❖ Chapter 6: Architecture / Introduction

Practice due Apr 30, 2023 23:59 PDT Completed

Consider the following assembly language program

```
add t, c, d

sub a, b, t
```

Assembly to High Level Language

1/1 point (graded)

Which of the following C programs corresponds to the assembly language program above

- (●) a = b - (c + d);
- ( ) a = b - c + d;
- ( ) a = b + c - d;

✔

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Registers

1/1 point (graded)

How many registers are in the RISC-V architecture?

32 ✔

\(\)

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Register Numbers

1/1 point (graded)

Later on, you'll need to be comfortable finding the table with mappings between register names and numbers. Identify this table in your notes, such as the slide handouts from the Introduction lecture. According to the table, which register number is ra?

1 ✔

\(\)

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Memory Operand

1/1 point (graded)

Which instruction stores the value from register t1 into word 20 of memory?

- sw t1, 20(zero)
- **sw t1, 80(zero)**
- sw 20, t1(zero)
- sw 20, 0(t1)
- lw t1, 20(zero)

✔

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Range of Immediates

1/1 point (graded)

What is the largest positive constant value that can be used in addi?

2047 ✔

2047

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Consider the following RISC-V program:

```
lui t2, 0xFEEDD

addi t2, t2, 0x1CE
```

Loading Constants

1/1 point (graded)

What value is in t2 after running the program above?

- **FEEDD1CE**
- 1CEFEEDD
- none of the above

✔

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Consider the following assembly language program:

```
andi t0, s1, 0x70F

xor t1, s1, s2

slli t2, s2, 4

srai t3, s2, 12
```

Suppose s1 = 0×12345ABC and s2 = 0xFF0000FF. Predict the values in the t registers after the program is run. Express your answers as 8 digit hexadecimal numbers with no leading 0x.

---

andi

1/1 point (graded)

What is the value of t0?

0000020C ✔

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---

xor

1/1 point (graded)

What is the value of t1?

ED345A43 ✔

Submit Try again (1 attempt remaining) Show answer

---

slli

1/1 point (graded)

What is the value of t2?

F0000FF0 ✔

Submit Try again (1 attempt remaining) Show answer

---

srai

1/1 point (graded)

What is the value of t3?

FFFFF000 ✔

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Suppose t0 contains 0×20003000 and t1 contains 0×00000102. Consider the results of running the following program:

```
mulh t3, t0, t1

mul t2, t0, t1
```

Multiplication

1/1 point (graded)

What value is written to t3? Express your result as an 8-digit hexadecimal number with no leading 0x.

20 ✔

20

Submit Try again (1 attempt remaining) Show answer

Multiplication

1/1 point (graded)

What value is written to t2? Express your result as an 8-digit hexadecimal number with no leading 0x.

40306000 ✔

40306000

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Consider the following RISC-V assembly language program

```
    addi s0, zero, 1

    addi s1, zero, 2

    bne s0, s1, L1

    add s1, zero, 1

L1: j L2

    add s1, zero, 3

L2:
```

Taking Branches

1/1 point (graded)

In this program, the bne and j instructions are:

- ○ not taken, and not taken
- ○ not taken, and taken
- ○ taken, and not taken
- ◉ taken, and taken ✔

Submit | Try again (1 attempt remaining) | Show answer

Predicting Results

1/1 point (graded)

At the end of the program (L2), what value is in s1?

2 ✔

2

Submit | Try again (1 attempt remaining) | Show answer

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If branching

1/1 point (graded)

Suppose int a is in s0 and b is in s1 and L1 is a label after the body of an if statement. What is the correct assembly language code for "if (a < b)"?

- ○ beq s0, s1, L1
- ○ bne t0, t1, L2
- ○ blt s0, s1, L1
- ◉ bge s0, s1, L1

✔

Submit Try again (1 attempt remaining) Show answer

---

if-else

1/1 point (graded)

Suppose int a is in s0 and b is in s1 and L2 is a label after the else of an if statement. In the code below, let ; indicate a line break. What is the correct assembly language code for "if (a == b) body1; else body2;"?

