CS M151B HW4

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1 4.13.1

add r5,r2,r1
nop
nop
lw r3,4(r5)
lw r2,0(r2)
nop
or r3,r5,r3
nop
nop
sw r3,0(r5)

In total of 10+4 = 14 cycles.

2 4.14.1

2.1 a

instruction	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
lw r2,0(r1)	IF	ID	EX	M	WB											
beq r2,r0,label2		IF	ID	*	EX	M	WB									
sw r1,0(r2)			IF	*	ID	*	*									
lw r3,0(r2)						IF	ID	EX	M	WB						
beq r3,r0,label1							IF	ID	*	EX	M	WB				
lw r2,0(r1)								IF	*	ID	EX	M	WB			
beq r2,r0,label2										IF	ID	*	EX	M	WB	
sw r1,0(r2)											IF	*	ID	EX	M	WB

2.2 b

instruction	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
lw r2,0(r1)	IF	ID	EX	M	WB													
beq r2,r0,label2		IF	*	*	ID	EX	M	WB										
sw r1,0(r2)					IF	nop	nop	nop	nop									
lw r3,0(r2)						IF	ID	EX	M	WB								
beq r3,r0,label1							IF	*	*	ID	EX	M	WB					
lw r2,0(r1)										IF	ID	EX	M	WB				
beq r2,r0,label2											IF	*	*	ID	EX	M	WB	
sw r1,0(r2)														IF	ID	EX	M	WB

3 4.16

3.1 4.16.1

Always taken: $3/5 = 60\%$
Always not taken: $2/5 = 40\%$

3.2 4.16.2

First predict: NT (False)
Second predict: NT (True)
Third predict: NT (False)
Fourth predict: NT (False)
Accuracy $= 1/4 = 25\%$

3.3 4.16.3

5: T (False) (upper-right)
6: NT (False) (lower-right)
7: T (False) (upper-right)
8: NT (False) (lower-right)
9: T (True) (upper-right)
10: T (False) (upper-left)
11: T (True) (upper-right)
12: T (False) (upper-left)
13: T (True) (upper-right)
14: T (True) (upper-left)
15: T (False) (upper-left)

16: T (True) (upper-right)

So 16 is the start of 4th iteration and it is at the same state as 11 which is the start of 3rd iteration. So the predictor will repeat this cycle forever and achieve a result close to $3/5 = 60\%$ accuracy.