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ELEN/COEN 21

Homework #1

1. Write the ASCII codes, in binary, for the string "Hello"

H = 01001000

e = 01100101

l = 01101100

l = 01101100

o = 01101111

2. (a) Generate the truth table for the following circuit, including the intermediate nodes (A, B, C, D)

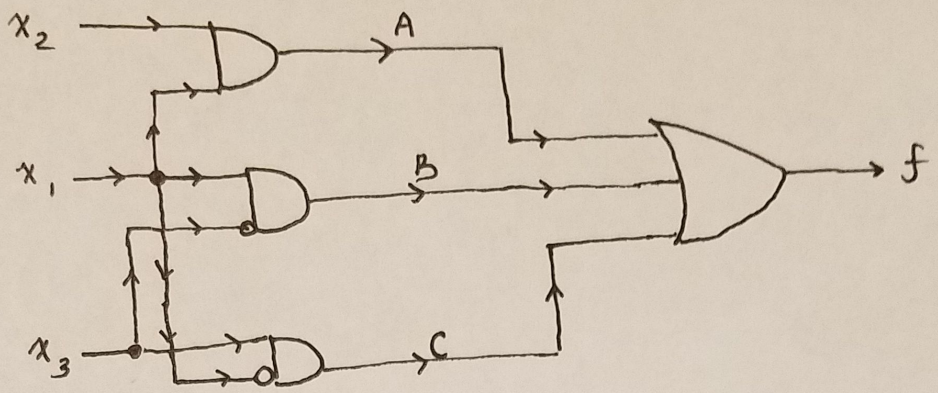
Row #	x1	x2	x3	x1*x2=A	x1*!x3=B	!x1*x3=C	A+B=D	D+C=F
0	0	0	0	0	0	0	0	0
1	0	0	1	0	0	1	0	1
2	0	1	0	0	0	0	0	0
3	1	0	0	0	1	0	1	1
4	0	1	1	0	0	1	0	1
5	1	1	0	1	1	0	1	1
6	1	0	1	0	0	0	0	0
7	1	1	1	1	0	0	1	1

(b) Write an algebraic equation for f(x1,x2,x3) that matches the structure of this circuit.

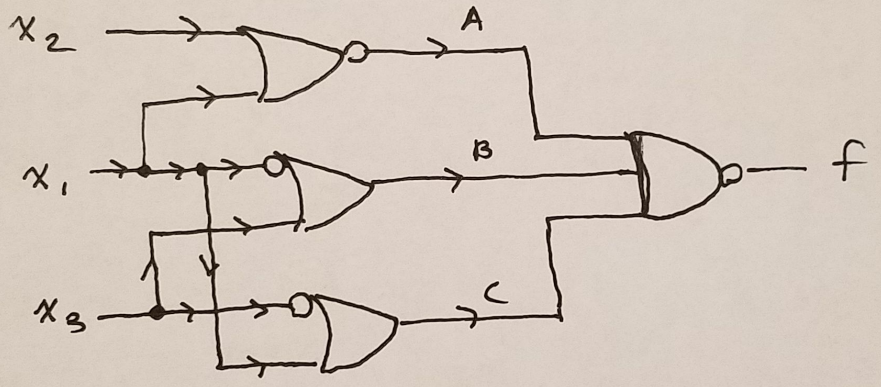
f(x1,x2,x3) = [(x1*x2) + (x1*!x3)] + (!x1*x3)

= x1*x2 + x1*!x3 + !x1*x3

(c) Two of these gates can be combined into a single 3-input gate. Redraw the circuit using this change in structure.



(d) DeMorgan's Theorem allows us to change the structure of this circuit. Draw the same function using just NAND gates and NOT gates. (You can use a 3-input NAND.)



(e) Looking at the truth table you generated in part (a), what are the minterms for this function? Write it using the summation shorthand (i.e., using the sigma symbol).

$$\sum m(1,3,4,5,7) = f(x_1, x_2, x_3)$$

$$= (!x_1 \cdot !x_2 \cdot x_3) + (x_1 \cdot !x_2 \cdot !x_3) + (!x_1 \cdot x_2 \cdot x_3) + (x_1 \cdot x_2 \cdot !x_3) + (x_1 \cdot x_2 \cdot x_3)$$

(f) Now write the canonical SOP equation.

$$(!x_1 \cdot !x_2 \cdot x_3) + (x_1 \cdot !x_2 \cdot !x_3) + (!x_1 \cdot x_2 \cdot x_3) + (x_1 \cdot x_2 \cdot !x_3) + (x_1 \cdot x_2 \cdot x_3)$$