Assignment-1
AI1110: Probability and Random Variables
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EE22BTECH11212

AIM : Generating random numbers using Shift Registers

Components Required :

1) Breadboard x1
2) Seven Segment Display x1
3) Decoder(IC 7447) x1
4) Flip Flop(IC 7474) x2
5) XOR Gate(IC 7486) x1
6) 555 IC x1
7) 10K Ω Resistor x1
8) 10M Ω Resistor x1
9) 1μ F Capacitor x1
10) 470n F Capacitor x1
11) Jumper Wires
12) USB-Type A adapter

Description : The 555 IC is used to generate a clock signal. This clock signal is then fed to the Flip Flops (Each IC 7474 has 2 Flip Flops). Initially after powering up the circuit, the flip flops produce random outputs. The outputs from the 1st and last flip flops are then fed into the XOR gate and the outputs of all Flip Flops are sent to the decoder. The decoder then depending on the input decides which segments of the Seven Segment Display should light up and which ones shouldn't. For example, if the input to the decoder is 0001 it lights up the segments b and c.

Meanwhile the output from the XOR gate is once again fed into the flip flops and this time we get different outputs and thus different segments light up, thus generating a different random number. New random numbers are generated this way until the original number is obtained again. Now the same sequence of random numbers is generated again and again and this cycle repeats.

The purpose of the clock is to ensure that each number has enough time to display and doesn't change instantaneously as the propogation time of the circuit for each cycle is extremely small. The clock does this by not letting the information propogate when the clock signal is low. The duration of this clock low period is determined by the values of the capacitor. When the capacitors are small, the clock period decreases and the random numbers are generated very fast, as clock speed is high. In this circuit to increase the display duration, the capacitors are taken of the order 10^{-6} and not smaller than that.

Also it is neccesary to connect every component with V_{cc} and GND to run them. The brightness of the Seven Segment Display depends on the value of the resistor connect it to V_{cc}, the larger it is, the dimmer the brightness. The circuit is powered by using a USB-Type A adapter.
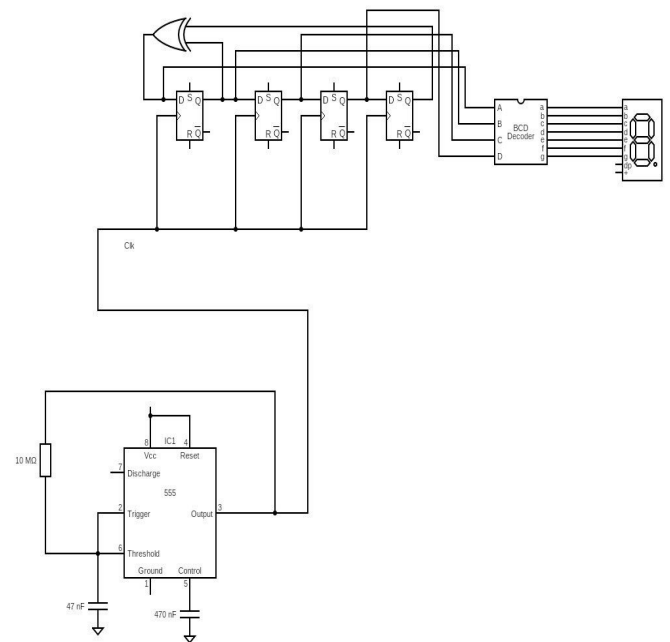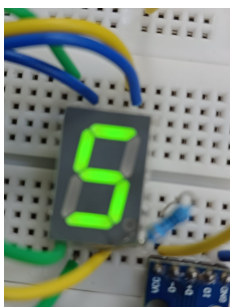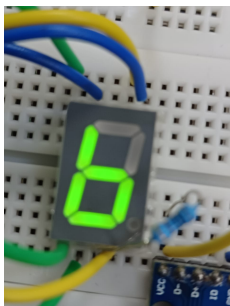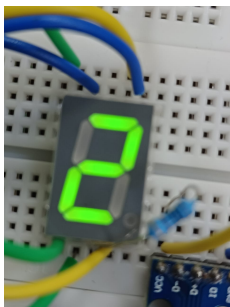
Sample Outputs :

Fig. 12. Block Diagram