2 - INPUT MULTIPLEXER.
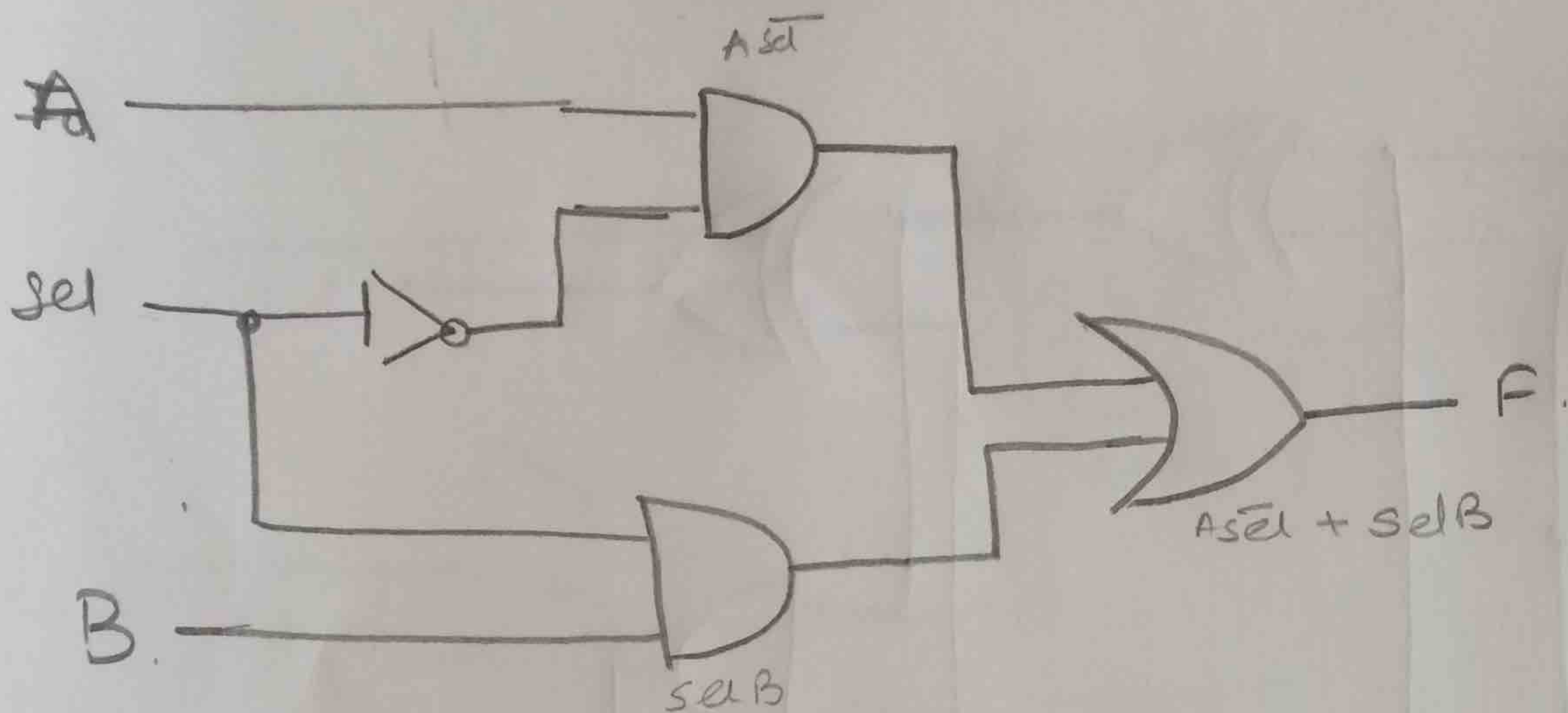