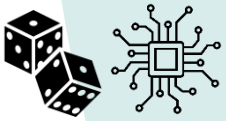
ASSIGNMENT Title:

Digital Dice 

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-Project Aim:

The aim of this project is to design and implement a Digital Dice using basic logic components. The Digital Dice will generate random numbers between 1 and 6, simulating a dice roll for games or educational purposes. This system will utilize basic digital logic design principles to produce a reliable and accurate output on a 7-segment display.

-Problem Statement:

In traditional dice games, the randomness of dice rolls can sometimes be influenced by human factors. This project aims to eliminate such biases by creating a digital system that simulates the roll of a dice. Using D-flip flops to store random values, IC 555 timers to generate timing signals, and BCD to 7-segment decoder to display the results, the system will generate numbers between 1 and 6 and display them on a 7-segment display. The problem being addressed is the need for a simple, low-cost, and accurate digital dice system that can be used in various applications without the need for physical dice

-Inputs:

- ## Clock Signal (CLK):

  A periodic signal generated by the IC 555 timer that drives the operation of the D-flip flops and controls the timing for generating random numbers.

- ## Manual Dice Roll Button:

  A physical button that the user presses to simulate the rolling action, which could trigger the clock signal or reset the system.

-Outputs:

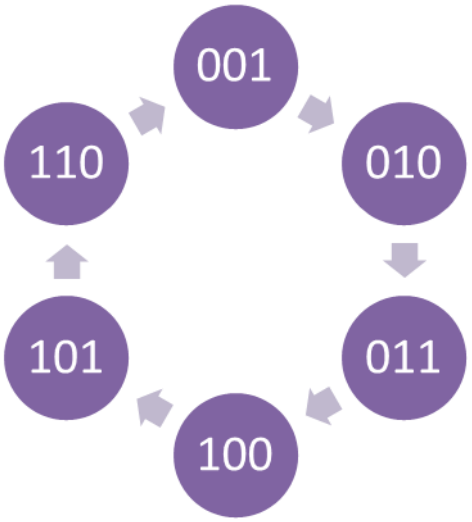
- ## BCD to 7-Segment Decoder Output:

  A BCD (Binary Coded Decimal) output connected to the 7-segment display. This converts the 4-bit binary number stored in the D-flip flops into the appropriate 7-segment display code to represent numbers between 1 and 6.

- ## 7-Segment Display:

  The main output of the system, which will display the generated random number (1 to 6) on a 7-segment display. Each number corresponds to a specific pattern on the display, generated by the BCD to 7-segment decoder.

-Now we need to design a D-flip flop circuit to generate a binary digits from 1 to 6:

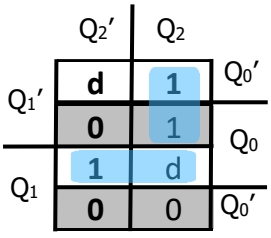


-PS NS & excitation table:

Q_2	Q_1	Q_0	Q_2^+	Q_1^+	Q_0^+	D_2	D_1	D_0
0	0	0	d	d	d	d	d	d
0	0	1	0	1	0	0	1	0
0	1	0	0	1	1	0	1	1
0	1	1	1	0	0	1	0	0
1	0	0	1	0	1	1	0	1
1	0	1	1	1	0	1	1	0
1	1	0	0	0	1	0	0	1
1	1	1	d	d	d	d	d	d

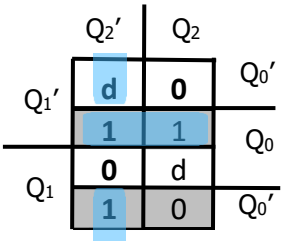
-K-maps:

For D_2:



$D_2=Q_1Q_0+Q_2Q_1'$

For D_1:



