ARDRILLO FINALS

Shaastra 2021

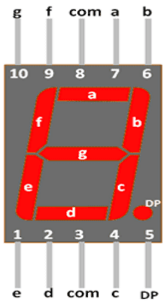
:

Scrodinger Realms

1.) **Understanding the 7 segment display.....**

Points : 20 + 10

Intro : The seven segment LCD pin typically consists of 10 pins. Each of the Arduino pin is connected to a particular pin in the lcd display. Corresponding Alphabet or number can be displayed by giving suitable high and low commands to the pins.



Problem : Write a code that converts an imaginary analog input *(0 to 7)* display in the 7 segment led display. For this generate a Random number every 2 seconds. Come up with a logic to power up the digital pins whenever a new number comes up.

*Print the binary form of the digit in the *serial monitor*, *along with the digit.*

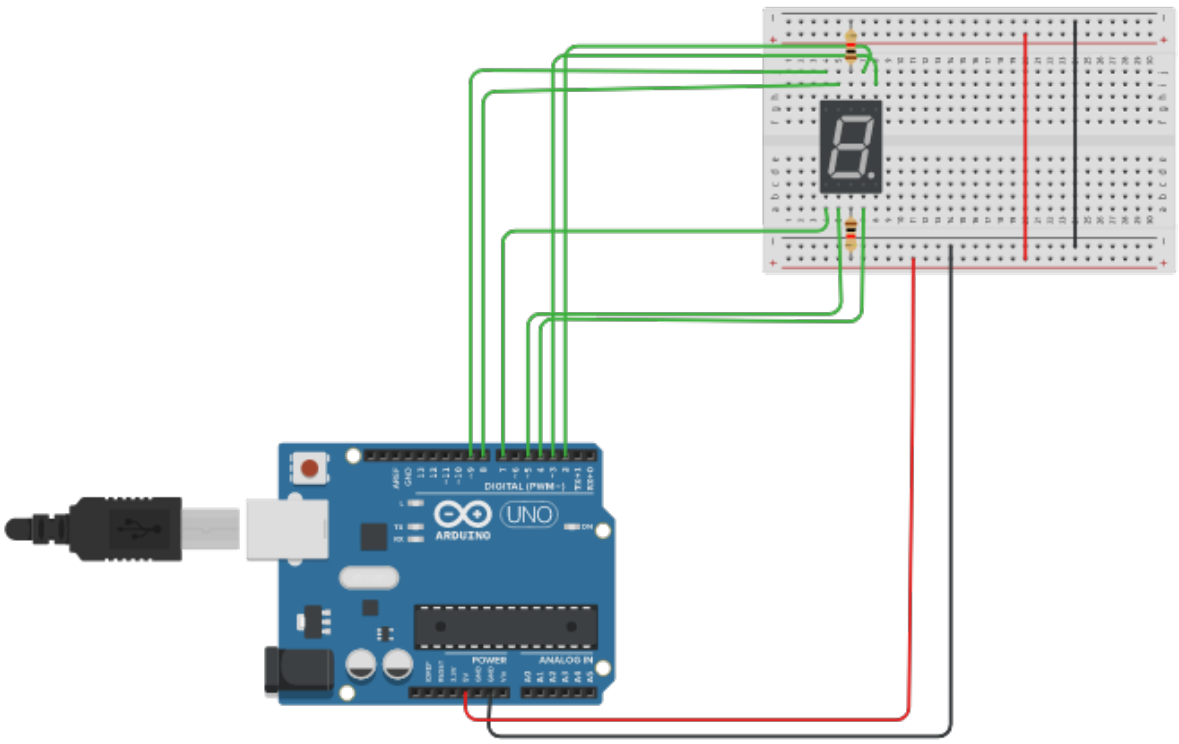
Convert the imaginary analog input into Binary and find and find functions to give each pin using binary digits as variables.
Example : binary no.s are **A, B, and C.** Function to power segment **a** in the 7 segment display is **a(A,B,C).**

*Give the total no.of logic gates that need to be used for each pin
*Submit a Screenshot of the working simulation

Below, there is an example setting of the pins and how they are connected. Use this setting to create your own in the simulator.