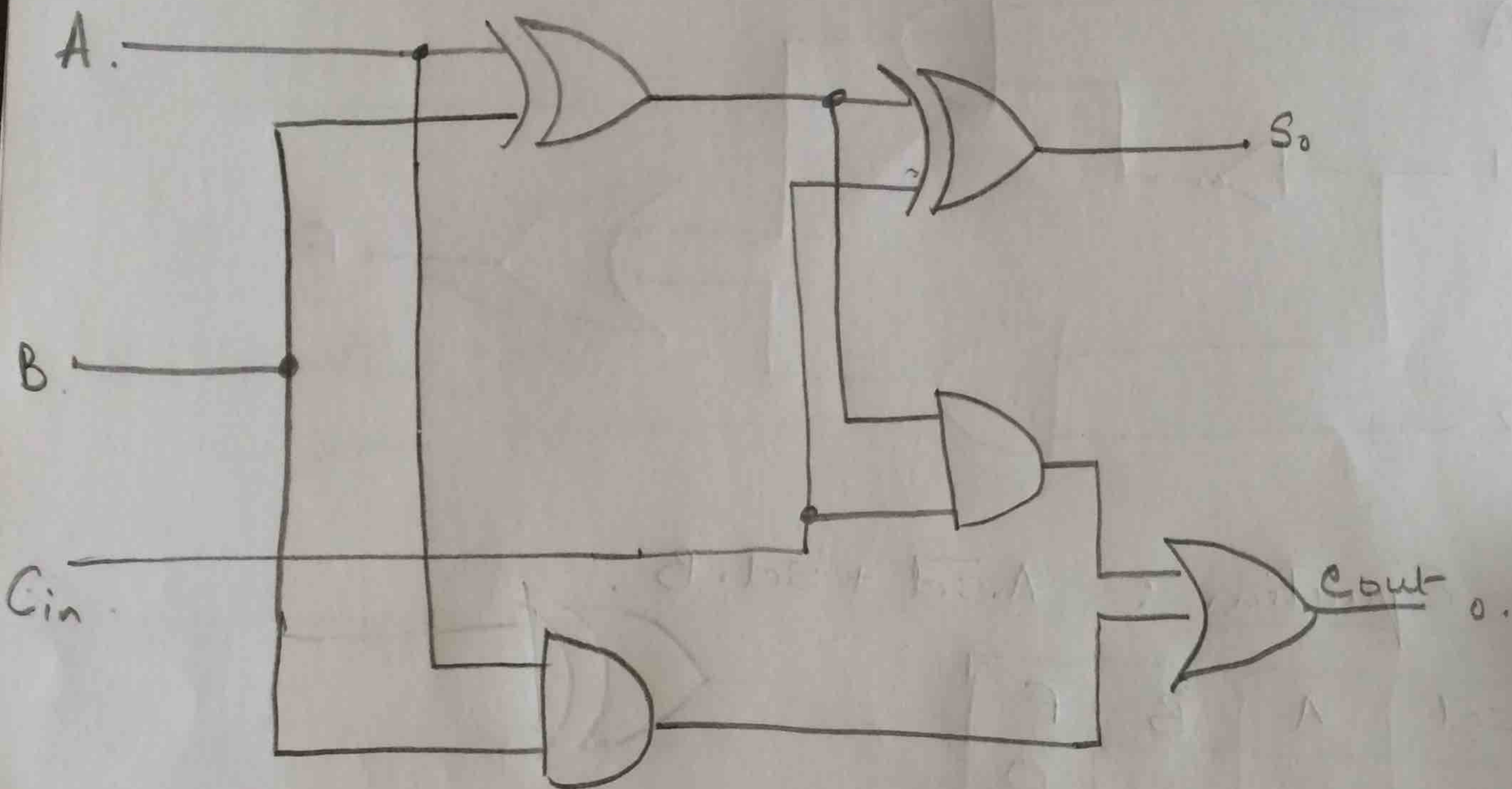
Equation :- $A.\overline{sel} + sel.B$.

