(LAB- 5)

⇒ ADDER

Adder is a combinational circuit which perform addition of number (binary number)

In computers and other other kind of processors. adders are used in Arithmetic Logic unit. (ALU). for calculate addresses, increament decreament operation.

(Major types of Adder)

(1) Half Adder

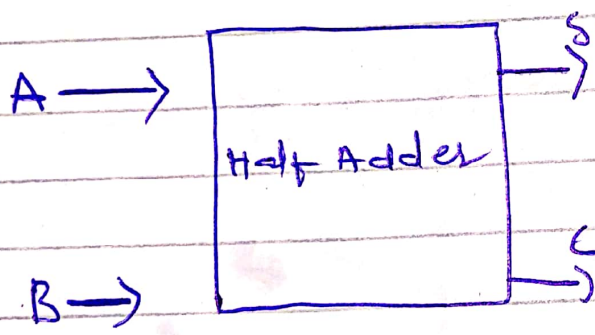
(2) Full Adder.

(Half Adder)

=> The half adder accepts two binary digits on its inputs and produce two binary digits output, a sum bit and a carry bit.

=> In other words it is a combinational circuit which performs arithmatic addition of two one bit numbers.

=> It does not take carry from previous sum.



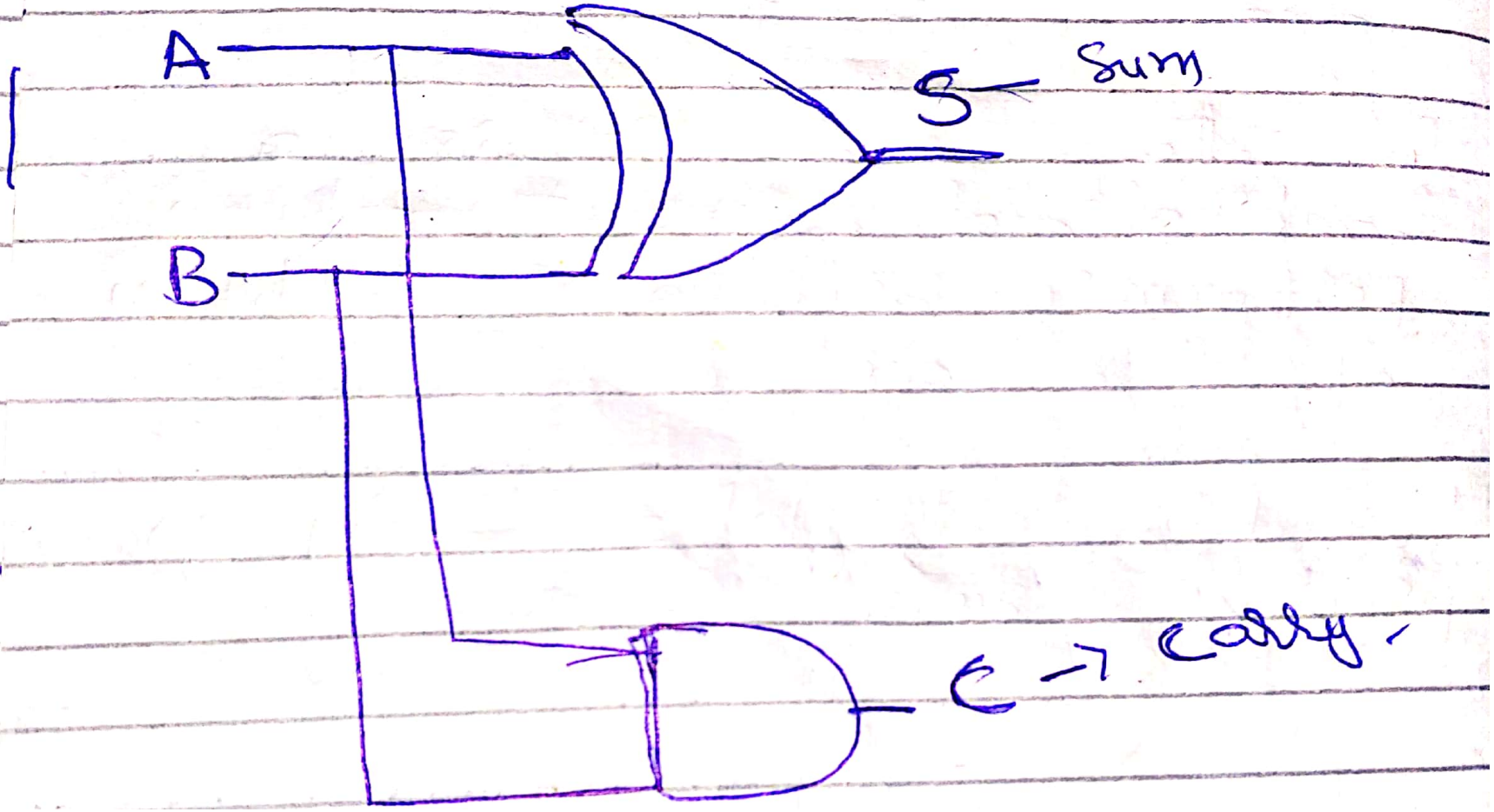
Inputs		outputs	
A	B	S	C
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

