

16.482 / 16.561: Computer Architecture and Design

Spring 2014

Homework #4

Due **Tuesday, 6/3/14**—**NO LATE SUBMISSIONS ALLOWED**

Notes:

- While typed submissions are preferred, handwritten submissions are acceptable.
- Any electronic submission must be in a single file. Do not scan individual pages and attach each page; copy and paste the images into a single document. If multiple files are strictly necessary, combine all files into a .zip archive—please do not use .rar format.
- 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] = {7, 4, 3, 2, 5, 1, 6, 10};
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>		
16	0x10	loop	...
			...
36	0x24		BNE R4, R0, else
			...
68	0x44		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 00. Assume the initial global history is 00. Determine the overall accuracy of this predictor using the same code as in Problem 1.