



<b>Name:</b>	<b>Group:</b>

**REMARKS:**

- Please make sure your **NAME** and **GROUP** appears in every sheet you return including the statement sheet.
- Calculators are not permitted.
- Time: 1h 45'

**Problem 1 (2 points)**

- Obtain the representation of  $A = 425_{10}$  in the following systems: binary, octal, hexadecimal, BCD and Gray's code.
- If  $B = 65_{10}$ , perform the operation  $A-B$ . Is there overflow?
- Express the result using the standard-754 (single precision).

**Problem 2 (5 point)**

In a chemical plant there are 30 workers that every day are manipulating different chemical reagents. In this context, it is extremely necessary to control conditions of temperature, humidity, and toxicity of the ambient.

For this purpose, there are three sensors ensuring that temperature (T), humidity (H), and toxicity of the air (Tox) are in proper levels to continuing working (0 – level ok, 1 – level out of range). There is also a button for emergency cases (Em) (0 – not pressed, 1 – pressed). There are three lights to indicate if there is any risk: a red light ( $L_{red}$ ), a yellow light ( $L_{yellow}$ ), and a green light ( $L_{green}$ ) (0 – off, 1 – on).

Design a system to meet the next requirements:

- The green light is turned on when the levels are proper.
- If the levels of humidity and temperature are out of the suitable range, the yellow light indicates the worker to take precautions.
- If the emergency button is pressed, the red light must be turned on.
- If a high level of toxicity is detected, the red light indicates the worker to stop manipulating.
- Only it is possible to have one light active at a time.

- Write the truth table following the next order: Em T H Tox (inputs)  
 $L_{red}$   $L_{yellow}$   $L_{green}$  (outputs)

Write down any clarification that you consider necessary.

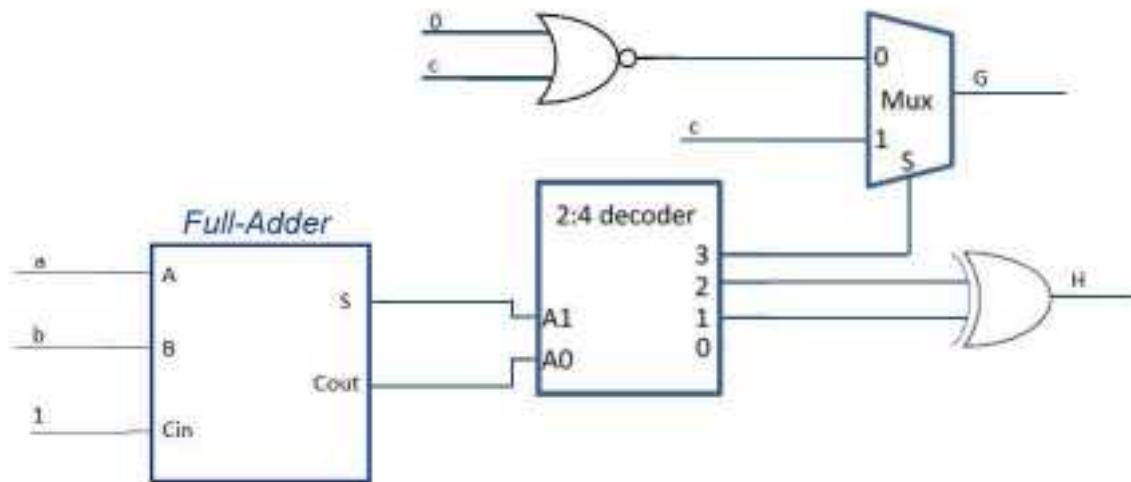
- Find the most simplified logic expression for the three output lights.



- c) Which is the minimum number of logic gates to implement the function  $L_{\text{yellow}}$ ?  
Represent the circuit.
- d) Implement  $L_{\text{yellow}}$  using only MUX4.

**Problem 3 (3 point)**

Complete the truth table for the following circuit with inputs a,b,c and output G and H.  
Write the intermediate steps that you need to get the table.



a	b	c	G	H
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		