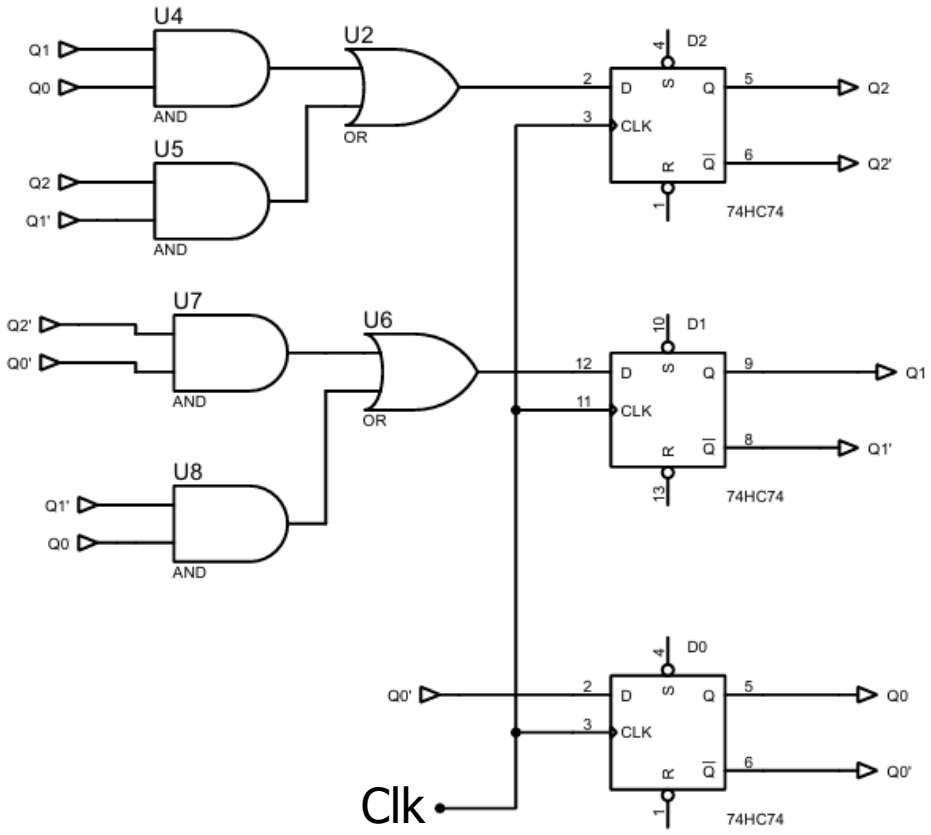
$D_1=Q_2'Q_0'+Q_1'Q_0$

For D_0:

Q_1' \ Q_2' Q_2	Q_2'	Q_2
Q_0'	d	1
Q_0	0	0
Q_1 \ Q_0'	0	d
Q_0'	1	1

$$D_0 = Q_0'$$

D-flip flop Design:



-Implementation:

Components: -

-IC 555

-Push button

-4013 (D-ff)

-7404 (NOT Gate)

-7432 (2-input OR Gate)

-7481 (2-input AND Gate)

-7447 (BCD to 7-segment)

-FJS5101B (7-segment)

-Resistors

-Capacitors

-Jumper wires

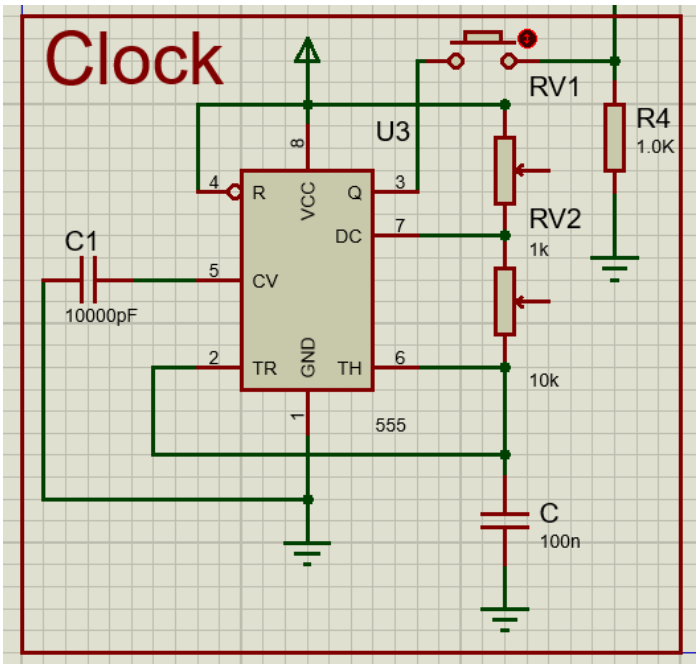
1-IC 555 Circuit (Clock Signal Generator)

- The IC 555 is configured in astable mode to generate a continuous clock signal.
- This clock signal drives the D-flip flops, providing the timing for state transitions, which result in the generation of random numbers.
- The speed of the clock determines how fast the numbers change before the dice "settles" on a final value when the clock stops.

