

BINARY ADDITION

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28 +	11100 +
22	10110
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50	110010

The diagram illustrates the logic for the Sum and Carry outputs of a full adder. It is divided into two sections by a vertical line.

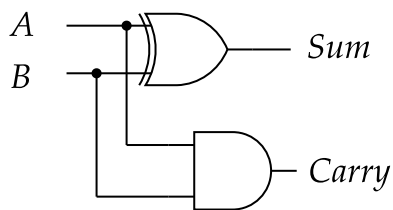
Left Section (Sum Output):

- Carry in:** 1, 1, 1, 1
- A:** 0, 0, 1, 1
- B:** 0, 1, 0, 1
- Sum:** 0, 1, 1, 0
- Operation:** XOR (A, B)
- Logic Gate:** An XOR gate with inputs A and B, and output Sum.

Right Section (Carry Output):

- Carry in:** 1, 1, 1, 1
- A:** 0, 0, 1, 1
- B:** 0, 1, 0, 1
- Carry:** 0, 0, 0, 1
- Operation:** AND (A, B)
- Logic Gate:** An AND gate with inputs A and B, and output Carry.

Half Adder



The diagram illustrates the implementation of a 1-bit full adder using two 2-input XOR gates. The truth table for the sum and carry-out is shown on the left, and the logic circuit is shown on the right.

Truth Table:

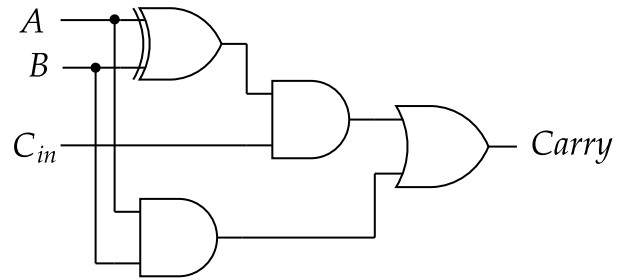
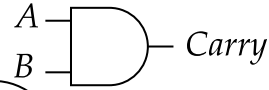
Carry in	A	B	Sum	Carry
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	0	1
1	0	1	1	1
1	1	0	0	1
1	1	1	1	1

Logic Circuit:

The logic circuit consists of two 2-input XOR gates. The first XOR gate takes inputs A and B, and its output is labeled $A \oplus B$. The second XOR gate takes inputs $A \oplus B$ and C_{in} , and its output is labeled Sum . The carry-out is calculated as $Carry = (A \oplus B) \oplus C_{in}$.

	A	B	Carry	Sum	
	0	0	= 0	0	
	0	1	= 0	1	
	1	0	= 0	1	
	1	1	= 1	0	
Carry in	1	0	0	= 0	1
	1	0	1	= 1	0
	1	1	0	= 1	0
	1	1	1	= 1	1

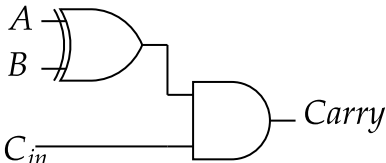
AND (A, B)



	A	B	Carry	Sum	
	0	0	= 0	0	
	0	1	= 0	1	
	1	0	= 0	1	
	1	1	= 1	0	
Carry in	1	0	0	= 0	1
	1	0	1	= 1	0
	1	1	0	= 1	0
	1	1	1	= 1	1

A
 B
 C_{in}
 $Carry$
 $AND(XOR(A, B), C_{in})$

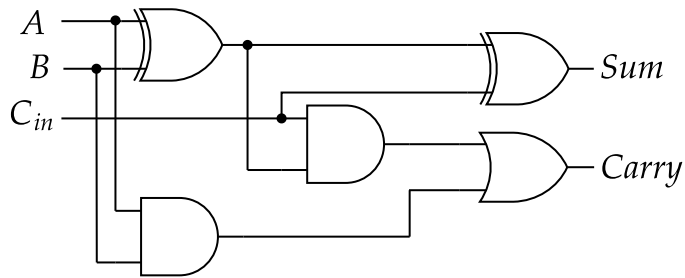
$XOR(A, B)$



AND (XOR (A, B), C_{in})

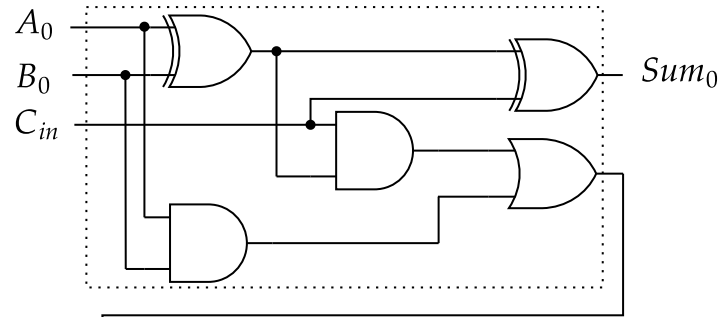
XOR (A, B)

Full Adder

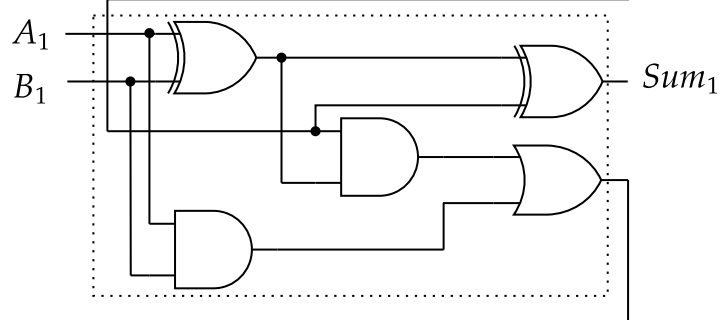


4 bit Adder

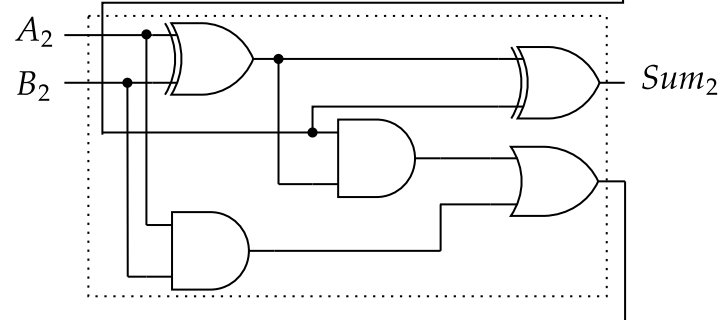
Full Adder 1



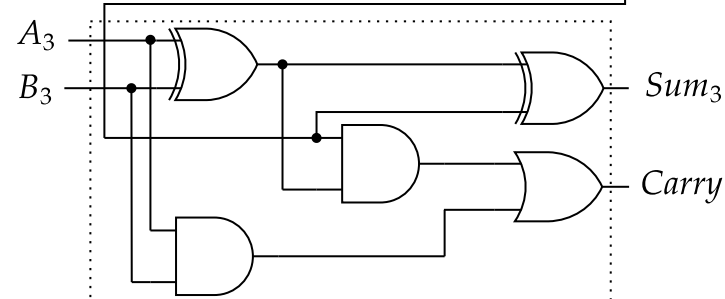
Full Adder 2



Full Adder 3



Full Adder 4



4 bit Addition

	C_{in3}	C_{in2}		
	1	1		
	A_3	A_2	A_1	A_0
	1	1	1	0
	B_3	B_2	B_1	B_0
	1	0	1	1
	<hr/>			
1	1	0	0	1
$Carry$	Sum_3	Sum_2	Sum_1	Sum_0