Additional Topics for the Final Exam

CS 315-01
Spring, 2015

In addition to the possible topics from the two midterms, the following topics may be covered on the final exam.

• Data Hazards
  – Forwarding EX to EX, EX to MEM, MEM to EX
  – Writeback to register for earlier instruction can overlap register-read for later instruction
  – Stalls, NOPs
  – Compiler reordering

• Control Hazards
  – Branch decision in EX stage vs ID stage
  – Branch taken vs fall-through.
  – Static branch prediction
  – Delayed branches or branch slots

• Cache
  – Memory hierarchy
  – Principle of temporal and spatial locality
  – Cache line/block
  – Collision, eviction
  – Hit, miss, hit rate, miss rate, hit time, miss penalty.
  – Direct-mapped cache.
  – Valid bit, tag, Index, word offset (block offset in text), byte offset.
  – Actual cache size vs data storage size
  – Miss rate vs cache size, line size
  – Miss rate and memory access time
  – Early restart, critical/requested word first
- Handling a read hit/miss
- Write-through vs write-back cache
- Write buffers
- Write-allocate vs no-write-allocate
- Dirty bit
- Split vs unified caches
- Memory stall cycles, AMAT
- N-way set-associative caches, fully associative cache.
  * Effect of set size on miss rate.
  * Replacement scheme: least recently used, random, or some less expensive variant of LRU
- Multilevel caches.
  * Performance of multilevel caches
  * Design considerations for multilevel caches: L1 minimize hit time, L2 minimize miss rate.