

ASSIGNMENT - 3

Date - 30/12/21

Submitted by -

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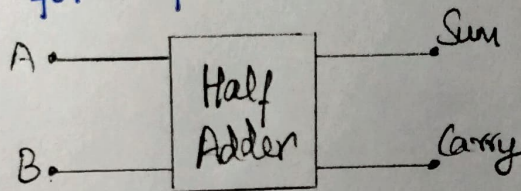
Half and Full Adders and Subtractors

(I) EXERCISE - A look at HALF-ADDER.

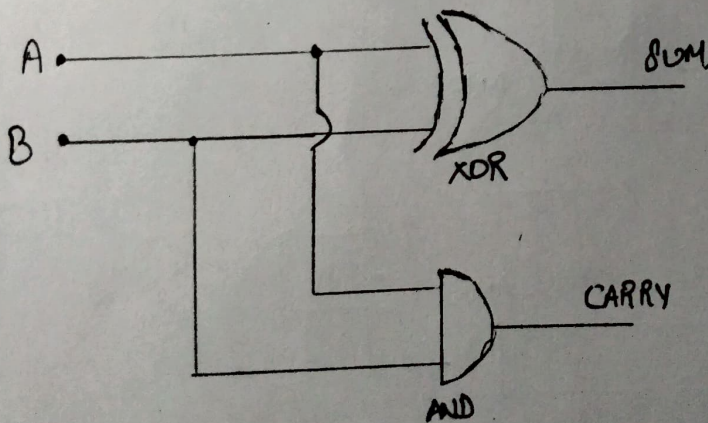
SOFTWARE USED - Logisim.

DETAILS → Used to add 2 single bit numbers.

Schematic for Half Adder:



Circuit diagram:



Truth table:

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

$$\text{Sum} = \bar{A}B + A\bar{B} = \underline{A \oplus B}$$

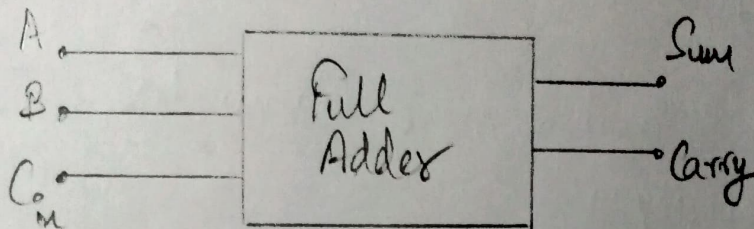
$$\text{Carry} = \underline{AB}$$

(II) EXERCISE - A look at FULL ADDER.

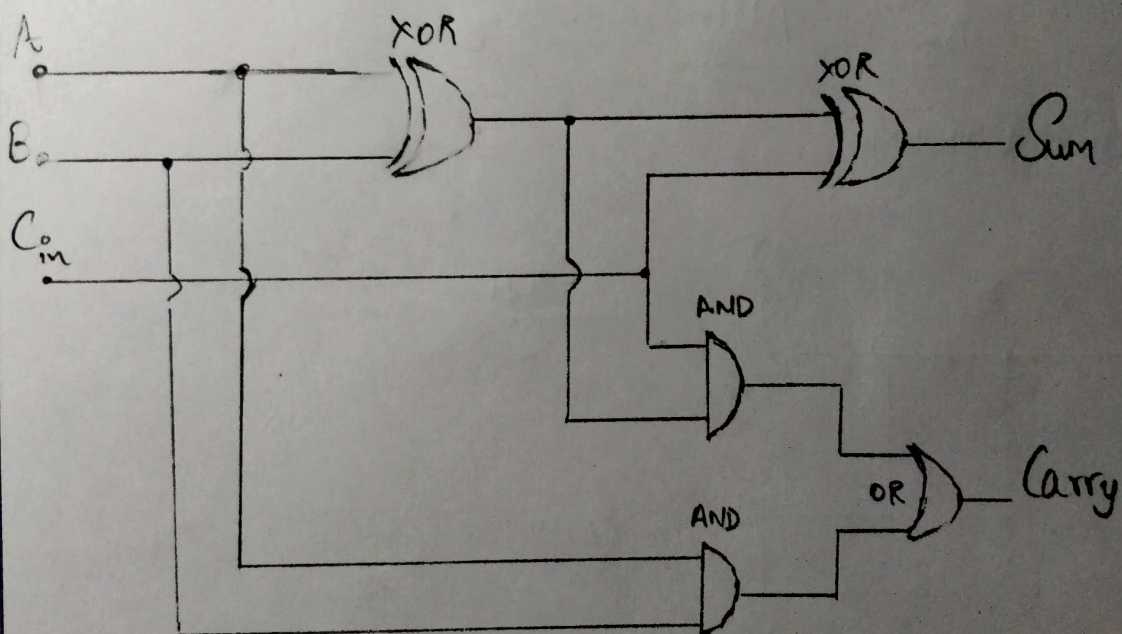
SOFTWARE USED - Logisim

DETAILS -

Schematic for full adder:



Circuit diagram:



