

Problem 0 below has been pre-solved, the solution and other files needed can be found in /data4/koppel/tca/hw03 on the ECE Solaris systems. The techniques used in its solution can be applied to the other problem.

Problem 0: Write an analyzer to determine the prediction accuracy of a first-order finite-context-method (FCM) data predictor for the results produced by integer ALU and load instructions. The prediction accuracy should be given as the fraction of attempted predictions that were correct, the fraction of load and ALU instructions that were correctly predicted, and the net number of correct predictions (correct predictions minus incorrect predictions) per instruction for load and ALU instructions. The following sample output

Used: CT 0.875, PT 0.841.

Hit ratios: CT 0.964, PT 0.798.

Load correct prediction 0.676 per attempt, 0.654 per instruction, net 0.340.

ALU correct prediction 0.654 per attempt, 0.629 per instruction, net 0.296

indicates that of the load instructions for which predictions were attempted 67.6% were correct, that of all load instructions, 65.4% were correctly predicted (the others were either incorrect or no prediction was attempted), and the number of correct predictions minus the number of incorrect predictions per load was 34.0%. The sample output also specifies the hit rate to the context table, 96.4%, and the prediction table, 79.8%.

Problem 1: Find an expression for the amount of memory used by the predictor in the solution to problem zero. The expression should be in terms of the table sizes and any other relevant parameters. Be sure to specify the amount of memory used by the simulated system, not the simulator. If the simulated system can use less memory than the simulator code implies, use the smaller value and explain. *Hint: consider some CT_Entry fields.*

Problem 2: Design and simulate a first-order finite context method (FCM) data predictor that makes efficient use of memory and that has a high number of net correct predictions. (Some form of confidence estimation might be used to withhold a possibly incorrect prediction so that it would be counted as no prediction rather than an incorrect prediction.) Provide an expression giving the amount of memory used by the predictor in terms of relevant parameters, such as number of table entries.

Problem 3: Provide simulation data comparing the prediction accuracy, including the number of net correct predictions, of your design and the problem zero design. The simulation experiments must be chosen so that valid comparisons can be made, perhaps simulating at various predictor sizes. (The sizes can be changed in the solution *and* the problem zero code.) Justify the relative sizes of the different tables used.