

第三章 2.4.6.7.8.19

2.	I1	I2	I3	I4	I5	I6
I1	-					
I2	\	-				
I3	WAW	RAW	-			
I4	\	WAW	WAR	-		
I5	\	\	RAW	RAW	-	
I6	\	\	\	\	WAR RAW	-

$$4. 1) S = \frac{t_A}{t_B} = \frac{CPI \times T \times N}{CPI \times T \times N} = \frac{CPI_A \times T \times N}{CPI_B \times T \times N} = \frac{1}{0.6} \times \frac{N+5.2-1}{N+7.425-1}$$

$$= \frac{5}{3} \times \frac{N+4.2}{N+6.425}$$

$$2) CPI_A = 0.8 \times 5.2 + 0.2 \times (5.2 + 5\% \times 2)$$

$$= 5.2 + 0.2 \times 0.05 \times 2 = 5.202$$

$$CPI_B = 7.425 + 0.2 \times 0.05 \times 5 = 7.43$$

6. 1) Loop:

```

ld    a1, 0(a2)
addi  a1, a1, 1  } RAW, WAW
sd    a1, 0(a2)  } RAW
addi  a2, a2, 4  } WAR
sub   a4, a3, a2 } RAW
bnez  a4, Loop   } RAW
    
```

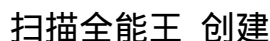


Instruction	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
ld a1, 0(a2)	IF	ID	EX	MEM	WB										
addi a1, a1, 1		IF	ID	S	S	EX	MEM	WB							
sd a1, 0(a2)			IF	ID	EX	S	S	S	MEM	WB					
addi a2, a2, 4				IF	ID	S	EX	MEM	WB						
sub a4, a3, a2					IF	ID	S	S	S	EX					
bnez a4, Loop						IF	ID	S	S	S					
											11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

$$1 - a_2 = 4 \quad 2 - a_2 = 8 \quad \dots \quad 25 \quad a_2 = 120$$
$$15 \times 25 = 375 \text{ cycles}$$

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

9	10	11
WB		
MEM	WB	
EX	MEM	WB

$$11 \times 25 = 275 \text{ cycles}$$


2) 1次 前3次 6 最后 17, 最后一次跳错在11纠正

$$7 - 2 \times 6 + 11 = 7 + 13 \times 8 + 11 = 186$$

8.1)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
ld a1, 0(a2)	IF1	IF2	ID1	ID2	EX1	FX2	M1	M2	WB1	WB2				
addi a1, a1, 1		IF1	IF2	ID1	ID2	S	S	S	EX1	EX2	M1	M2	WB1	WB2
sd a1, 0(a2)			IF1	IF2	ID1	ID2	EX1	EX2	S	S	M1	M2	WB1	WB2
addi a2, a2, 4				IF1	IF2	ID1	ID2	EX1	EX2	M1	M2	WB1	WB2	
sub a4, a3, a2					IF1	IF2	ID1	ID2	S	EX1	EX2	M1	M2	WB1
bnez a4, Loop						IF1	IF2	ID1	ID2	S	S	EX1	EX2	M1

15
WB2
15
M2
16
WB1
17
WB2

$$9 + 23 \times 7 + 17 = 187$$

$$6-2 \quad \frac{375}{625} = \frac{375}{150} = 2.5$$

$$7-1 \quad \frac{275}{625} \approx 1.83$$

$$7-2 \quad \frac{156}{625} \approx 1.24$$

$$8-1 \quad \frac{187}{625} \approx 1.296$$

19.	1)	add	addi	ld	sd	bne	jal	jalr
	需要2T?	✓	✗	✗	✓	✓	✓	✓
2)	lw a4, 0(a3)	IF	ID	EX	MEM	WB		
	addw a1, a4, a1		IF	ID	S	S	ID	EX, MEM, WB
	addiw a2, a2, 1			IF	ID	EX	MEM	WB
	addiw a3, a3, 4				IF	ID	EX	MEM, WB
	bnez a3, Loop					IF	S	S, ID, EX

12
MEM
11
WB



	1	2	3	4	5	6	7	8	9	10
3) lw a4, 0(a3)	IF	ID	EX	MEM	WB					
addw a1, a4, a1		IF	ID	S	EX	MEM	WB			
addiw a2, a2, 4			IF	ID	S	EX	MEM	WB		
addiw a3, a3, 4				IF	ID	S	EX	MEM	WB	
bne2 a2, Loop					IF	S	ID	EX	MEM	WB
10										