$TH=0.693\times(R1+R2)\times C1$

$TH=0.693\times(1K\Omega+10K\Omega)\times 10\mu F$

$TH\approx.07623$ seconds



$TL=0.693\times R2\times C1$

$TL=0.693\times 10K\Omega\times 100\mu F$

$TL\approx 0.0693$ seconds

$T_{tot}=TH+TL$

$=0.07623$ seconds$+0.0693$ seconds

≈ 0.14553 seconds

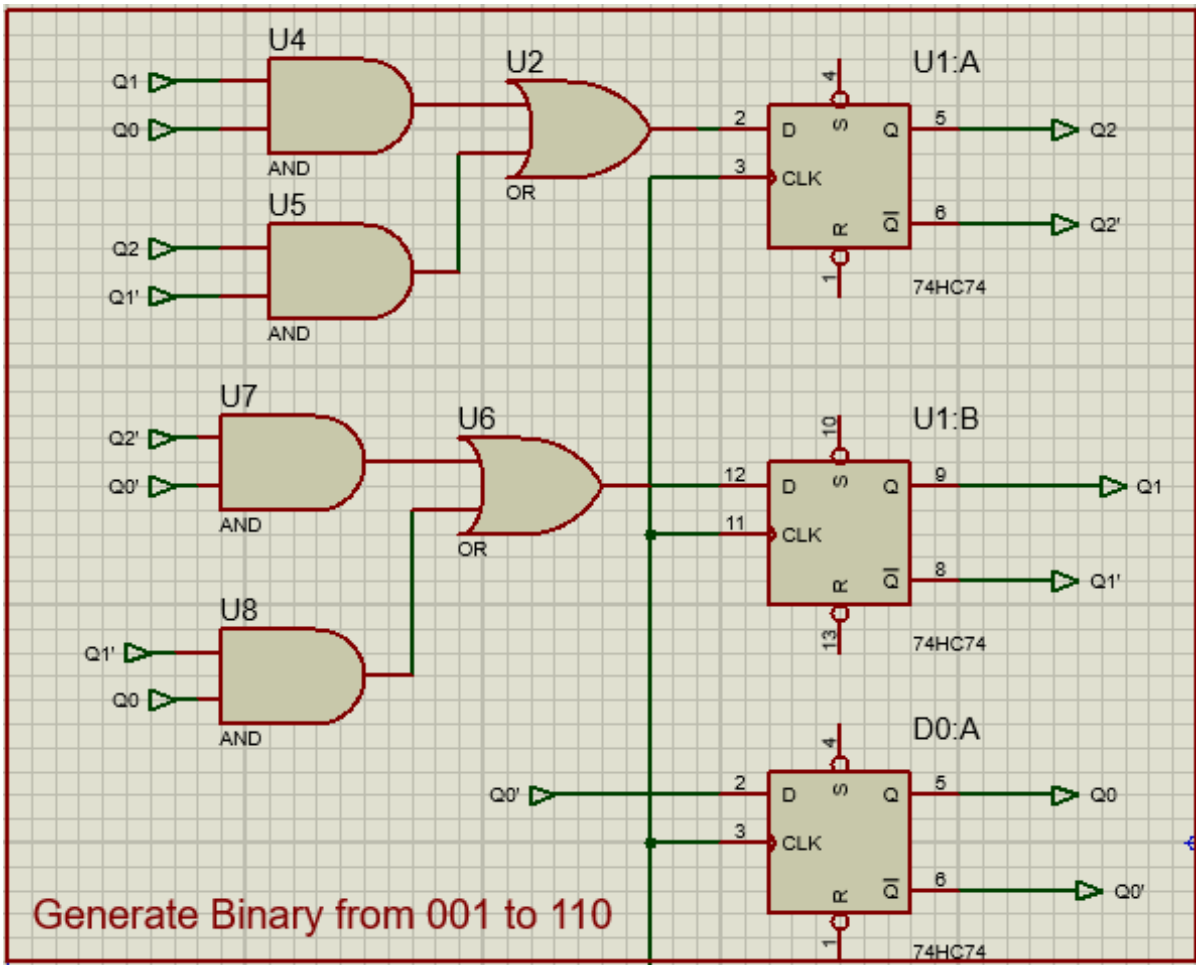
2-D-Flip Flops (Random Number Generator):

- A series of D-flip flops store the binary values that represent the dice numbers.
- The flip-flops are triggered by the clock signal and toggle their states based on the logic design.
- Their outputs collectively form a 3-bit binary number, which corresponds to the dice values (1 to 6).

3-Basic Logic Gates (Logic Control):

Additional logic gates used to:

- Limit the output to the valid dice range (1 to 6).

