

Implement a 3-bit adder/subtractor circuit using only 2-input NAND gates.

▣ A three-bit adder will add two three-bit binary numbers and returns another 3 or 4 bit binary number. For each bit, we will have a full adder and rightmost one will be a half adder because there is no carry from previous one.

▣ For a half adder:

If input two bits are A and B

$$\text{Sum, } S = A \oplus B$$

$$\text{Carry, } C = AB$$

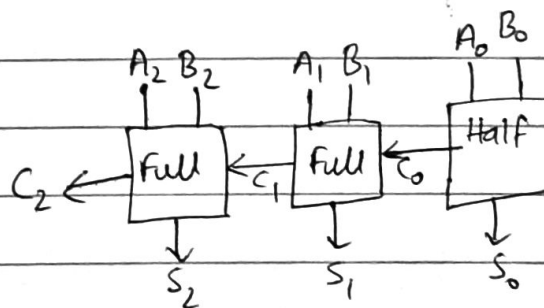
▣ For a full adder:

inputs A and B and previous carry C_{-1}

$$\text{Sum, } S = A \oplus B \oplus C_{-1}$$

$$\text{Carry, } C = AB + C_{-1}(A \oplus B)$$

▣ 3 bit adder



Truth Tables

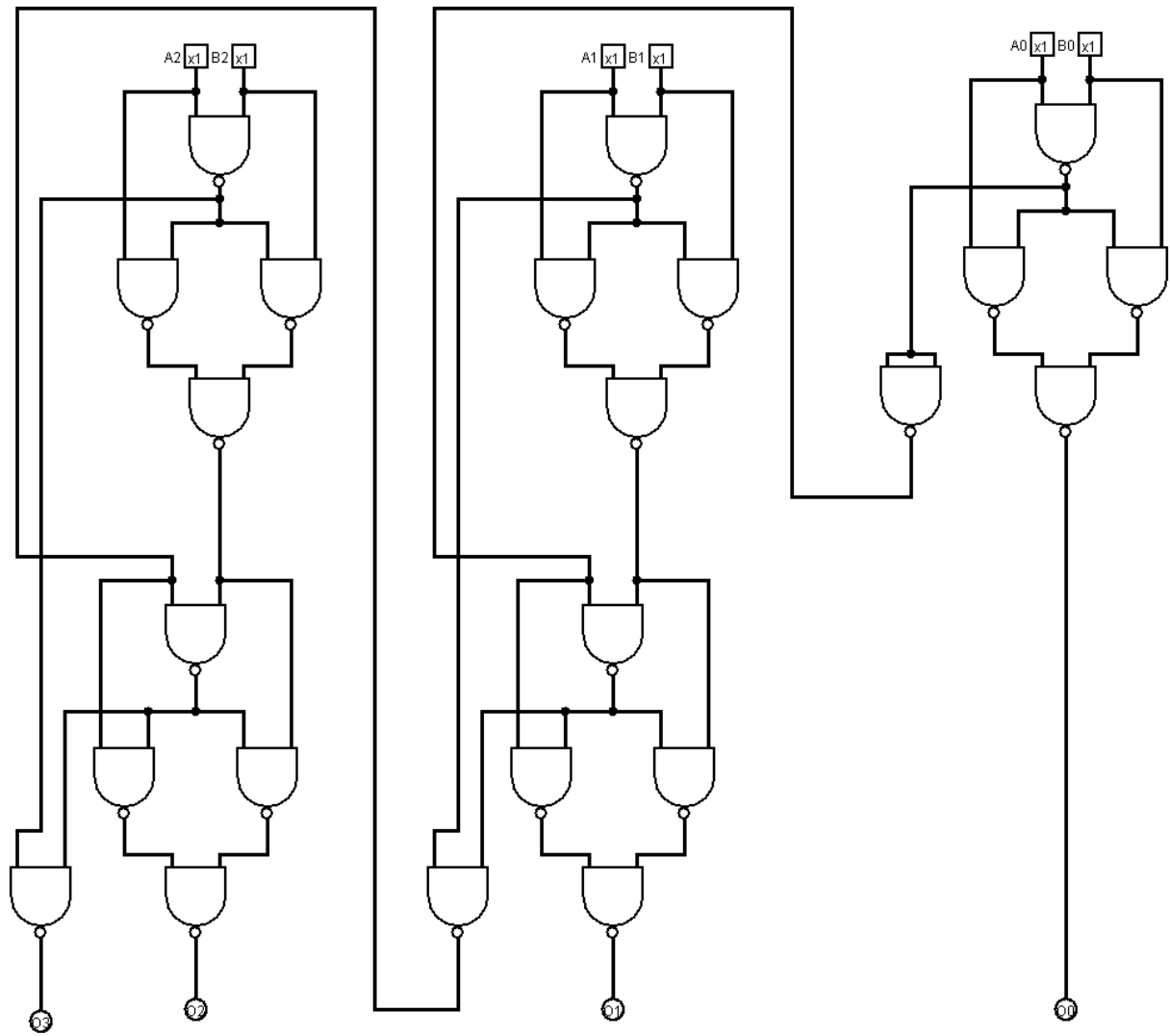
Half adder :—

A	B	S	C
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

Full adder :—

A	B	C_{-1}	S	C
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

Now, we will implement the 3-bit adder using only two-input NAND gates.



3 BIT ADDER CIRCUIT