

作业 8

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

4. 完成 1 条指令 : A: CPI pipe = 1 + 5 - 1 = 5 个周期 延时 0.2T,

$$\therefore T_A = 5T + 0.2T = 5.2T \approx 7ns$$

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

$$(1) T_1 = \frac{1}{5} = 1.2ns \quad CPI_1 = 1 + 5 + \frac{5}{5} = 6$$

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

$$\therefore S = \frac{T_1 CPI_1}{T_2 CPI_2} = 14.55$$

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

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

$$= 17.1$$

	I1	I2	I3	I4	I5	I6
I1						
I2	RAW					
I3	WAN	WAN/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 bneq a4, loop



No.

Date.

(2)	1	2	3	4	5	6	7	8	9	10	11	12	B	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	S	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个流水线时钟周期，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	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						

$$25 \times 11 = 275$$

$$(2) \cancel{25 \times 10} \times \cancel{25 \times 11} - 10 \times 4 = 235 \quad 25 \times 1 - 24 \times 4 = 19$$

8. (1)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
ld a1, 0(a2)	IF	IF2	ID1	ID2	EX1	EX2	MEM1	MEM2	WB1	WB2										
addi a1, a1, 1	IF	IF2	ID1	ID2	S	S	EX1	EX2	MEM1	MEM2	WB1	WB2								
sd a1, 0(a2)	IF	IF2	ID1	ID2	S	S	ID1	EX1	EX2	MEM1	WB1	WB2								
addi a2, a2, 4	IF	IF2	S	S	S	S	ID1	ID2	EX1	EX2	MEM1	WB1	WB2							
sub a4, a3, a2	IF	S	S	S	ID2	ID1	EX1	EX2	MEM1	MEM2	WB1	WB2								
bnez a4, loop	S	S	S	ID1	ID2	S	EX1	EX2	MEM1	MEM2	WB1	WB2								



扫描全能王 创建

$$25 \times 20 = 500$$

(2) ⑥ CPI = $\frac{16}{6} = \frac{8}{3}$ (CPI 执行单位指令所需时钟周期数)
 ⑦ CPI = $\frac{16}{6}$
 ⑧ CPI = $\frac{20}{6} = \frac{10}{3}$

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

(2)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
lw a ₄ ,0(a ₃)	IF	ID ₁	ID ₂	EX	MEM	WB										
addiw a ₁ ,a ₄ ,a ₁	IF	S	ID ₁	S	S	ID ₂	EX	MEM	WB							
addiw a ₂ ,a ₂ ,-1		S	IF	S	S	S	ID ₁	ID ₂	EX	MEM	WB					
addiw a ₃ ,a ₃ ,a ₄							IF	S	ID ₁	ID ₂	EX	MEM	WB			
bne a ₂ ,loop									IF	S	ID ₁	ID ₂	EX	MEM	WB	

16个周期

(3)	1	2	3	4	5	6	7	8	9	10	11	12	13		
lw a ₄ ,0(a ₃)	IF	ID ₁	ID ₂	EX	MEM	WB									
addiw a ₁ ,a ₄ ,a ₁	IF	S	ID ₁	ID ₂	EX	MEM	WB								
addiw a ₂ ,a ₂ ,-1		S	IF	S	ID ₁	ID ₂	EX	MEM	WB						
addiw a ₃ ,a ₃ ,a ₄				IF	S	ID ₁	ID ₂	EX	MEM	WB					
bne a ₂ ,loop						IF	S	ID ₁	EX	MEM	WB				

13个周期