Bonus : A simple way of doing this without using the logical functions is to use an IC that does the job for us. Use a suitable IC to connect to the 7 segment display and give it's name.

*Submit a Screenshot of the connections and the code to make it work.



2.) **Password lock and age calculator using LCD Screen display …….**

Points : 25

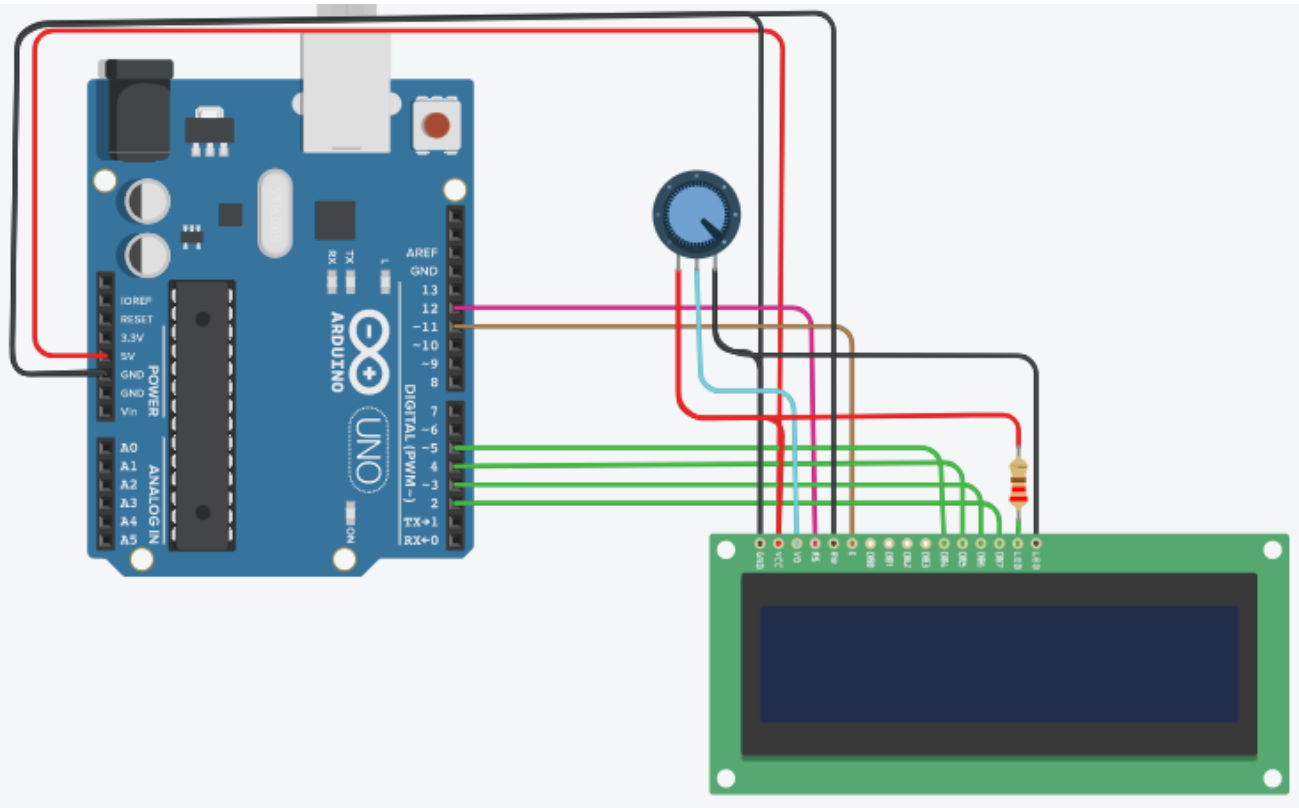
Intro: LCD display(Liquid crystal display) is a common component used When we build real life/real world electronics based projects, acts as a medium/device to display output values and messages. It can display 32 ASCII characters, 16 characters per line.

Problem : Create a lock and password mechanism out of an age calculator, through the code. After the user enters the correct password, go inside and ask the user his/her birth date. Then ask for the format that he/she wants to see their age.

