EECS 370 HW 5
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1. (a) 23 instructions

   (b) 23 cycles / 23 instructions = 1 CPI

   (c) (10 cycles for 2 LW) +
   (4 cycles * 20 instructions) +
   (2 cycles for halt) +
   = 52 cycles / 23 instructions = 2.26 CPI

2. (a)

Cycle	lw1	add	lw2	beq1	nand	beq2	noop	halt
0	IF							
1	ID	IF						
2	EX	NOOP						
3	MEM	NOOP						
4	WB	ID	IF					
5		EX	ID	IF				
6		MEM	EX	NOOP				
7		WB	MEM	ID	NOOP			
8			WB	EX	NOOP			
9				MEM		IF		
10				WB		ID	NOOP	
11						EX	NOOP	
12						MEM	IF	
13						WB	ID	IF
14							EX	ID
15							MEM	EX
16							WB	MEM
17								WB
18								
19								
20								

   (b) 17 cycles / 8 instructions = 2.13 CPI

(c)

Cycle	lw1	add	lw2	beq1	nand	beq2	noop	halt
0	IF							
1	ID	IF						
2	EX	NOOP						
3	MEM	ID	IF					
4	WB	EX	ID	IF				
5		MEM	EX	ID	IF			
6		WB	MEM	EX	ID	IF		
7			WB	MEM	SQUASH	ID	IF	
8				WB		EX	ID	IF
9						MEM	EX	ID
10						WB	MEM	EX
11							WB	MEM
12								WB
13								
14								
15								
16								

(d) 12 cycles / 8 instructions = 1.5 CPI

(e) No, because it takes 4 cycles to initially fill the pipeline and then a minimum of 1 cycle for each additional instruction.

3. (a) Time per cycle = 25ns
23 cycles * 25ns = 575ns

   (b) Time per cycle = 10ns
52 cycles * 10ns = 520ns

   (c) 50 cycles / 23 instructions = 2.17 CPI
50 cycles * 10ns = 500ns

   (d) 30 cycles / 23 instructions = 1.3 CPI
30 cycles * 10ns = 300ns

4. (a) 4 not takens / 13 total branches = 30.77% accuracy

   (b) 6 correct / 13 total branches = 46.15% accuracy

   (c) 10 correct / 13 total branches = 76.92% accuracy