Branch Prediction Report

Computer Architecture (CS201)

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Objective:

a. The objective of this report is to evaluate four branch prediction (Always taken, Always not-taken, 1-bit dynamic branch predictor 2-bit dynamic branch predictor) algorithms' accuracy three with respect to three different test cases.

1) **Always taken**:

The control flow features of the programme have a major impact on the accuracy of the always taken strategy. When most of the branches are occupied, it operates effectively. However, its accuracy greatly decreases in programmes that have a combination of taken and not-taken branches. As a result, its accuracy may be poor overall.

Accuracy table:

Algorithm	Accuracy
Quick sort	2.61%
Sqrt test	2.489%
Factorial test	2.27%

2) **Always not-taken**:

As with the always taken strategy, the control flow patterns of the programme have a major impact on how accurate the always not-taken strategy is. When the majority of branches are not taken, it usually performs well. But in

situations when chosen branches are common, it has a significant misprediction rate, which reduces its total accuracy.

Algorithm	Accuracy
Quick sort	97.38%
Sqrt test	97.511%
Factorial test	97.72%

3) 1-bit dynamic branch predictor:

When comparing the 1-bit dynamic branch predictor to static methods like always taken or always not-taken, the former provides higher accuracy. It makes some degree of behavioral adaptation to the programmer by monitoring the results of earlier branches. But because of its oversimplified methodology, it is not as accurate as it may be, especially when branch behavior varies a lot.

Algorithm	Accuracy
Quick sort	99.51%
Sqrt test	99.69%
Factorial test	96.62%

4) 2-bit dynamic branch predictor:

Out of all the algorithms that have been discussed, the 2-bit dynamic branch predictor usually yields the best accuracy. It can better react to changes in the program's control flow and catch more subtle patterns in branch behaviour by using a 2-bit saturating counter. As a result, it outperforms simpler predictors in terms of accuracy rates.

Algorithm	Accuracy
Quick sort	99.95%
Sqrt test	99.94%
Factorial test	97.87%