=> Here sum is behaving like X-OR and carry is behaving Like And gate

F

$S = A \oplus B = \bar{A} \cdot B + A \cdot \bar{B}$

$C = A \cdot B$

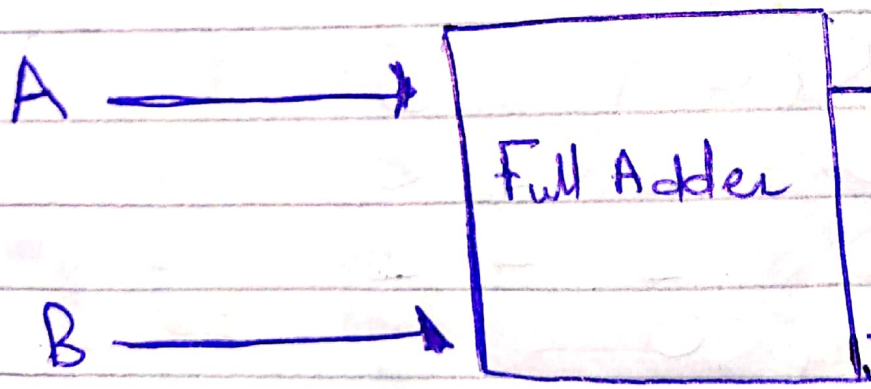


(Full Adder)

⇒ The full adder accepts two inputs bits and an input carry and generates a sum output and an output carry

⇒ It can add two one-bit numbe A and B and carry C

⇒ Full adder is developed to overcome the draw back of Half Adder circuit.



Note that

$1+1 = 10$ (1 = carry, 0 = Sum)

$1+1+1 = 11$ (1 = S, 1 = C)

SNO	A	B	Cin	S	Co
0	0	0	0	0	0
1	0	0	1	1	0
2	0	1	0	1	0
3	0	1	1	0	1
4	1	0	0	1	0
5	1	0	1	0	1
6	1	1	0	0	1
7	1	1	1	1	1

MY OWN Formula

$A+B = S1$ (S)

$S1 + Cin = S \quad Co$

	A+B = S1	= S1 + Cin = S	Co
0	0+0 = 0	= 0+0 = 0	0
1	0+0 = 0	= 0+1 = 1	0
2	0+1 = 1	= 1+0 = 1	0
3	0+1 = 1	= 1+1 = 0	1
4	1+0 = 1	= 1+0 = 1	0
5	1+0 = 1	= 1+1 = 0	1
6	1+1 = 0	= 0+0 = 0	1
7	1+1 = 0	= 0+1 = 1	1

