16.482 / 16.561: Computer Architecture and Design
Summer 2015

Homework #4
Due **Tuesday, June 2**

Notes:
- While typed submissions are preferred, handwritten submissions are acceptable.
- Any electronic submission must be in a single file. Archive files will not be accepted.
- Electronic submissions should be e-mailed to Dr. Geiger at Michael_Geiger@uml.edu.
- This assignment is worth a total of 100 points.

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

```
A[8] = {10, 4, 6, 7, 1, 5, 2, 3};
for (i = 0; i < 8; i++) {
     if (A[i] > 4)       {  <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.

Address			
Decimal	Hex		
16	0x10	loop	…
			…
44	0x2C		BNE R4, R0, else
			…
120	0x78		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:

Entry #	Value
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 (in other words, what fraction of the predictions are incorrect).

2. <u>Correlating branch predictors</u> (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 (percentage of correct predictions) of this predictor using the
    same code as in Problem 1.