

National Institute of Technology, Tiruchirappalli

Digital Electronics Lab Project Report

Project Name:

OTP Generator using Integrated Circuits

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OTP Generator using Integrated Circuits

AIM:

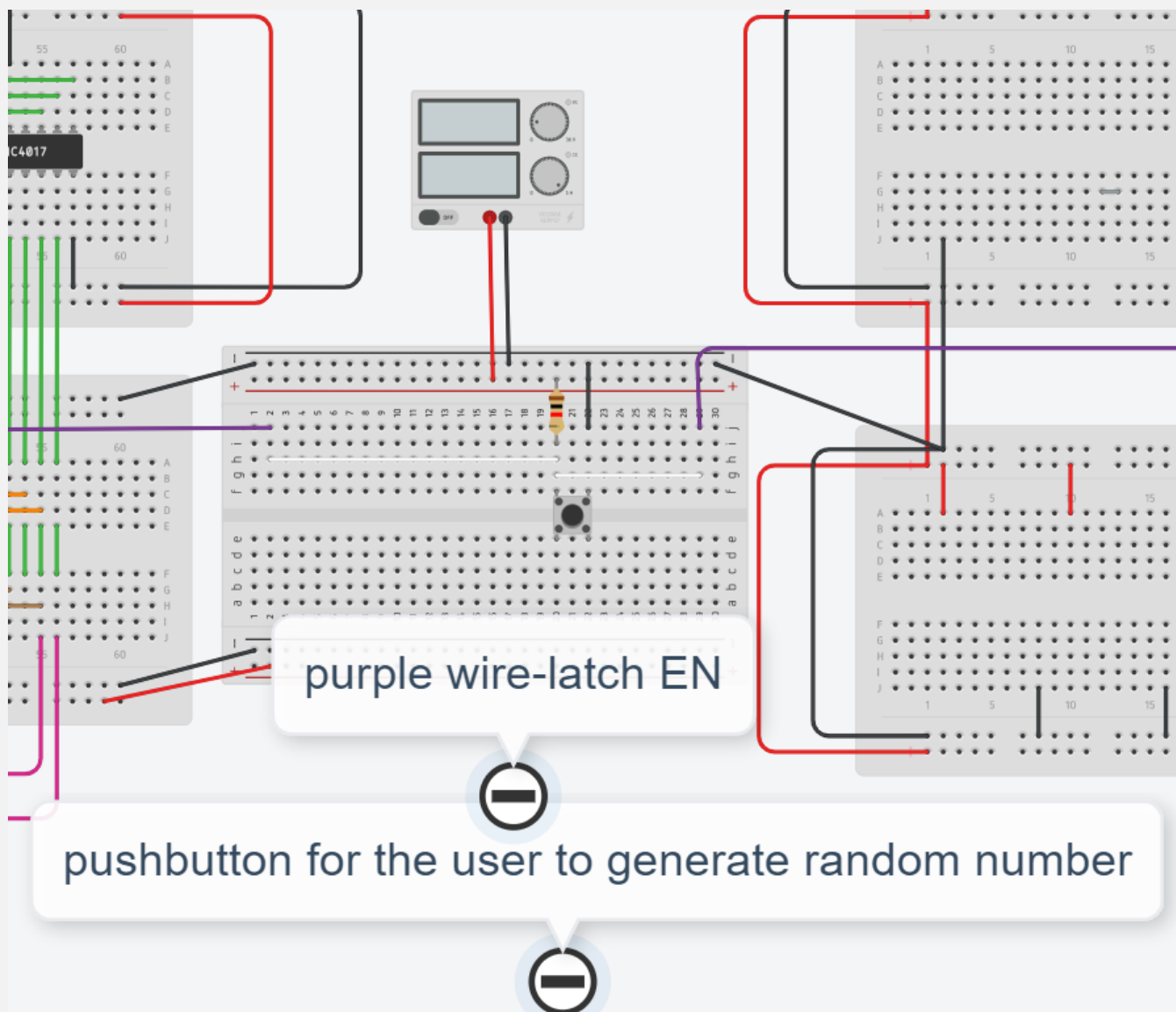
To design an OTP generator (random two-digit number generator) using integrated circuits.

APPARATUS REQUIRED:

1. Power Supply - 5V
2. Breadboard
3. Resistors - 330 Ω and 1K Ω
4. Pushbutton
5. MAN 72 common cathode seven segment display - 2
6. 74HC4017 Johnson Decade counter - 2
7. CD4511 7-segment decoder - 2
8. 7404 Hex Inverter NOT Gate
9. 7432 OR gate
10. Function Generator
11. Connecting wires

THEORY:

The IC CD4511 is a binary to seven segment decoder. The pin 5, known as the Latch Enable Pin (ACTIVE LOW), should be driven LOW in order to enable the IC to take the binary inputs given to it. If this pin is driven HIGH by a voltage source, the previous state in which the Latch Enable Pin was LOW is maintained throughout. As a result the number displayed in the 7-segment display is maintained throughout.



Therefore, by driving the Latch Enable Pin LOW at random intervals of time using a Pushbutton, random numbers get generated on the 7-segment display.

See that a pull up resistor is used in the above figure.

10:4 BCD to binary encoder:

To convert the output of the 74HC4017 Johnson decade counter to a binary number so that it can be fed as an input to the CD4511 7-segment decoder we design a 10:4 BCD to binary encoder using OR gates.

