

第三章习题

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

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

$$(2) t_{old} = 7N \quad t_{new} = 2.1N + 5.4$$

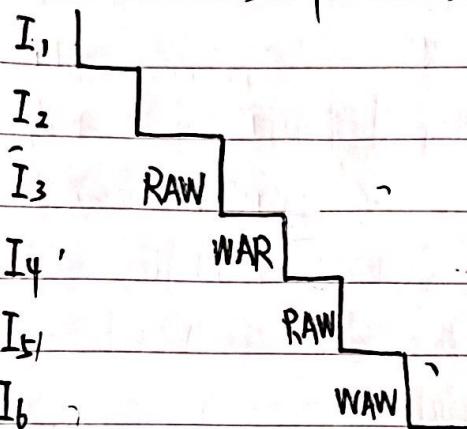
$$\therefore S = \frac{t_{old}}{t_{new}} = \lim_{N \rightarrow \infty} \frac{7N}{2.1N + 5.4} = 3.33$$

(3) ∵ 无限划分，每个阶段 $t_i \rightarrow 0$

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

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

2. I₁, I₂, I₃, I₄, I₅, I₆.



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

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

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

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

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

6. (1)

I₁, I₂, I₃, I₄, I₅, I₆.



(2) 该 LOOP 共执行 25 次循环

将一数组中前 25 个元素分别 +1

Id	a _{1,0} (a ₂)	IF ID EX MEM WB
1	addi a _{1,0} , 1	IF ID S S EX MEM WB
2	sd a _{1,0} (a ₂)	IF ID S S S EX M WB
3	addi a _{2,0} , 4	IF ID EX M S S S WB
4	sub a _{2,0} , a _{3,0}	IF ID S S S S EX M WB
5	bnez a _{4,0} , Loop	IF ID S S S S S S S

分支跳转

25个周期， $25 \times 17 = 425$ 个周期

I P E S T

: 9003, 1st

RW M X3 SOT ID FI CEC10 PA. W1

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

ld a1, 0(a2) IF ID EX M WB . X3 ID FI H-CON WITH

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

sd a1, 0(a2) IF ID . S EX M WB . : 9001, 5P, 89nd

addi a2, a2, 4 IF ID EX M WB . : 9001, 5P, 89nd

sub a4, a3, a2 IF ID EX M WB . S I : 151

bnez a4, LOOP IF ID EX M WB FI CEC10 PA. W1

$25 \times 11 = 275$ 个周期 RW M X3 3 3 ID FI 10, PA, W1

(2) 预测执行 LOOP 在 7F 后方可开始 $25 \times 6 + 4 = 154$ 个周期 H-CON WITH

8. RW M X3 10T FI PERIODIC

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

bnez 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 (1): $\frac{275}{150} = 1.83$ (2): $\frac{154}{150} = 1.03$

题8: CPI: $\frac{161}{150} = 1.07$

16 17.

19. (1) add addi ld sd bne jal jalr

要 不要 不要 要 不要 不要

M WB

PLUS

1 2 3 4 5 6 7 8 9 10 11 12

(2). Loop:

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

bnez a2, Loop IF ID EX M WB

该循环共 N 次，将数向前 N 位和求和共 $9N$ 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

bnez a2, Loop IF ID EX M WB

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

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

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

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