ALU Design Continued

The basic arithmetic capability of the ALU is enhanced with testing and decision capability.

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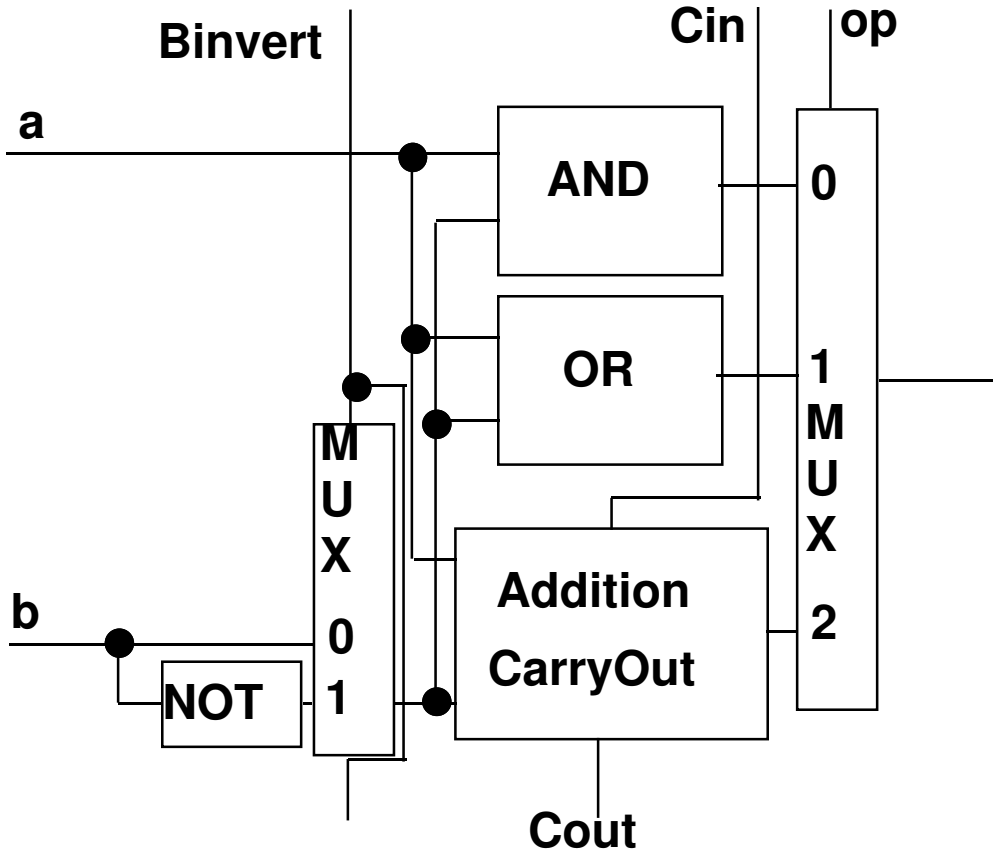
1-Bit AND-OR-Add-Sub ALU