The truth table is as follows:

From the truth table, we can deduce that:

$$A_3 = Y_9 + Y_8$$

$$A_2 = Y_7 + Y_6 + Y_5 + Y_4$$

$$A_1 = Y_7 + Y_6 + Y_3 + Y_2$$

$$A_0 = Y_9 + Y_7 + Y_5 + Y_3 + Y_1$$

10:4 BCD to Binary Encoder:

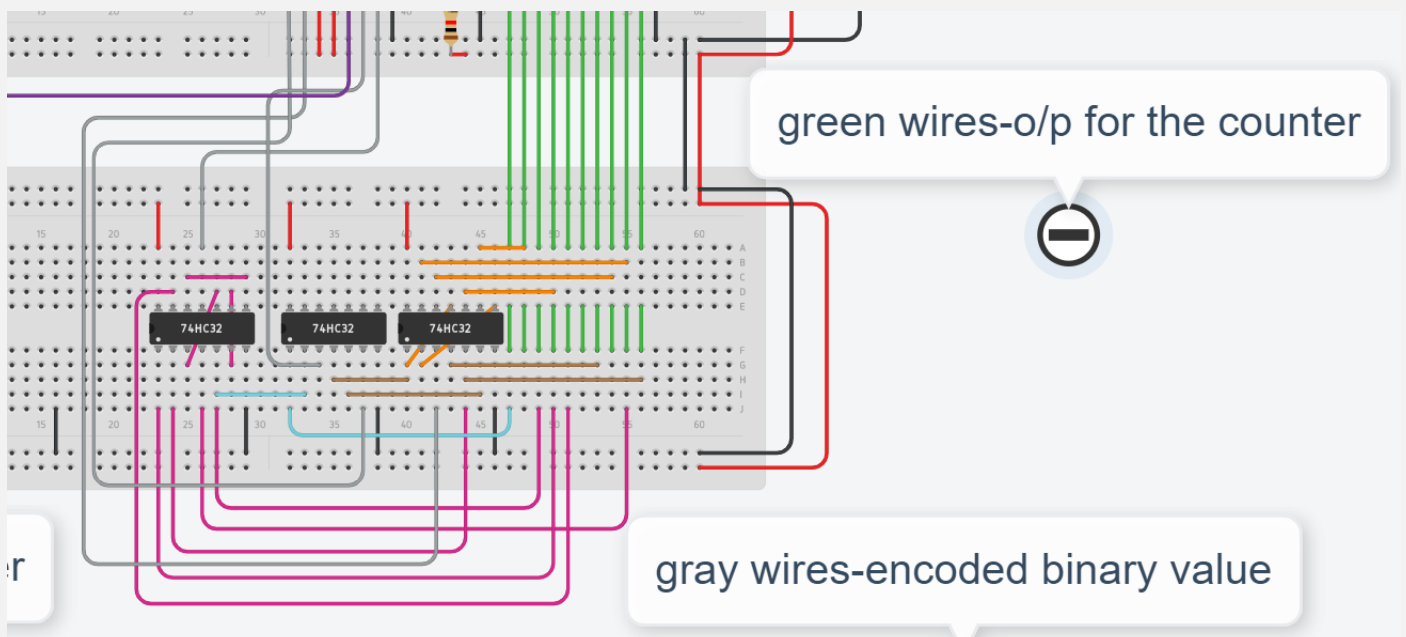
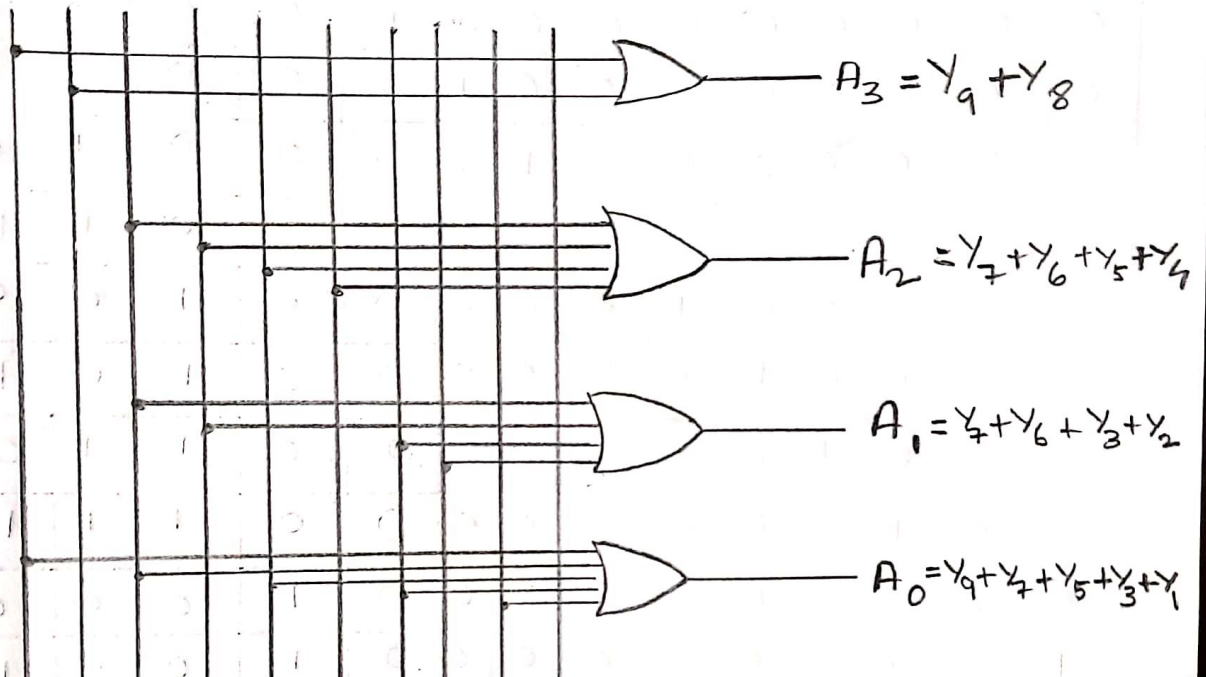
Truth table:

