Adders

module 9

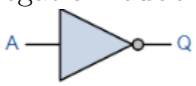
10/23/2023

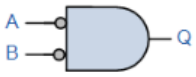
1 Active inputs & ouputs

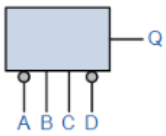
Logic devices can be active high or active low

- HIGH: 1 activates a input or ouput
- LOW: 0 activates a input or ouput

Negation bubble denotes an active low input, inputs without them are active high.







2 Adder

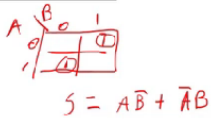
Adders are the basic building blocks of digital system processors.

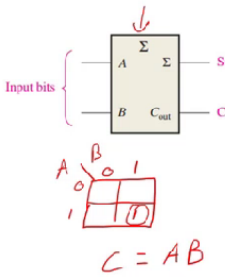
2.1 building an adder

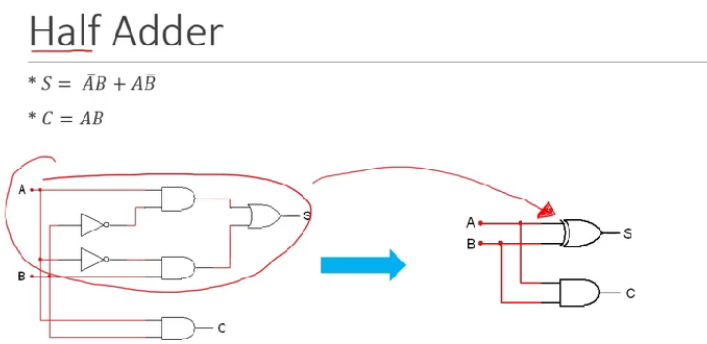
- Buid a trut table
- take the sum of the inputs →s is the sum and c is the carry
- They can also be simplified by mapping

* There are 2 inputs (A,B) and two outputs (sum and carry)

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





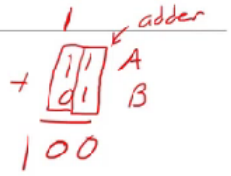


2.2 Full adder

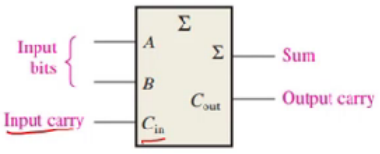
- Same as a half adder but can now accpet a carry in bit
- Carry out of first sum becomes the carry in of the next

Full Adder

* Full adder is similar to a half adder, but can accept a carry in bit

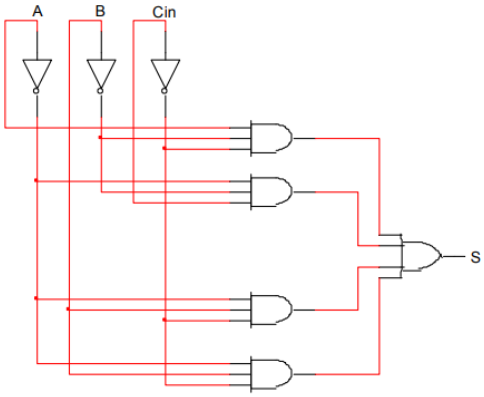


A	B	Cin	S	Cout
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

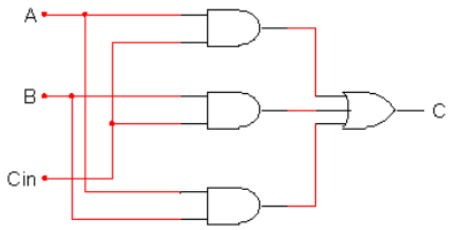


Full Adder

* SOP circuit for full adder



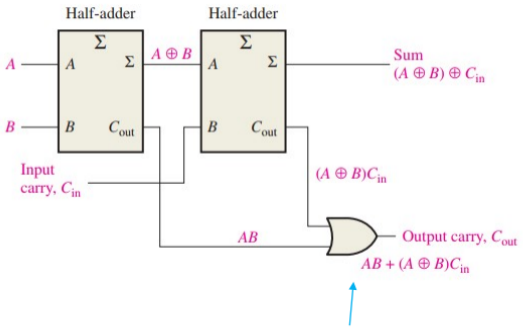
$$S = A\overline{B}\overline{C_{in}} + \overline{A}\overline{B}C_{in} + ABC_{in} + \overline{A}B\overline{C_{in}}$$



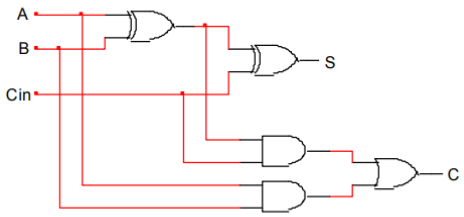
$$C = AC_{in} + BC_{in} + AB$$

2.3 Cascadng half adders

Cascading two half adders in seires produces a full adder



A carryout can come from any of the half adders



2.4 Cascading Full Adders

In binary math, a full adder is implemented for every two digits (bits) added together. Cascading multiple adders increases the size of the binary numbers that can be added together.

- Two full adders add 2 bit binary numbers
- A ground symbol on an adder indicates the LSB diigt