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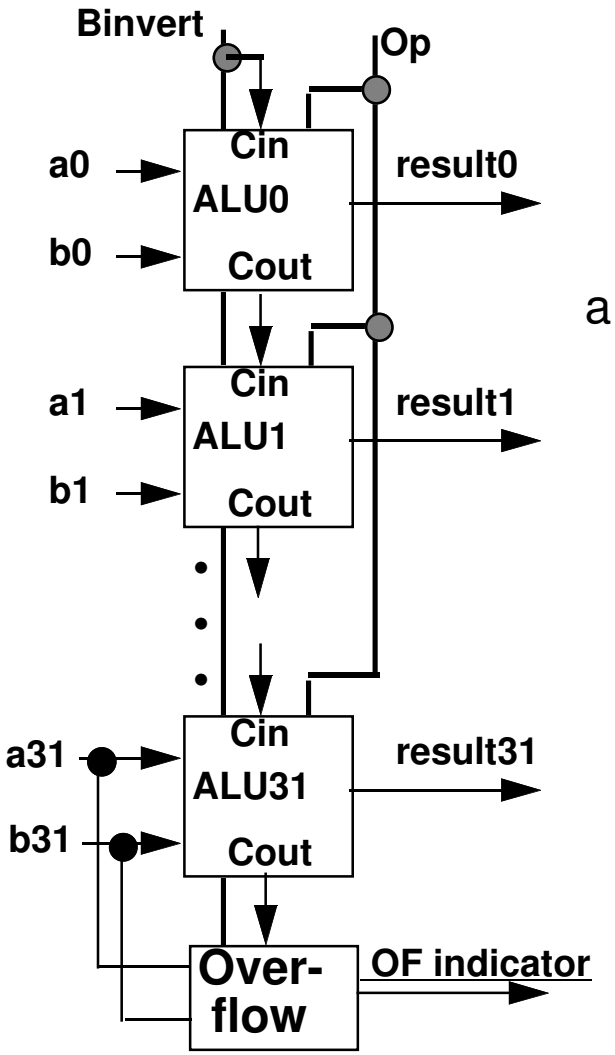
32-Bit ALU



$a + b + 1 = a + (b + 1) = a + (-b) = a - b$

The Binvert control signal will always match the carry in:

add => Binvert=0 => Cin=0

sub => Binvert=1 => Cin=1

so the two lines can be connected.

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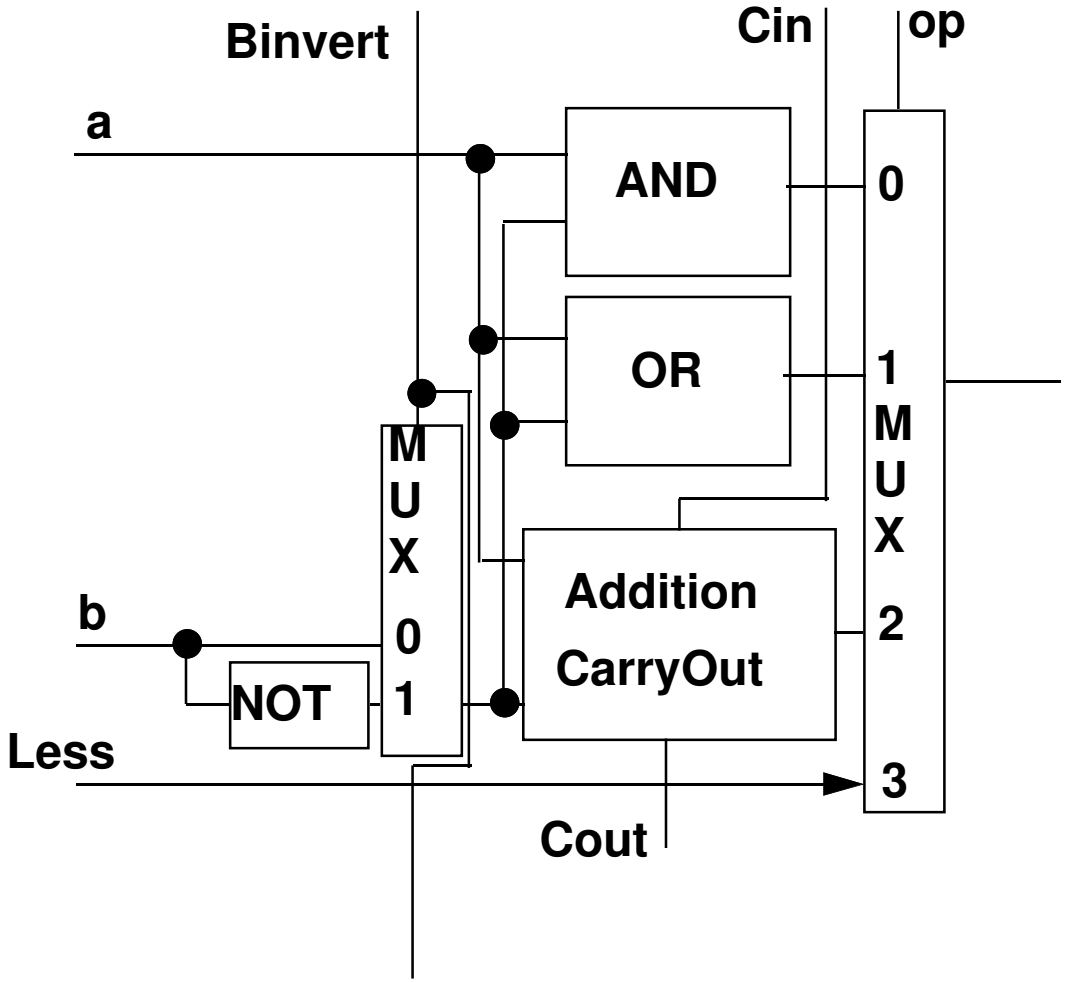
Less-than-test



