

$$1. 11) T_{cycle}' = (T_{cycle} + 0.1ns \times 4) \div 5 = 1.48ns$$

$$12) S = \frac{T_{cycle}}{T_{cycle}} = \frac{1.48}{7} = 0.21$$

$$13) S' = \frac{1}{K} = \frac{1}{5} = 0.2$$

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

$$4. 11) S = \frac{\frac{T_B}{K_B}}{\frac{T_A}{K_A}} \times \frac{CPI_B}{CPI_A} = \frac{\frac{1}{5}}{\frac{0.6}{12}} \times \frac{\frac{1}{8}}{\frac{1}{5}} = \frac{22}{5}$$

$$12) CPI_A = \frac{5}{1 \times (2+1)} \times 5\% \times 20\% = \frac{1}{60}$$

$$CPI_B = \frac{24}{0.6 \times (3+1)} \times 5\% \times 20\% = \frac{1}{10}$$

和 sol
6. 11) ld 和 addi 的 a1 会发生 RAW.

sol 和 addi 的 a2 会发生 RAW, WAW

addi 和 sub 的 a2 会发生 RAW.

No.

Date

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

lcl a1, 0(a2) IF ID EX MEM WB

addi a1, a1, 1 IF ID s s EX MEM WB

scl a1, 0(a2) IF s s ID EX MEM WB

addi a2, a2, 4 IF ID s s EX MEM WB

sub a4, a3, a2 IF s s ID s s EX MEM WB

bnez a4, Loop IF s s ID s s EX MEM WB

$$20 \times 18 = 360 \uparrow$$

7.11) 1 2 3 4 5 6 7 8 9 10

lcl a1, 0(a2) IF ID EX MEM WB

addi a1, a1, 1 IF ID EX MEM WB

scl a1, 0(a2) IF ID EX MEM WB

addi a2, a2, 4 IF ID EX MEM WB

sub a4, a3, a2 IF ID EX MEM WB

bnez a4, Loop IF ID EX MEM WB

$$10 \times 20 = 200 \uparrow$$

12)

8. ii)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
ld a1, 0(a2)	IF ₁	IF ₂	ID ₁	ID ₂	EX ₁	EX ₂	M ₁	M ₂	WB ₁	WB ₂								
addi a1, a1, 1	IF ₁	IF ₂	ID ₁	ID ₂	s	s	s	EX ₁	EX ₂	M ₁	M ₂	WB ₁	WB ₂					
sd a1, 0(a2)	IF ₁	IF ₂	ID ₁	s	s	s	ID ₂	s	s	s	EX ₁	EX ₂	M ₁	M ₂	WB ₁	WB ₂		
addi a2, a2, 4	IF ₁	IF ₂	s	s	s	ID ₁	s	s	s	ID ₂	s	s	s	EX ₁	EX ₂			
sub a4, a3, a2	IF ₁	s	s	s	IF ₂	s	s	s	ID ₁	s	s	s	ID ₂	s				
bnez a4, Loop					IF ₁	s	s	s	IF ₂	s	s	s	ID ₁	s				
	19	20	21	22	23	24	25	26	27	28	29	30						

addi a2, a2, 4 M₁ M₂ WB₁ WB₂

sub a4, a3, a2 s s EX₁ EX₂ M₁ M₂ WB₁ WB₂

bnez a4, Loop s s ID₂ s s s EX₁ EX₂ M₁ M₂ WB₁ WB₂

$$30 \times 20 = 600$$

$$(2) CPI_6 = 3$$

$$CPI_7 = \frac{5}{3}$$

$$CPI_8 = 5$$