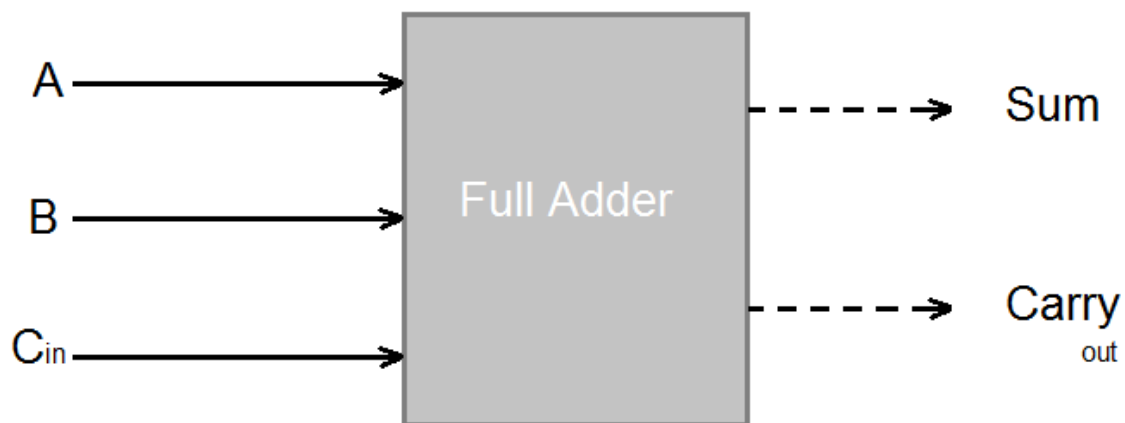


The 8-bit binary adder/subtractor is a combinational circuit which performs arithmetic operations, i.e., addition and subtraction, with binary digits. This circuit adds or subtract two 8-bit binary inputs (A & B) and the result is produced in the output. In order to create a Full 8-bit adder, we used eight Full 1-bit adders and connect them.

Full adder has three inputs. The first two inputs are A and B and the third input is an input carry as C-in. The output carry is designated as C OUT and the normal output is designated as S.



To implement the Full Adder, we used logic circuits instead of Block diagram of Full adder so, truth table is created with 3 inputs and 2 outputs and then we simplify the output of sum and carry out by k-maps and draw circuit with (And, or, xor) logic gates

Inputs			Outputs	
A	B	C – IN	Sum	C – Out
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

For S:

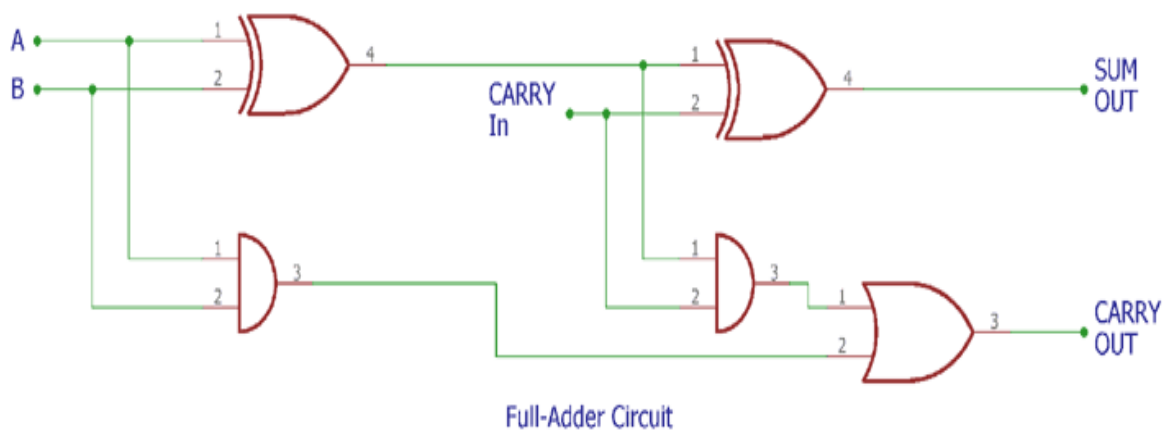
	BC_{in}	$\overline{B}\overline{C}_{in}$	$\overline{B}C_{in}$	BC_{in}	$B\overline{C}_{in}$
A					
\overline{A}		1			1
A	1		1		

$$S = A \oplus B \oplus C_{in}$$

For C_{out} :

