

C3

2.

	I1	I2	I3	I4	I5	I6
I1	-					
I2		-				
I3		RAW	-			
I4				-		
I5				RAW	-	
I6					RAW	

6.

1) $ld\ a1, 0(a2)$ } RAW
 $addi\ a1, a1, 1$ } RAW
 $sd\ a1, 0(a2)$ } RAW
 $addi\ a2, a2, 4$ } RAW
 $sub\ a4, a3, a2$ } RAW
 $bnez\ a4, Loop$ } RAW

2) 1 2 3 4 5 6 7 8 9

$ld\ a1, 0(a2)$ IF ID EX MEM WB
 $addi\ a1, a1, 1$ IF ID s EX MEM WB

$sd\ a1, 0(a2)$ IF s ID EX s MEM

$addi\ a2, a2, 4$ IF ID s EX MEM

$sub\ a4, a3, a2$ IF s ID s

$bnez\ a4, Loop$ IF s

$addi\ a2, a2, 4$ WB

$sub\ a4, a3, a2$ s EX MEM WB

$bnez\ a4, Loop$ s ID s s EX MEM WB

4.

1) A: $CPI = 1 + \frac{1}{5} = \frac{6}{5}$

B: $CPI = 1 + \frac{1}{8} \times 3 = \frac{11}{8}$

$S = \frac{1ns \times CPI_A}{0.6ns \times CPI_B} = \frac{1 \times \frac{6}{5}}{0.6 \times \frac{11}{8}} = \frac{16}{11}$

加速比是 $\frac{16}{11}$

(2) A: 分支指令 $\rightarrow 2 \times 5\% + 1 \times 95\% = 1.05$

$CPI = \frac{6}{5} \times (80\% \times 1 + 20\% \times 1.05) = \frac{303}{250}$

B: $5 \times 5\% + 1 \times 95\% = 1.2$

$CPI = \frac{11}{8} \times (80\% \times 1 + 20\% \times 1.2) = \frac{143}{100}$

共需要400个时钟周期 $16 \times \frac{100}{4} = 400$

A: $CPI = 1.212$

B: $CPI = 1.437$



扫描全能王 创建

7.

1) 1 2 3 4 5 6 7 8 9

ld a1,0(a2) IF ID EX MEM

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

sd a1,0(a2) IF S ID EX MEM

addi a2,a2,4 IF ID EX MEM WB

sub a4,a3,a2 IF ID EX MEM

bnez a4,Loop IF ID EX

// sub a4,a3,a2 WB

bnez a4,Loop MEM WB

共需要275个时钟周期 $11 \times 25 = 275$

2) 分支预测准确 一轮 6个指令

$6 \times 25 + (11 - 1) = 160$ 个时钟周期

8.

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 MEM1 MEM2

addi a1,a1,1 IF1 IF2 ID1 ID2 S S S EX1 EX2 MEM1 MEM2 WB1 WB2

sd a1,0(a2) IF1 IF2 ID1 S S S ID2 EX1 EX2 S MEM1 MEM2

addi a2,a2,4 IF1 IF2 S S S ID1 ID2 EX1 S EX2 MEM1 MEM2 WB1 WB2

sub a4,a3,a2 IF1 S S S IF2 ID1 ID2 S S EX1 EX2 MEM1 MEM2

bnez a4,Loop IF1 IF2 ID1 S S ID2 S EX1 EX2

// sub a4,a3,a2 WB1 WB2

bnez a4,Loop MEM1 MEM2 WB1 WB2

18 19 20 21



分支预测器 一轮6个指令

$$6 \times 25 + (21 - 1) = 170 \text{ 个时钟周期}$$

2) 对6.题 2)

$$CPI = 1 + \frac{1}{6} \times (6 + 4) = \frac{8}{3}$$

对7.题 1)

$$CPI = 1 + \frac{1}{6} \times (1 + 4) = \frac{11}{6}$$

对7.题 2)

$$CPI = 1 + \frac{1}{6 \times 25} \times \frac{1}{6} \times 1 = \frac{7}{6}$$

对8.题 1)

$$CPI = 1 + \frac{1}{6} \times 6 = 2$$

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

lw a4, 0(a3) IF ID EX MEM

addw a1, a4, a1 IF S ID EX MEM WB

addiw a2, a2, -1 IF ID EX MEM WB

addiw a3, a3, 4 IF ID EX MEM WB

bnez a2, Loop IF ID EX MEM WB

单次迭代需要10个周期

19.

a) add addi ld sd bne jal jalr

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要2周期

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

lw a4, 0(a3) IF ID EX MEM

addw a1, a4, a1 IF ID1 ID2 EX MEM WB

addiw a2, a2, -1 IF ID ^S EX MEM WB

addiw a3, a3, 4 IF S ID EX MEM WB

bnez a2, Loop IF ID S EX MEM WB

循环单次迭代需要11个周期

