cycle
- given a piece of assembly code,
  - identify the data dependences
  - identify the potential instructions for a delayed branch slot
  - fill a pipeline diagram (with F,D,X,M,W, etc. – including floating point)
  - fill in a scoreboard diagram
- compare and contrast various static branch prediction techniques
- compute the speedup from pipelining
- identify which hardware modifications lead to out-of-order execution and out-of-order completion, and identify the potential data hazards that result
- for the IEEE 754 floating point spec,
  - list the special floating point numbers
  - given a 32-bit binary number and a description of the spec, derive the floating point number that is represented
  - determine whether adding a certain number (e.g., 0.1 or 0.25) in floating point introduces roundoff error, and why

Sample short answer questions:
- What is the hardest part of designing the control of a computer?
- What is a “precise exception”?
- What is the difference between a “dependence” and a “hazard”?
• What are the three types of hazards?
• What are the three types of data hazards?
• What type of data dependence is introduced by having multiple functional units?
• What may become out-of-order?
• What type of data hazard is caused by out-of-order execution?
• When was the IEEE floating point spec finalized? When did Intel introduce its 8087 math coprocessor?
• What is pipelining?
• What is the hardest part of designing the control of a computer?
• Even if a computer is listed as IEEE 754-compliant, what part of the spec might not be fully implemented?