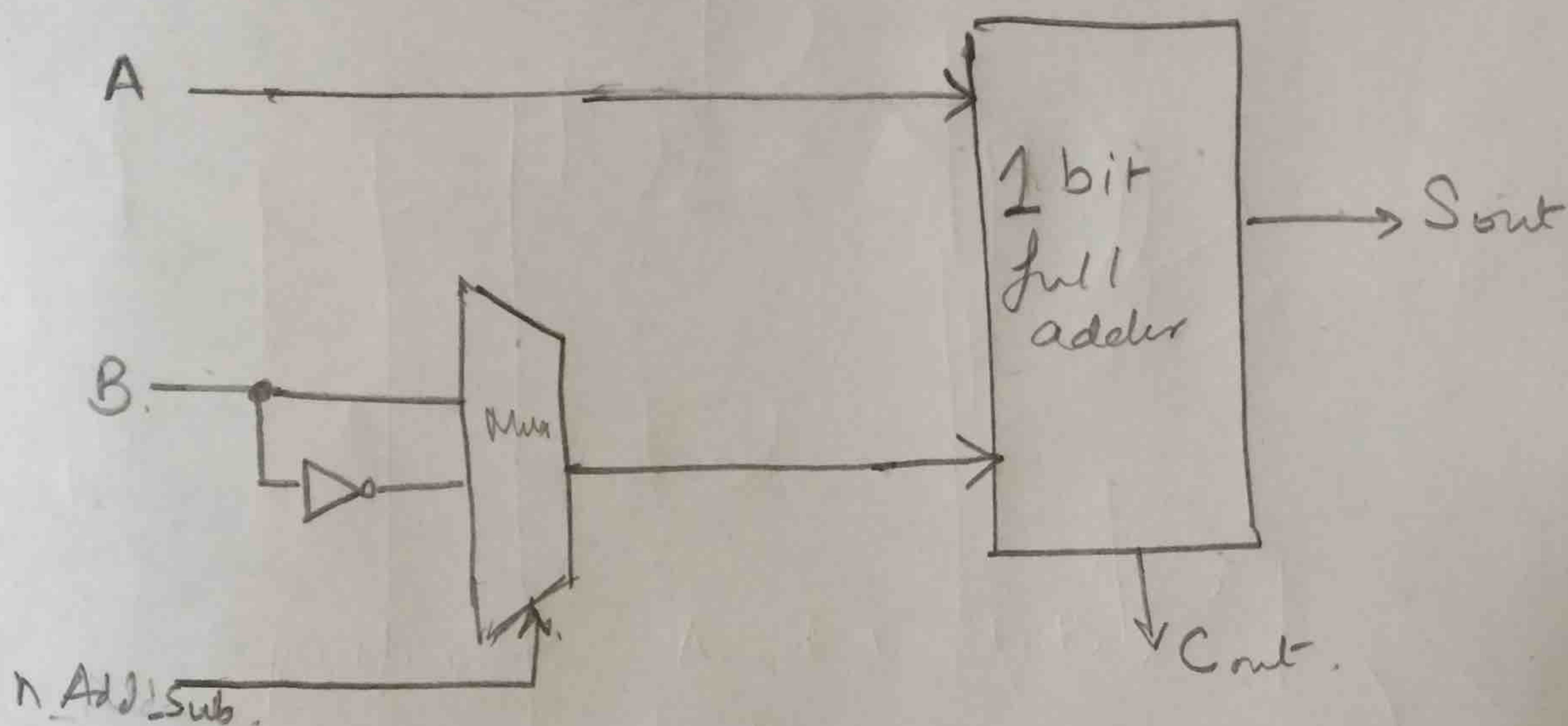| Sel	A	B	F
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

Full Adder :-

A	B	Cin	S₀	Cout
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

Boolean Expression :- $S_0 = A \oplus (B \oplus Cin)$.

$Cout = BCin + ACin + AB$.

Adder/Subtractor Unit with contrd.

nAdd_Sub.

nAdd_Sub bit acts as the select for the mux,

Test cases included :-

	A	B	nAddSub	Sout	Cout	
1.	0	0	0	0	0	← Adds, and outputs 0
2.	1	1	0	0	1	← Subtracts Adds, and there is a carry bit.
3.	0	0	1	0	1	← Adds. Subtracts.
4.	1	0	1	1	1	← Subtracts and outputs 1
5.	1	1	1	0	1	← Subtracts and has a carry bit.

I included the above test cases because the test all values and conditions under which the circuit should work.