Computer Organization, Fall, 2013

Lab 6: Cache Simulator

Due: 2013/1/6 23:59:59

1. Goal

Cache performance is important for system performance. In this lab, you are demanded to simulate cache behaviors by C/C++ style cache simulators. By this training, you will understand the performance difference between different cache architectures.

2. Basic Problem (60%)

a. Tracing the memory addresses in the CPU (single cycle or pipelined CPU) by the file "lab6_test_data.txt". The file is a 3-way matrix multiplication program.

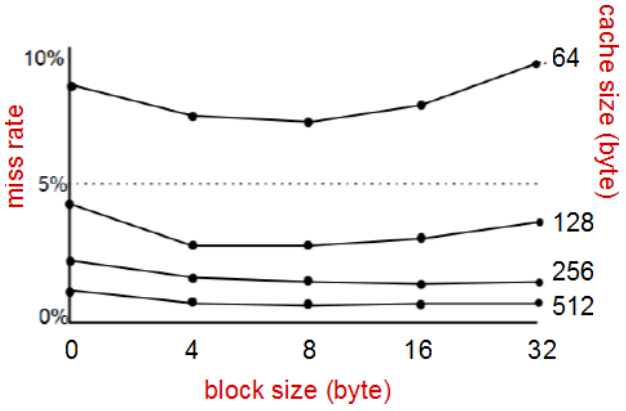
b. The supplied files are described as follows:

TestBench.v -

A verilog testbench, please refer to it and then modify your CPU to get the memory addresses when the program is running.

direct_mapped_cache.cpp –

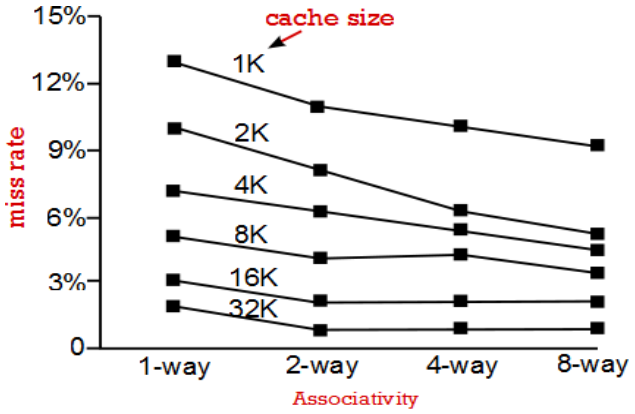
A simple cache simulator, please take the file "ICACHE.txt" and "DCACHE.txt" that are produced by the CPU, as inputs of the simulator and then running it. Changing the parameters (cache size or block size) when you do the simulation. Please draw a graph as the following example and describe the reason of rise and fall of the lines in the report. (Please separate ICACHE from DCACHE).



3. Advanced Problems (60%)

a. (40%)In this problem, you have to implement a n-way set-associative cache simulator (by

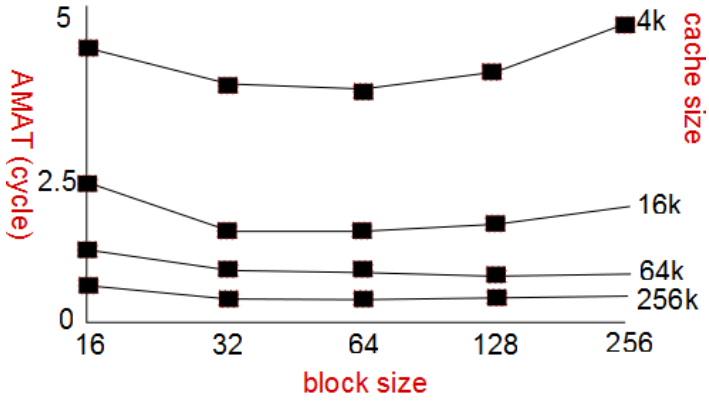
C/C++) (LRU replacement policy). Inputting the file LU.txt and RADIX.txt that are the memory trace from two benchmarks to the simulator. Please draw a graph as the following example and describe the reason of rise and fall of the lines in the report. (Please separate LU from RADIX).



b. Bonus(20%)

In this problem, you have to implement a 2-level cache. Please set the parameters of caches as follows: L1 cache size is 1Kbyte, block size is 4byte, 4-way, and L2 cache is 4-way.

Suppose that L1 access time = 1 cycle, L2 access time = 10 cycles, memory access time = 100 cycles. Changing L2 cache size and block size and then calculating the AMAT (average memory access time). Please list the formula of AMAT and draw a graph as the following example in your report. (Please separate LU from RADIX).



4. Grade

a. Total: 120 points, **Copy will get 0 point!**

b. Basic: 60 points, advanced: 60 points

c. Delay: 10% off/day

5. Hand in

Please submit your file to e3.

Please compress your report and the code (if you have done advanced problems) into one single file.

The file should be named : student ID1_student ID2.rar **(Format must be correct or you will get some penalty)**

6. Q&A

If you have any queston, please go to course forum: https://sites.google.com/site/nctuco/q-a-forum