BCD										BINARY			
Y_9	Y_8	Y_7	Y_6	Y_5	Y_4	Y_3	Y_2	Y_1	Y_0	A_3	A_2	A_1	A_0
0	0	0	0	0	0	0	0	0	1	0	0	0	0
0	0	0	0	0	0	0	0	1	0	0	0	0	1
0	0	0	0	0	0	0	1	0	0	0	0	1	0
0	0	0	0	0	0	1	0	0	0	0	0	1	1
0	0	0	0	0	1	0	0	0	0	0	1	0	0
0	0	0	0	1	0	0	0	0	0	0	1	0	1
0	0	0	1	0	0	0	0	0	0	0	1	1	0
0	0	1	0	0	0	0	0	0	0	0	1	1	1
0	1	0	0	0	0	0	0	0	0	1	0	0	0
1	0	0	0	0	0	0	0	0	0	1	0	0	1

The logic circuit is as follows:

Logic Circuit:

$Y_9 Y_8 Y_7 Y_6 Y_5 Y_4 Y_3 Y_2 Y_1 Y_0$



Orange wires-A3

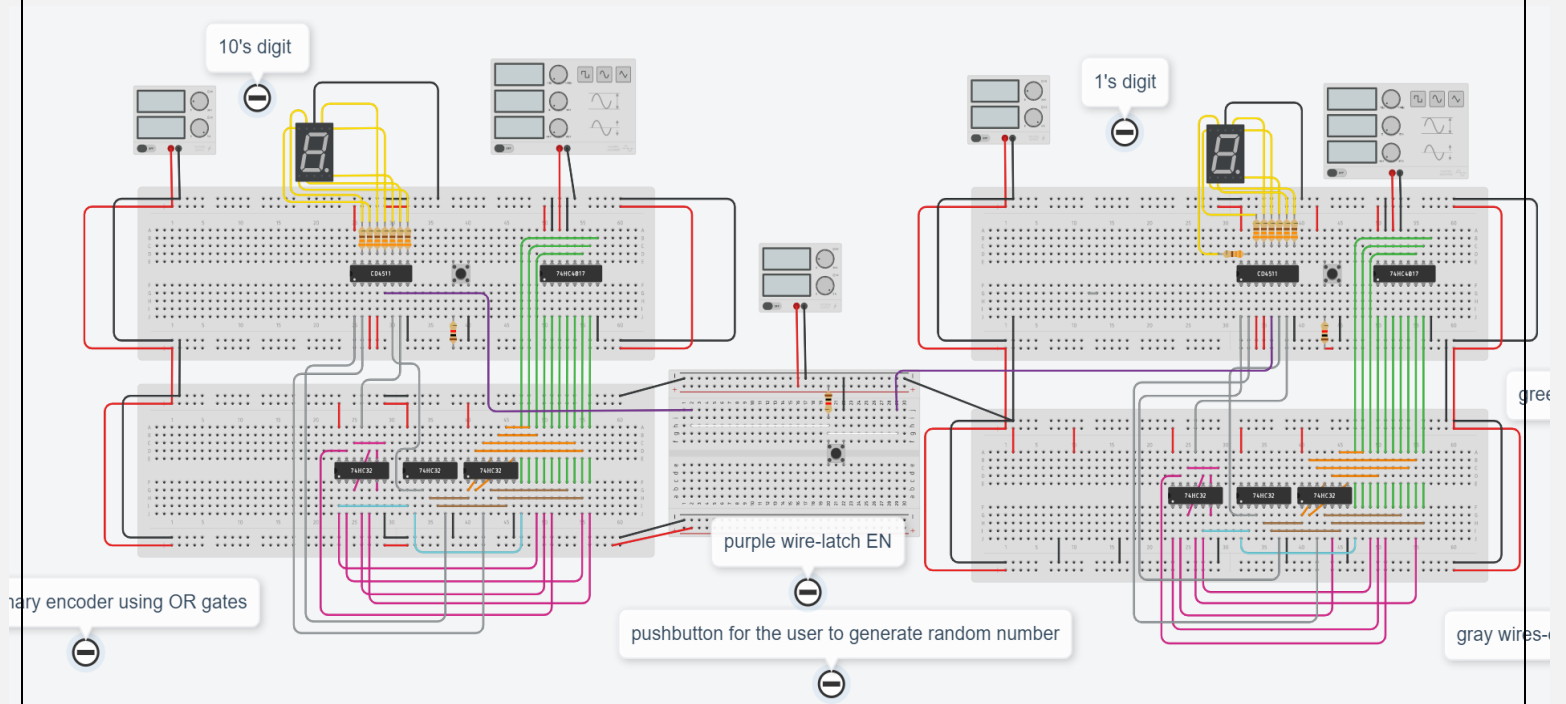
Brown wires-A2

pink wires-A1

Turquoise wire-A0

Now finally these encoded values is given as an input to the CD4511 7-segment decoder to drive the 7-segment display.