- ○ beq s0, s1, else; body1; j L2; else: body2; L2:
- ◉ bne s0, s1, else; body1; j L2; else: body2; L2:
- ○ bne s0, s1, L2; body1; j L2; else: body2; L2:
- ○ bne s0, s1, else; body1; j else; else: body2; L2:
- ○ bne s0, s1, else; body1; else: body2; L2:

✔

Submit Try again (1 attempt remaining) Show answer

---

while

1/1 point (graded)

Suppose int a is in s0 and b is in s1 and L3 is a label after the body of a while statement. In the code below, let ; indicate a line break. What is the correct assembly language code for "while (a != b) body1;"?

- ◉ while: beq s0, s1, L3; body1; j while; L3:
- ○ while: bne s0, s1, L3; body1; j while; L3:
- ○ while: body1; bne s0, s1, while; L3:

✔

Submit Try again (1 attempt remaining) Show answer

for

1/1 point (graded)

Suppose int a is in s0 and b is in s1 and L4 is a label after the body of a for statement. In the code below, let ; indicate a line break. What is the correct assembly language code for "for (init; a == b; postop) body;"?

- for: bne s0, s1, L4; init; body; postop; j for; L4:
- for: bne s0, s1, L4; init; body; j for; L4: postop;
- init; for: bne s0, s1, L4; postop; body; j for; L4:
- init; for: bne s0, s1, L4; body; postop; j for; L4:

✔

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Consider the following code. Let the base address of ary be in s0 and the base address of str be in s4. Let a, b, and c be in s1, s2, and s3, respectively.

```
int ary[100];

char str[50];

int a, b, c;

a = ary[7];

b = ary[a];

c = str[b];
```

Accessing constant element of array

1/1 point (graded)

Which line of code does a = ary[7]?

- ○ sw s1, 7(s0)
- ○ sw s0, 28(s1)
- ◉ lw s1, 28(s0) ✔

Submit | Try again (1 attempt remaining) | Show answer

Accessing variable element of array

1/1 point (graded)

Which snippet of code does b = ary[a]?

- ○ lb s2, s0(s0)
- ○ lw s2, s1(s0)
- ○ slli t0, s1, 4; lw s2, t0(s0)
- ◉ slli t0, s1, 2; add t0, t0, s0; lw s2, 0(t0) ✔

Submit | Try again (1 attempt remaining) | Show answer

Accessing variable element of string

1/1 point (graded)

Which snippet of code does c = str[b]?

- ○ lb s3, s2(s4)
- ○ lb s3, s4(s2)
- ◉ add t1, s2, s4; lb s3, 0(t1) ✔
- ○ slli t1, s2, 2; add t1, t1, s4; lw s3, 0(t1)

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Function Caller

1/1 point (graded)

What is the order of steps to call a function f?

- (●) put arguments in a0...7 register; jal f; look for result in a0
- ( ) put argument in a0 register; j f; look for result in a1
- ( ) jal f; look for arguments in a0...a7 registers; look for result in a1

✔

Submit Try again (1 attempt remaining) Show answer

Callee

1/1 point (graded)

What is the order of steps for callee function f

- ( ) Look for arguments in s0...s7; put result in s0; jr ra
- (●) Look for arguments in a0...a7; put result in a0; jr ra
- ( ) Look for arguments in a0; put result in a1; jal f

✔

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Callee Save

1/1 point (graded)

What registers must be the same at the end of a callee function as at the beginning (e.g. must be saved and restored if the callee wishes to modify them)? Check all that apply.

- [x] s0-s11 registers
- [ ] t0-t6 registers
- [ ] a0-a7 registers
- [x] sp
- [x] ra

✔

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Restoring Registers

1/1 point (graded)

What would happen if the ra register were not saved and restored in the recursive factorial function?