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

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

or

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

Truth table:

A	B	C_{in}	Sum	Carry
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

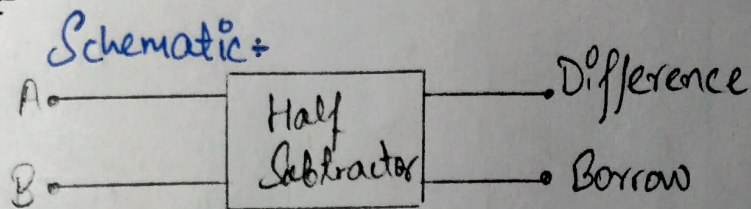
$$\begin{aligned}
 \text{Sum} &= \bar{A}\bar{B}C_{in} + \bar{A}B\bar{C}_{in} \\
 &\quad + A\bar{B}\bar{C}_{in} + ABC_{in} \\
 &= A \oplus B \oplus C_{in}
 \end{aligned}$$

$$\begin{aligned}
 \text{Carry} &= \bar{A}B C_{in} \\
 &\quad + B\bar{C}_{in} + A C_{in} + AB
 \end{aligned}$$

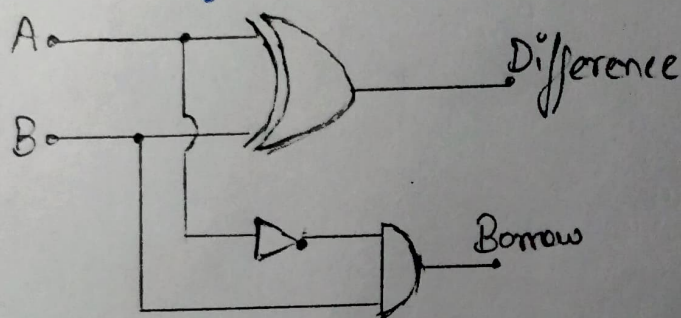
(III) EXERCISE : A look at HALF SUBTRACTOR.

SOFTWARE USED : Logisim.

DETAILS :



Circuit diagram:-



Truth table:-

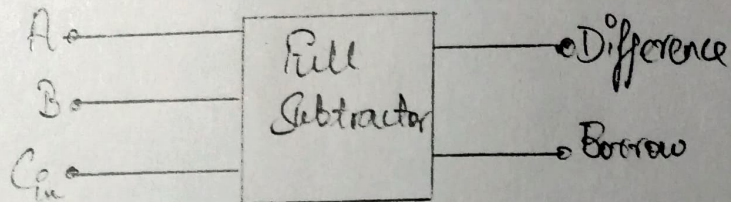
A	B	Difference	Borrow
0	0	0	0
0	1	1	1
1	0	1	0
1	1	0	0

$$\text{Difference} = A \oplus B$$
$$\text{Borrow} = \bar{A} B$$

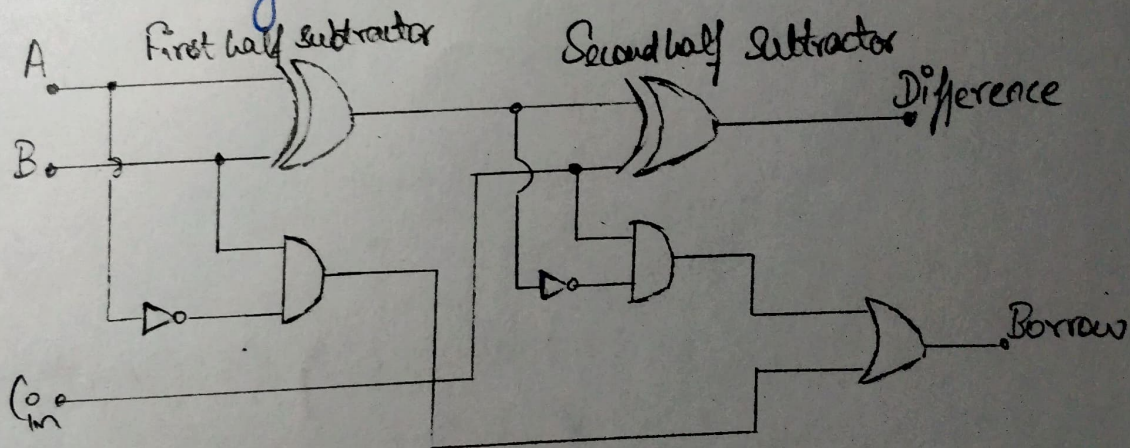
(IV) EXERCISE :- A look at FULL SUBTRACTOR

SOFTWARE USED :- Logisim.

DETAILS :- Schematic:



Circuit diagram:-



Truth table:-

A	B	C	Difference	Borrow
0	0	0	0	0
0	0	1	1	1
0	1	0	1	1
0	1	1	0	1
1	0	0	1	0
1	0	1	0	0
1	1	0	0	0
1	1	1	1	1

$$\text{Difference} = A \oplus B \oplus C$$

$$\text{Borrow} = BC + \bar{A}C + \bar{A}B$$