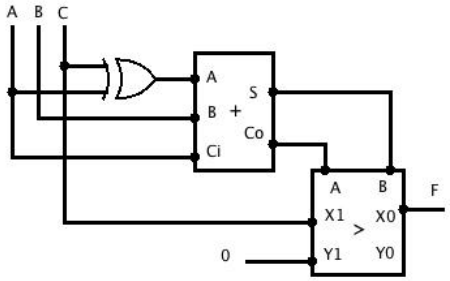
Digital Systems

Combinatorial circuits

1. Implement a complete 1 bit adder circuit in Logisim. Using that circuit, build an adder circuit of 4 bits.

2. Implement a 1 bit comparator circuit in Logisim. Using that circuit, build a comparator of 4 bits.

3. Simplify the function $F(A, B, C)$, represented by the circuit in the following picture:



4. Implement the function $F(A, B, C, D, E, F)$ using combinatorial circuits, where F is defined by:

$$F(A,B,C,D,E,F) = \begin{cases} A > B & \text{if } C = 1 \\ D & \text{if } C = 0 \text{ and } (E+F) > 1 \\ (E+F) > 1 & \text{otherwise} \end{cases}$$

(the + symbol represents the sum operation and not the usual *OR*.)

5. Project and buid a circuit that converts code X to binary according to the following table.

Code X	Decimal
0011	0
0101	1
0110	2
1001	3
1010	4
1100	5

6. Build the circuit that implements the function $F(A, B, C, D, E, F, G)$ that only takes value 1 when the input variables with value 1 is pair.

7. Consider that you have a 7 segment display (a,b,c,d,e,f):

   (a) Draw the circuit that decodes binary to hexadecimal.

   (b) Repeat last exercise (7a) using the "Combinatorial Analysis"of LogiSim and compare the results.

   (c) Complete the circuit in the simulator and verify if it's working.

8. Implement in LogiSim the 4x2 priority encoder circuit presented in the theoretical class. Expand that circuit for an 8 input encoder and check how it works.