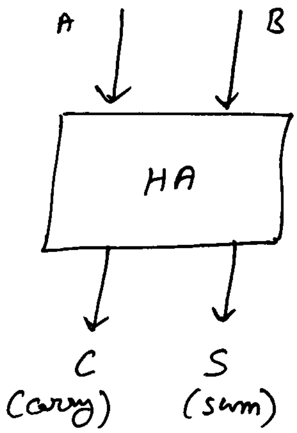
Half adder:-

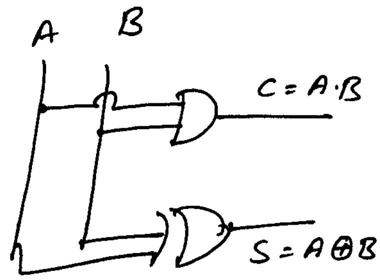
→ The circuit which adds two bits, ignoring the carry from the previous bit addition is called half adder.

→ It has two inputs and two outputs.

→ 2 inputs are 2 bits to be added and 2 outputs are sum & carry



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



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

$$C = A \cdot B$$

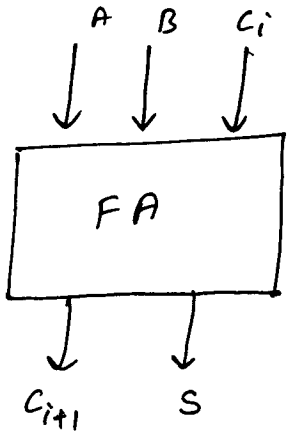
Full adder:-

→ Full adder is meant to add two bits along with carry from the former bit addition.

ex:

```
      1011
    + 1110
    ------
S     0101
Ci   1 1 0 1 0
    ------
sum  11001
```

except LSB, full adder is required for remaining bits



A	B	C_i	S	C_{i+1}
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

$\boxed{S = A \oplus B \oplus C_i}$ ∵ sum = 1 when input has odd number of 1's.

$$C_{i+1} = \bar{A}BC_i + A\bar{B}C_i + AB\bar{C}_i + ABC_i$$

$$(+ ABC_i + A\bar{B}C_i)$$

$$= BC_i + AC_i + AB$$

$$\boxed{C_{i+1} = AB + BC_i + AC_i} = \underline{(A \oplus B)C_i + AB}$$