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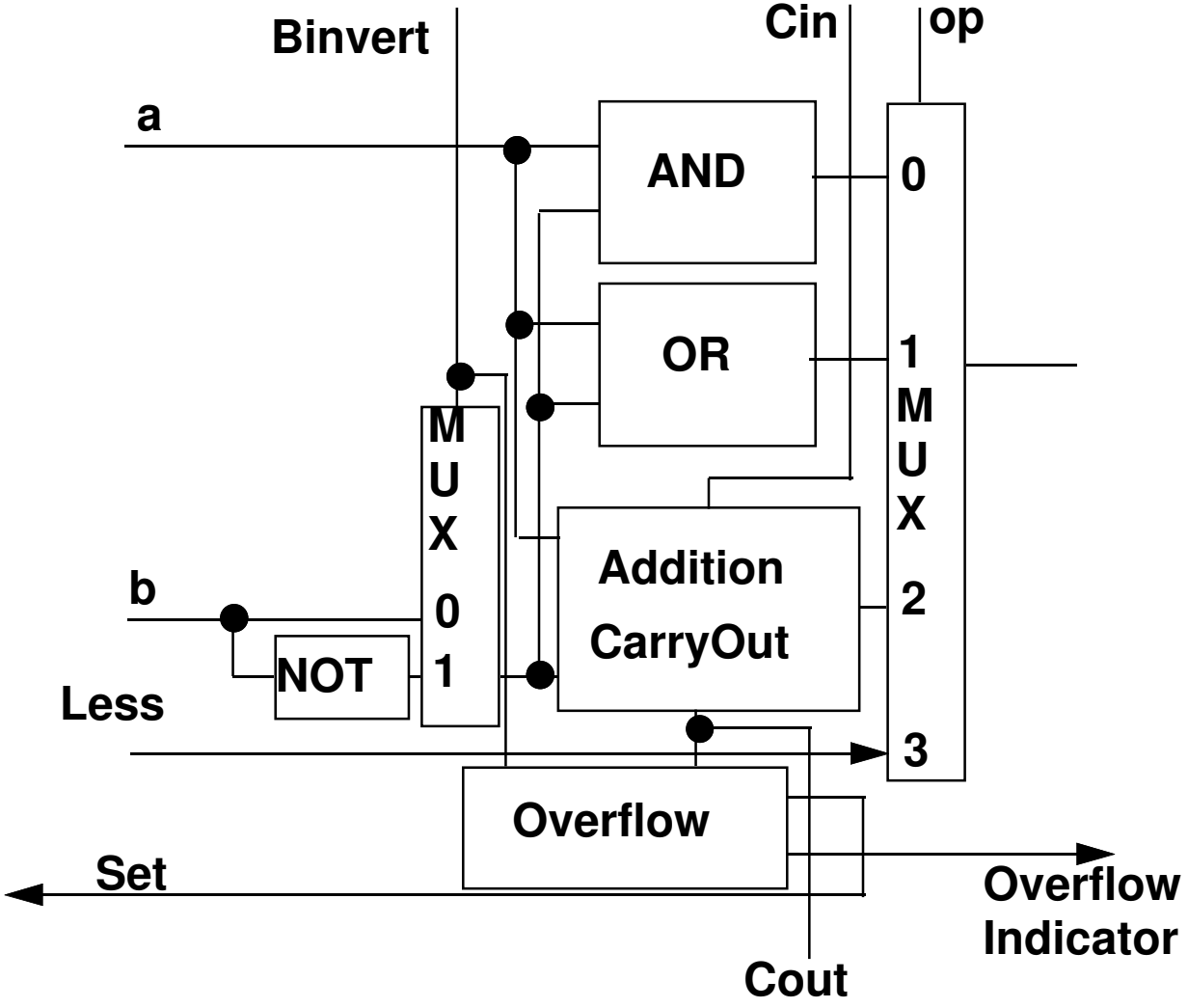
MSB 1-Bit ALU