- ○ Nothing would change
- ◉ The function would get stuck in an infinite loop
- ○ The function would return the value 1 for any n
- ○ The function would return n

✔

Submit Try again (1 attempt remaining) Show answer

Duplicate of 'Restoring Registers'

1/1 point (graded)

What would happen if the a0 register were not saved and restored to t1 in the recursive factorial function? Specifically, suppose the lw t1, 4(sp) line were omitted and the mul became mul a0, a0, a0

- ○ Nothing would change
- ○ The function would get stuck in an infinite loop
- ◉ The function would return the value 1 for any n
- ○ The function would return n

✔

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Function Returns

1/1 point (graded)

Which pseudoinstructions are equivalent to jalr x0, ra, 0? Check all that apply.

- [x] ret
- [x] jr ra
- [ ] jal 0
- [ ] j end

✔

Submit Try again (1 attempt remaining) Show answer

Pseudoinstruction

1/1 point (graded)

Which instruction is equivalent to the pseudoinstruction mv rd, rs

- ( ) lw rd, 0(rs)
- (•) addi rd, rs, 0
- ( ) andi rd, rs, 0
- ( ) or rd, rs, rd

✔

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Machine Language

1/1 point (graded)

The slt instruction is an R-type instruction with op = 0110011, funct3 = 010, and funct7 = 0000000. What is the machine language representation of slt x5, x3, x0? Express your result in hexadecimal with no leading 0x.

0001a2b3 ✔

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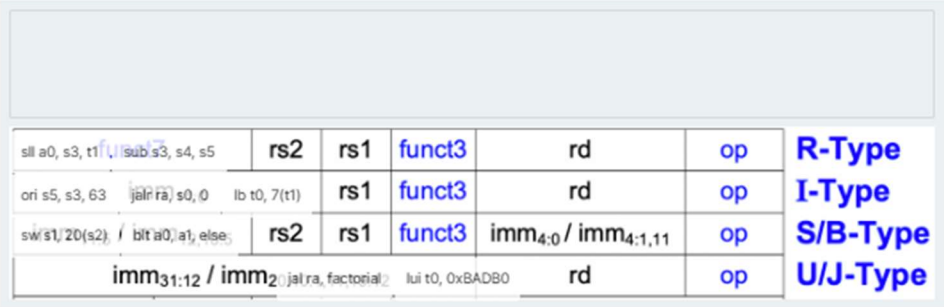
Instruction Formats

1/1 point (graded)

Keyboard Help

Drag each assembly language instruction onto its corresponding machine language format.



Reset

FEEDBACK

Good work! You have matched assembly and machine language formats.

J-Type Machine Language

1.0/1.0 point (graded)

Suppose a program contains the instruction "jal ra, funct" at address 0×0000100. funct is at address 0×0023460. jal is a J-type instruction with an op code of 1101111. ra is register x1. Write the jal in machine language. Express your answer in hexadecimal with no leading 0x.

360230EF ✔

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Immediate Encodings

1/1 point (graded)

Why does RISC-V scramble the immediates in such a strange order.

- ○ To make writing machine language by hand difficult for programmers so you will buy their assembler instead.
- ○ The placement of immediates in the instruction were random.
- ◉ To make particular bits of the immediate show up in the same bits of the instruction as much as possible to minimize the amount of hardware required to extract the immediate.
- ○ Look, that rabbit's got a vicious streak a mile wide, it's a killer!

✔

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Decoding Machine Language

1/1 point (graded)

Decode the RISC-V machine language instruction 0×00412083 into assembly language. Refer to Appendix B of the textbook for machine language encodings (see the DDCA RISC-V Edition tab on the top bar of EdX).

- ○ lb x2, 4(x1)
- ◉ lw x1, 4(x2)
- ○ addi x2, x1, 4
- ○ add x2, x1, x4

✔

Submit Try again (1 attempt remaining) Show answer