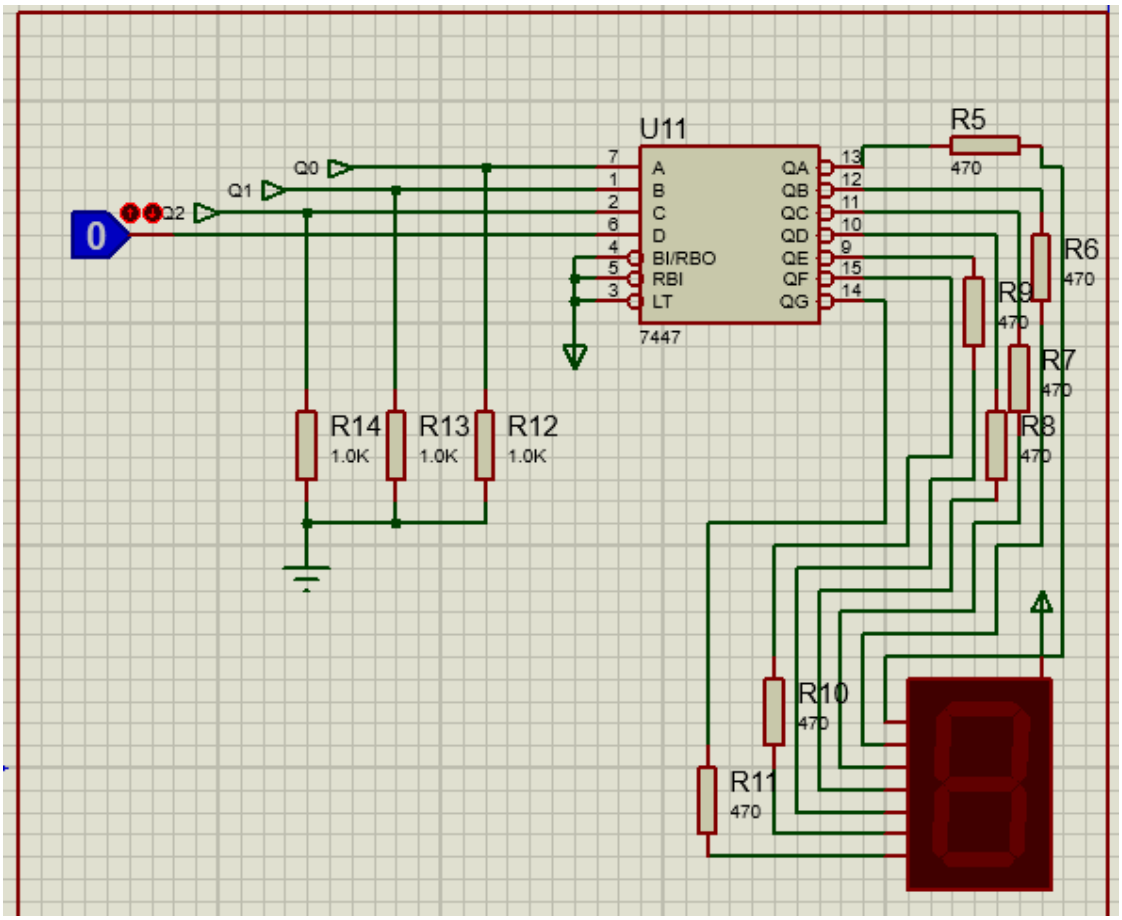


4-BCD to 7-Segment Decoder (IC 7447):

- This IC takes the 3-bit binary output from the flip-flops and converts it into signals that can drive the 7-segment display.
- It maps the binary values to the correct patterns on the 7-segment display to show numbers 1 through 6.

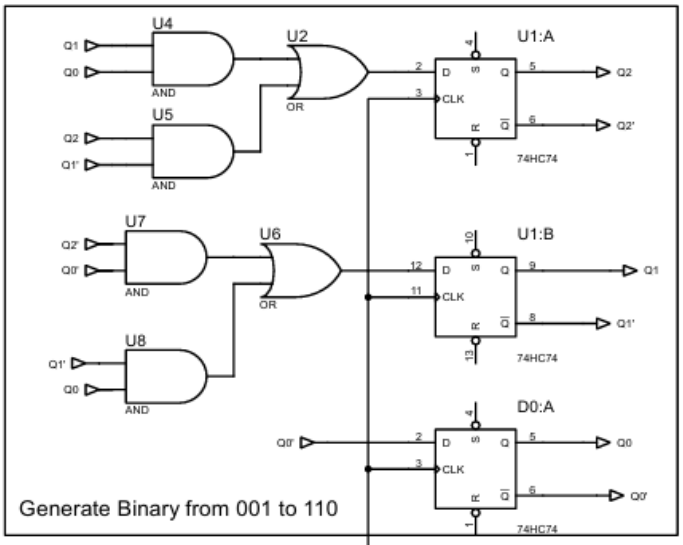
5-7-Segment Display (Output Display):

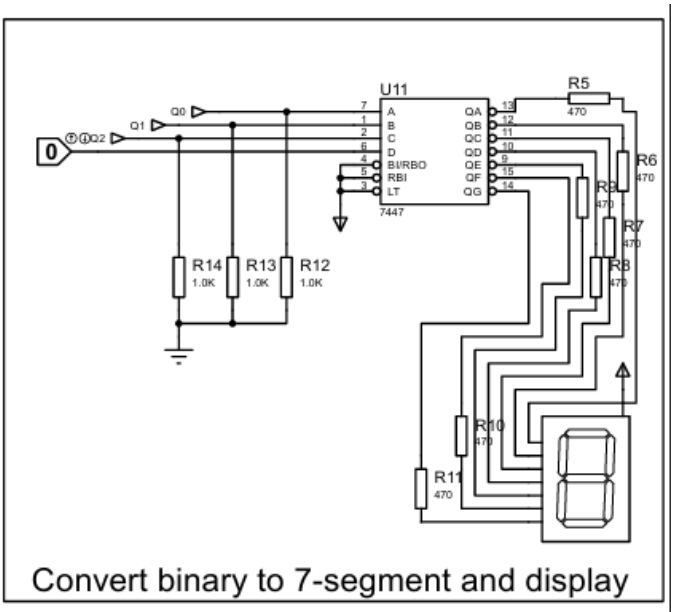
- It uses the signals from the BCD decoder to visually display the generated dice number.

