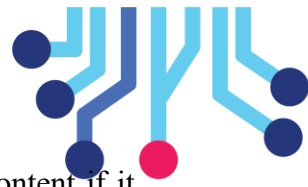# Digital Design Verification

DLD – Worksheet 1

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NUST Chip Design Centre (NCDC), Islamabad, Pakistan

Question 1: The state of a 16-bit register is 1000 0101 0011 1001. What is its content if it represents:

a) Four decimal digits in BCD?
b) Four hexadecimal digits in the Gray code?

Question 2: Perform the following number systems conversions.

    i. $(11100010)_2 = (?)_{10}$. Let the binary number is in signed 2's complement form.
    ii. $(5C7B.6)_{16} = (?)_2 = (?)_{10}$
   iii. $(367)_{10} = (?)_8$

Question 3: Determine the most simplified SOP form of the Boolean equation given in equation (1) using Boolean algebra. Also determine the most simplified SOP form using the K-map method. Do both methods yield the same result? Explain with reasoning.

$$f(A,B,C,D) = \bar{A}BCD + \bar{A}CD + ABCD + \bar{B}\bar{C}D + \bar{A}B \quad\quad (1)$$

Question 4: Determine the most simplified POS form of the Boolean function $f(A,B,C,D) = \sum(0,1,6,7,14,15)$ with don't care condition $d(2)$. Implement the simplified POS equation using NOR gates only.

Question 5: Design a circuit using logic gates to convert 4-bit Binary number to its equivalent Gray code. Clearly explain the functionality of your design.

Question 6: Consider the circuit below. Determine the logic equation for each output. Let the input to this circuit is a 4-bit BCD number (0000 → 1001), draw a single truth table enlisting all the inputs and outputs. What does this circuit do? Design another circuit which takes $E_3E_2E_1E_0$ as input and generates $B_3B_2B_1B_0$ as output.