Nile High Institute For Engineering and Technology
Department: Communication
Level: 200
Type: 2nd —Term

Course-Title: Digital & Logic Circuit
Course-Code: ELE 221
Date: / / 2018
Total Marks: 50 Points
Time allowed: 2 hour(s)

Question No. 1 **[5 Points]**

A. An 8-bit register contains the following: **11111111**
   (i) Interpret this content as an unsigned decimal number
   (ii) Interpret this content as a signed decimal number

B. What is the highest signed decimal that can be represented by four bits?

C. How many bits are required to represent **-20**?

Question No. 2 **[15 Points]**

A. Simplify the following Boolean equation using Boolean theorems
$Y = B + \bar{B} + \bar{A}B\bar{C} + (\overline{A + \bar{C}})$

B. A logic circuit implements the following Boolean function: $\boldsymbol{F = \bar{A}C + A\bar{C}\bar{D}}$
It is found that the circuit input combinations $\boldsymbol{A = C = 1}$ can never occur. Find a simpler expression for $\boldsymbol{F}$ using the proper don't care conditions

C. Obtain the truth table for the following function and express each function in SOP and POS $F = (xy + z)(y + xz)$

Question No. 3 **[15 Points]**

A. A combinational circuit is specified by the following three Boolean functions:
$F_1 = \sum(0,3,4)$ $F_2 = \sum(1,2,7)$ $F_3 = \prod(0,1,2,4)$
Implement the circuit with a decoder and external OR gate

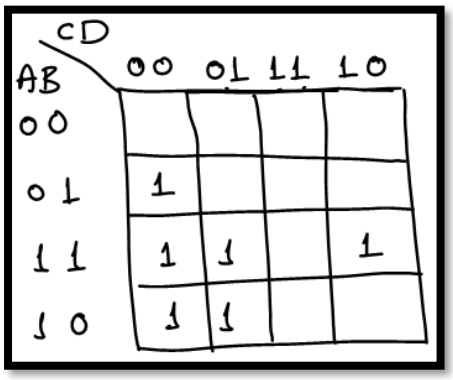
B. Implement the following Boolean function $F(A, B, C, D) = \sum(0,3,5,6,9,10,11)$ with $\boldsymbol{4 \times 1}$ **Multiplexer** (**Do not use** 8×1 MUX)

C. Design a **4-input priority encoder** with input **Do having the lowest priority** and input D3 the highest priority

D. Design a circuit that can select between two 4-bit numbers **A and B** to be the output of this circuit

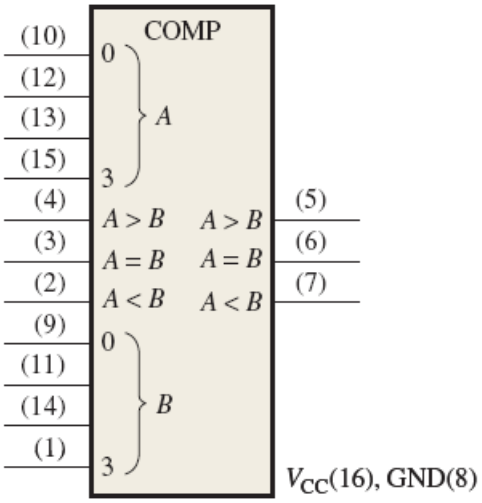
Question No. 4 **[15 Points]**

A. Reduce the Map below to get the minimum reduction



B. Design a logic circuit that computes the function $\boldsymbol{f(x) = x^2 + x + 1}$ for a **2-bit number x**

C. Design a **two 3-bit magnitude comparator**. Output F becomes one whenever the value of input A is **less than or equal** to the value of input B **using 74HC85**



D. Design a two 2-bit adder circuit using 4-bit parallel adder

Best wishes
Dr. Mostafa Elhosseini