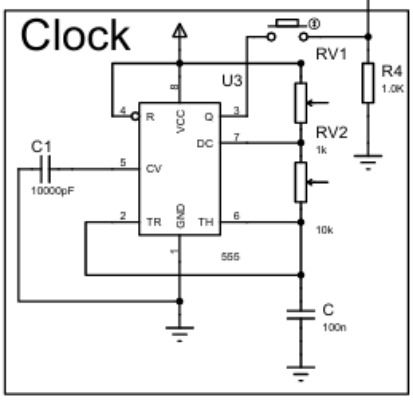


-Summary

- **IC 555 Timer:** Generates the clock signal for timing.
- **D-Flip Flops:** Store and update binary numbers based on the clock.
- **Logic Gates:** Provide range limiting, control, and auxiliary features.
- **BCD to 7-Segment Decoder:** Converts binary numbers to 7-segment display signals.
- **7-Segment Display:** Shows the dice number (1-6) to the user.

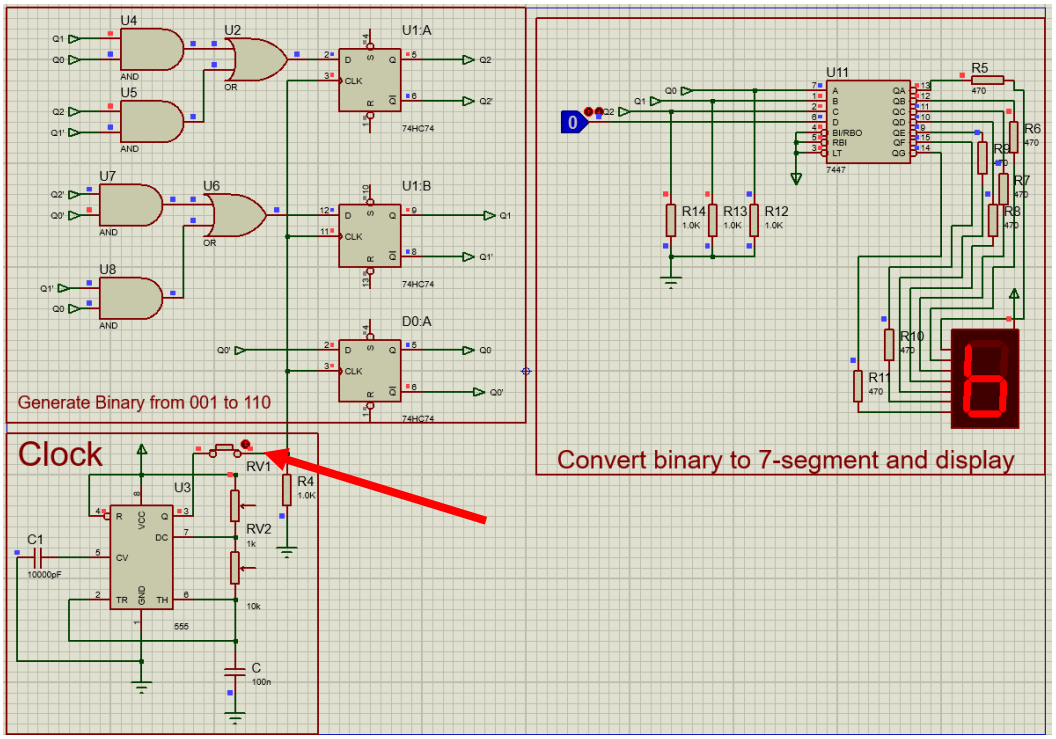


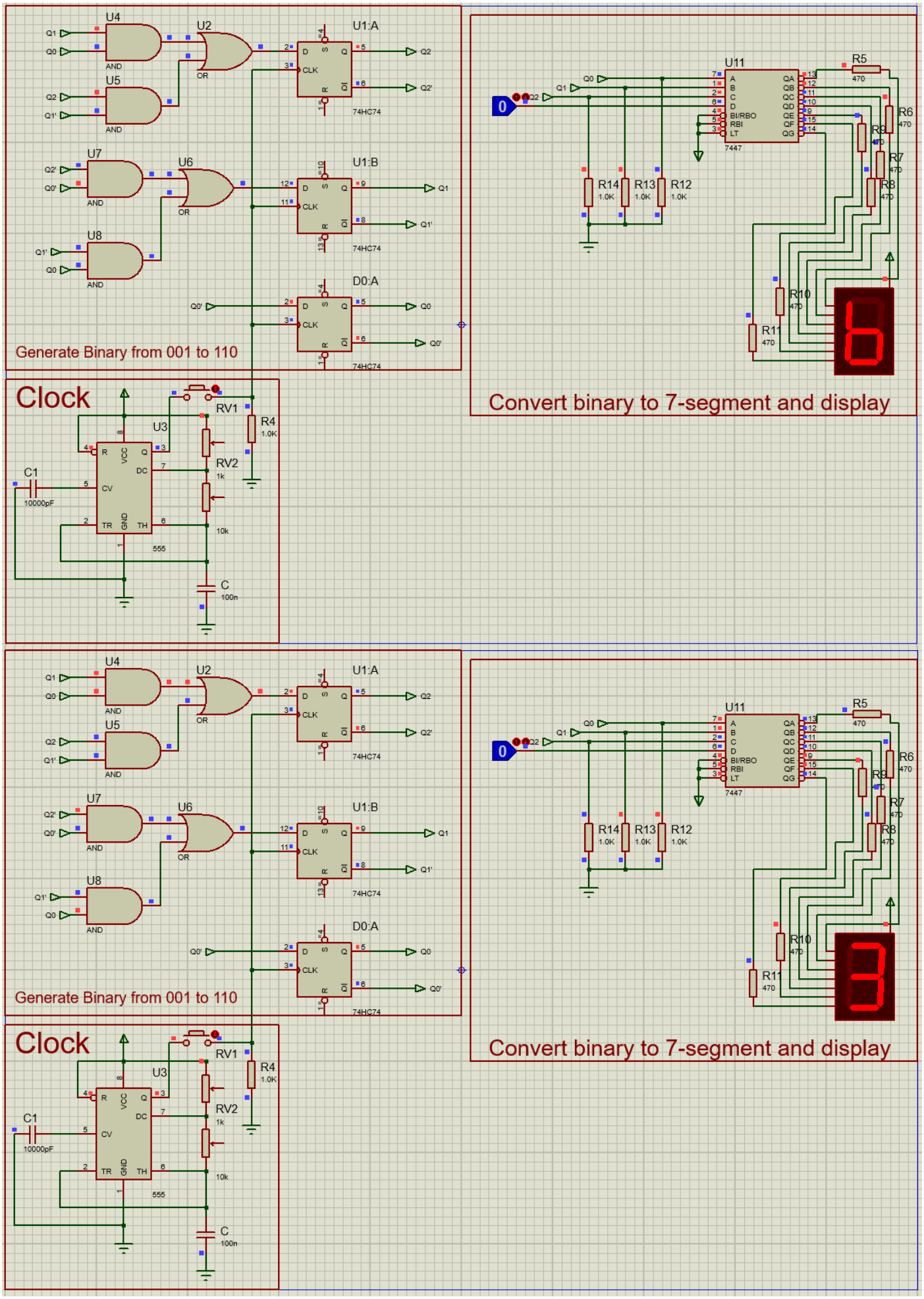


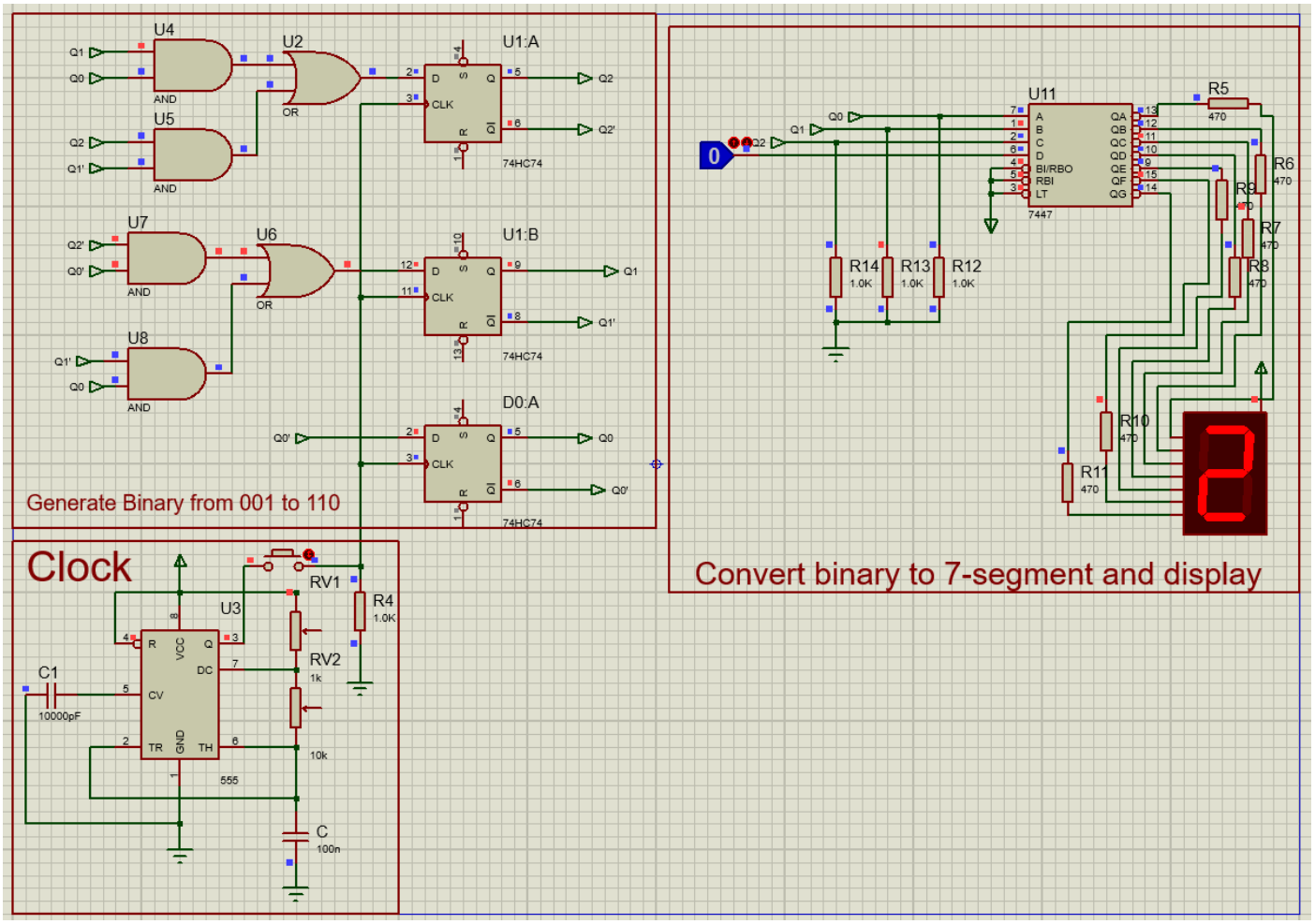


-Test

-first stay pushing the push button the 7-segment will display a numbers from 1 to 6 at a high speed once you release push button a random number from 1 to 6 will be displayed




