

CS103 – Monsoon 2018 — Homework 3

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1. Assume the following register contents:

\$t0 = 0x89ABCDEF, \$t1 = 0x12345678

For the register values shown above, what is the value of \$t2 for the following sequence of instructions? There are some instructions whose functionality you might have to look up in the textbook, or on the Internet. Show your work.

- (a) srl t2,t0, 3
andi t2,t2, 0xFFEF

Solution: Binary value of \$t0 = 10001001101010111100110111101111
According to the first instruction, \$t0 is shifted by 3bits:

$$\$t2 = 00010001001101010111100110111101$$

Binary value of 0xFFEF is 1111111111101111
According to the second instruction,

$$\begin{aligned} &00010001001101010111100110111101 \text{ \textbf{AND}} 00000000000000001111111111101111 \\ &= 000000000000000000111100110101101 \\ &\implies \$t2 = 0x000079AD \end{aligned}$$

- (b) sll \$t2, \$t0, 10
or \$t2, \$t2, \$t1

Solution: Binary value of \$t0 = 10001001101010111100110111101111
According to the first instruction, \$t0 is shifted by 10bits:

$$\$t2 = 10101111001101111011110000000000$$

According to the second instruction:

$$\begin{aligned} &10101111001101111011110000000000 \text{ \textbf{OR}} 00010010001101000101011001111000 \\ &= 10111111001101111111111001111000 \\ &\implies \$t2 = 0xBF37FE78 \end{aligned}$$

2. instructions to save/restore values on the stack and update the stack pointer. Assume that `procA` and `procB` were written independently by two different programmers who are following the MIPS guidelines for caller-saved and callee-saved registers. In other words, the two programmers agree on the input arguments and return value of `procB`, but they can't see the code written by the other person. Be sure to read the textbook and lecture slides so you understand the MIPS guidelines for caller-saved and callee-saved registers.

Solution: `procA`:

```

$s0 = ...
$t1 = ...
$s1 = ...
$t2 = ...
$s2 = ...
$t0 = ...
L
$a1 = ..
$a0 = ...
addi $sp, $sp, -12
sw $ra, 8($sp)
sw $a0, 4($sp)
sw $a1, 0($sp)
jal procB
lw $ra, 8($sp)
lw $a0, 4($sp)
lw $a1, 0($sp)
addi $sp, $sp, 12
M
... = $s1
... = $t0
... = $t1
... = $a0
... = $s3
jr $ra

```

`procB`:

```

U
addi $sp, $sp, -8
sw $s2, 4($sp)
sw $s3, 0($sp)
... = $a0
... = $a1
$s2 = ...

```

\$s3 = ...

\$t0 = ...

lw \$s2, 4(\$sp)

lw \$s3, 0(\$sp)

addi \$sp, \$sp, 8

X

jr \$ra