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Computation Structures 2: Computer Architecture

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LE9.2

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Calculator

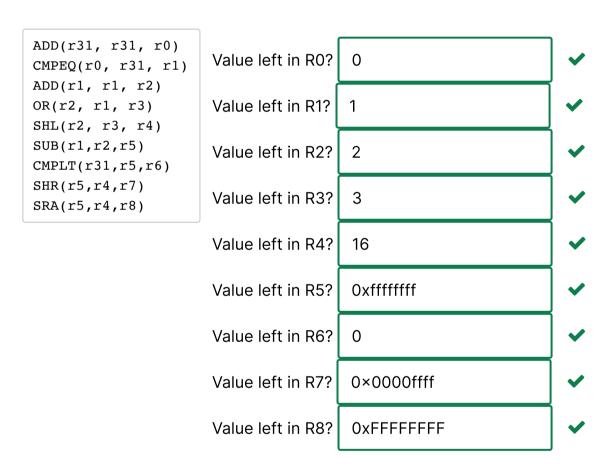## LE9.2.1: ALU Instructions

1.0/1.0 point (ungraded)

- Summary of Instruction Formats (PDF)
- Beta Documentation (PDF)

For the Beta instruction sequence shown below, indicate the 32-bit two's complement values of the specified registers after the sequence has been executed by the Beta. The effect of the instructions is cummulative, later instructions use the values stored by earlier instructions.

You can find detailed descriptions of each Beta instruction in the "Beta Documentation" handout -- see link above. Remember that register values and the ALU use a 32-bit two's complement representation.

Hint: You can enter answers in hex by specifying a "`0x`" prefix, *e.g.*, 17 could be entered as "`0x11`". Usually one would enter addresses, values in memory, etc. using hex. You can also use a "`0b`" prefix to enter a binary value, e.g., "0b10001".

Hint: It's best to figure out the answers by hand since that will give you practice in understanding Beta assembly language. If you need help, you can copy and paste the code into the BSim Standbox in the Overview section and simulate its execution step-by-step.

```
ADD(r31, r31, r0)
CMPEQ(r0, r31, r1)
ADD(r1, r1, r2)
OR(r2, r1, r3)
SHL(r2, r3, r4)
SUB(r1,r2,r5)
CMPLT(r31,r5,r6)
SHR(r5,r4,r7)
SRA(r5,r4,r8)
```

Value left in R0? `0` ✔

Value left in R1? `1` ✔

Value left in R2? `2` ✔

Value left in R3? `3` ✔

Value left in R4? `16` ✔

Value left in R5? `0xffffffff` ✔

Value left in R6? `0` ✔

Value left in R7? `0×0000ffff` ✔

Value left in R8? `0xFFFFFFFF` ✔

Assume that the first instruction is stored in location 0 of main memory.

What is the location for the `CMPLT(r31,r5,r6)` instruction? `0×18` ✔

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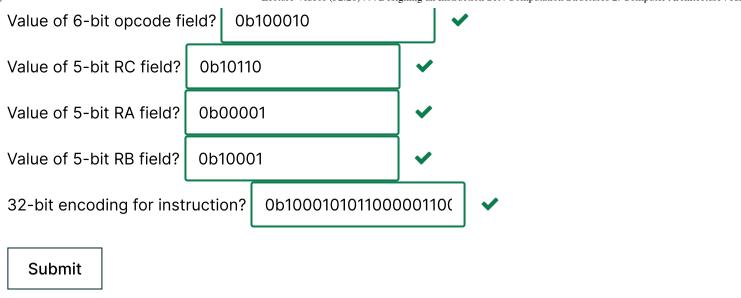

LE9.2.2: ALU Instruction Encoding

1.0/1.0 point (ungraded)

Please give the 32-bit binary encoding for the ALU instruction shown below. Start by figuring out the encoding for each of the 4 instruction fields, then concatenate the fields appropriately to determine the final 32-bit encoding.

```
MUL(R1,R17,R22)
```

You'll need the Summary of Instruction Formats handout to determine the encoding for the MUL opcode -- see the link in the first problem. As before, it's easiest to enter your answer in hex by using a "0x" prefix or binary by using a "0b" prefix.

Calculator

Value of 6-bit opcode field? `0b100010` ✔

Value of 5-bit RC field? `0b10110` ✔

Value of 5-bit RA field? `0b00001` ✔

Value of 5-bit RB field? `0b10001` ✔

32-bit encoding for instruction? `0b100010101100000110(` ✔

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LE9.2.3: ALU Instruction Encoding

1.0/1.0 point (ungraded)

Please give the 32-bit binary encoding for the ALU instruction shown below. Note that the symbolic form of our instructions allows as an operand any expression that yields a constant value! Only the low-order 5 bits of the value are used when filling in a 5-bit register field; the rest of the bits in the value are discarded.

```
SRA(R27,3+0x11,-1)
```

Of course, we'd never write an instruction in so inscrutable a form. It would be impossible to read and understand :)

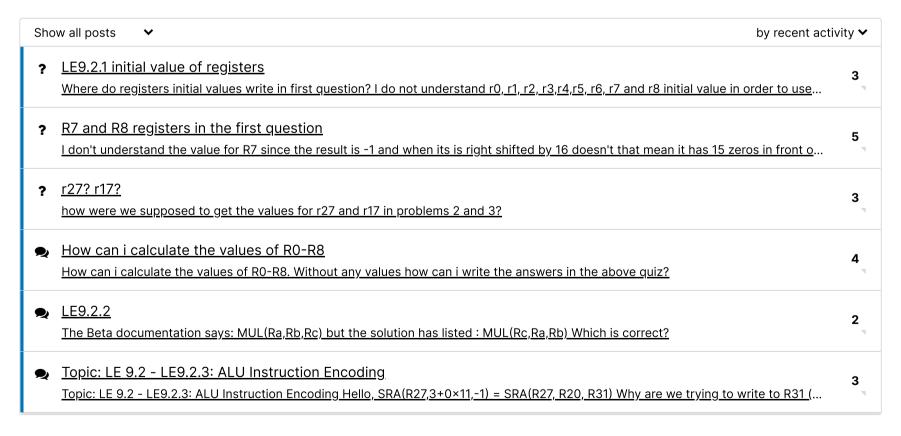32-bit encoding for instruction? `0b10111011111110111010(` ✔

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? **LE9.2.1 initial value of registers** Where do registers initial values write in first question? I do not understand r0, r1, r2, r3,r4,r5, r6, r7 and r8 initial value in order to use...	3
? **R7 and R8 registers in the first question** I don't understand the value for R7 since the result is -1 and when its is right shifted by 16 doesn't that mean it has 15 zeros in front o...	5
? **r27? r17?** how were we supposed to get the values for r27 and r17 in problems 2 and 3?	3
💬 **How can i calculate the values of R0-R8** How can i calculate the values of R0-R8. Without any values how can i write the answers in the above quiz?	4
💬 **LE9.2.2** The Beta documentation says: MUL(Ra,Rb,Rc) but the solution has listed : MUL(Rc,Ra,Rb) Which is correct?	2
💬 **Topic: LE 9.2 - LE9.2.3: ALU Instruction Encoding** Topic: LE 9.2 - LE9.2.3: ALU Instruction Encoding Hello, SRA(R27,3+0×11,-1) = SRA(R27, R20, R31) Why are we trying to write to R31 (...	3

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