

4.13.1
4.14.1
4.16.1 - 4.16.3

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CSM518

CSM518 - HW #5

4.13.1	add r5, r2, r1		1	2	3	4	5	6	7	8	9	10	11	12	13	14
lw r3, 4(r5)	ADD	IF	ID	EX	M	WB										
lw r2, 0(r2)	NOP		.													
or r3, r5, r3	NOP			.												
sw r3, 0(r5)	lw1				IF	ID	EX	M	WB							
	lw2					IF	ID	EX	M	WB						
	NOP							.								
	OR								IF	ID	EX	M	WB			
	NOP								.							
	NOP									.						
	sw										IF	ID	EX	M	WB	

• Takes 14 cyc to exec

4.14.1
(9) **lb11**: lw r2, 0(r1)
beg r2, 0, lb12 ~~Not taken~~, ~~Not taken~~
lw r3, 0(r2)
beg r3, r0, lb11 ~~Not taken~~
add r1, r3, r1

lb12: sw r1, 0(r2)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
lw1	IF	ID	EX	M	WB												
beg1		IF	ID	ID	ID	EX	M	WB									
lw2			IF	IF	IF	ID	EX	M	WB								
beg2				.	.	IF	ID	ID	ID	EX	M	WB					
lw1							IF	IF	IF	ID	EX	M	WB				
beg1										IF	ID	ID	ID	EX	M	WB	
sw											IF	IF	IF	ID	EX	M	WB

4.14.1

(b)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
lw1	IF	ID	EX	M	WB												
beq1		IF	ID	ID	ID	EX	M	WB									
lw2			IF	IF	IF	ID	EX	M	WB								
beq2						IF	ID	ID	ID	EX	M	WB					
lw1							IF	IF	IF	ID	EX	M	WB				
beq1										IF	ID	ID	ID	EX	M	WB	
sw											IF	IF	IF	ID	EX	M	WB

4.16.1

Actual	T	NT	T	T	NT
Predicted	T	T	T	T	T

• Taken accuracy $\Rightarrow \frac{3}{5} = \boxed{60\%}$

• Not Taken accuracy $\Rightarrow \frac{2}{5} = \boxed{40\%}$

4.16.2

Actual	T	NT	T	T
Predicted	NT	NT	NT	NT

Accuracy $\Rightarrow \frac{1}{4} = \boxed{25\%}$

4.16.3

Actual	T	NT	T	T	NT	T	NT	T	T	NT	T	NT	T	T	NT
Predicted	NT	NT	NT	NT	T	NT	T	NT	T						

- After the 3rd iteration (occurring during the 4th), the pattern reaches a steady state, in which the predictor keeps predicting the branch will be taken.
- In this state, there is a pattern of 3 T, 2 NT.
- Thus \Rightarrow accuracy $\Rightarrow \frac{3}{5} = \boxed{60\%}$