*Submit your code along with screenshots of your simulations in tinkercad.
3 screen shots of *password entering, *Birthdate entering and *format chosing.

3 formats :
1) Years(floating no.)
2) Days(floating no.)
3) Y: ,M: ,D: (count upto the previous day)

You are supposed to use “LiquidCrystal.h” Library. We’ve s hown a sample setting of LCD display.



3.) **Binary Showcasing by LED PWM Displays……**

Points : 25 + 10

Intro : LED and PWM : A Light Emitting Diode (LED) is a semiconductor light source that emits light when current flows through it. The color of the light is determined by the energy band gap of the semiconductor. Modern day LED diode TV screens uses RGB leds combination (and controlled by a powerful microprocessor) to display moving frames on the screen. The PWM is a high frequency signal that makes AC into DC in a short way. It is the signal used to power the led's. Hence can make them bright or dim based on the frequency.

Coprimes are numbers which have GCD or HCF as 1. Example : 15 and 14 are coprime to each other. Another special no. Is Mersenne prime. That is a prime no. In the form of :$M_n = 2^n - 1$ for some integer n. They are named after Marian Mersenne, a French Minim friar, who studied them in the early 17th century.

Problem : Given an array of integers in the serial input monitor. Find out the number of pairs of *Coprimes*. And convert the number to binary to display it in the serial monitor as output. Also find the no. Of *Mersenne Primes.* Convert this no. Too into binary to display it in the serial monitor as output.

Now add the two numbers and display it in binary as well as decimal in the serial monitor. Also Output the integers along with it

Eg :

10 (Coprime pairs)

01010

3 (Mersenne Primes)

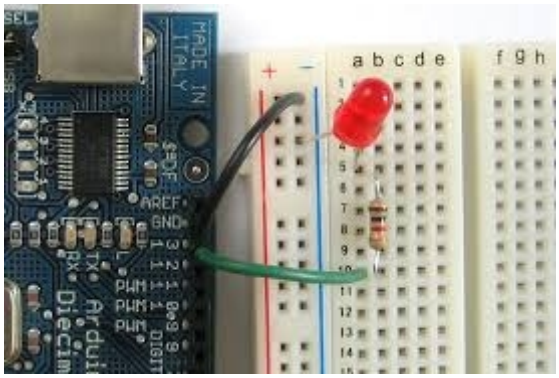
00011

13 (Total sum)

01101

At present these *3 binary no.s in order need to be showcased in the form of LED displays. 1-led on, 0-led off.
(LED's need to be placed in an orderly fashion)

First two binary no.s should be shown for 1 second in the LED's each with 1 second interval. The last binary no. Must be shown until user gives next set of integers as input. Assume that the limit of the integers given in input can be upto *10,000.*



Remark : We know that you can solve this problem :) But we want to test you based on algorithm and the time taken to solve. The maximum number of digits in an element of the sample input array will be 6. Use **millis()** and output the time taken to execute the algorithms. (Before the led display starts)

*Submit the code and the Screenshot of the Led displays while working.

Bonus : You can also make the representation of the final sum display in the strip of 10 Neo pixels. The required library is “Adafruit_Neopixels.h”. Each strip to represent a digit, use 4 strips to indicate the sum.

*Attach the screenshot and the code for the working of neopixels.

4.) **Accomplishing Tasks with Master Arduino and Slave Arduino……**

Points : 15 +(10) + 5

Intro : Connection of two Arduino’s : Just like two humans communicate to each other, computers can communicate between themselves to accomplish tasks at ease. There will be a Master Arduino and a Slave Arduino. They can communicate with I^2C protocol, Through 2 analog connections. Where one is SCP(serial clock pin) and another in SDA(serial data pin). Now let’s see some simple tasks that you can accomplish with them.

