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CSEN 702: Microprocessors
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Practice assignment 6

Exercise 1

Consider the following pseudo-code

```
a=99;
b=88;

Loop
     a = getInputFromUser();
     b = getInputFromUser();

     if(a==-1) {a=0;}
     if(b==-2) {b=0;}
     if(a==b) {// do something}


goto Loop
```

Assume the user enters -1 for a and -2 for b for two iterations then starts entering -1 for a and anything other than -2 for b.

Part A)

Using a bimodal 1-bit predictor that uses the lower 2 bits of the branch address, track the accuracy of the prediction for 4 iterations. Assume all predictions start as not taken initially. Also assume branch lower 2 bits addresses do not collide.

Part B)

We wish to test the accuracy of a correlated branch predictor that uses the history of 2 branches (GR size =2). Consider a PHT with 1-bit prediction scheme that starts with all “not taken” as default (NT or 0). The GR starts as all zeroes.

Show the contents of the GR register and the PHT after each branch for 4 iterations and compute how many times the prediction was wrong (call the branches br1, br2, br3).

Exercise 2

Consider a global-set predictor that uses the past 4 outcomes of a branch, the lower 3 bits of the PC (excluding the least significant 2 bits) and a 2-bit predictor scheme.
Assume that the branch at address (0000 0001 1001) last outcomes were NT, T, T, T. Show the content of the predictor before and after this branch executes, if the real outcome this time turns out to be NT. Assume that the PHT contains '11' in all fields.

Exercise 3

A) What's the total number of bits (or bytes) needed for the prediction table(s) and additional overhead if any when using the lower 6 bits of the branch address in a bimodal predictor using the 2-bit prediction scheme?

B) What's the total number of bits (or bytes) needed when using the outcome of the 5 previous branches in a global history predictor employing the 2-bit scheme?

C) Consider a Gshare predictor that uses the lower 4 bits of the branch address to concatenate them with the outcomes of the 4 previous branches. What's the total number of bits needed if the scheme was also the 2-bit prediction?

D) Consider a global-set predictor using the lower 3 bits of the branch address, and 2-bit prediction scheme, and the local history of the last 5 outcomes of the branch. What's the total number of bits?
Generalize this value when using the lower K bits of the address, n history outcomes and 2-bit scheme.

E) What's the total size for a (m,2) predictor that uses the lower K bits of the branch address?