

16.482 / 16.561: Computer Architecture and Design

Spring 2014

Homework #3

Due **Thursday, 2/28/13**

Notes:

- While typed submissions are preferred, handwritten submissions are acceptable.
- Any handwritten solutions that are scanned and submitted electronically must be clearly legible and combined into a single file—simply sending a picture of each scanned page is not an acceptable form of submission.
- This assignment is worth a total of 100 points.

1. Branch history tables (50 points) Say you are executing a program that contains the following high-level code snippet:

```
A[8] = {3, 7, 4, 9, 2, 1, 8, 4};
for (i = 0; i < 8; i++) {
    if (A[i] < 5)          { <fall-through code>  }
    else                  { <branch taken code>  }
}
```

When compiled, this code contains two branches, as shown below. The BNE is part of the `if` statement above—if the condition is true, the branch is not taken; if the condition is false, the branch is taken. The BEQ controls the end of the loop.

<u>Address</u>			
<u>Decimal</u>	<u>Hex</u>		
20	0x14	loop	...
			...
40	0x28		BNE R4, R0, else
			...
52	0x34		BEQ R7, R8, loop

Your processor contains an eight-entry, 2-bit branch history table; its state when the processor reaches this code is as follows:

<u>Entry #</u>	<u>Value</u>
0	10
1	11
2	01
3	00
4	01
5	00
6	11
7	10

Determine the overall misprediction rate of the branch predictor for this code.

2. Correlating branch predictors (50 points) Now assume you have a 4-line, (2,2) correlating branch predictor, with all entries initially set to 11. Assume the initial global history is 11. Determine the overall accuracy of this predictor using the same code as in Problem 1.