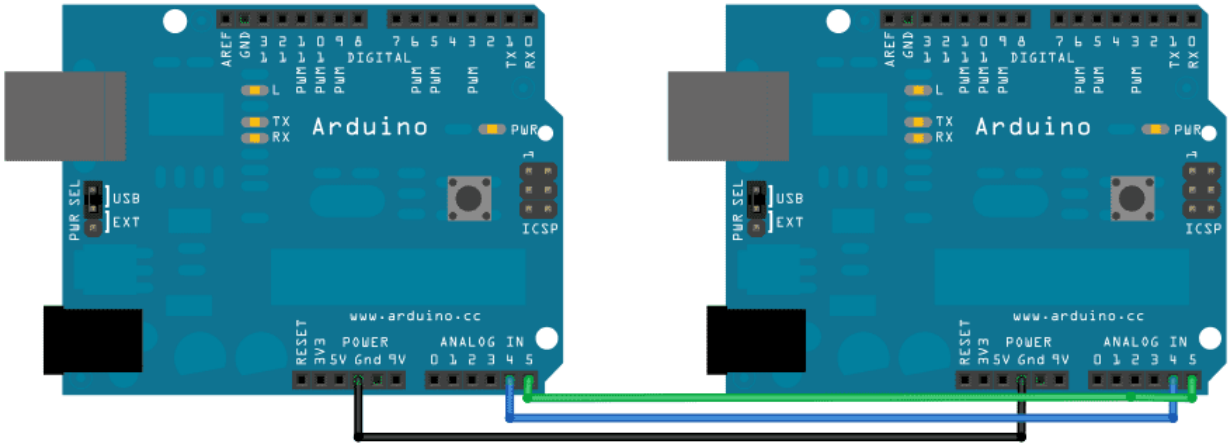
Problem : The entire problem is split into 2 parts. Now imagine there are 2 slaves. One Master for each slave. Tasks for separate slaves are given. You can try to use One master for both slaves. You will get extra (10) points for this.

SLAVE NO.1 : Imagine there is a military lvl communication line. The Information sharing is always encrypted. In a situation where a military operation takes place, a drone needs to get instruction from the base. In such a way, user enters a text The Master Arduino should send a text in some form of encryption. And the encryption can be of any sort, your choice. You can use python encryption functions of any format or make it simple in C++.

The user should input the text to be transmitted. The encrypted form of text should be shown in the serial monitor of Master Arduino and The decrypted form of text should be shown in the serial monitor of Slave Arduino(1).

SLAVE NO.2 : This is also a simple task. I hope you all will be familiar with the Potentiometer sync with the Servomotor problem. This time we're going to Connect the Potentiometer to the Master and Servomotor to the Slave(2). And Make their movements synchronize.

Here is a demonstration of I2C Interface.....



Hint : Use library "Servo.h" and "Wire.h".

*Submit Screenshots of the simulations and the code and Input Outputs of the Serial Monitor.

Bonus : Meanwhile Try to Communicate back with the Master Arduino from the slave Arduino. Try the Encryption and Decryption in part (1) by inputting in the Serial monitor of Slave arduino. Use .requestFrom and .Onrequest functions to communicate. *Submit this code separately.*

5.) **Extended version of Binary tree. Solving for nodes at a distance k**

Points : 20

Intro : An extension of Binary Tree : It is a data strucuture where, a parent node only has **many** children nodes. Starting

from the first node, It goes on splitting till it reaches a certain no. “N”.
Find a suitable definition of a node and code the algorithm as per the problem.

Problem : A graph is given, find the count of nodes that are at a certain distance from the chosen node.
Use **millis**() to see how efficient your program is, once the user gave all his input.

Input format :

-->first line is the no. Of nodes (N) 0<=N<=100

-->from second line the node datas are represented in the form of rows.
For example the above picturized graph is given as

```
10                      #no. Of nodes (N)
50 : 17 72              #The no.s are node data

17 : 23 54 76
72 : 9 14 67                #2nd row completed

23 :        #should provide user to input nodes
54 :                        #skipped
76 :


9 :
14 : 12
67 :                        #3rd row completed

12 :                        #skipped
```

-->For the last 2 lines,User provides the target(CHOSEN) node and the distance k

Output format : Count of nodes at a distance k from the chosen node n

Sample :
Input:
6
3 : 2 4

2 : 5 1
4 : 6

5 :
1 :
6 :

2
2

Output:
1

Now, write an algorithm that can solve for 1<=N<=100 ! !

----------Thank you for your participation--------