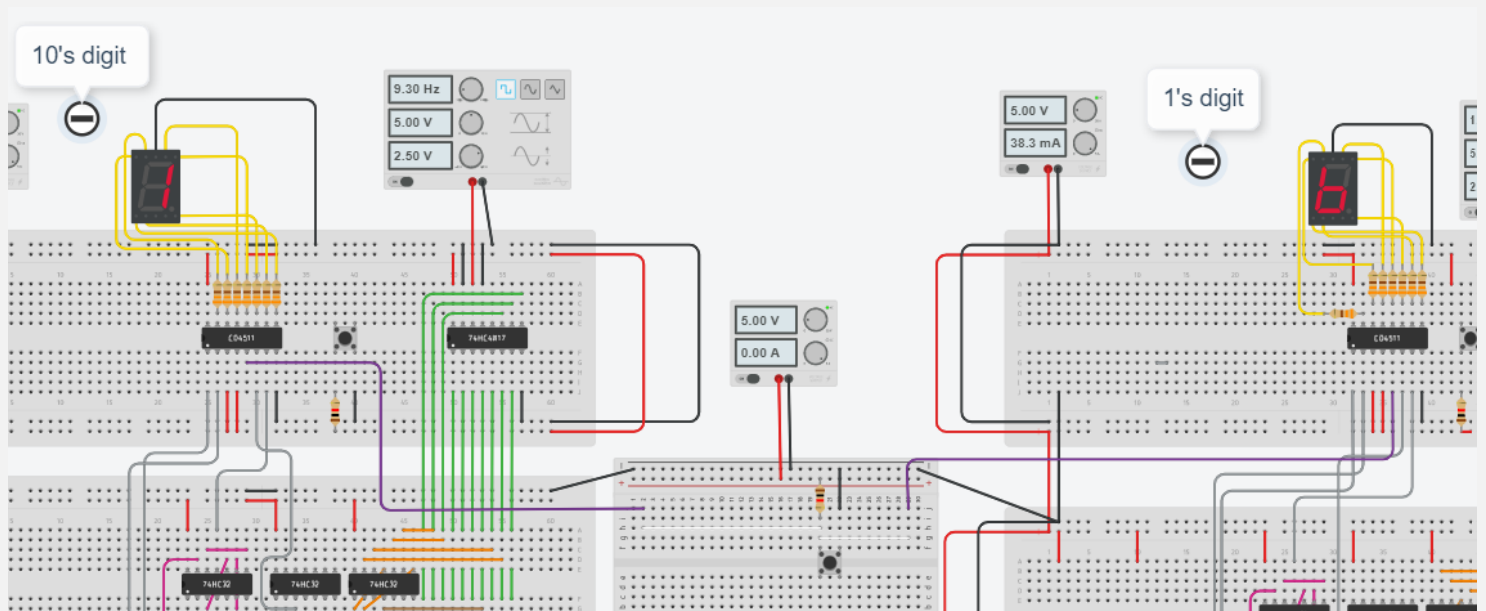
CIRCUIT DIAGRAM:



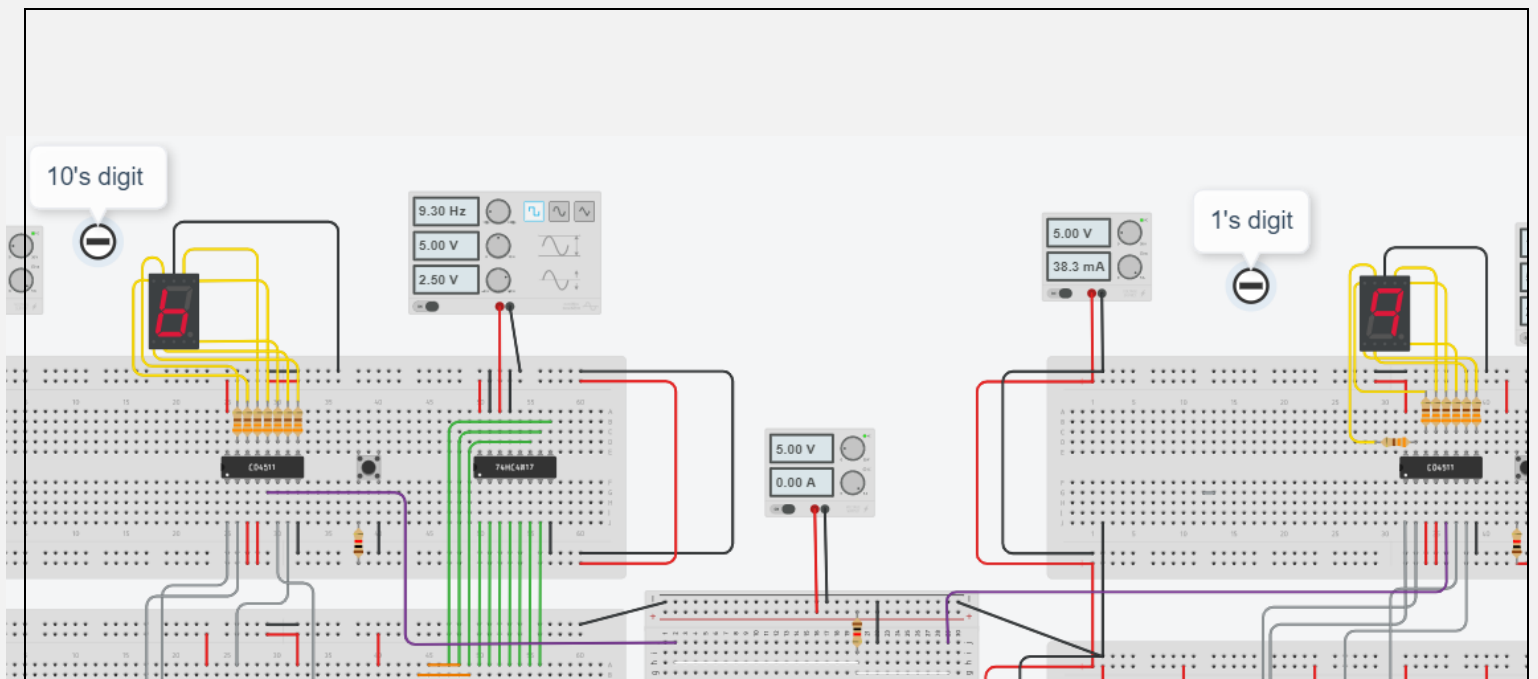
PROCEDURE:

1. Check the ICs provided, using IC tester.
2. Mount the IC's on a bread board carefully.
3. Connect VCC and ground pins of IC to the corresponding terminals in the power supply.
4. Wire up the circuit as per circuit diagram obtained from the Boolean expression.
5. Use LEDs to test whether your circuit is right at the intermediate steps .
6. Press the pushbutton at various time intervals and check if a random number is being generated.

