

第三章习题

1. $t = \max(1+0.1, 1.5+0.1, 1+0.1, 2+0.1, 1.5+0.1) = 2.1 \text{ ns}$

$\therefore T = 2.1 \text{ ns}$

② $t_{old} = 7N$ $t_{new} = 2.1N + 5.4$

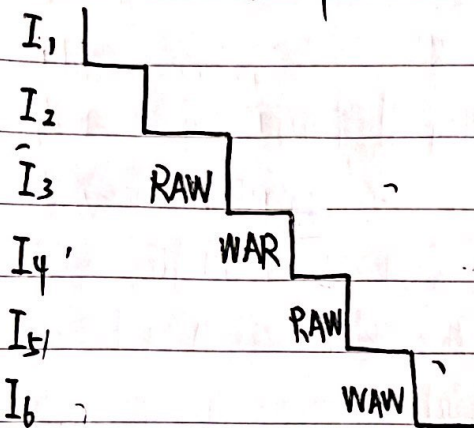
$\therefore S = \frac{t_{old}}{t_{new}} = \lim_{N \rightarrow \infty} \frac{7N}{2.1N + 5.4} = 3.33$

③ \because 无限分割, 每个阶段 $t_i \rightarrow 0$

$\therefore T = 0.1 \text{ ns}$

$\therefore S = \frac{7}{0.1} = 70$

2. $I_1, I_2, I_3, I_4, I_5, I_6$



4. (1) 处理器 A: $CPI_A = \frac{5+1}{5} = 1.2$

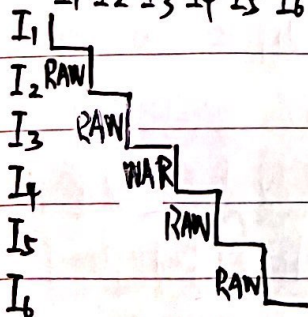
处理器 B: $CPI_B = \frac{8+3}{8} = 1.375$

$\therefore S = \frac{1.375 \times 0.6}{1.2 \times 1} = 1.45$

(2) $CPI_A = 0.95 \times 1.2 + 0.05 \times (1.2 + 0.2 \times 2) = 1.22$

$CPI_B = 0.95 \times 1.375 + 0.05 \times (1.375 + 0.2 \times 5) = 1.425$

6. (1) $I_1, I_2, I_3, I_4, I_5, I_6$



(2) 该 Loop - 共执行 25 次循环

将一数组中前 25 个元素分别 +1

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
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	S	S	S	S	EX	M	WB			
addi a2, a2, 4				IF	ID	EX	M	S	S	S	WB			
snb a4, a3, a2					IF	ID	S	S	S	S	S	EX	M	WB
bnez a4, LOOP						IF	ID	S	S	S	S	S	S	S

分支跳转

25个循环, $25 \times 17 = 425$ 个周期

7.

11) 1 2 3 4 5 6 7 8 9 10 11 12 13 14
ld a1, 0(a2) IF ID EX M WB

addi a1, a1, 1 IF ID S EX M WB

sd a1, 0(a2) IF ID S EX M WB

addi a2, a2, 4 IF ID EX M WB

sub a4, a3, a2 IF ID EX M WB

bneq a4, Loop IF ID EX M WB

$25 \times 11 = 275$ 个周期

2) 预测新 Loop 在 16 处可开始. $25 \times 6 + 4 = 154$ 个周期

8.

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

ld a1, 0(a2) IF₁ IF₂ ID₁ ID₂ EX₁ EX₂ M₁ M₂ W₁ W₂

addi a1, a1, 1 IF₁ IF₂ ID₁ ID₂ S S S EX₁ EX₂ M₁ M₂ W₁ W₂

sd a1, 0(a2) IF₁ IF₂ ID₁ ID₂ EX₁ EX₂ M₁ M₂ W₁ W₂

addi a2, a2, 4 IF₁ IF₂ ID₁ ID₂ EX₁ EX₂ M₁ M₂ W₁ W₂

sub a4, a3, a2 IF₁ IF₂ ID₁ ID₂ S EX₁ EX₂ M₁ M₂ W₁ W₂

bneq a4, Loop IF₁ IF₂ ID₁ ID₂ S S EX₁ EX₂ M₁ M₂ W₁ W₂

$25 \times 6 + 11 = 161$ 个周期

2) 题 6: $CPI = \frac{425}{150} = 2.83$ 题 7 11: $\frac{275}{150} = 1.83$ (2): $\frac{154}{150} = 1.03$

题 8: $CPI = \frac{161}{150} = 1.07$

16 17

19.11) add addi ld sd bne jal jalr
要 不要 要 要 要 不要 要

M WB . PLUS

(2). Loop:

	1	2	3	4	5	6	7	8	9	10	11	12
lw a4, 0(a3)	IF	ID1	ID2	EX	M	WB						
addw a1, a4, a1		IF	ID1	ID2	S	EX	M	WB				
addiw a2, a2, -1			IF	ID	EX	M	WB					
addiw a3, a3, 4				IF	ID	EX	M	WB				
bne a2, 0, Loop					IF	ID	EX	M	WB			

该循环共N次，将数组前N位和求出。共9N周期

(3) :

	1	2	3	4	5	6	7	8	9	10
lw a4, 0(a3)	IF	ID1	ID2	EX	M	WB				
addw a1, a4, a1		IF	ID	S	S	EX	M	WB		
addiw a2, a2, -1			IF	ID	EX	M	WB			
addiw a3, a3, 4				IF	ID	EX	M	WB		
bne a2, 0, Loop					IF	ID	EX	M	WB	

共9N周期

$$d.f = \frac{174}{25} \approx 6.96 \approx 7$$

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