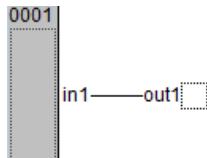


# ASSIGNEMENT 3

**31342 - Introduction to Programmable Logic Controllers**

# Hello World

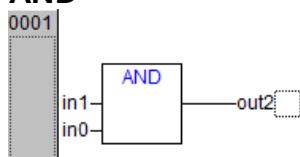
Just as a first test to understand the basic functionality of PLCs an hello world program, where pressing a button would turn a light on. The FDB is the following:



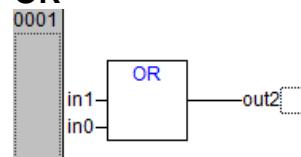
## Basic Logic Functions

The next step was to implement the following logic functions:

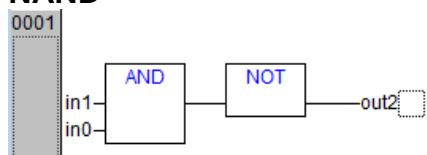
**AND**



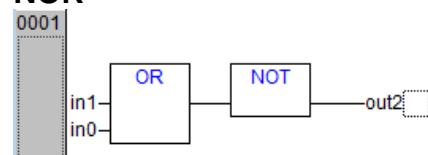
**OR**



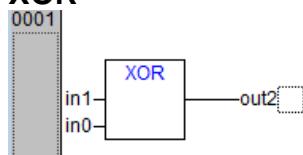
**NAND**



**NOR**

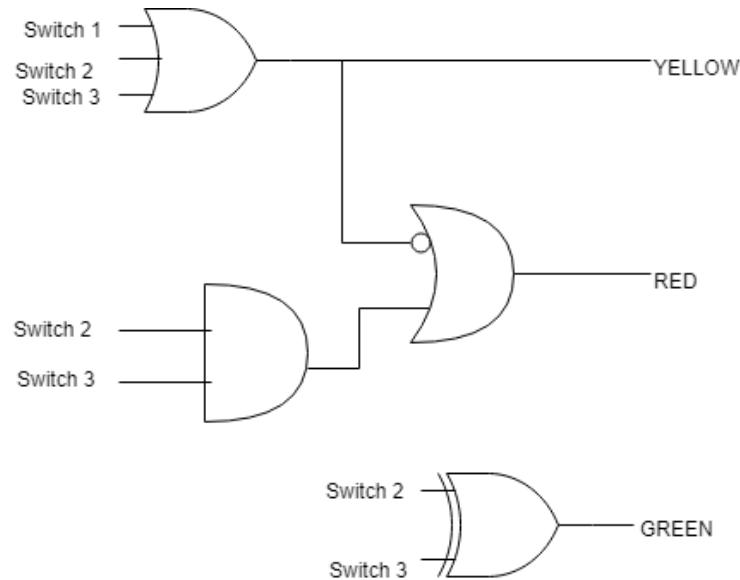


**XOR**

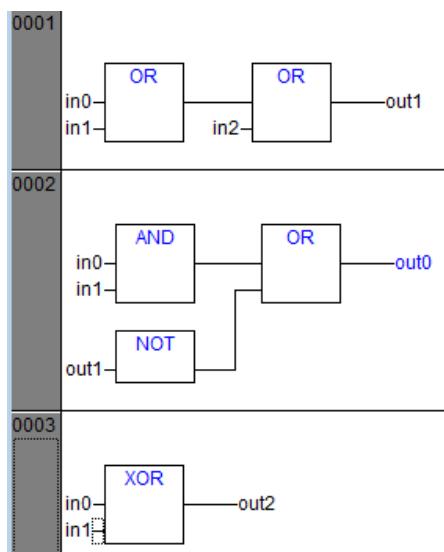


# Logic Function

After looking for a bit to the truth table, the following schematic was made, (an other alternative would be to make the Karnaugh map for every output)



After that, this schematic was converted into this FBD



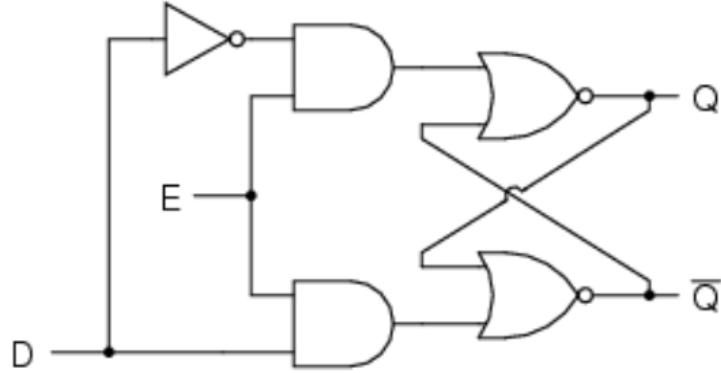
Where the mapping between the two schematics is the following:

In0	In1	In2	Out0	Out1	Out2
Switch3	Switch2	Switch3	Red	Yellow	Green

Thus it's concluded that the circuit can be made with just 6 Logic Gates.

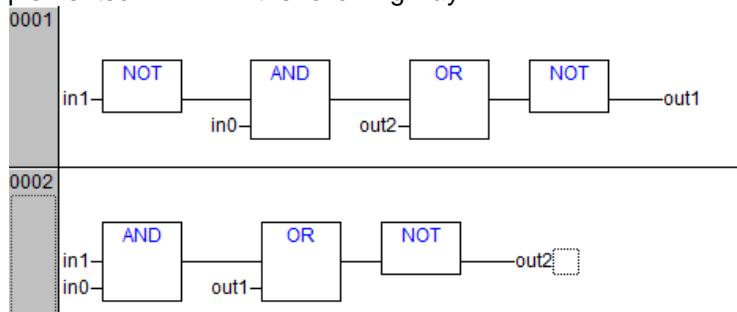
# Latch

It was chosen the D Latch to be implemented:



In this latch, when E is ON, the latch is 'capturing' to the value of D. As soon as E is turned off, the latch does not check the value of D anymore, instead its value Q is equal to the last value of D before turning off E.

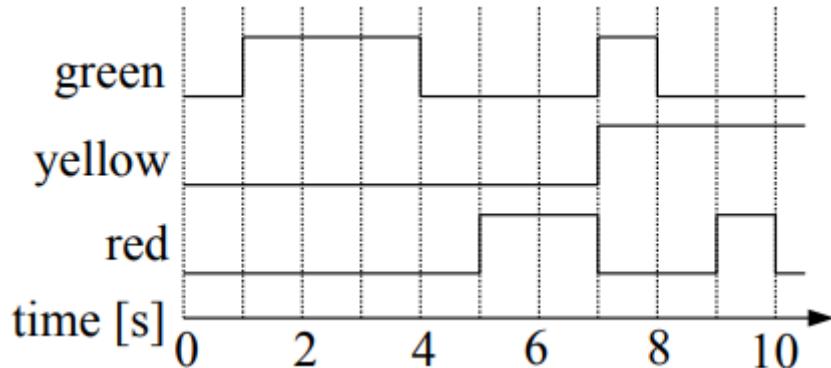
This system was implemented in FBD in the following way:



After testing it in the box it was confirmed that it was working as expected. (See Video in Attachment)

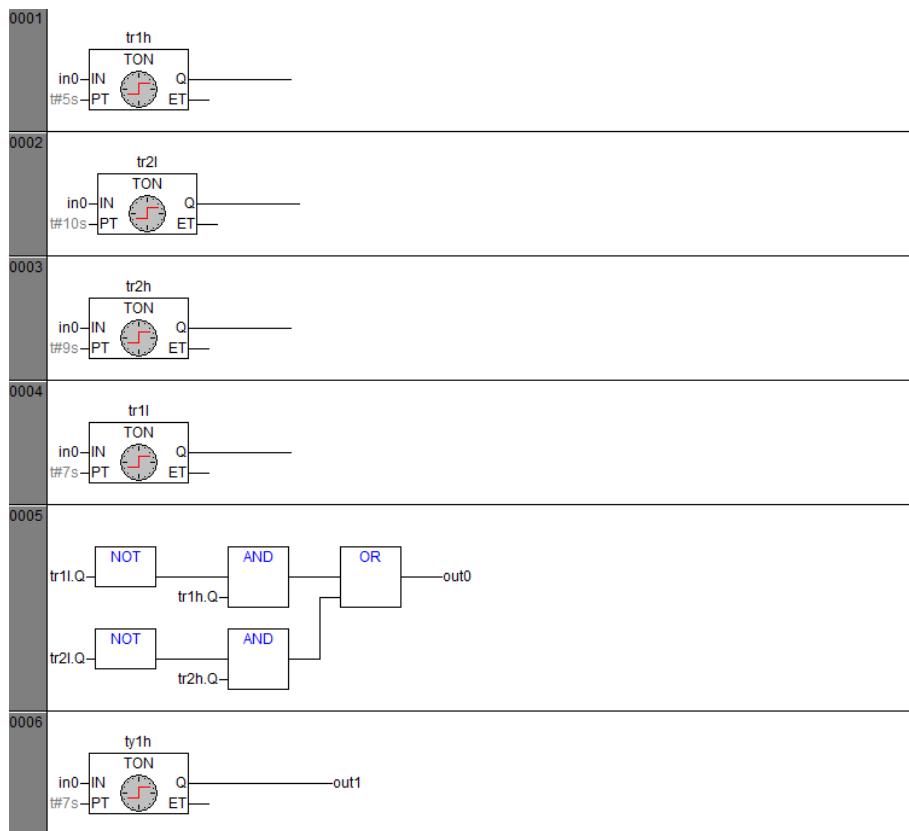
# Timers

Using the technique displayed in [http://aut.elektra.dtu.dk/staff/sh/plc/faq\\_q4.html](http://aut.elektra.dtu.dk/staff/sh/plc/faq_q4.html), for each interval that a certain light was ON, two timers were needed.

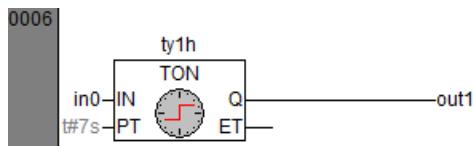


So, by looking at the image above we see that RED has 2 ON intervals, YELLOW is just a delayed step function, and GREEN has also 2 ON intervals:

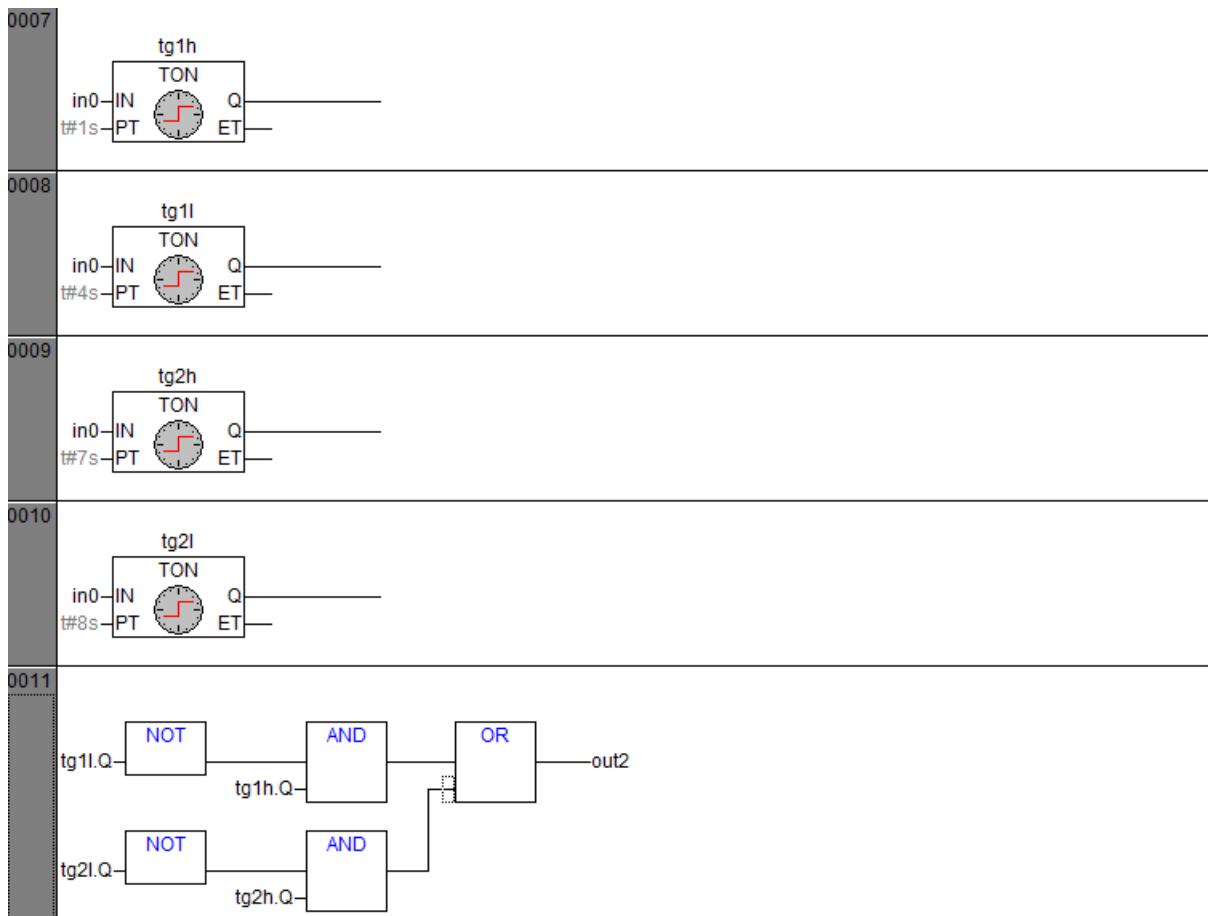
So, for the RED is produced by the following networks:



For YELLOW:



And for GREEN:



After implementing this nets it was confirmed that the system was working well. (See Video in Attachment)

# Attachment

## LATCH



## Timers

