

Homework #6: ECE 461/661

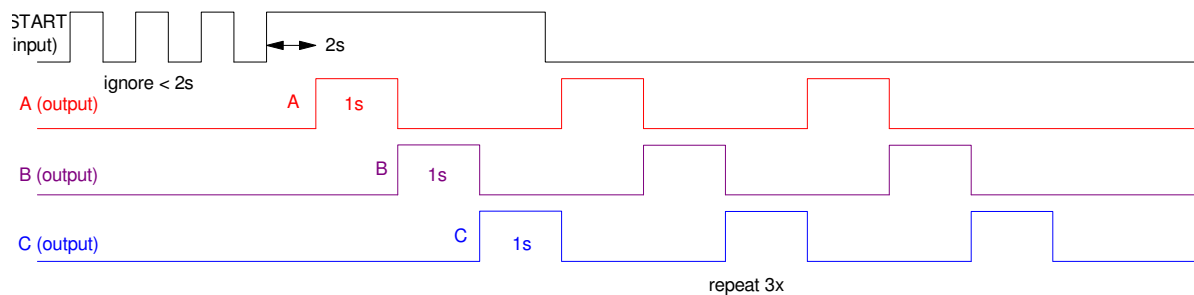
Counter Blocks, Sketching a Root Locus Plot

Ladder Logic & Counter Blocks

Write a ladder-logic program which uses timer blocks to implement a watering system

- In order to start operation, the START button has to be held down for 2 seconds.
- Once started, a counter is cleared, sprinkler A turns on for 1 second, and then turns off.
- When A turns off, sprinkler B turns on for 1 second then turns off.
- When B turns off, sprinkler C turns on for 1 second then turns off.

The process then repeats three times using a counter block. After three cycles, the process 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

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

Sketching a Root Locus Plot with Real Poles

4) Draw the root locus for the following system

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

Calculate and show the following on your root-locus plot

- The real axis loci
- The asymptotes (number, intersect, angles)
- The breakaway points (estimate is OK)
- The jw crossing

5) Draw the root locus for the following system

$$G(s) = \left(\frac{2(s+1)}{(s-1)(s+2)(s+5)(s+7)} \right)$$

Calculate and show the following on your root-locus plot

- The real axis loci
- The asymptotes (number, intersect, angles)
- The breakaway points (estimate is OK)
- The jw crossing

Sketching a Root Locus with Complex Poles & Zeros

6) Draw the root locus for the following system

$$G(s) = \left(\frac{100(s+3j)(s-3j)}{s(s+4)(s+2+2j)(s+2-2j)} \right)$$

Calculate and show the following on your root-locus plot

- The real axis loci
- The jw crossing
- The asymptotes (number, intersect, angles)
- The departure angle from the complex poles
- The approach angle to the complex zeros

7) Draw the root locus for the following system

$$G(s) = \left(\frac{10(s+1+3j)(s+1-3j)}{s(s+0.5)(s+2+2j)(s+2-2j)} \right)$$

Calculate and show the following on your root-locus plot

- The real axis loci
- The asymptotes (number, intersect, angles)
- The breakaway points
- The jw crossing