	BC_{in}	$\overline{B}\overline{C}_{in}$	$\overline{B}C_{in}$	BC_{in}	$B\overline{C}_{in}$
A					
\overline{A}			1		
A		1	1	1	

$$C_{out} = AB + BC_{in} + C_{in}A$$

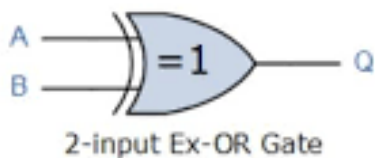


Subtraction operation

A Binary Adder-Subtractor is one which is capable of both addition and subtraction of binary numbers in one circuit itself. The operation being performed depends upon the binary value the control signal holds. The control line M that holds a binary value of either 0 or 1 which determines that the operation being carried out is addition or subtraction.

The control line M and B are inputs in xor gate. If the value of M is 1, the output of $B \text{ xor } M = B'$ (Complement B). Thus, the operation would be $A + (B')$. Now 2's complement subtraction for two numbers A and B is given by $A + (B' + 1)$. This suggests that when $M=1$, the operation being performed on the eight-bit numbers is subtraction.

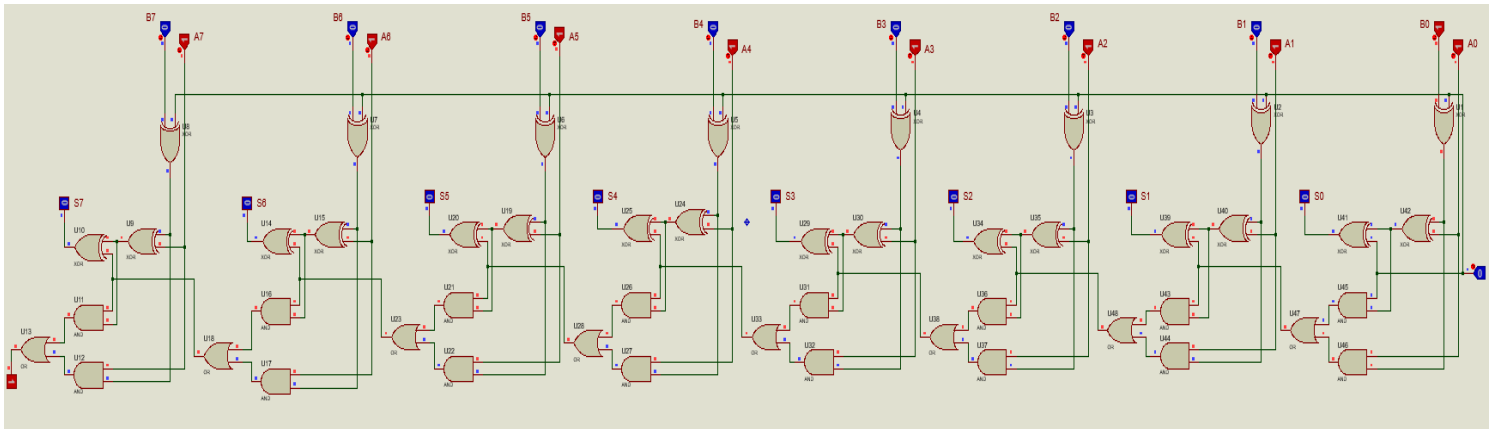
Similarly, If the Value of $M=0$, $B \text{ xor } M = B$. The operation is $A+B$ which is simple binary addition. This suggests that When $M=0$, the operation being performed on the eight-bit numbers is addition.

Symbol	Truth Table		
 2-input Ex-OR Gate	A	B	Q
	0	0	0
	0	1	1
	1	0	1
	1	1	0
Boolean Expression $Q = A \text{ XOR } B$			

Applications on 8-bit binary adder and subtractor

1. It is one of the components of the ALU (Arithmetic Logic Unit).
2. Adder and subtractor are basically used for performing arithmetical functions like addition, subtraction, multiplication and division in electronic calculators and digital instruments.
3. Adder and subtractor are also used in microcontrollers for arithmetic additions, PC (program counter) and timers.
4. It is also used in networking and DSP (Digital signal processor) oriented system.

Simulation for adder



Simulation for subtraction

