Computer Organization
Lab 6: Cache Simulator

Due: 2020/7/12 23:55

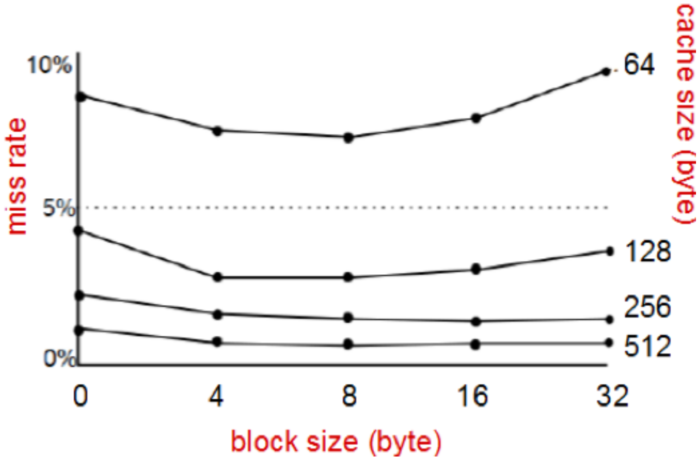
1. Goal

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.

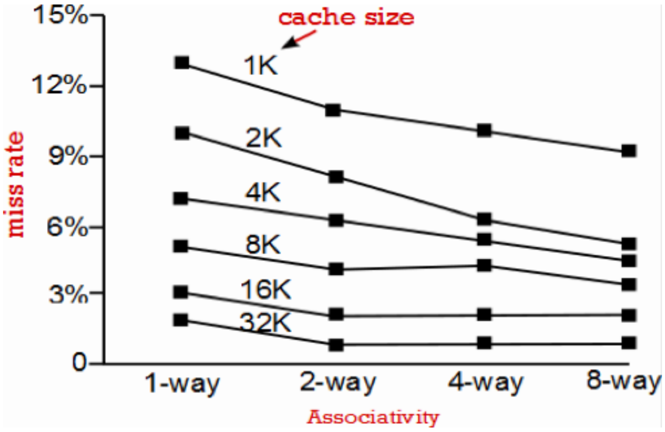
2. Problem

In this problem, you have to implement an n-way set-associative cache simulator (LRU replacement policy). Inputting the file Trace.txt that is the memory trace from a benchmark to the simulator. We will supply the direct_map_cache.cpp file, you can refer to this and implement your program.

a. Fix the associativity on 1 (direct_map_cache), and then observe the difference when adapting the cache size and block size. Please draw a graph as the following example and describe the reason of rise and fall of the lines in the report.



b. Fix the block size on 32 (byte), and then observe the difference when adapting the cache size and associativity. Please draw a graph as the following example and describe the reason of rise and fall of the lines in the report.



3. Input/Output

- Input
    a. memory trace file (Trace.txt)
    b. block size (16B to 256B)
    c. cache size (1KB up to256KB)
    d. associativity (from direct-mapped to fully associative)
- Output
    a. miss rate (%)
    b. Hits instructions
    c. Miss instructions

4. Execution Example

- Input: Trace1.txt (byte address)

```
0xbfa437cc
0xbfa437c8
0xbfa437c4
0xbfa437c0
0xbfa437bc
0xbfa437b8
0xbfa437b8
0xbfa43794
0xb8088ea8
0xb8088eac

cache size    = 1024 (bytes)
block size    = 32   (bytes)
associativity = 2
```

- Output

```
Hits instructions: 2,3,4,6,7,10
Misses instructions: 1,5,8,9
Miss rate: 40%
```

5. Requirements

a. Please implement this Lab in C/C++ language.
b. One person form a group.
c. Please submit your file to E3.
d. Please compress your report and the code into one single file. The file should be named as: student_ID.zip (Format must be correct or you will get some penalty)
e. Files to upload
    i. code (.cpp/.c/.h)
    ii. report (.pdf)
    iii. test file (Trace.txt)

7. Grade

a. **Total:** 100 points (Report 20% / Program 80%)
b. **Late submission:** No late submission is allowed.
c. **Score of this Lab is a reference to bias the final score of this course!**