

2.4

 $s0 = f$   
 $s1 = g$   
 $s2 = h$   
 $s3 = i$ 

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```

sll $t0, $s0, 2    # $t0 = f * 4
add $t0, $s6, $t0   # $t0 = &A[f]
sll $t1, $s1, 2    # $t1 = g * 4
add $t1, $s7, $t1   # $t1 = &B[g]
lw $s0, 0($t0)      # f = A[f]
addi $t2, $t0, 8    # $t2 = &A[f] + 8 = &A[f+2]
lw $t0, 0($t2)      # $t0 = A[f+2]
add $t0, $t0, $s0   # $t0 = A[f+2] + A[f]
sw $t0, 0($t1)      # B[g] = A[f+2] + A[f]

```

$$\underline{B[g] = A[f+2] + A[f]}$$

2.10

$$s0 = 0x80000000 \quad s1 = 0xD0000000$$

2.10.1 add \$t0, \$s0, \$s1

$$\begin{aligned}
 \$t0 &= 0x80000000 + 0xD0000000 \\
 &= \underline{0x50000000}
 \end{aligned}$$

2.10.2 overflow

2.10.3 sub \$t0, \$s0, \$s1

$$\begin{aligned}
 \$t0 &= 0x80000000 - 0xD0000000 \\
 &= \underline{0xB0000000}
 \end{aligned}$$

$$\begin{array}{r}
 1000 \ 0000 \\
 - 1101 \ 0000 \\
 \hline
 1000 \ 0000 \\
 + 0011 \ 0000 \\
 \hline
 1011 \ 0000
 \end{array}$$

2.10.4 no overflow

2.12

	6	5	5	5	5	6
	op	rs	rt dest	rd	shamt	funct
2.12.1	0000 00	10 000	1 0000	1000	1000 00	10 0000

Rtype add instruction

add \$s1, \$s0, \$s0

2.12.2

i type save word instruction

	6	5	5	5	5	6
	op	rs	rt			
	1010 11	01 010	01 001	0000 0000	0010 0000	

sw

32

0xAD490020

2.12.3

	6	5	5	5	5	6
	op	rs	rt	rd	shamt	funct
	000000	01001	01010	01000	00000	100010
		\$t1	\$t2	\$t0		34 → sub

R type subtraction instruction

sub \$t0, \$t1, \$t2

0000 0001 0010 1010 0100 0000 0010 0010 (2)

2.17

1) `sl $t2, $t0, 4`

$$\$t2 = \$t0 \ll 4$$

$$\$t2 = \underline{0xBBBBBBB0}$$

2) `or $t2, $t2, $t1`

$$\$t2 = \$t2 \vee \$t1$$

$$\$t2 = \underline{0xBBBBFFFF}$$

2.21

1) `sl $t2, $0, $t0`

$$\$t2 = 1$$

2) `bne $t2, $0, ELSE`

$$\$t2(1) \neq 0.$$

3) `ELSE addi $t2, $t2, 2`

$$\$t2 = 1 + 2 = 3$$

4) DONE

$$\underline{\$t2 = 3}$$

2.22

2.22.1 `0x10000000 jal`

$$0x10000000 \sim 0x1 \frac{FFFFFC}{\substack{\text{first 4 bits of PC} \quad 2^{26} \ll 2 \quad \text{address} \times 4 \quad \text{offset} \\ \text{last 26 bits are 0}}}$$

$$= \underline{0x10000000 \sim 0x1FFFFFFC}$$

2.22.2 `0x10000000 beq`

$$(-2)^{15} 4 \sim 0x10000000 \sim (2^{15} - 1) 4 \quad \text{offset 4}$$

$$(-2)^{15} 4 + 4 \sim 0x10000000 \sim (2^{15} - 1) 4 + 4 \quad \text{PC is added 4 before jump}$$

$$0x10000000 - 2^{15} 4 + 4 \sim 0x10000000 + 2^{15} 4 - 4 + 4$$

$$= 0x10000000 - 0x0001FFFF \sim 0x10000000 + 0x0001FFFF$$

$$= \underline{0x0FFE0004 \sim 0x1001FFFF}$$

2.24

0 2 1 0 5 2 t20K0.  
1 ≠ 0. 1000 — dir.  
2 -- = 1 1 -- = 0  
slr add.  
u j

2.24.1 5N + 2

2.24.2 \$s1 = A \$s2 = B \$t1 = i \$t2 = temp

while (0 < i) {  
i --;  
B += 3;  
}

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