

Instructions: You must show your work and put your final answers in the blanks. If you round a numerical answer, **you must give at least 3 significant digits.**

Q1. Write the MIPS code for the following statement Using the following mapping:
f:\$s0, g:\$s1, h:\$s2, i:\$s3, j: \$s4

$$f = (g + h) - (i + j);$$

Solution:

```
add $t0, $s1, $s2    # temp = g + h
add $t1, $s3, $s4    # temp = i + j
sub $s0, $t0, $t1    # f=(g+h) - (i+j)
```

- Q2.** Write the MIPS code for the following if-else statement Using the following mapping:
f:\$s0, g:\$s1, h:\$s2, i:\$s3, j: \$s4

If-else statement	MIPS Code
if (i == j) f=g+h; else f=g-h;	<pre> beq \$s3, \$s4, True # branch i==j sub \$s0, \$s1, \$s2 # f=g-h (false) j Fin # goto Fin True: add \$s0, \$s1, \$s2 # f=g+h (true) Fin: </pre>

MIPS Instruction Formats:

Name	Fields					
Field Size	6 bits	5 bits	5 bits	5 bits	5 bits	6 bits
R-Format	opcode	rs	rt	rd	shamt	funct
I-Format	opcode	rs	rt	address/immediate		
J-Format	opcode	target address				

MIPS Instructions:

Instruction	Type	opcode/funct (hex)*	Example	Meaning
add	R	0/20	add \$s1, \$s2, \$s3	$R[rd] = R[rs] + R[rt]$
addi	I	8	addi \$s1, \$s2, 100	$R[rt] = R[rs] + \text{SignExImm}$
and	R	0/24	and \$s1, \$s2, \$s3	$R[rd] = R[rs] \& R[rt]$
andi	I	c	andi \$s1, \$s2, 100	$R[rt] = R[rs] \& \text{ZeroExImm}$
beq	I	4	beq \$s1, \$s2, 25	If $(R[rs] == R[rt])$ $PC = PC + 4 + \text{Imm} * 4$
bne	I	5	bne \$s1, \$s2, 25	If $(R[rs] \neq R[rt])$ $PC = PC + 4 + \text{Imm} * 4$
j	J	2	j 2500	$PC = \text{jumpAddr}^{[1]}$
jal	J	3	jal 2500	$R[31] = PC + 4$; $PC = \text{jumpAddr}^{[1]}$
jr	R	0/8	jr \$ra	$PC = R[rs]$
lui	I	f	lui \$s1, 100	$R[rt] = \{\text{imm}, 16 \text{ of } 0s\}$
lw	I	23	lw \$s1, 100(\$s2)	$R[rt] = \text{MEM}[R[rs] + \text{SignExImm}]$
nor	R	0/27	nor \$s1, \$s2, \$s3	$R[rd] = \sim(R[rs] R[rt])$
or	R	0/25	or \$s1, \$s2, \$s3	$R[rd] = R[rs] R[rt]$
ori	I	d	ori \$s1, \$s2, 100	$R[rt] = R[rs] \text{ZeroExImm}$
sll	R	0/0	sll \$s1, \$s2, 10	$R[rd] = R[rt] \ll \text{shamt}$
slt	R	0/2a	slt \$s1, \$s2, \$s3	$R[rd] = (R[rs] < R[rt]) ? 1 : 0$
slti	I	a	slti \$s1, \$s2, 100	$R[rt] = (R[rs] < \text{SignExImm}) ? 1 : 0$
srl	R	0/2	srl \$s1, \$s2, 10	$R[rd] = R[rt] \gg \text{shamt}$
sub	R	0/22	sub \$s1, \$s2, \$s3	$R[rd] = R[rs] - R[rt]$
sw	I	2b	sw \$s1, 100(\$s2)	$\text{MEM}[R[rs] + \text{SignExImm}] = R[rt]$

MIPS Register Convention:

Use	Number	Name
The constant 0	\$0	\$zero
Reserved for Assembler	\$1	\$at
Return Values	\$2-\$3	\$v0-\$v1
Arguments	\$4-\$7	\$a0-\$a3
Temporary	\$8-\$15	\$t0-\$t7
Saved Temporaries	\$16-\$23	\$s0-\$s7
Temporary	\$24-\$25	\$t8-\$t9
Used by Kernel	\$26-\$27	\$k0-\$k1
Global Pointer	\$28	\$gp
Stack Pointer	\$29	\$sp
Frame Pointer	\$30	\$fp
Return Address	\$31	\$ra