Final Exam Review

CS 351: Systems Programming
Michael Saelee <lee@iit.edu>
Coverage

- Memory hierarchy
- Caching
- Virtual Memory
- Dynamic Memory Allocation
- Garbage Collection
- I/O
Memory Hierarchy

- types & relative speeds of memory
- motivation for hierarchical design
- temporal & spatial locality
- registers vs. cache (code vs. hardware memory optimization)
Caching

- Direct-mapped / Fully-associative / Set-associative
- Hit/Miss rates
- Write policies: write-through/back; write-around/allocate
- Multi-level caching
- Cache optimization
Virtual Memory

- Roles of MMU & OS
- Impl: Simple relocation / Segmentation / Paging (pros/cons)
- Motivation for TLB
- Multi-level paging
- Page size / Page table size computations
Dynamic Memory Allocation

- Basic (C) API
- Role of OS vs. User in memory/heap management
- “Self-describing” block features: metadata + payload
- Impl: Implicit list / Explicit list / Segmented fits (pros/cons)
- Metrics: throughput & utilization
Garbage Collection

- Motivation
- Impls: reference counting vs. garbage collection (pros/cons)
- Conservative GC in C (why?)
- Mark & Sweep implementation
I/O

- Unix FS as namespace architecture
- V-node → OFD → FD breakdown: architecture & motive
- I/O buffering: motive & effects
Written Problems

- Cache hit/miss rate computation (i.e., cache simulation)
- VM → PM translation & Cache lookup
- Malloc/Free implementation (based on implicit list)
- Garbage collection (mark & sweep)