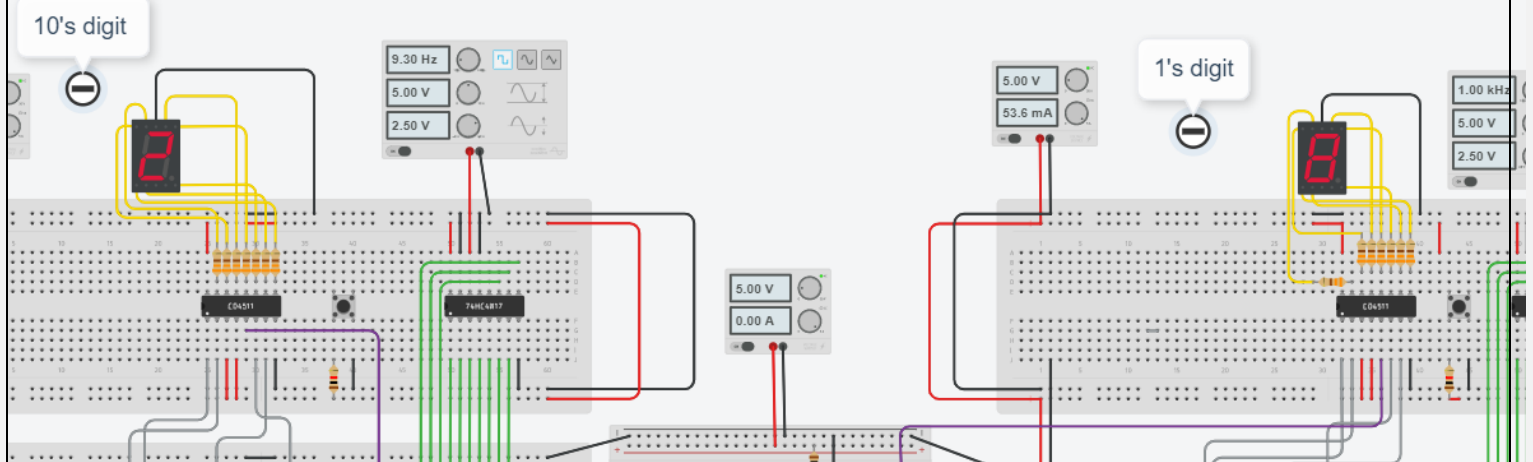
SIMULATION RESULTS IN TINKERCAD:



