Project: Evaluating Branch Prediction Strategies

Introduction

In this project, you will implement several branch prediction strategies using SimpleScalar toolset and evaluate them using common benchmarks. Your implementation will be restricted to the *bpred.c/h* files. The branch predictor interfaces to *sim-outorder.c* do not require any modifications.

Description

In this project, you would need to implement the following branch predicition strategies:

- Strategy 7 from the paper "A Study of Branch Prediction Strategies" by James Smith [2],
- G-share predictor [1],
- and a branch predictor of your choice.

You need to compare the branch prediction of these three strategies with the default branch predictor in SimpleScalar (http://www.simplescalar.com). Some benchmarks will be provided by the TA for comparisons, but you are encouraged to find other benchmarks to further compare the performance of all the branch prediction strategies. Explain why each predictor fails to capture the branch behavior of certain benchmarks, if any. Use the statistics provided by SimpleScalar to perform analysis of the data that you get to explain the results. Comment on the effectiveness of branch predictors in terms of misprediction rate and also the IPC.

For the branch predictor of your choice, please do NOT implement a branch prediction using neural networks. If you refer to research papers when you implement your idea (which is not a minus at all), please cite the papers in your report. Otherwise, it will be treated as plagiarism.

Requirement

Source code

Each group must prepare its own solution independently from other groups. The code must be submitted to Sakai, separately from the final report. Electronic means would be used to check for any similarity with existing code or code from other students in class. Any detected source code copy will automatically result in an F with **no exception**.

Final Report

You would need to write a report summarizing the results of your experimental study. Since you shall be exploring a rather large design space, you will need to express your results in a compact and meaningful manner (preferably in the form of graphs or tables). Please write your report as clearly as possible. Feel free to include any comments on how you think one may improve this scheme.

The report should not include only the graphs/tables, but also discuss: What is the problem? Why is it an important problem to solve? What are the methods used to solve the problem?

Do NOT include the code in the final report (the code is submitted separately as stated above). However, pseudocode can be used in the report to illustrate the idea of the method.

Each group should submit only a single copy of the final report and indicate all group members on the report. The report must be submitted in PDF format.

You must indicate any external sources (papers, source code, etc.) you have used in your project.

Demo

You will need to show your evaluation with your benchmarks to the TA during demo session. You will be asked to reproduce some results you showed on the final report and answer some questions from the TA.

Presentation

You will need to prepare a presentation in class at the end of the course.

SimpleScalar Tutorial

The following tutorials are useful when working with SimpleScalar:

SimpleScalar Tutorial

SimpleScalar Hacker's Guide

SimpleScalar User's Guide

References

[1] S. McFarling. Combining Branch Predictors. Technical report, Western Research Laboratory, 06 1993.

[2] J. E. Smith. A study of branch prediction strategies. In *Proceedings of the 8th Annual Symposium on Computer Architecture*, ISCA '81, pages 135–148, Los Alamitos, CA, USA, 1981. IEEE Computer Society Press.