ECE 6373: Advanced Computer Architecture

Course Project

<u>Fall 2018</u>

Due: 11:59PM CST, Dec 10, 2018

This course project has to be done individually.

In this course project, you will be asked to use the SimpleScalar "sim-outorder" model and the SPEC 2000 benchmark suite to evaluate the performance impact of a number of basic cache configuration parameters, such as the L1 and L2 cache size, associativity, block size, and so on.

The following is a list of example configurations you can start with, you are not required to exactly follow them, and you are free to think out and try any configuration you would like to test. Actually, if you can try some other configurations besides the following ones, I will give you some bonus on your project.

a) Instruction cache size (compare 8KB, 32 KB and 64KB, block size and associativity follow the default configuration)

b) Data cache size (compare 2KB, 32KB, and 128KB, all 4-way set associative, block size follow the default configuration)

c) Data cache associativity (compare 1-way, 2-way, 8-way, all 32KB, block size follow the default configuration)

d) L2 cache size (compare 128KB, 512KB, and 1MB, block size and associativity follow the default configuration)

e) L1 and L2 block size (compare 32B, 64B, 128B, and 256B, cache size and associativity follow the default configuration)

You are suggested to run the simulator using the default parameters except for the parameters under study to better evaluate the impact of the configurations on the performance. You are suggested to run each SPEC2000 benchmark for 100 million instructions after skipping 100 million instructions. **Note**: skipping a large number of instructions is quite important to warm up the cache, and run a relatively large number of instructions is important to get more accurate results.

The results should be compared by using the number of instructions per cycle (IPC), cache miss rate, the number of load/store instructions, and any other useful information you can obtain from the simulator outputs for the executed program.

You are asked to write a report in which you should present the results (a good method to present results is drawing figures), analyze the results, and draw conclusions about the impact of the above cache configurations on the performance.

Report format highlights:

- Report must be submitted in printable PDF format.
- Text must be in 11pt font size, double column, single-spaced.
- There is no page limitation on the report. Generally, the report should be approximately 2-4 pages long.

Submission:

The project report will due 11:59PM CST 12/10/2018. Please submit your report via the blackboard.

Late project report will be accepted with 15% penalty per day up to two days.

Simulator and Benchmarks

You are able to download the SimpleScalar simulator and the SPEC2000 benchmark suite from the blackboard.

Whereas SimpleScalar is an older simulator, you will find that it is well established and still widely used. Here are a few links to get you started, but a quick google search should provide you with everything that you need:

SimpleScalar home page

SimpleScalar Technical report

SimpleScalar Hacking Guide (for version 2 but you will use the slightly different version 3)

SimpleScalar Toolset version 3.0