1-bit ALU

AND/NOR operation

This operation is done with a single piece of hardware i.e. AND gate. The inputs to it is selected via two 2x1 muxes. They pass either a or a' and b or b' as output depending on the values of Ainvert and Binvert respectively. The result of AND operation can be obtained by selecting 00 in operation mux.

If Ainvert is 0 and Binvert is 0 then it does normal AND operation.

If Ainvert is 1 and Binvert is 1 then it does NOR operation.

OR/NAND operation

This operation is done with a single piece of hardware i.e. OR gate. The inputs to it is selected via two 2x1 muxes. They pass either a or a' and b or b' as output depending on the values of Ainvert and Binvert respectively. The result of OR operation can be obtained by selecting 01 in operation mux.

If Ainvert is 0 and Binvert is 0 then it does normal OR operation.

If Ainvert is 1 and Binvert is 1 then it does NAND operation.

ADD/SUB

This operation is done via Full Adder. The inputs to it is fed by two 2x1 muxes. They pass either a or a' and b or b' as output depending on the values of Ainvert and Binvert respectively and an additional input carry in that comes from previous ALU.

If Ainvert is 0 and Binvert is 0 and carry in is 0 it performs ADD operation.

For subtract 2's complement of b is taken. So Binvert is 1 and carry in is 1.

The result of this operation can be obtained by selecting 10 in operation mux.

Zero flag

For zero flag if result of SUB operation is 0 then its output is high.

a>b

For this flag b-a (Ainvert=1) is done and msb of result is observed if its 1 then the less flag is set high and result of this operation is obtained by selecting 11 in operation mux.

ALU Control Signals

	Ainvert	Binvert	Carry in	operation
AND	0	0	0	00
OR	0	0	0	01
NAND	1	1	0	01
NOR	1	1	0	00
ADD	0	0	0	10

SUB	0	1	1	10
a>b	1	0	1	11