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Class Group: COMP1D-X

Lab 6 – Adders

1. Complete the following truth table for a binary half adder:

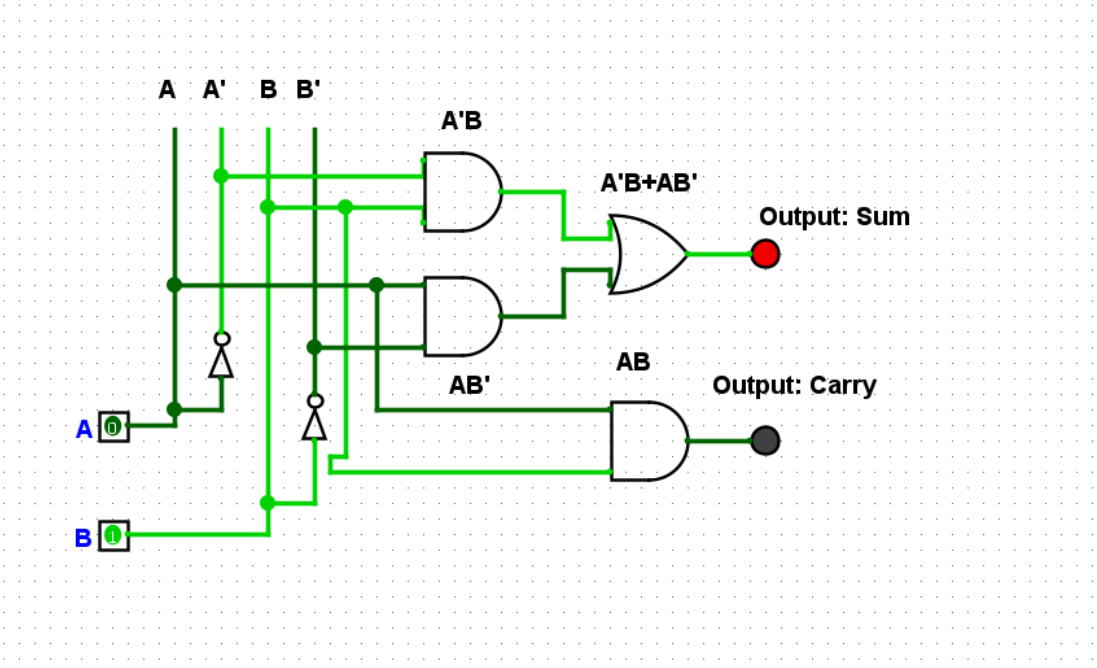
   Truth Table:

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

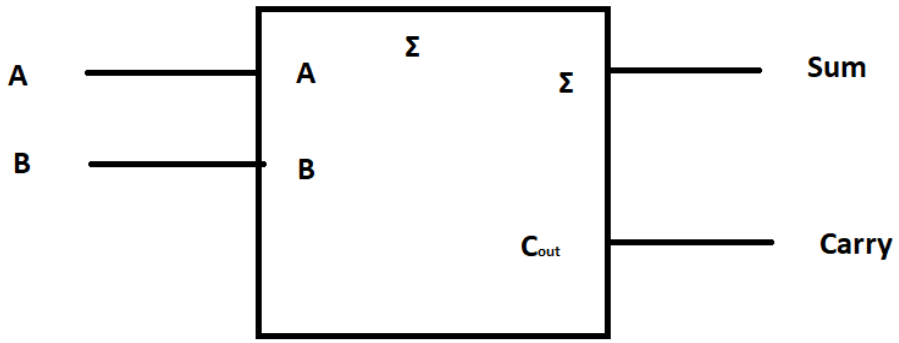
2. Using the truth table above, design a half adder circuit which adds two bits.

   Circuit:

   $S = A' B + A B'$ or $S = A \oplus B$
   $C = AB$



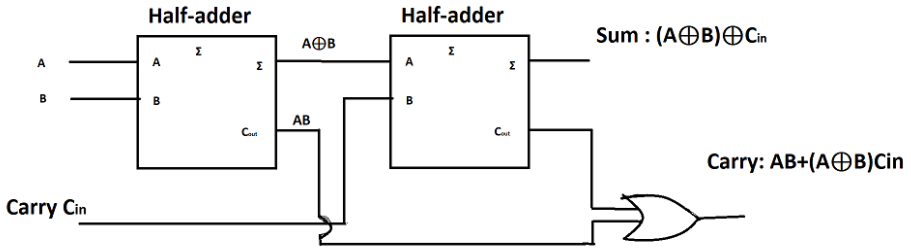
3. Draw the black box representation of a half adder.



