McGill University
Department of Electrical and Computer Engineering
Computer Organization and Architecture
ECSE 425 – Fall 2008
Project

Due date: December 2, 2008, 9:30 AM

Deliverables

1. Submit a single .zip file on WebCT including:
    - A single PDF file of your report
    - Your well-written, commented source code.
    - **Other formats / multiple files will not be marked.**

2. Submit a hardcopy version of your report (including your code) in the assignment box.

3. Your submission is not complete without both the hardcopy and electronic versions.

4. In your report, describe how to run your code. We must be able to reproduce your results using the instructions you give.

Summary of the Project

Architectural simulation: This project consists of writing a software behavioral simulator for a dynamic branch predictor.

GENERAL GUIDELINES

- You may make use of reasonable assumptions of your own for those data that might be missing in the following problem text, provided that they are explicitly and clearly stated, and not contrasting with the text itself.

- You may submit a partial project. The grading will be scaled balancing problem complexity and fraction completed.

- You may work on this project alone or in teams of **at most two students**. **Teams of three will NOT be accepted under any circumstances.** If you don't have a partner, see the course instructor. Team partners will be jointly responsible for the whole work, and will receive the same grade. Team partners will submit only one copy of their project report.

- A project should consist of 8 to 14 pages **maximum** of text, plus an appropriate amount of graphical or tabular data. In addition to this text, include an appendix which gives instructions on how to run your code and reproduce your results. The appropriateness and the presentation of the supporting data will influence the mark greatly.

- Remember, your job is to present your work very clearly to those who read the report. It is hard to appreciate a poorly presented design, no matter how clever it is.

DETAILED GUIDELINE

You are to write a software simulator for a dynamic (m,n) branch predictor. The software simulator is to be used to derive statistics relative to the performance as a function of design parameters. For example, predictors would be compared as a function of their complexity and storage requirements.

The input to your simulator will be a *trace file*. The trace file is the result of running a real program and reflects the information about the execution of each branch of the program. An example of a portion of a trace file is given below:

```
4257192 0
4257215 1
…
```

The first entry on each line is the address of a branch instruction and the next entry is a 0 if the branch was not taken and 1 if the branch was taken. The simulator takes as input a trace file and as output produces statistics as to the performance. In all cases, the output should be stored in a file in human readable form.

The simulator should be coded in C, C++, or Java. As any program, its design consists of data structures and algorithms. The data structure must be designed to reflect the storage components, while the algorithm should reflect the logic that controls them. In any case, it is important to design a program which is highly structured so it is easy to debug.

One of the advantages of having a software simulator is that parameters can be changed easily. Model various branch predictors by changing the values of m, n, and the size of the branch history table. Make these parameters easy to change by supplying them to the program as command line options. For input, you should use trace files collected from the execution of actual programs. Such traces are provided to you on WebCT. Plot graphs showing the effect of changing a parameter on the misprediction rate. Also, consider the effect of a “cold start” vs. a “warm start”. A warm start runs the input data once to initialize the history table and then again to collect the statistics. What conclusions can you draw from your results? A discussion of your results is very important.