

ECE 462/562

Homework 2

Due: Monday, February 13, 11.59pm.

- *Work in your project groups. Assign benchmarks to different group members. Each group member must run simulations for at least one of the benchmarks.*
- *This homework assumes some basic knowledge of Linux commands (e.g., cd, tar, etc.) If you don't know how to do something, Google it, or interact with your colleagues.*

Analyze MiBench benchmarks

You are tasked with performing the design time cache design space exploration for a range of applications represented by the MiBench benchmarks. The cache has a minimum bank size of 2 KB—each bank represents a cache way—and multiple banks can be combined to form a larger cache up to a maximum physical size of 8 KB (in power of two increments). For each cache configuration, cache line sizes can range from 16 B to 64 B.

You need to perform the design space exploration to determine the data cache configuration that achieves the best instructions per cycle (IPC) and data cache miss rate, given a static instruction cache configuration. Using SimpleScalar's **sim-outorder**, run complete simulations of the complete design space for all the MiBench benchmarks. For each benchmark, report the data cache configuration that achieves the best IPC and data cache miss rate, and the improvement over the base configuration.

Assume the following static configurations:

iCache configuration: 8 KB size, 4-way set associative, 64 B line size

Base dCache configuration: 8 KB size, 4-way set associative, 64 B line size

iCache and dCache access latency: 1 cycle

Memory latency: 80 cycles

Processor: inorder

You may write a Perl script (or any other language) to automate your simulations and parse the results. Use the following command:

```
$simplescalar/sim-outorder -cache:il1 il1:8:64:4:1 -cache:dl1 dl1:<size>:<line_size>:<associativity>:1 -  
cache:il1lat 1 -cache:dl1lat 1 -mem:lat 80 2 -issue:inorder -redir:sim <statistics_output_file> $cmd
```

The specified options override the default. Only the options in '<>' need to be changed as necessary in your simulations. \$cmd is the benchmark and command line options for the benchmark.

Report the following information in the provided *analyze_mibench.txt* file (examples shown):

Group member (the group member who ran the experiments for this benchmark): Gary Oldman

Benchmark: crc

Base IPC: 1.72

Best IPC: 1.69

IPC improvement (%): 1.7

Best IPC configuration (size KB, assoc-way, line size B): 8 KB, 4-way, 64 B

Base dCache miss rate: 0.038

Best dCache miss rate: 0.036

dCache miss rate improvement (%): 5.2

Best dCache configuration (size KB, assoc-way, line size B): 8 KB, 4-way, 32 B