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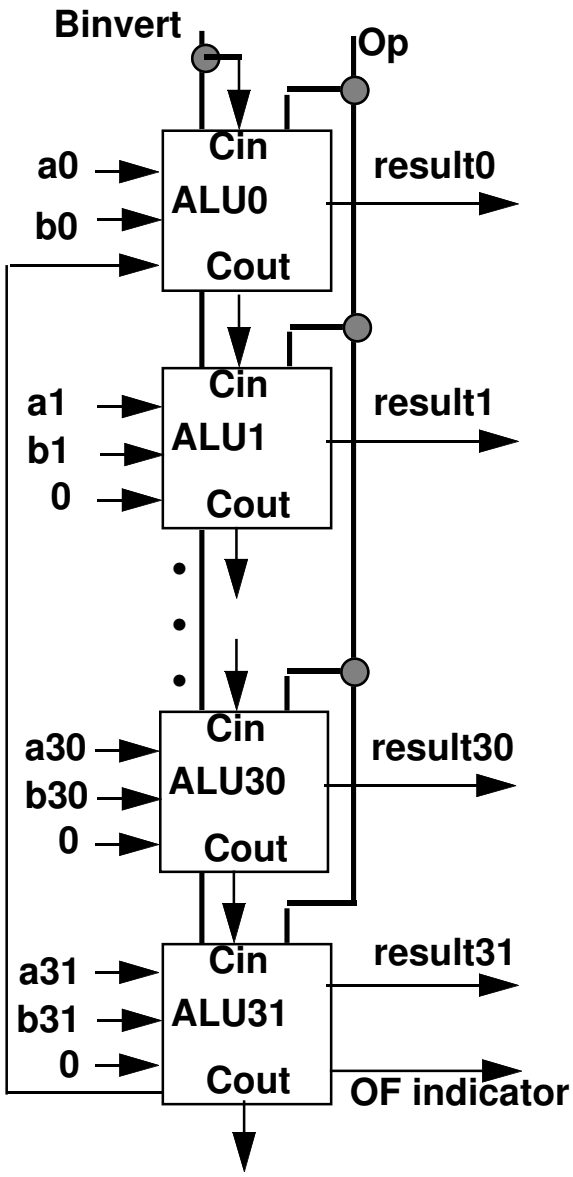

AND-OR-Add-Sub-SLT ALU

The Set line feedsback to become the input to Less for bit-0. All other bits have Less set to zero.

