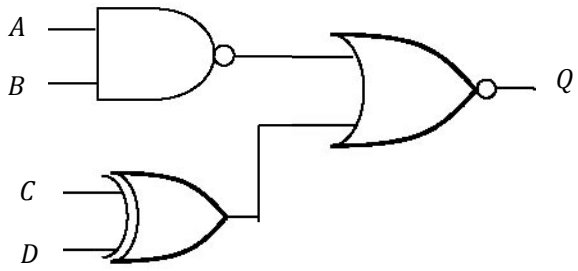
P116B Homework 2

Due 2/1/2019

1. Consider the following logic circuit:



   (a) Fill out a truth table for all 16 combinations of the inputs.

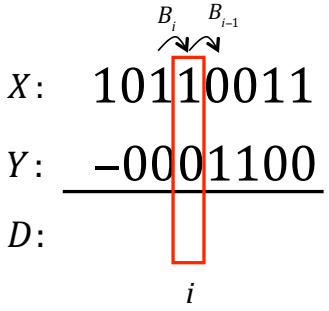
   (b) Write a logical expression for this circuit, including a logical representation of each individual gate. Do *not* use the exclusive OR operator ($\oplus$)

   (c) Use De Morgan's rule to reduce this to an expression in which any inversions operate only on individual terms.

   (d) Design a functionally equivalent circuit using only NAND gates. (Note: It might take quite a few)

2. H&H 10.13

3. Write a truth table for a "full-subtractor" for calculating the i^{th} bit of $D = X - Y$, where B_i is a request to borrow from bit $i+1$ to bit i.



B_{i-1}	X_i	Y_i	D_i	B_i
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

4. Solve the following problems by converting the numbers to binary and solving with twos complemement arithmetic. For the whole numbers, use 8-bit signed integers, and for the numbers with fractions, use fixed-point arithmetic with 8 bits for the fractional part and 16 bits total. Converty back to decimal and verify that your answers are correct.

   (a) $65 + 32$

   (b) $19 - 41$

   (c) $12.35 + 57.6$

   (d) $55.2 - 74.11$