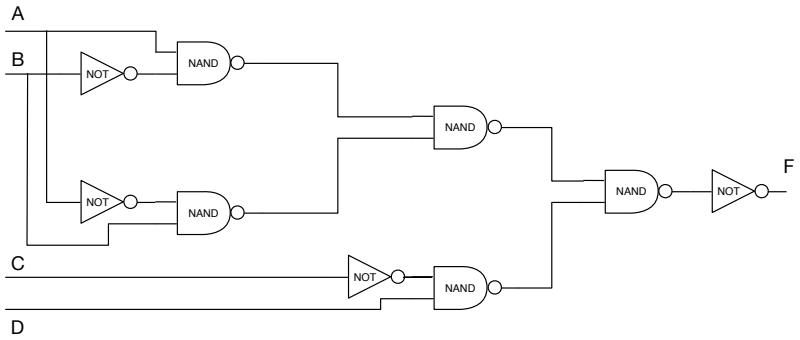
ELEC 2607 ('14) **Assignment 2** 10 Marks

1. Prove or disprove that the function $Z = ab + c(a + b)$ is self-dual. Note that self-dual functions satisfy the property $\overline{f(a, b, c)} = f(\bar{a}, \bar{b}, \bar{c})$. 2 marks

2. Convert the following NAND-NOR circuit to an AND-OR circuit (bubbles i.e. inverters allowed). 2 marks



3. Perform the following conversions by showing your work. 2 marks

   (a) $(11001.001)_2 = (?)_{10}$
   (b) $(1001110.11)_2 = (?)_8$
   (c) $(1001110.11)_2 = (?)_{16}$
   (d) $(125.86)_{10} = (?)_2$ upto 3 fractional digits

4. Let $A = 11100100$, $B = 11000110$ be two numbers encoded using the 2's complement system with 8 bits. Perform the following operations and indicate if there is an overflow. 1.5 marks

   (a) $A + B$
   (b) $B - A$
   (c) $-A - B$

5. Draw the K-Map for the expression $a\bar{b}c + d\bar{c}b + adc + \bar{a}cd + a\bar{b}\bar{c}d$. Using the K-Map reduce the expression to its simplest form. 1.5 marks

6. Find a simplified expression for the following K-Map. 1 mark