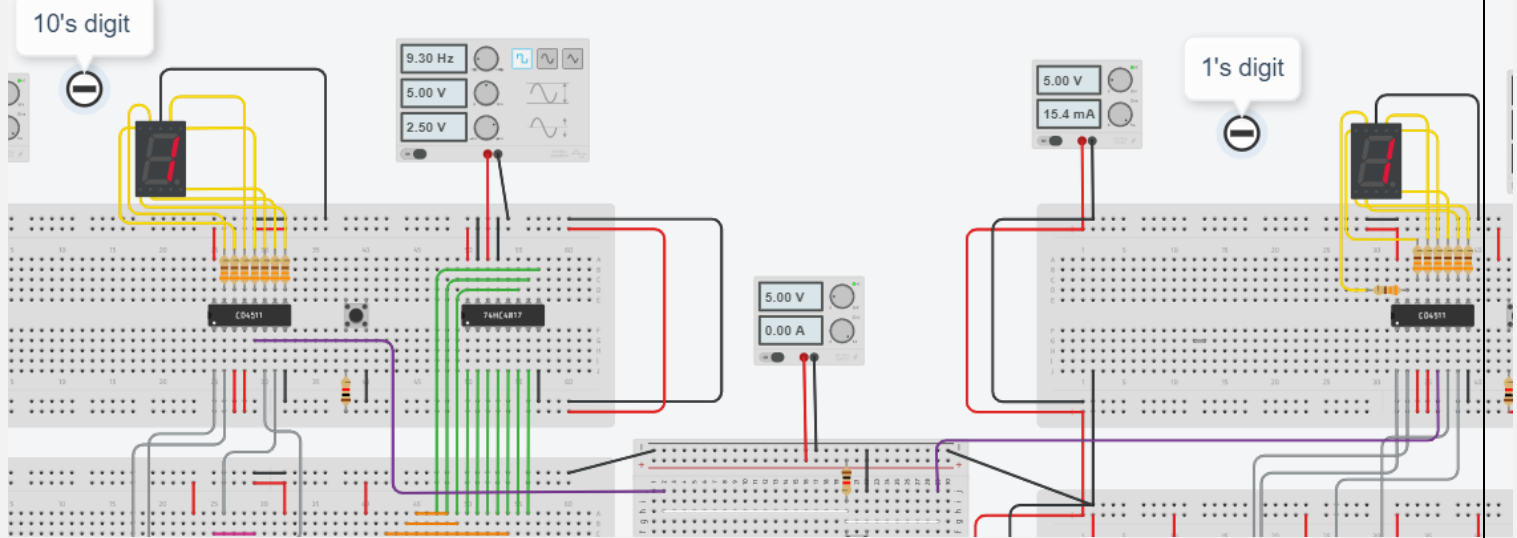
OTP 16 is generated



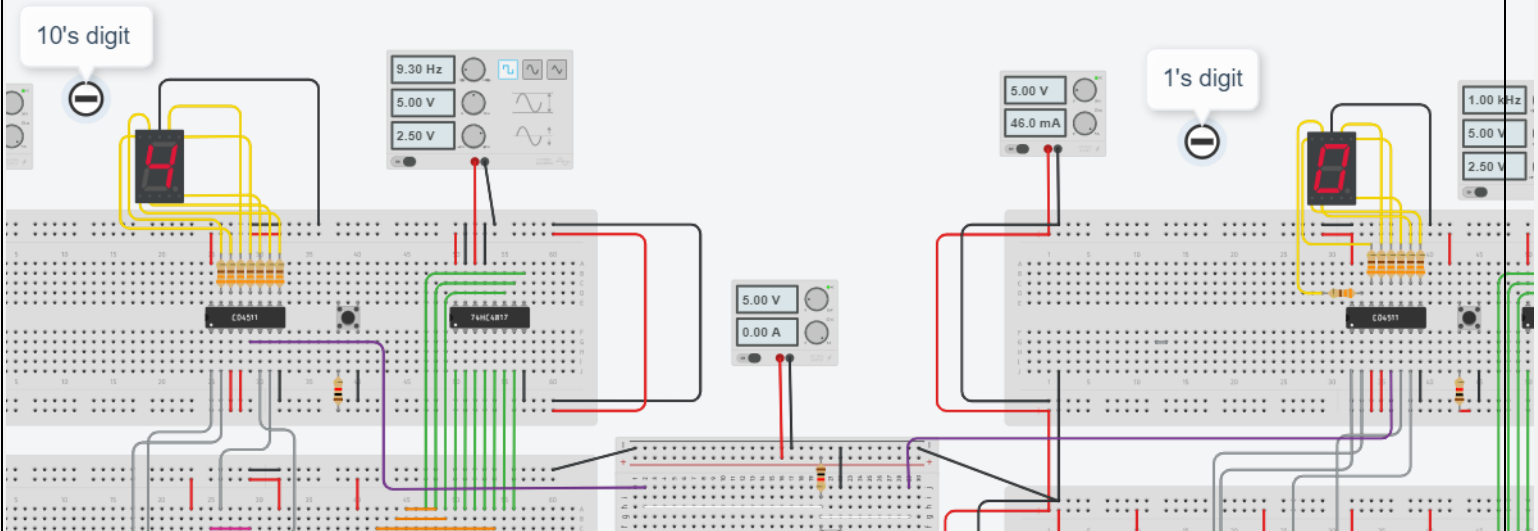
OTP 69 is generated



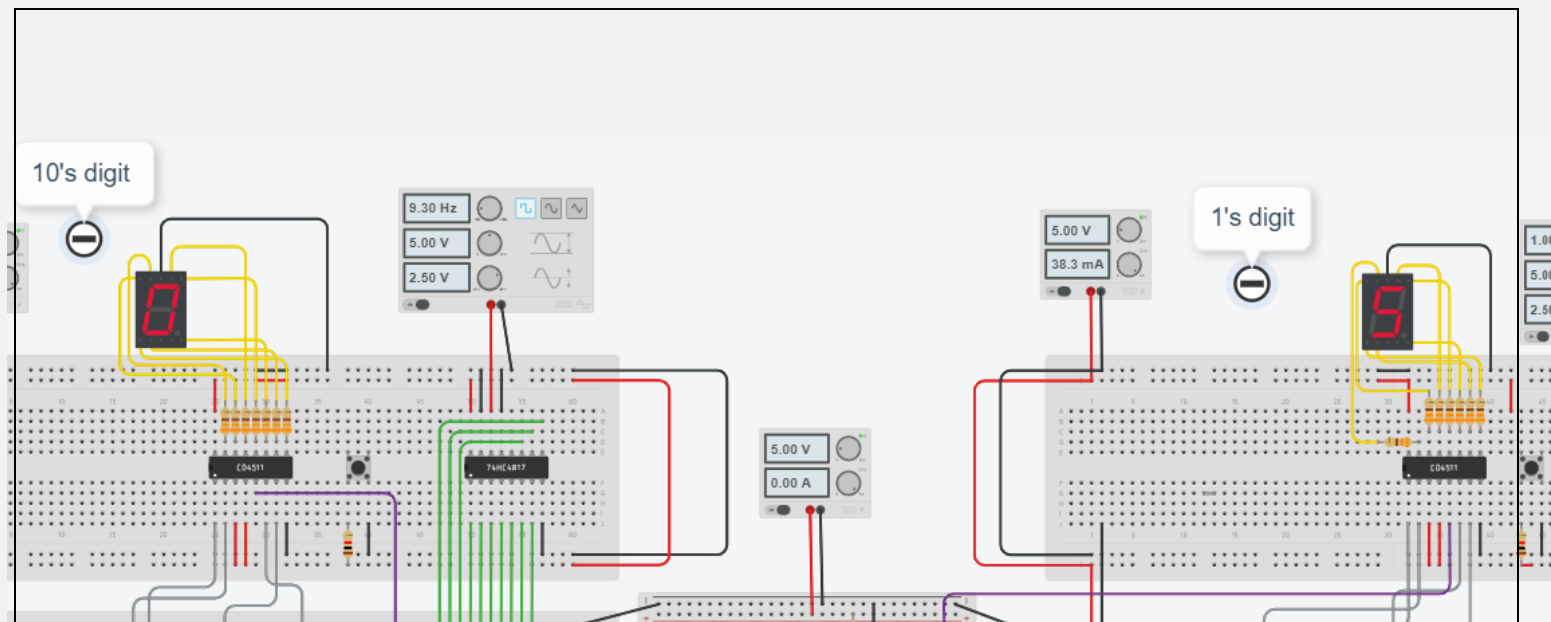
