ELL100: Introduction to Electrical Engineering
Module: Digital Circuits
Tutorial 1

Q1. Convert the following numbers from given base to indicated base:
   (a) $(4231)_5 \rightarrow (\quad)_{10}$
   (b) $(129)_{10} \rightarrow (\quad)_2$
   (c) $(35.33)_{10} \rightarrow (\quad)_2$
   (d) $(11001011.001101)_2 \rightarrow (\quad)_8$
   (e) $(23.21)_8 \rightarrow (\quad)_{16}$

Q2. If n=11010 and m=101011, Obtain the following:
   (a) n+m
   (b) n-m
   (c) m-n

Q3. If F= ab + cd then prove that FF' = 0 and F+F' =1

Q4. Convert each of the following expressions into sum of products and product of sums:
   (a) (x+y'z)(xz+y)
   (b) (ab +bc)(a'+bc')

Q5. Implement the Boolean function F(A, B, C, D) = $\square$(2, 3, 6, 9, 10, 11, 13, 14, 15) using NAND gates only

Q6. Use DeMorgan's Theorem to simplify the following expressions:
   (a) $\overline{(a + d)} . \overline{(\overline{b} + c)}$
   (b) $\overline{(a.b.\overline{c})} + \overline{(\overline{c}.d)}$
   (c) $(\overline{a} + d) . (b + \overline{c}) . (\overline{c} + d)$

Q7. Simplify the following Boolean expressions to minimum number of literals
   (a) x'y(w' + z'w) + y(x + x'zw)
   (b) (x + z)(x' + y)(z + y)
   (c) x' + y' + xyz'
   (d) xy' + y'z' + x'z'

Q8. Show that sum of all minterms of a Boolean function of n variables is equal to 1 for:
   (a) n = 3
   (b) General proof

Q9. Express the following Boolean Function as:

$$F = A'C + B'C + AB' + ABC$$

   (a) Sum of minterms
   (b) Minimal SOP expression

Q10. Simplify the Boolean function as:

$$F = \sum(7, 9, 11, 12, 13, 15)$$

   (a) SOP
   (b) POS