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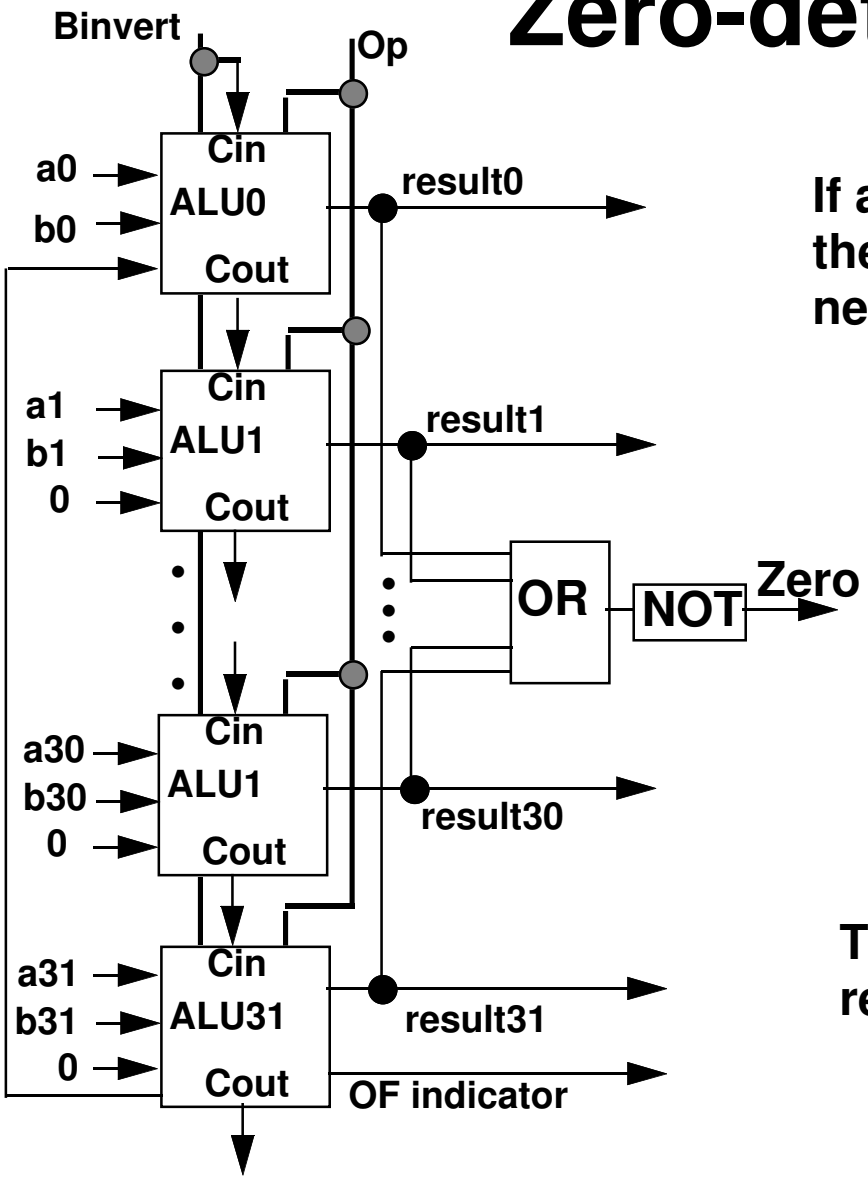
Zero-detecting ALU



If all output bits are nonzero, the OR is false, so its negation is true.

Testing for alternative representations?

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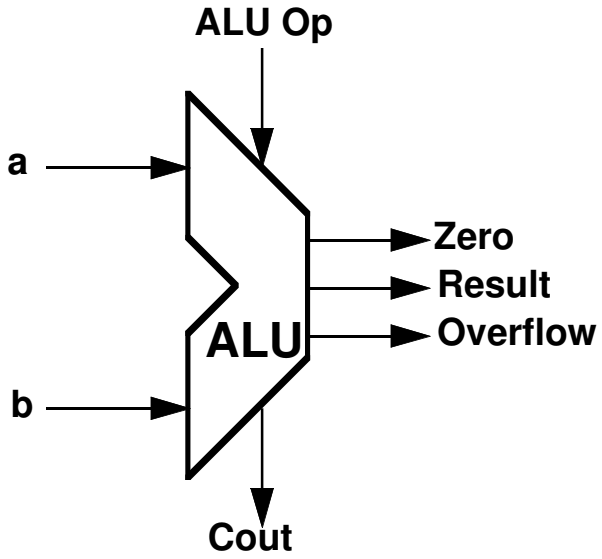
Abstracting ...



ALU Operation	Function
0 00	AND
0 01	OR
0 10	Add
1 10	Sub
1 11	SLT

Binvert Op

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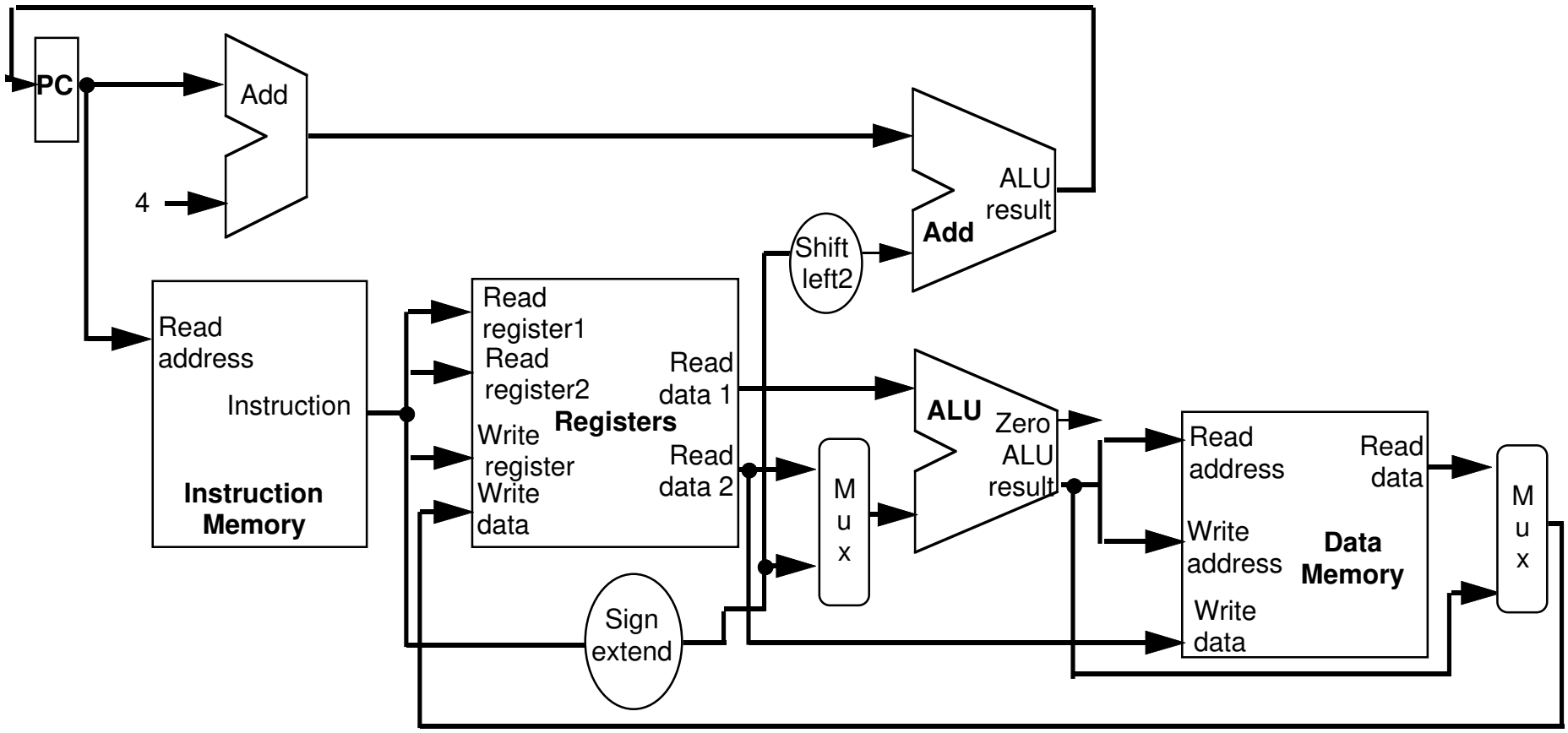
Using the ALU

The datapath uses the ALU structure several times, though not always in its full generality.



