AFRICAN INSTITUTE OF COMPUTER SCIENCES
PAUL BIYA TECHNOLOGICAL CENTER OF EXCELLENCY
PO BOX 13719 Yaounde (Cameroon) Tel. (237) 22 72 99 57/22 72 99 58
Web site: www.iaicameroun.com E-mail: contact@iaicameroun.com

CATCHUP EXAM OF DIGITAL ELECTRONICS

Duration: 1 hour **Class: BA1 A&B**

Note: No Calculator

EXERCISE 1: (0.5 + 2 + 1.5 + 1 = 5 marks)

A two's complement generator, that can provide the two's complement representation of a four-bit binary number after having changed its sign, is to be designed. This circuit has the inputs B_3, B_2, B_1 and B_0, and the outputs T_3, T_2, T_1 and T_0.

1. Complete the input values and Fill up the following truth table of the two's complement generator

Inputs				Outputs			
B_3	B_2	B_1	B_0	T_3	T_2	T_1	T_0
0	0	0	0				
0	0	0	1				

2. simplify the functions T_0, T_1, T_2 and T_3 using the Karnaugh map;
3. for each of the functions T_1, T_2 and T_3, determine X_{i-1} so that the next logic expression is verified:

$$T_i = X_{i-1} \oplus B_i, \qquad i = 1, 2, 3.$$

4. implement this circuit using only 2-input OR and XOR gates

EXERCISE 2: (9 Marks)

On a car, there are four independent controls:

- C_V for the night lights,
- C_C for the two low beam headlights,
- C_R for the two high beam headlights,
- C_A for the two fog lights

(logic 1 for ON and logic 0 for OFF).

We note the variables: V for the night lights , C for the low beam, R for high beam and A for fog lights (logic 1 for ON and logic 0 for OFF). Knowing that the night lights are not counted as classic lights,we consider the following:

- the 4 headlights cannot be switched on simultaneously,
- The low beam headlights have priority over the high beam headlights and fog lights,
- The fog lights have priority over the high beam headlight,
- The night lights can be switch on alone but switching on the low beam or high beam or fog lights automatically switches on the night lights.

1. Give the truth table linking V, C, R and A to C_V, C_C , C_R and C_A. (3)
2. Simplify functions using Karnaugh's table. (3)
3. Draw the logic circuit using 3 NOR gates, 1 NAND gate and 1 AND gate. (3)

EXERCISE 3: (6 marks)

Using FAs, XORs and others gates, draw one logic circuit implementing both following operations: A3A2A1 + B3B2B1 and B3B2B1 – A3A2A1. Indicate the value of the control signal to implement each operation