

Final Exam Review



CS 351: Systems Programming
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Coverage

- Memory hierarchy
- Caching
- Virtual Memory
- Dynamic Memory Allocation

Memory Hierarchy

- Types & relative speeds of memory
- Motivation for hierarchical design
- Temporal & spatial locality
- Code vs. Hardware memory optimization

Caching

- Direct-mapped / Fully-associative / Set-associative
 - Terminology and organization
- Write policies: write-through/back; write-around/allocate
- Multi-level caching
- Cache optimization

Virtual Memory

- Roles of MMU & OS
- Impls: Simple relocation / Segmentation / Paging (pros/cons)
- Motivation for TLB
- Multi-level paging
- VA \rightarrow PA translation procedure

Dynamic Memory Allocation

- Basic (C) API
- Role of OS vs. User in memory/heap management
- “Self-describing” block features: metadata + payload
- Impls: Implicit list & Explicit list (pros/cons)

Exam format

- Multiple choice questions: concepts & computations
- ~2-4 Written problems
- ~1-2 Coding problems

Computational questions

- [Mem] Relative/Absolute speeds of SRAM/DRAM/etc.
- [VM] page table size, num memory accesses
- [DMA] Aggregate payload / Peak memory utilization
- [DMA] Block size (given payload request); Min block size

Written Problems

- Cache/Array mapping and lookup (i.e., cache simulation)
- VM \rightarrow PM translation & Cache lookup
- DMA operation and implementation (implicit list)

Coding problems

- Cache optimization (e.g., via blocking)
- Implicit list implementation
 - e.g., block splitting/coalescing, heap navigation/search