

CS 203 (2019 Fall) Assignment #3

Student ID #:

Name:

1. Consider the following RISC-V instructions:

```
Loop:  LD      X1, 0(X3)
        ADD    X2, X1, X4
        MUL   X1, X2, X6
        ADD   X1, X1, X5
        ADD   X7, X7, X1
        ADDI  X12, X12, -1
        BNEZ  X12, Loop
        ADDI  X16, X16, 4
        LD    X3, 0(X16)
```

Assume the initial value of X12 is 2. Please answer the following question.

- (1) Assume the branch instruction is in the BTB and the branch is always predicted taken. Please list the instruction sequence will executed.



2. You are asked to evaluate the performance of the following branch prediction schemes:

A: Static backward taken, forward not taken.

B: Local predictor with two-bit state machine (Saturating counter/Bimodal).

C: Global predictor based on 4-bit history and a 2-bit state machine associate with each entry. (4,2) correlating predictor.

Now, you are given the following code segment. Assume each of the branch PC never cause conflicts/alias with other branches and the predictors are initialized as all zeros.

Please evaluate the branch prediction accuracy for the following code snippet with all the give prediction schemes.

```
(1) int i, j;
```

```
    i = 0;
    do {
        j = 0;
        do {
            loop c[i][j] = a[i][j] + b[i][j];
        } while( ++j < 5);
    } while ( ++i < 100);
```

```
(2) int i, j;
```

```
    i = 0;
```

```
    do {
```

```
        j = 0;
```

```
        do {
```

```
            loop c[i][j] = a[i][j] + b[i][j];
```

```
        } while( ++j < 2);
```

```
    } while ( ++i < 100);
```