Homework #3, 10 points

Due Friday, 24 October at the beginning of class or by e-mail before the beginning of class. (Los Alamos students: having the proctor fax them to me or send them via courier is also okay as long as they're stamped as having been turned in Wednesday). Half credit if turned in before the test on Friday, 10 October. There will be no extension.

You can always stop by my office or e-mail if you have any questions or need help, but you can also e-mail me your answers and I'll reply with which ones are right and which ones are wrong.

1 (6 points). For each of the following caches, what will be the number of sets, the number of lines per set, and the number of bits in the tag? Assume a 32-bit, physically addressed, byte-addressed, word-aligned cache (like a typical MIPS processor would have).

a. A direct mapped, 8KB cache with 128-byte cache lines.

b. A fully associative, 128 KB cache with 256-byte cache lines.

c. A 4-way set-associative cache, 1MB in size, with 512-byte cache lines.

d. An 8-way set-associative cache, 1 MB in size, with 512-byte cache lines.

e. A 4-way set-associative cache, 1 MB in size, with 128-byte cache lines.

f. A 4-way set-associative cache, 2MB in size, with 512-byte cache lines.

2 (4 points). For each of the following four scenarios, identify the most likely culprit as compulsory misses, capacity misses, or conflict misses. (Although a given program and cache can suffer from two or three of the "3 C's," for these questions just identify the most likely one.)

a. The working set of a program is 1 MB, and you have a single 256 KB cache. What is the most likely reason for the miss rate to be high when you run that program?

b. When you first boot the machine, the miss rate is very high throughout the bootup process. Why might this be?

c. The working set of your program is 8 KB, and the memory accesses are at a very regular stride. Your cache is 256 KB, yet you still have a high miss rate. Why might this be?

d. On a 1 MB fully associative cache, a very large Java program exhibits a high miss rate. What's the most likely cause?