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North South University

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Department of Electrical and Computer Engineering

Assignment
EEE211/CSE231 (Digital Logic Design)
Total Points: 60

Direction: Please answer all the questions. You must show the steps of your calculations.

STUDENT's NAME: _____

STUDENT's ID: _____ **SECTION:** 10

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1. **[2+6+2 = 10 points]** Convert the following numbers with the indicated base to Decimal
   a) (2A3.CE4) Hex to ( )$_{10}$
   b) $(110101101110)_2$ = ( )$_8$ = ( )$_{16}$ = ( )$_{10}$
   c) 5602 = ( )$_{BCD}$

2. [**3+2+2+3 = 10 points**] Draw the logic diagram of a full adder circuit. Also show the carry propagator (Pi) and carry generator (Gi). What is the purpose of using carry-look-ahead generator? Derive the Boolean equations and draw a 4 bit carry-look-ahead generator circuit.

3. **[2+2+3+3 = 10 points]** For the Boolean function, **F = xyz + xy'z +x'y + xy'**
   a) Obtain the truth table of F
   b) Use Boolean algebra to simplify the function to a minimum number of literals
   c) Implement the simplified function obtained in (b) using NAND only logic
   d) Implement the function **F** using 2-to-4 Decoder with Enable

4. **[3 + 2 + 5 = 10 points]**

   Consider the following function:
   $F(W, X, Y, Z) = \Sigma(1,3, 7, 8, 10, 15) + \Sigma_d(0, 2, 9)$

   Using K-Map
   a) Express the simplified Boolean expression.

5. [**10 points**] A **Minority Finder** is a digital circuit that will produce a 1 only if the Majority of the inputs are 0s. Design a logic circuit for a **3-input Minority Finder**. State any assumptions you have made in your design. Your circuit should be as simple as possible in terms of number of literals and/or gate input counts.

6. [**10 points**] Design Problem:

Consider the above chemical plant that has four large tanks with sensors A, B, C, and D. Sensor A and B are *liquid-level sensors* and sensor C and D are *heat sensors*. The value of A and B are 'LOW' if the liquid level is satisfactory and 'HIGH' when the level is in danger. Similarly, the value of C and D are 'LOW' if the temperature is normal and 'HIGH' if the temperature drops below the threshold limit.

Design a logic circuit that will take input from these four sensors and produce an alarm ('HIGH') whenever any of the following conditions is True:

a) If the level in tank A and tank B is too high (danger) at the same time
b) If either one of the tank A or tank B is too high (danger) and at the same time that the temperature of tank C or tank D is below the limit.
c) If the temperature of both tank C and tank D is below the limit.

Implement your logic design using any one of the following two methods:

Using Universal gates only (should be minimized first)

OR

Using 8-to-1 Multiplexer

You must show the step-by-step design procedure