

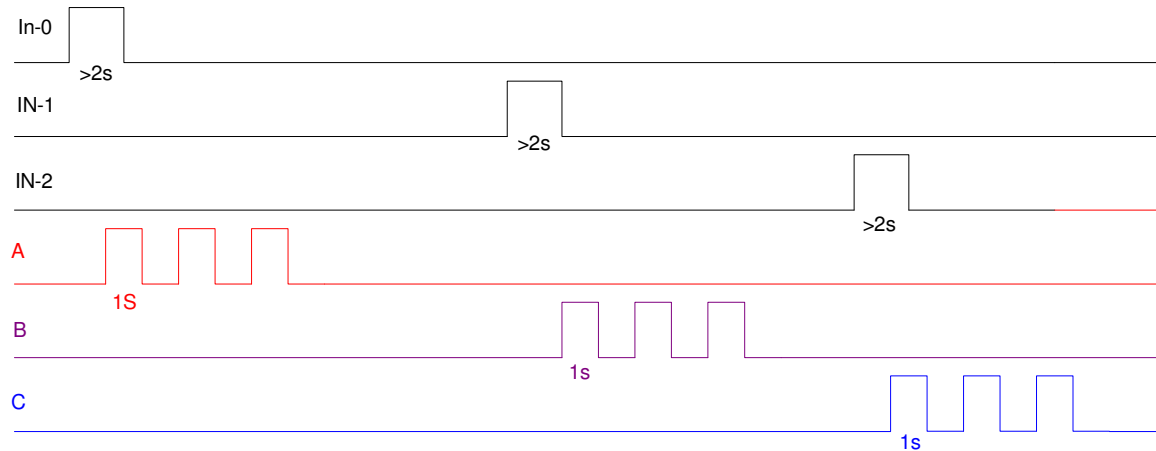
Homework #7: ECE 461/661

If-Statements in Ladder Logic, Gain Compensation, Lead Compensation

If-Statements in Ladder Logic

Write a ladder-logic program for an irrigation system

- If Button 0 (IN-0) is held down for 2 seconds, sprinkler A turns on and off three times then stops.
- If Button 1 (IN-1) is held down for 2 seconds, sprinkler B turns on and off three times then stops.
- If Button 2 (IN-2) is held down for 2 seconds, sprinkler C turns on and off three times then stops.



1) Write a ladder logic program using timer blocks to implement this watering system

- Your pick which program
- Code Composer Workbench or PLC Fiddle recommended

suggestion: Define four operating modes (Off, A, B, C).

- If in Off mode and a button A is held down for two seconds, go into mode A
- If in mode A, jump to that routine.
- In mode A, cycle three times then go back to mode Off.
- Ditto for B and C

2) Verify your code's operation

- Button presses less than 2 seconds are ignored
- Once started, the process continues turning on all three outputs, one at a time

3) Demonstrate your ladder logic program

- In-person
- Make a short video
- Over zoom

Gain Compensation: $K(s) = k$

Problem 4-5) Assume

$$G(s) = \left(\frac{2}{(s+1)(s+3)(s+7)(s+10)} \right)$$

4) Find a gain compensator that results in the closed-loop poles being at the breakaway point. For this value of k

- Find the error constant, K_p
- Find the closed-loop poles
- Plot the step response of the closed-loop system

5) Find a gain compensator that results in 20% overshoot for the step response. For this value of k

- Find the error constant, K_p
- Find the closed-loop poles
- Plot the step response of the closed-loop system

Lead Compensation: $K(s) = k \left(\frac{s+a}{s+10a} \right)$

6) Design a lead compensator which results in 20% overshoot for the step response. For this $K(s)$,

- Find the error constant, K_p
- Find the closed-loop poles
- Plot the step response of the closed-loop system

7) Give an op-amp circuit to implement $K(s)$