1. Objectives

The main objective of this project is the cache performance evaluation. Cache performance is determined by the elements of cache design such as line size, cache size, and replacement algorithm. This project is to run the SMPCache simulator with various combinations of parameter values and then evaluate the cache performance (i.e., the hit ratio) under different configurations.

2. Requirements

The only requirement for this project is to learn how to use the software, that is, the SMPCache simulator. The getting started manual of the simulator will help.

3. Development

3.1. Part 1

Configure a system with the following architectural characteristics:

- Processors in SMP: 8
- Cache coherence protocol: MESI
- Scheme for bus arbitration: Random
- Word wide: 32 bits
- Main memory size: 1024 KB (the number of blocks in main memory will vary)
- Replacement policy: LRU

You have to run the simulation with all possible combinations consisting of the following configurations:

- Configure the words by block using the following 10 configurations: 2 (block size = 8 bytes), 4, 8, 16, 32, 64, 128, 256, 512, and 1024 (block size = 4096 bytes).
- Configure the number of blocks in cache in order to get the following 4 cache sizes: 4 KB, 8 KB, 16 KB, and 32 KB.
- Configure the mapping using the following 5 configurations: Direct, two-way set associative, four-way set associative, eight-way set associative, and fully-associative (remember: Number_of_ways = Number_of_blocks_in_cache / Number_of_cache_sets).

3.2. Part 2

Select the 10 best configurations from Part 1 to evaluate the replacement policy. For each of the ten, configure the replacement policy using the following 4 configurations: Random, LRU, LFU, and FIFO.

Question: How many runs are required?

4. Reports

The professor will assign each group a set of benchmarks (memory traces) to run. Send the professor an e-mail to obtain your benchmark set.

The conclusions of this project about multiprocessors must be typed. Organize your results into tables. Plot graphs to illustrate all sorts of hit ratio comparisons. Analyze and discuss the results of your simulations based on your tables and graphs. Justify your analyses using the theory you learned from the class. What is the best configuration and what is its hit ratio? Why is it the best? Also evaluate and discuss the *locality grade* of your benchmarks.

Include the following parts in your report:

1. Names of the group members and the benchmarks (memory traces) run by your group.
2. Organized tables and graphs of the simulation results (50%). Don't throw unorganized raw data to the professor!
3. Analysis, discussion, evaluation, and justification (40%).
4. Conclusion, comments, suggestions, and what you learned from this project (10%).