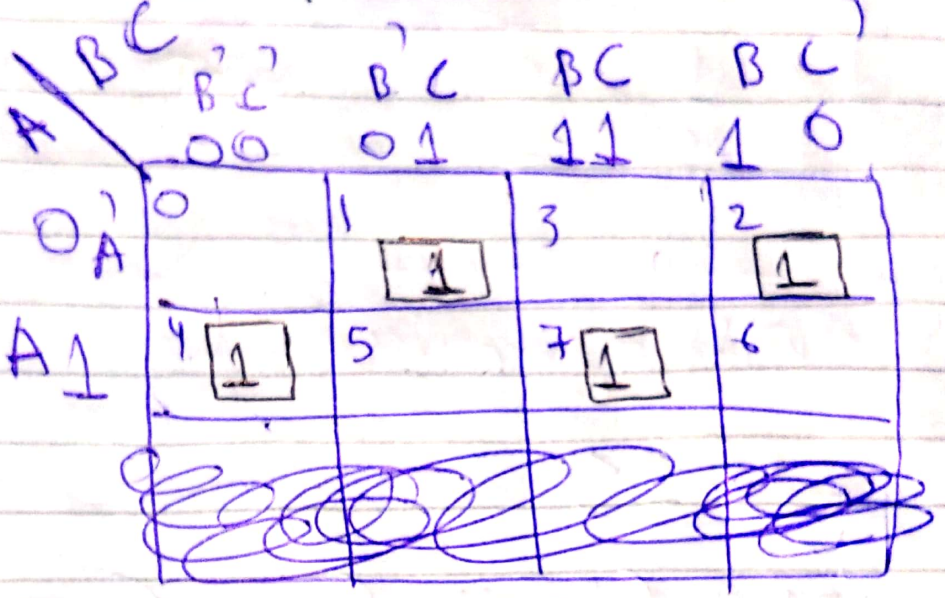
Sum

$$S = A \oplus B \oplus C$$

Carry

$$C = AB + A \cdot C_{in} + B \cdot C_{in}$$

For Sum



$$F = A \cdot B'C' + A'B'C + ABC + A'BC'$$

$$F = B'(A \cdot C' + A'C) + B(AC + A'C')$$

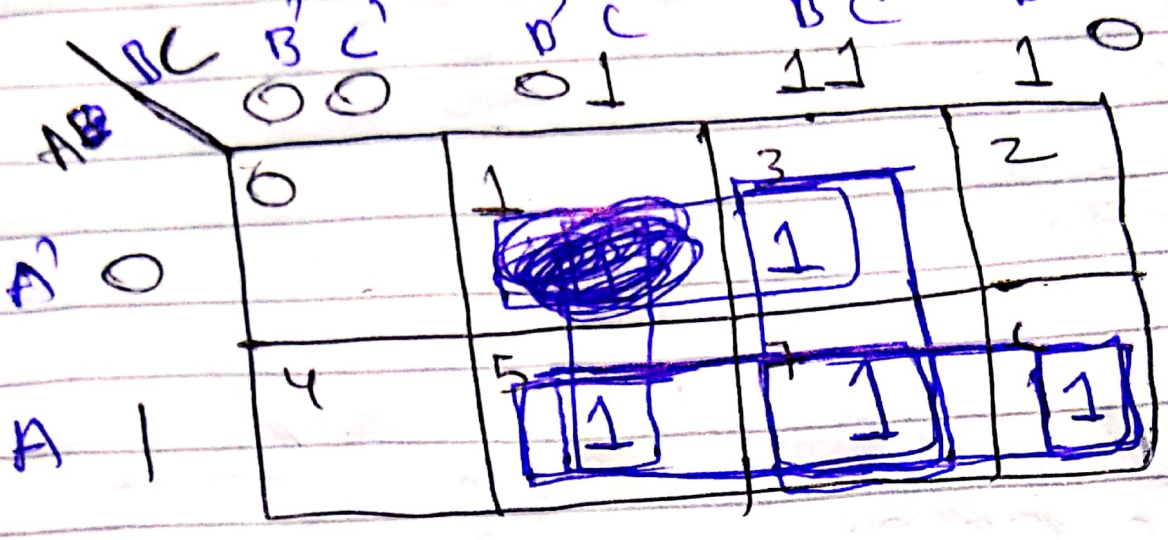
Here $AC' + A'C = X\text{-}OR = A \oplus C$

