Dalhousie University Faculty of Computer Science
Introduction to Computer Organization with Assembly
Assignment 1 CSCI 2121 14 Jan 2016 Due: 21 Jan 2016

1. (a) *(i)* Show that the NOR gate is *complete*.
   *(ii)*Identify the gate that is the dual of the NOR gate.
   (b) Show that the set $\{AND, NOT\}$ is *complete*.
   (c) Draw the circuit for $F = XYZ + \bar{X}\bar{Z} + \bar{X}\bar{Y}$ using only AND and NOT gates. Show the calculations that led you to your answer.

2. (a) Construct a truth table for a three input XOR gate.
   (b) Using the truth table you construct, obtain the Boolean function describing the three input XOR gate.
   (c) Suppose you want to transmit a 3-bit message $X\ Y\ Z$ with an *even* parity bit. *i.e.* You need to construct a circuit that outputs a parity bit P, such that the 3 message bits and the parity bit taken together have an even number of '1's. Give the circuit diagram, with an explanation, of the (even) parity generator. (*hint: examine 2.(a)*)

3. Consider the 3-i/p majority function F_m. F_m is true if the majority its i/ps are true (See example used in class notes).
   (a) Write the algebraic expression for F_m in *(i)* Sum of minterms form *(ii)* Sum of maxterms form.
   (b) Simplify the sum of minterms form to the SOP form: $AB + AC + BC$
   (c) Implement the circuit using **only** NAND gates.

4. Use an appropriate decoder and OR gates to implement the boolean functions: $F = \bar{A}B\bar{C} + \bar{A}\bar{B}C + A\bar{B}C + \bar{A}BC$ and $G = \bar{A}B\bar{C} + ABC$. Explain your answer clearly.