Winter ’12 CIS 429/529 Midterm Review

You may bring one page of notes, front and back.

You may bring a calculator but shouldn’t need one.

Questions will be in short-answer format with partial credit for partial answers.

Topics:

- Performance metrics: execution time, speedup, Amdahl’s law
- Caching: principal of locality, set associativity, placement, lookup, replacement, write policies
- Basic cache optimizations: reducing compulsory, capacity, and conflict misses
- Advanced cache optimizations: compiler optimizations
- Pipelining: latency versus throughput, CPI, structural/data (RAW)/control hazards
- Branch prediction: 2-bit saturating predictors, local/global/correlating predictors
- Data dependencies: true/name, antidependencies (WAR), output dependencies (WAW)
- Static scheduling: pipeline scheduling, loop unrolling
- Dynamic scheduling: Reservation Stations for register renaming (buffering operand values)
- Speculation: Reorder Buffer for enforcing commit order, instruction transactions
- Multiple issue: benefits/drawbacks of dynamic versus static scheduling

Sample questions:

1. [10] Assume that you have an architecture which runs a specific benchmark in 10 seconds. Now assume that you can improve the architecture to run 30% of the instructions with a speedup of 6. What is the new execution time and overall speedup?


3. [10] How many total bits of memory are required to implement a (4, 2) global predictor?

4. [10] Assume that computer A operates at 2.0 Ghz and runs a particular benchmark with a CPI of 1.5 and that computer B operates at 1.0 Ghz and runs the same benchmark with a CPI of 1. Which is the faster computer for this benchmark? Why?

5. [10] Briefly explain how a Reorder Buffer allows an out-of-order processor to safely execute speculative instructions: