



SNS COLLEGE OF TECHNOLOGY



Coimbatore-35.

An Autonomous Institution

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Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

**COURSE NAME : 19ITT202 – COMPUTER ORGANIZATION AND
ARCHITECTURE**

II YEAR/ III SEMESTER

UNIT – II Arithmetic Operations

Topic: Design of Fast Adders

Mrs. M. Lavanya

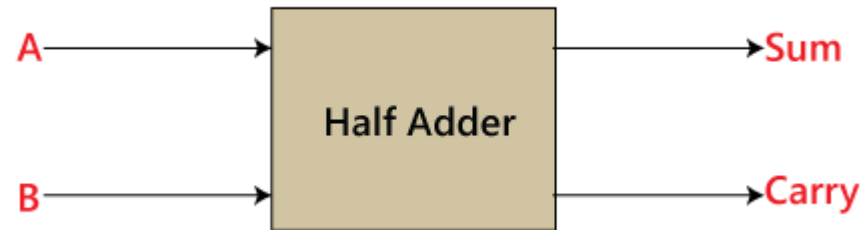
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HALF ADDER

- A half adder is a combinational circuit that performs addition / subtraction operation for two input values and gives the output SUM and CARRY.
- The carry of previous operation is not carried for next operation.



- The addition of 2 bits is done using a combination circuit called a Half adder.
- The input variables are augend and addend bits and output variables are sum & carry bits. A and B are the two input bits.



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

$$S = A \oplus B$$

$$C = A \cdot B$$

A \ B	0	1
0	0	1
1	1	0

$$\text{Sum} = A \text{ XOR } B$$

A \ B	0	1
0	0	0
1	0	1

$$\text{Carry} = A \text{ AND } B$$

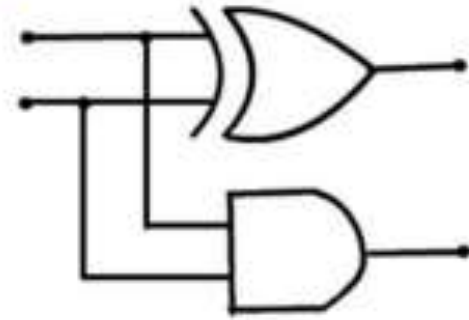


Half-Adder

A	B	S	C

INPUT

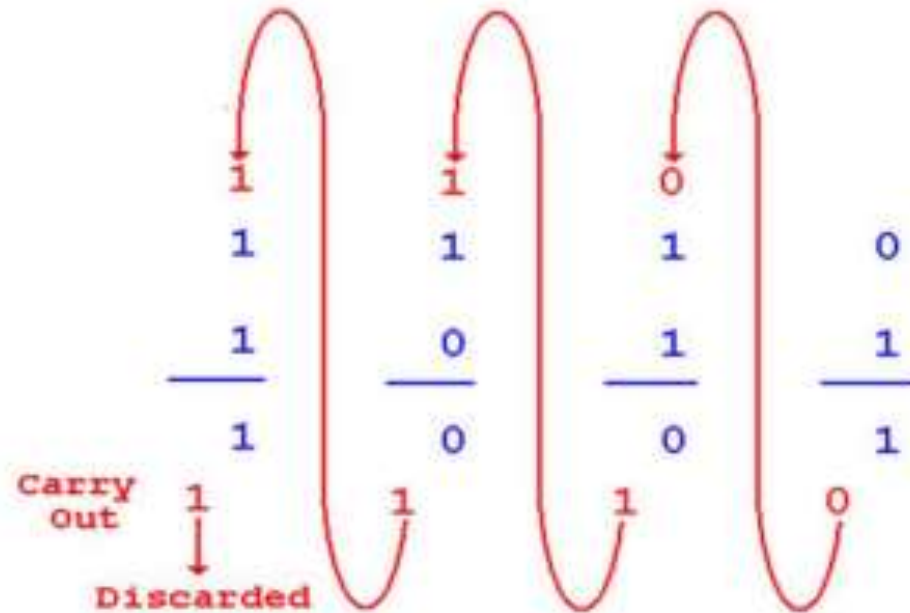
A
B



OUTPUT

$$S = A \oplus B$$

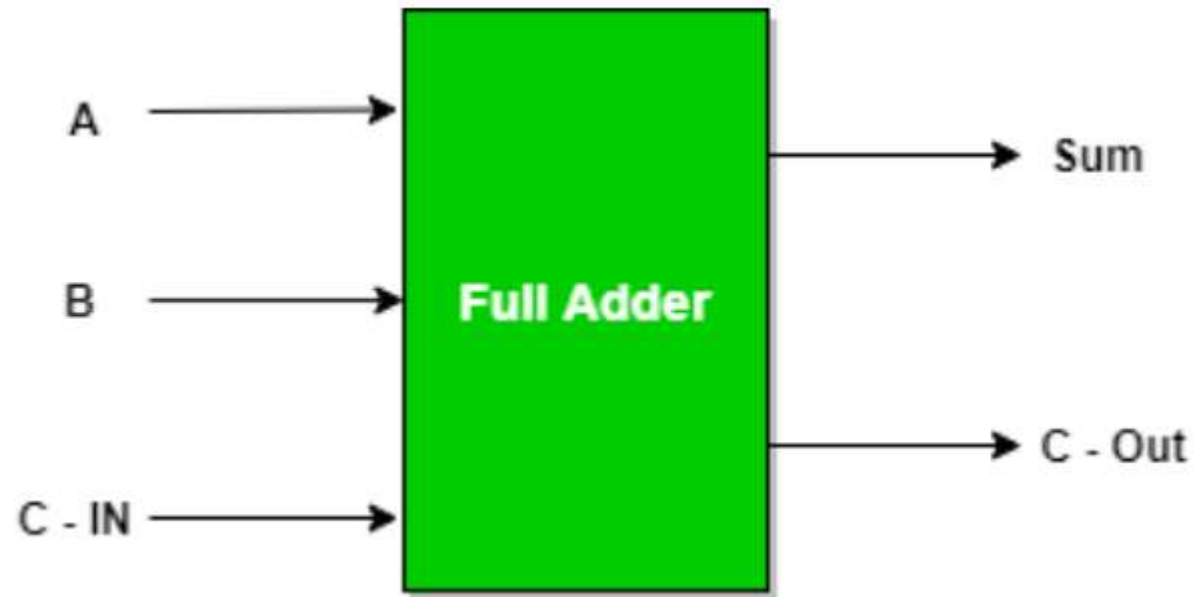
$$C = A \cdot B$$





FULL ADDER

- A complete circuit to perform a single stage of addition is called as a full adder (FA).
- It is used to add 3 values.

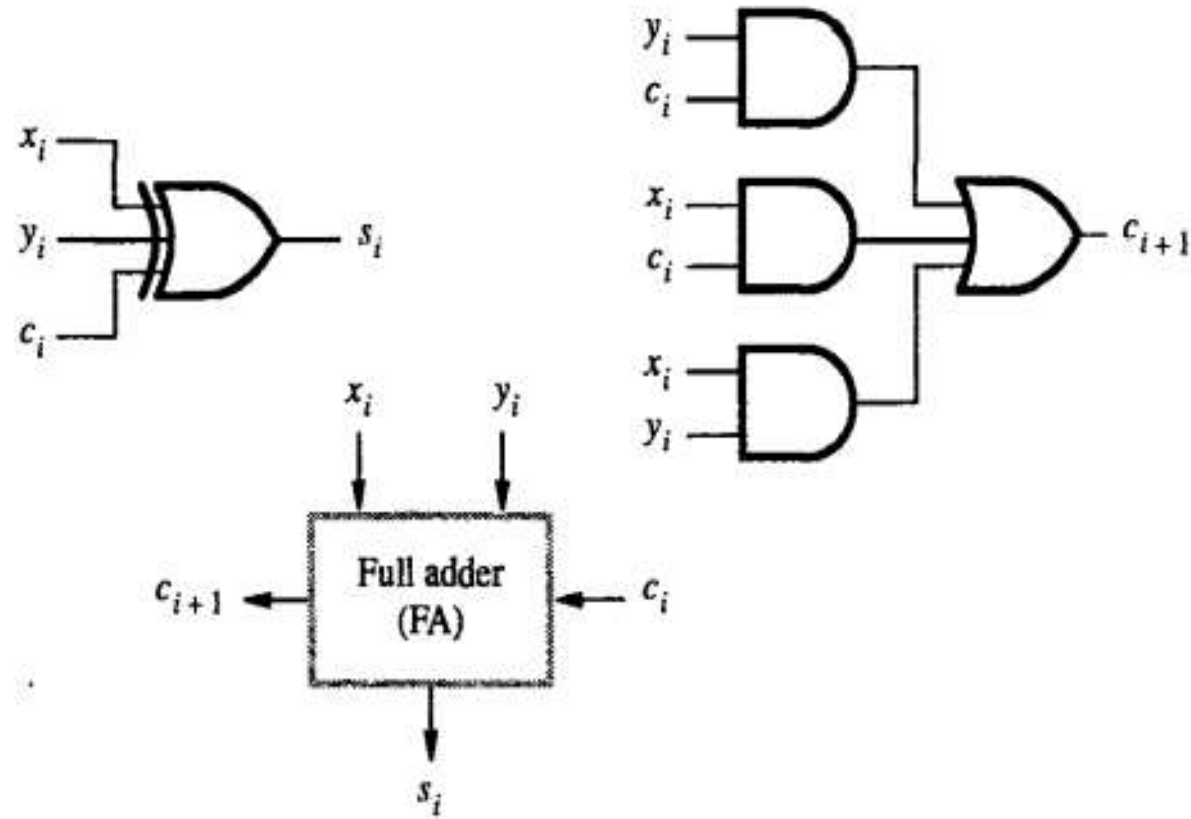




x_i	y_i	Carry-in c_i	Sum s_i	Carry-out c_{i+1}
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

$$s_i = \bar{x}_i \bar{y}_i c_i + \bar{x}_i y_i \bar{c}_i + x_i \bar{y}_i \bar{c}_i + x_i y_i c_i = x_i \oplus y_i \oplus c_i$$

$$c_{i+1} = y_i c_i + x_i c_i + x_i y_i$$

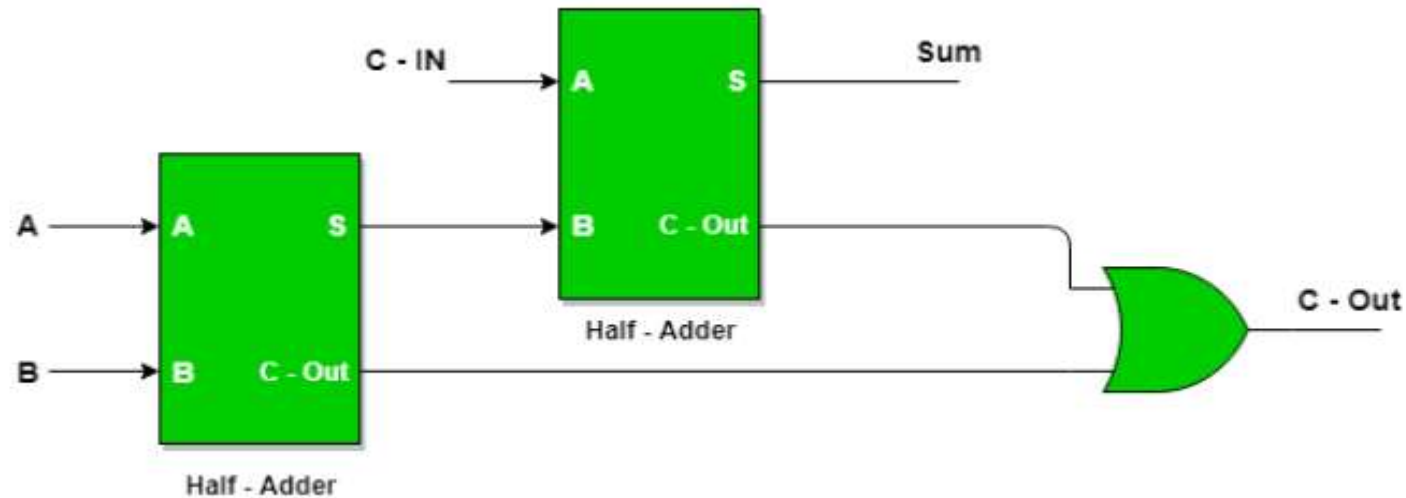


(a) Logic for a single stage



Construction of Full Adder from 2 Half Adder

- A full adder can be constructed with the help of two half adder (HA)
- The difference is that the carry of the previous sum can be given as input for the next addition/operation in full adder.

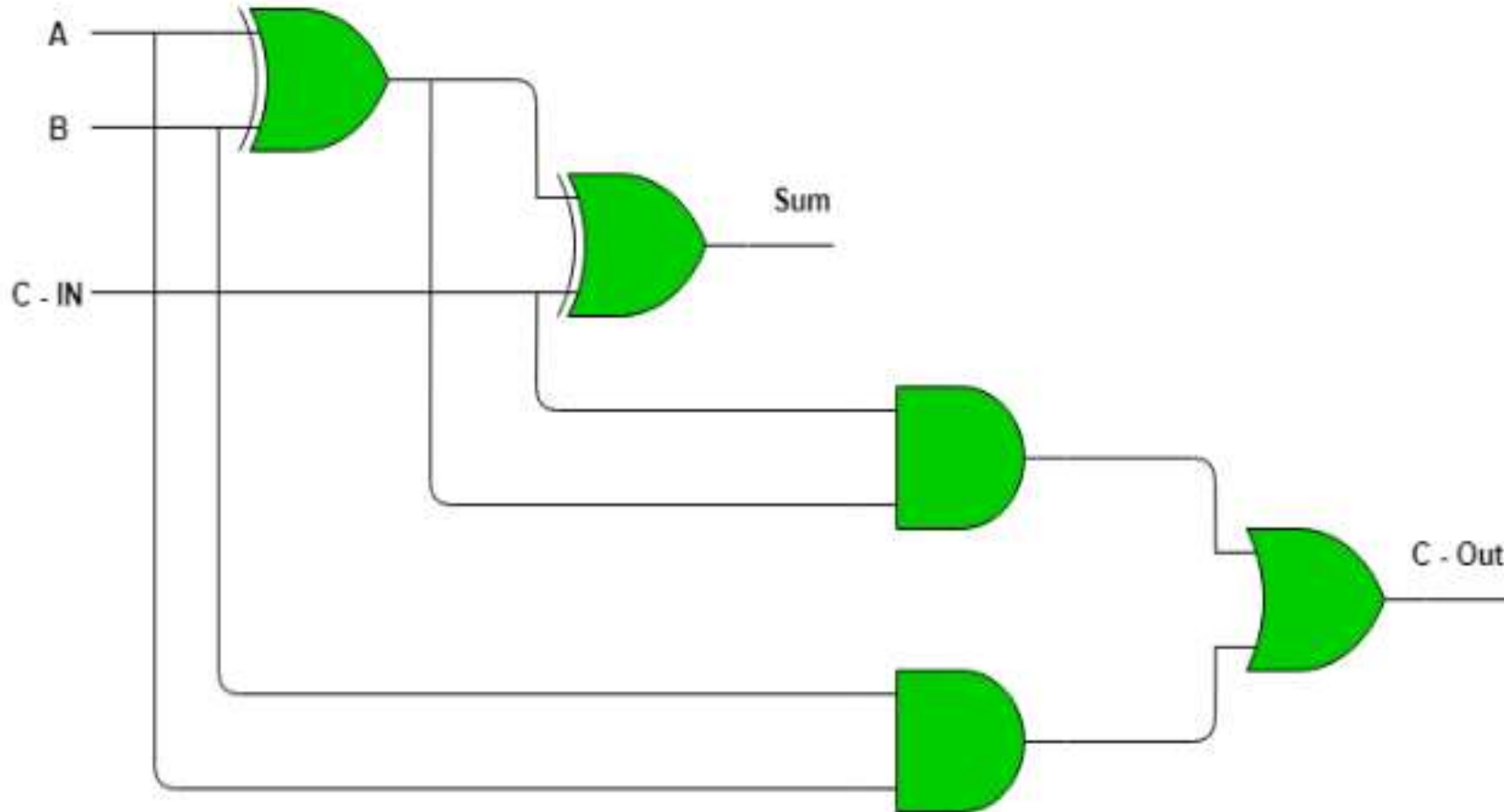




Inputs			Outputs	
A	B	C – IN	Sum	C – Out
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

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

$$C_{out} = AB + (A \oplus B)C_{in}$$



Full Adder logic circuit.

