Sample Midterm Exam Questions

1. Suppose a computer has a 4-way set associative cache with one-word blocks. It has a capacity of 256 bytes. Given the sequence of byte addresses 8, 64, 96, 128, 64, 96, 256, 192, 24 show the nal cache contents and state the number of hits and misses.

2. A machine has a base CPI of 2 clock cycles. Measurements obtained show that the instruction miss rate is 12% and the data miss rate is 6%, and that on average, 30% of all instructions contain one data reference. The miss penalty for the cache is 10 cycles. What is the total CPI?

3. A machine has a 500MHz system clock. Memory takes 30 ns to access a word. How many clock cycles is this?

4. A machine has a 32-bit virtual address space and a 16KB page size. It has 1GB of physical memory. How many pages does a process have? How many bytes are needed for a page table, assuming 4 control bits and that disk addresses are stored elsewhere?

5. A machine with a two level cache has a base CPI of 1.5 when all references hit the primary cache. Given the following characteristics:

   - a clock rate of 250MHz
   - memory access time of 100ns
   - miss rate at the primary cache of 5%
   - secondary cache access time of 10ns
   - miss rate at secondary cache of 1%

   what is the total CPI?

6. Draw a picture showing the organization of a direct-mapped cache with 16 words per block, with a capacity of 128KB. Show any multiplexors, gates, needed. Show how a 32-bit physical address is mapped to a cache block.