4. Complete the following truth table for a full adder:

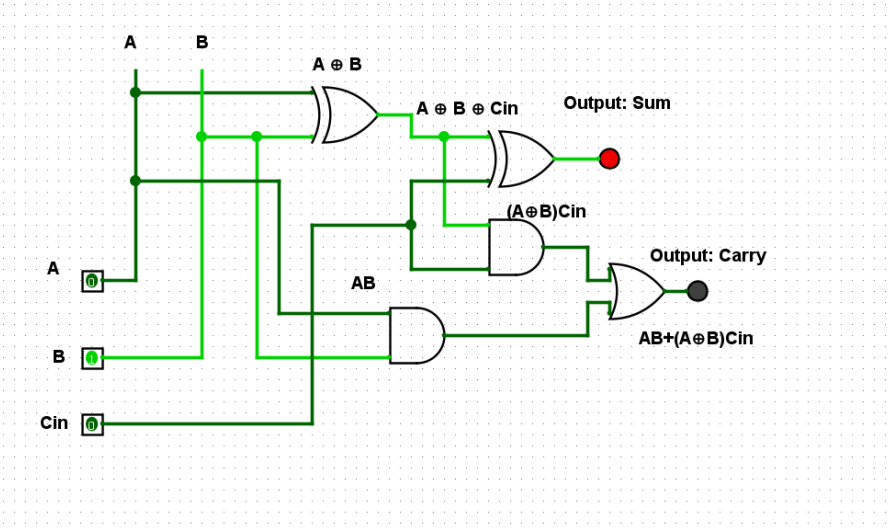
A	B	C	Sum	Carry
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

5. Using the black box representation of a half adder (from Q.3), design a full adder which is capable of adding two bits and a carry-in bit.



6. Implement the full adder design in Logisim using XOR, AND and OR gates.

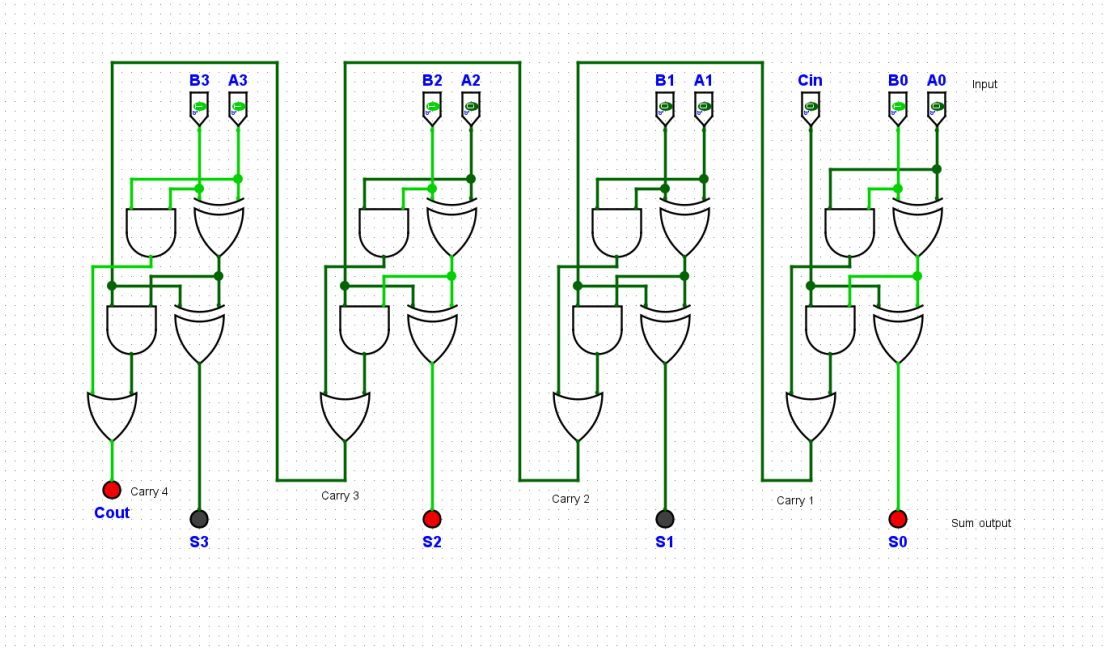
Circuit:



7. Using the partial circuit given on Canvas, ripple-burst.circ, complete the ripple carry adder which is capable of adding two 4-bit numbers. Test your circuit by adding the following 4-bit numbers (include a screenshot for each sum):

   a. 0011 + 0111 = 1010
   b. 0101 + 0001 = 0110
   c. 0011 + 0010 = 0101
   d. 1000 + 0011 = 1011
   e. 1010 + 0011 = 1101
   f. 1101 + 1000 = 1010 1 # (Carry output 1)

Circuit:



8. Using a black box design (i.e. use black box full adder blocks), draw the 4-bit ripple carry adder below: