Exercise 3: Traffic Lights

# Objective

Design and implement a two-traffic light intersection control system. The system should use one PLC to control two red-green-yellow traffic lights. One traffic light should control north-south traffic and the other east-west.

# Build the circuit

Build a circuit with 3 LED: 1 for each light in the north-south stack. Control the LEDs with your ladder logic. There are only 4 digital outputs on Arduino Uno so we can only have one physical red-yellow-green traffic light stack. The second light stack will be present in ladder logic and the HMI only.

# Build the Ladder Logic

* Each light should use timers to cycle the lights through red-green-yellow.  The lights should cycle with green on for 10 seconds, yellow on for 5 seconds, and then red on.  The north-south red light should be on when the east-west green or yellow lights are on. The east-west red light should be on when the north-south green or yellow lights are on. There is no timer needed for the red lights. The red lights can simply use OR logic.
* Add safety logic in the ladder to ensure the following properties.
  1. To be green, the red LED in the other stack must be on and the green and yellow LED in the other stack must be off.
  2. To be yellow, the red LED in the other stack must be on and the green and yellow LED in the other stack must be off.

# Build the HMI

* The HMI should display each LED's state.
* The HMI should display a counter next to each light in the stack that counts down to transitions.
* In the HMI add a background image that shows the intersection.

# Post Exercise Report

Answer the following questions.

1. Submit a short video of your working traffic light.