OTP 28 is generated



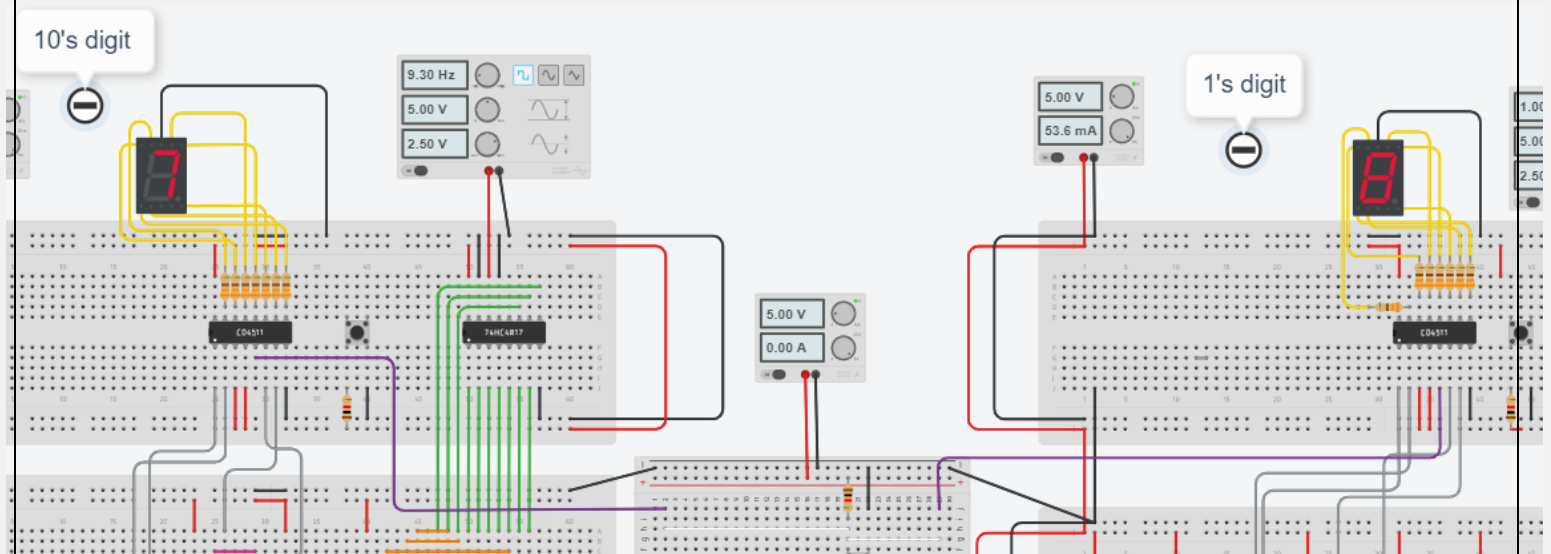
OTP 11 is generated



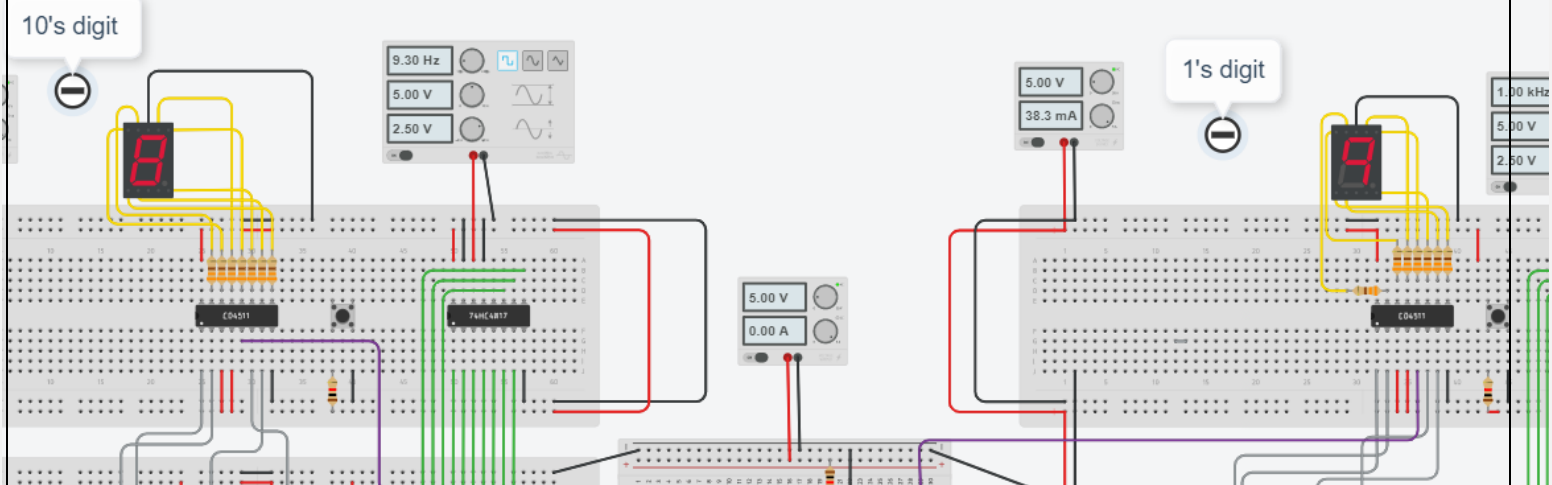
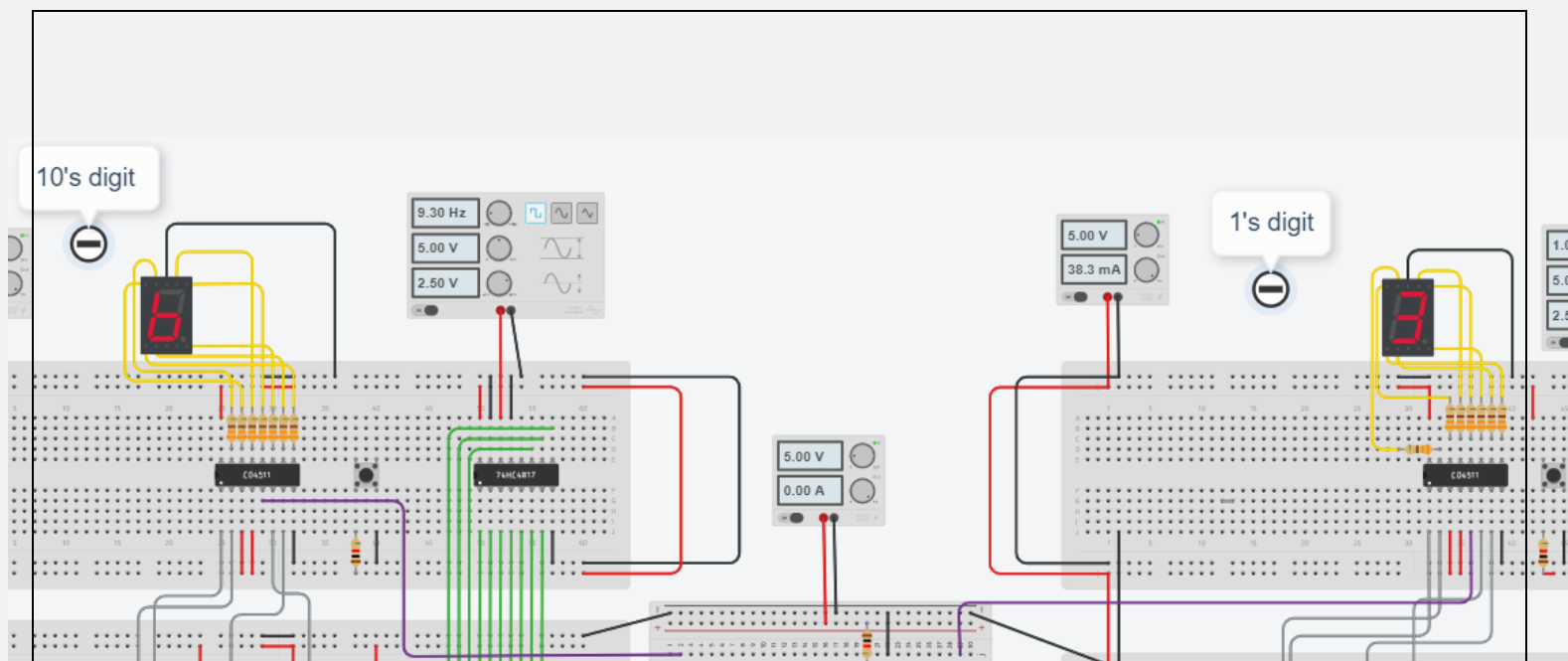
OTP 40 is generated

