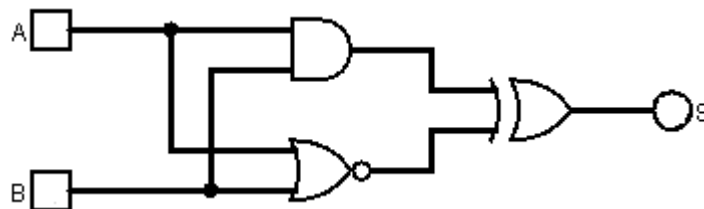


Machine Structures 2 exam (duration 1h30)

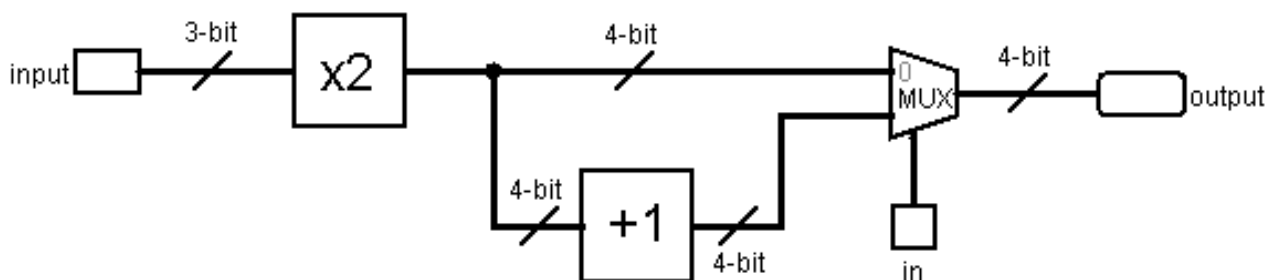
Exercise 1 :(4 points)

1. In digital systems, name the main two used values to represent information.
2. Name and give the schematic symbols of universal gates. Explain why they are called universal.
3. Give the difference between Moore and Mealy machines regarding (في ما يتعلق ب) their outputs.
4. Trace the Truth Table of the following circuit :



Exercise 2 :(10 points)

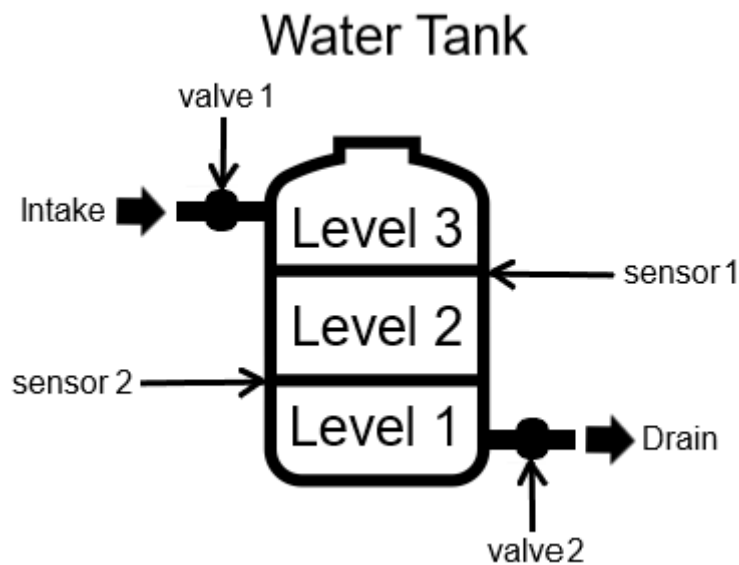
1. Following the 5-step method, construct the circuit that doubles (x2) the value of an unsigned 3-bit integer as input, and produces a 4-bit unsigned integer as output.
2. Using Bubble Push method, transform this circuit to a circuit with only NOR gates.
3. Perform an execution of the value 3 in binary (011) through (عبر) the diagram below (without recreating the internal circuits), with the input $in = 0$, then $in = 1$. Knowing that the circuit (+1) adds 1 to a 4-bit unsigned integer, and (x2) was designed in question 1.



4. By analysing the previous execution on diagram, deduce the mathematical formulas depending (تعلقاً) on the input in ($in = 0$ and $in = 1$). And give the purpose (هدف) of the circuit.

Exercise 3 :(7 points)

You have to design a Sequential Circuit to control the water tank (خزان الماء) described in the figure below. The goal of the controller is to always maintain some quantity of water in the tank. The controller has 2 sensors (أجهزة الاستشعار) to detect the water level. And has to control 2 valves (صمامات), one to enter (intake) the water and one to drain the water.



The controller can detect the level of the water using the sensors. If the level of the water is at level 3, the controller should close valve 1 and open valve 2. If the water is at level 2, valve 1 and valve 2 should be open. If the water is at level 1, the controller should open valve 1 and close valve 2. The initial state is when the tank is totally empty (فارغ).

Q : Use the 7-step method to design the Sequential Circuit of the water tank controller.

Note : a sensor returns the logic value 1 if it detects water and 0 otherwise. And the valve opens if it is driven by 1 and closes when driven by 0.

دعوة بالتوفيق