U4
U2
U1:A
U5
U7
U6
U1:B
U8
D0:A
AND
OR
74HC74
Generate Binary from 001 to 110
U11
7447
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
1.0K
470
Convert binary to 7-segment and display
Clock
U3
555
RV1
RV2
R4
C1
C
10000pF
10k
100n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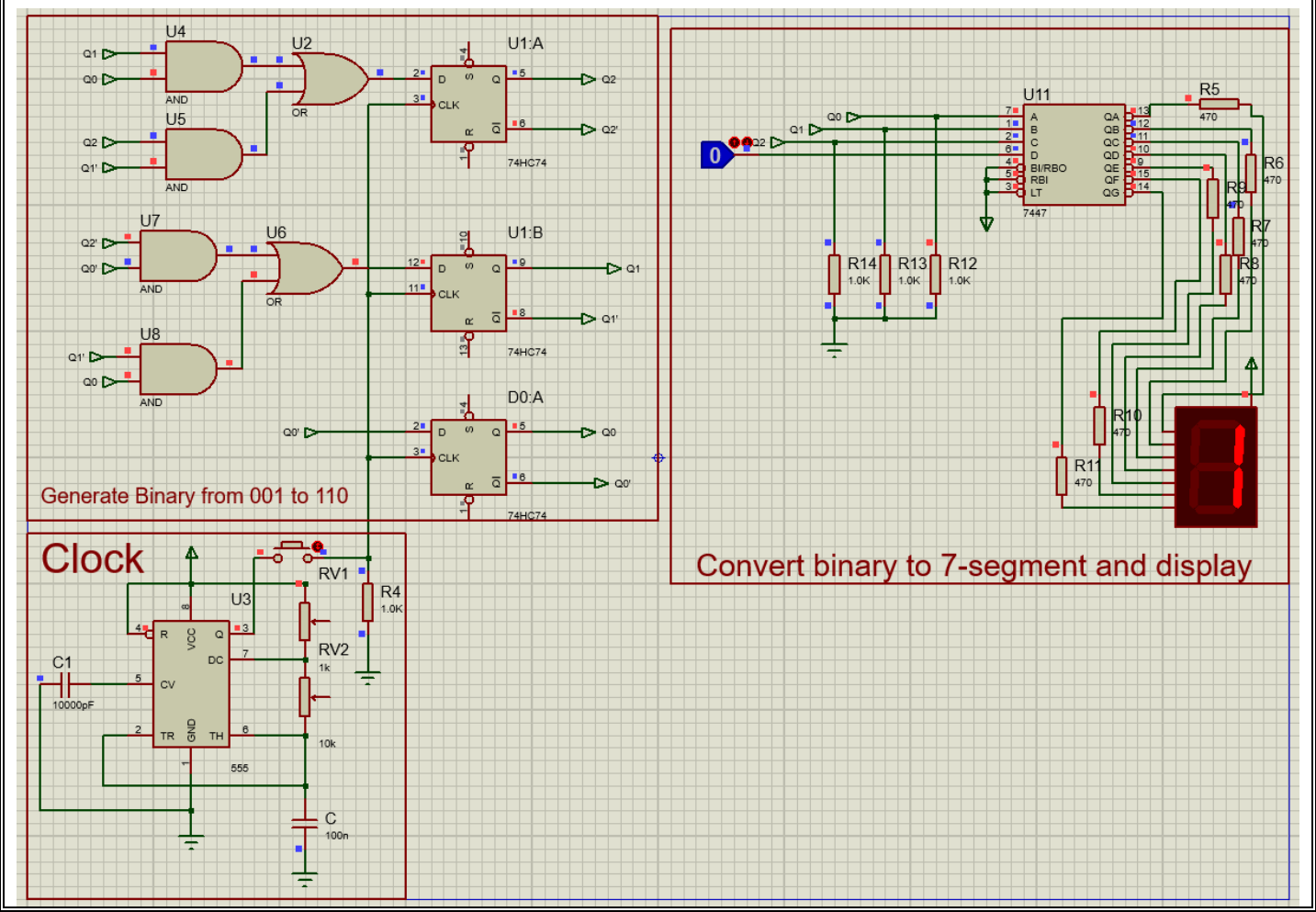
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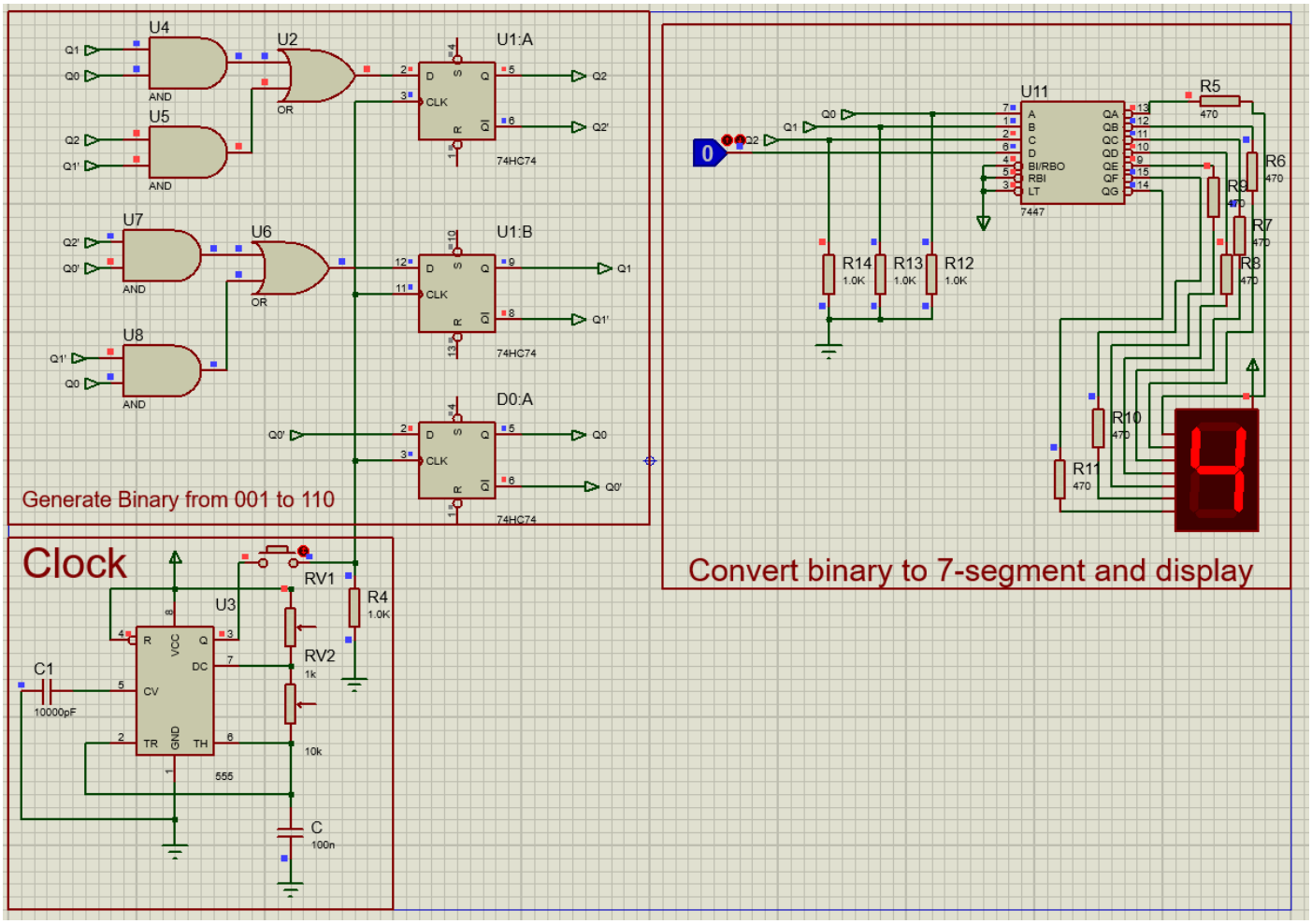
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