Q1 Overflow
4 Points

RISC5 does not raise exception for overflow during integer addition. How can we detect overflow in software ? Assume instruction ADD x1, x2, x3 is executed and you want to detect overflow and branch to a label "ERROR" if an overflow has happened. Please write RISC5 assembly code below to do that.

```
ADD x1, x2, x3
SLTI x4, x2, 0
SLT x5, x1, x3
BNE x4, x5, ERROR


/* reasoning: only overflow when if one is negative and the final answer is l
ess than the positive one or not one is not 0 and the final answer is greater.
if not equal then error!! */
```

Q2 ALU
2 Points

The picture of our 64-bit ripple carry ALU is shown to the right (shown up to 32nd bit in the carry chain but you can extend the same to 64 bits). By mistake the hardware designer forgets to connect the CarryOut[0] to CarryIn[1] and instead connects CarryIn[1] to 0.
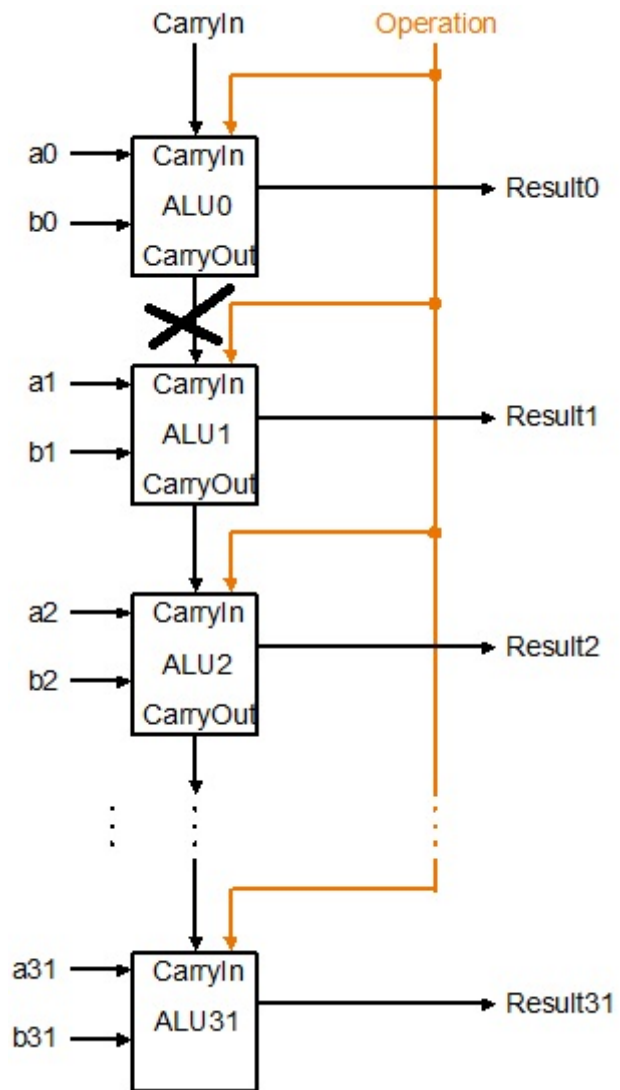
Which of the following operations will still work correctly ? Decimal numbers stored in x2, x3, x4, are 23, 5, -2

O   add x1, x2, x3

◉   add x1, x3, x4

O   sub x1, x2, x3

Q3 Registers
4 Points

Q3.1
2 Points

Lets say we want to expand number of registers from 32 to 64 in RISC-5 but want to retain the 32 bit instruction length. Now consider the BEQ instruction in this new ISA where we shrink the immediate field to compensate so that BEQ can fit into 32 bit instruction format. How big of a jump forward (in number of 32 bit instructions) can BEQ make to branch ?

Input only a NUMBER in the box below.

512

Q3.2 Work
2 Points

Show your work here

immediate value of original BEQ: 12 bits. space for registers 5 bits and 5 bits respectively. space for funct3 and opcode, 10 bits. total: 32 bits. good.

New # of registers = 64: New register bit size: 6 bits. space for registers is now 6 + 6 = 12 bits. opcode and funct3 still take up 10 bits. 22 bits total taken up already, 10 bits left for BEQ immediate value.

jump for original BEQ statement is +/- 2^11 instructions for 12 bits. Thus, jump for new BEQ statement is +/- 2^9 instructions for 10 bits.

📄 No files uploaded

Quiz 2   ● GRADED

STUDENT
LIANG, NEVIN

TOTAL POINTS

7 / 10 pts

QUESTION 1

Overflow   **4** / 4 pts

QUESTION 2

ALU   **2** / 2 pts

QUESTION 3

Registers   **1** / 4 pts

3.1   (no title)   **0** / 2 pts

3.2   Work   **1** / 2 pts