& and $AC + A'C' = X\text{-}NOR = \overline{A \oplus C}$

$$F = B'(A \oplus C) + B\,\overline{(A \oplus C)}$$

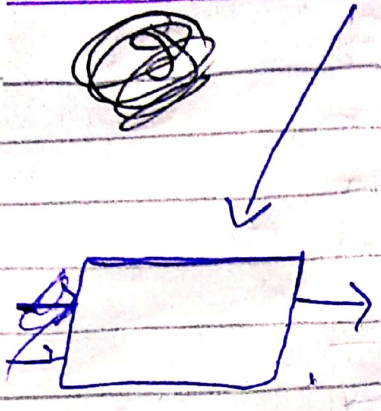
Again $F = B \oplus A \oplus C$

For carry



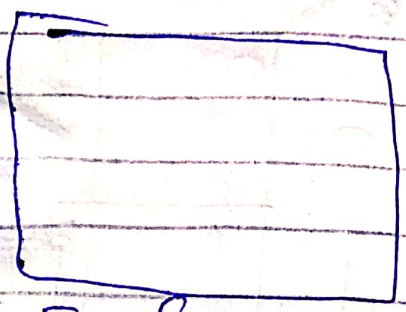
$$C = AC + BC + B.A$$

Combinational Vs Sequential circuit



=> In combinational circuit the output only depends on present input
exp:- Adder

$$\begin{array}{r} 0 \\ +\ 1 \\ \hline 1 \end{array}$$



=> In sequential circuit the output depends on previous output and as well as present input

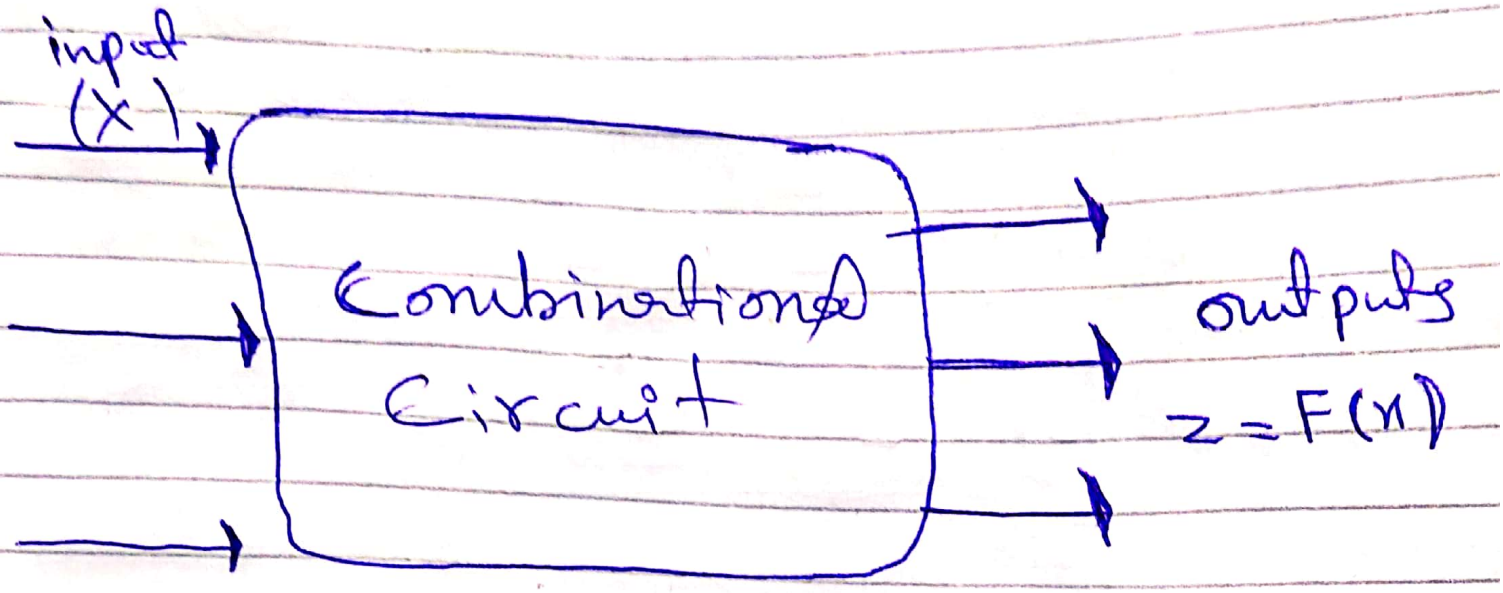
example
counter

+1 prev = 6

6 + 1 = 7
prev

7 + 1 = 8
/
prev

Combinational circuit



Sequential circuit