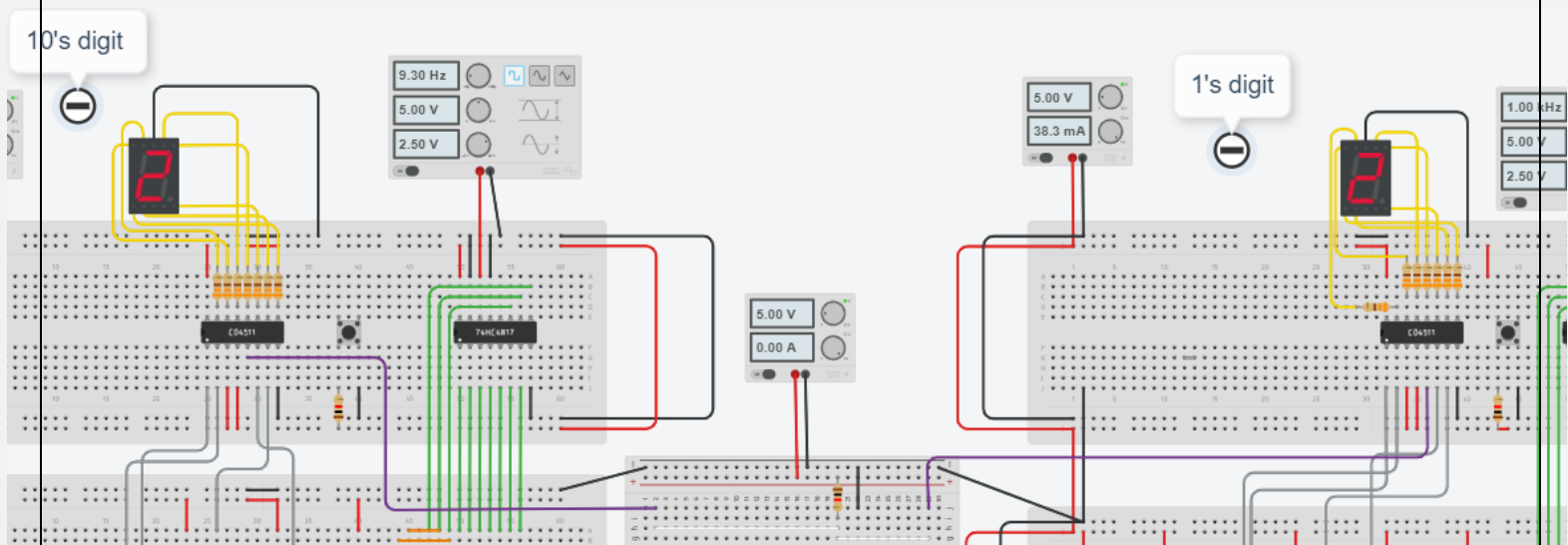


OTP 5 is generated



OTP 78 is generated





OTP 22 is generated

TINKERCAD LINK:

RESULT:

OTP generator circuit was designed and ten random OTP numbers were generated.

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