

作业 8

	I1	I2	I3	I4	I5	I6
I1						
I2						
I3	WAW	RAW				
I4		WAW	WAR			
I5	RAW	RAW	RAW	RAW		
I6					WAW	

4. 完成 1 条指令: A: $CPI_{pipe} = 1 + 5 - 1 = 5$ 个周期 延时 $0.2T$

$$\therefore T_A = 5T + 0.2T = 5.2T = 5.2ns$$

完成 1 条指令: B: $CPI_{pipe} = 1 + 12 - 1 = 12$ 延时 $\frac{3}{8}$

$$1) T_1 = \frac{1}{5} = 0.2ns \quad CPI_1 = 5 + \frac{5}{5} = 6$$

$$T_2 = \frac{0.6}{12} = 0.05ns \quad CPI_2 = 12 + \frac{3}{8} \times 12 = 16.5$$

$$\therefore S = \frac{T_1 \cdot CPI_1}{T_2 \cdot CPI_2} = 1.455$$

$$(2) [20\% \times 5\% \times (1 + 0.2 + 2) + (1 - 20\% \times 5\%) \times (1 + 0.2)] \times 5 = 6.1$$

$$[20\% \times 5\% \times (1 + \frac{3}{8} + 5) + (1 - 20\% \times 5\%) \times (1 + \frac{3}{8})] \times 12 = 17.1$$

6. 11)

	I1	I2	I3	I4	I5	I6
I1						
I2	RAW					
I3	WAW	WAW	WAR			
I4	WAR		WAR			
I5				RAW		
I6					RAW	

I1 ld a1, 0(a2)

I2 addi a1, a1, 1

I3 sd a1, 0(a2)

I4 addi a2, a2, 4

I5 sub a4, a3, a2

I6 bnez a4, Loop



No.

Date.

(2)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
ld a1, a2(10)	IF	ID	EX	MEM	WB											
addi a1, a1, 1		IF	ID	S	S	EX	MEM	WB								
sd a1, 0(a2)			IF	ID	S	ID	EX	MEM	WB							
addi a2, a2, 4				S	S	IF	ID	EX	MEM	WB						
sub a4, a3, a2							IF	ID	S	S	EX	MEM	WB			
bnez a4, loop								IF	S	S	ID	S	S	EX	MEM	WB

代码 25 个周期后跳出循环，每个周期 16 个流水级时钟周期，共 400 个

7.

1)	1	2	3	4	5	6	7	8	9	10	11
ld a1, a2(10)	IF	ID	EX	MEM	WB						
addi a1, a1, 1		IF	ID	S	EX	MEM	WB				
sd a1, 0(a2)			IF	S	ID	EX	MEM	WB			
addi a2, a2, 4				S	IF	ID	EX	MEM	WB		
sub a4, a3, a2						IF	ID	EX	MEM	WB	
bnez a4, loop							IF	ID	EX	MEM	WB

$$25 \times 11 = 275$$

$$(2) \quad \cancel{25 \times 10} \quad 25 \times 11 - 10 \times 4 = 235 \quad 25 \times 11 - 24 \times 4 = 179$$

8.11)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
ld a1, 0(a2)	IF1	IF2	ID1	ID2	EX1	EX2	MEM	MEM	WB1	WB2										
addi a1, a1, 1		IF1	IF2	ID1	ID2	S	S	S	EX1	EX2	MEM	MEM	WB1	WB2						
sd a1, 0(a2)			IF1	IF2	ID1	S	S	S	ID1	EX1	EX2	MEM	MEM	WB1	WB2					
addi a2, a2, 4				IF1	IF2	S	S	S	ID1	ID2	EX1	EX2	MEM	MEM	WB1	WB2				
sub a4, a3, a2					IF1	S	S	S	IF2	ID1	ID2	S	EX1	EX2	MEM	MEM	WB1	WB2		
bnez a4, loop						S	S	S	IF1	IF2	ID1	ID2	S	S	EX1	EX2	MEM	MEM	WB1	WB2



$$25 \times 20 = 500$$

12) ⑥ $CPI = \frac{16}{6} = \frac{8}{3}$ (CPI 执行单位指令所需时钟周期数)

⑦ $CPI = \frac{4}{6}$

⑧ $CPI = \frac{20}{6} = \frac{10}{3}$

19. 11)	add	addi	ld	sd	bne	jal	jalr
是否需要2周期	是	是	是	是	是	否	是

12)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
lw a4, 0(a3)	IF	ID1	ID2	EX	MEM	WB										
addiw a1, a4, a1		IF	S	ID1	S	S	ID2	EX	MEM	WB						
addiw a2, a2, 1			S	IF	S	S	S	ID1	ID2	EX	MEM	WB				
addiw a3, a3, a4								IF	S	ID1	ID2	EX	MEM	WB		
bnez a2, Loop										IF	S	ID1	ID2	EX	MEM	WB

16个周期

13)	1	2	3	4	5	6	7	8	9	10	11	12	13
lw a4, 0(a3)	IF	ID1	ID2	EX	MEM	WB							
addiw a1, a4, a1		IF	S	ID1	ID2	EX	MEM	WB					
addiw a2, a2, 1			S	IF	S	ID1	ID2	EX	MEM	WB			
addiw a3, a3, a4						IF	S	ID1	ID2	EX	MEM	WB	
bnez a2, Loop								IF	S	ID1	EX	MEM	WB

13个周期