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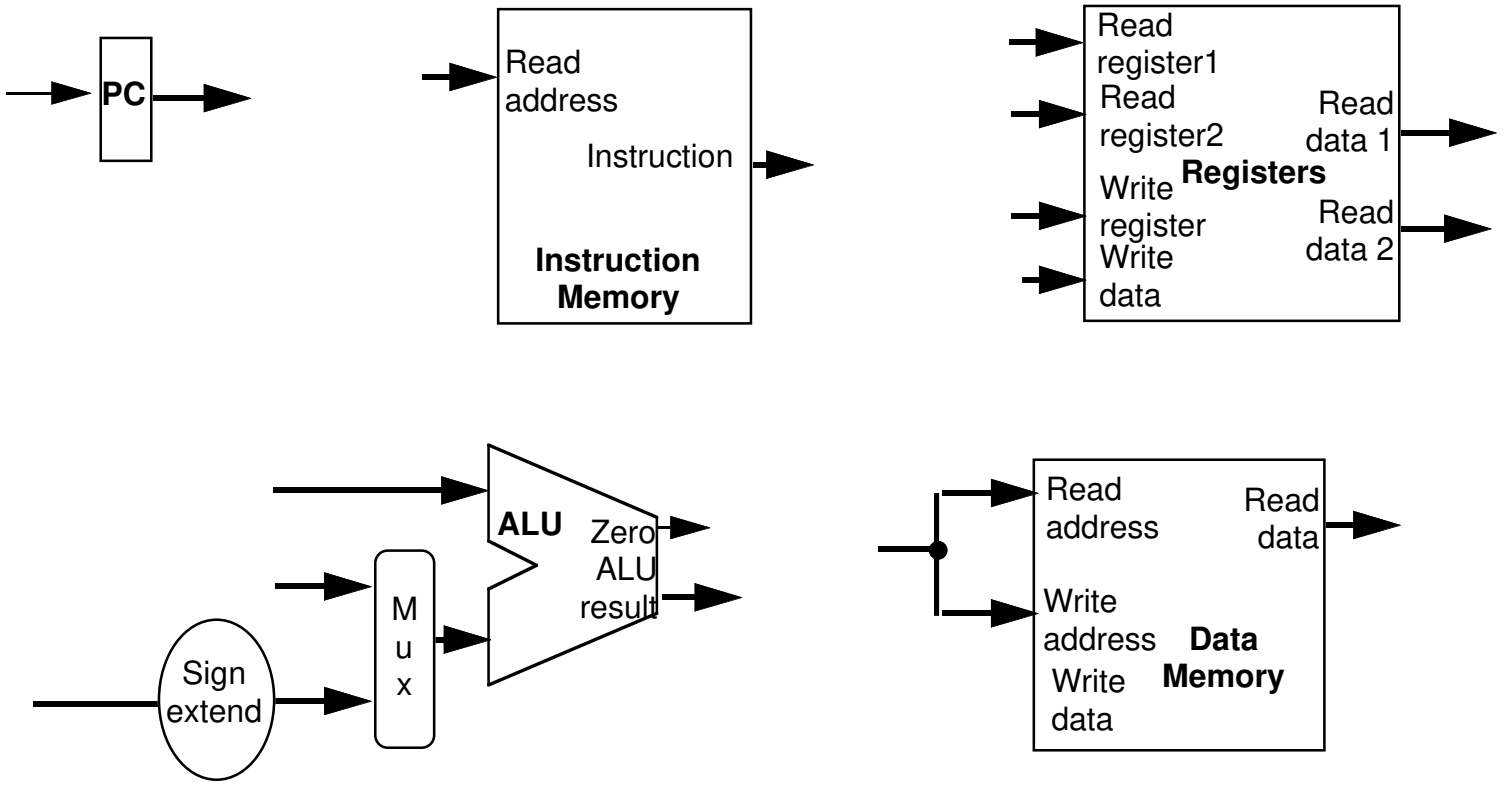
Building Blocks



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