

# **COL-215P ASSIGNMENT-5**

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# Contents

<b>1</b>	<b>Implementation and Work Done</b>	<b>2</b>
<b>2</b>	<b>Details of Circuit</b>	<b>2</b>
2.1	Details of FSM Used . . . . .	3
2.2	Initial Display as soon as switched on . . . . .	4
2.3	Snaps of Rotation in State-B . . . . .	5
2.4	Snaps of Rotation in State-C . . . . .	7
2.5	Waveform Obtained . . . . .	9
2.6	Utilization Report . . . . .	9

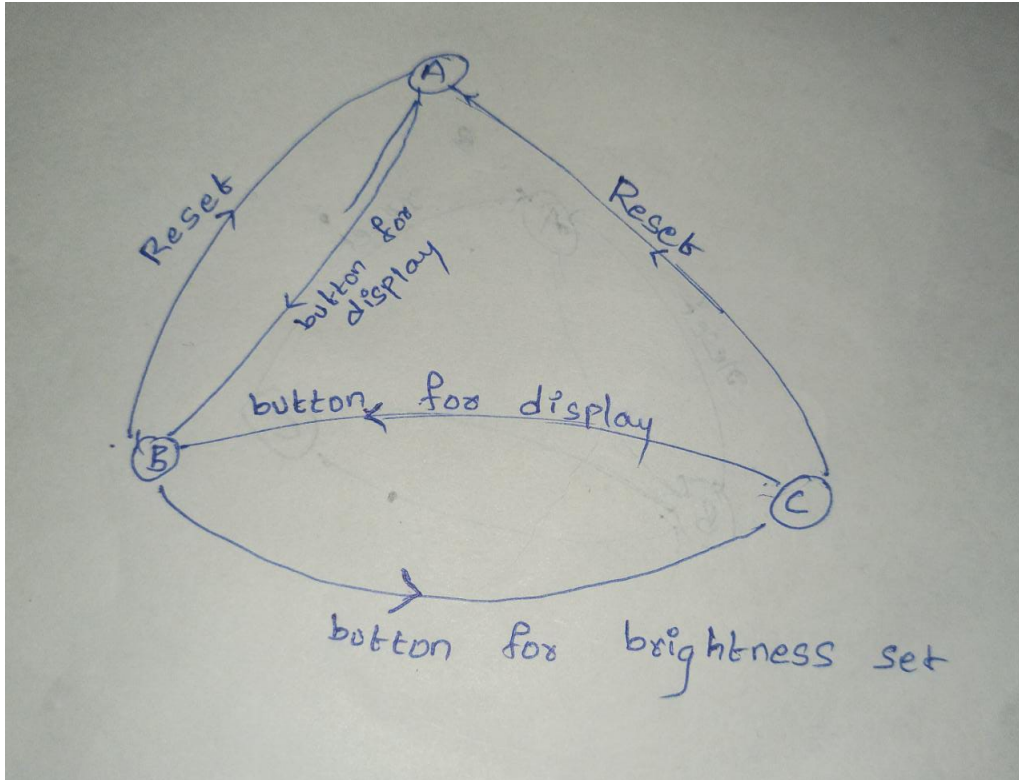
# 1 Implementation and Work Done

We built upon the seven segment display with a suitable refresh rate to display all the 4 digits implemented in the previous lab. Since, we need to provide inputs through button presses, we used a debouncer circuit to ensure that the button inputs work properly. We initially divided the clock into equal fourths for each display and corresponding to the level of display, we assigned  $(\frac{8}{32})^{th}$ ,  $(\frac{6}{32})^{th}$ ,  $(\frac{4}{32})^{th}$ ,  $(\frac{2}{32})^{th}$  of the clock cycles to be displayed to ensure that there is variation in levels of brightness.

## 2 Details of Circuit

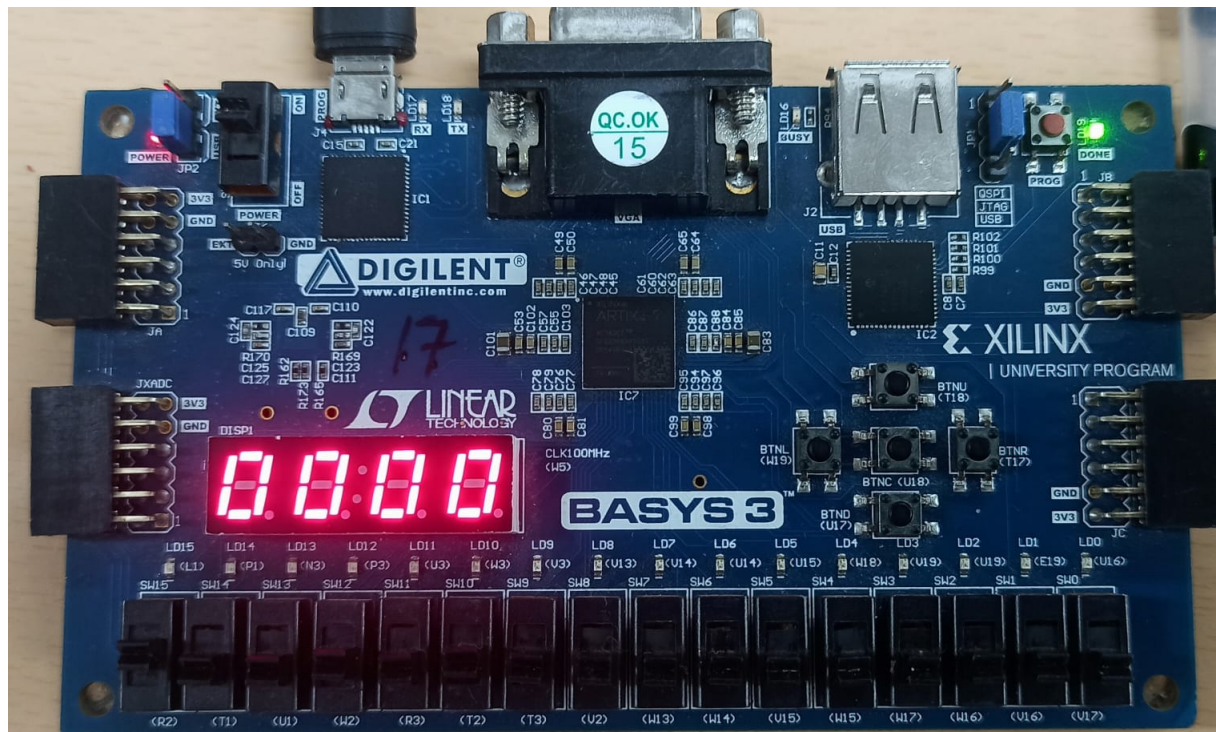
We used a seven segment display component built in the last assignment, a 4:1 multiplexer and a 32-bit counter to build the circuit. The counter counts up for every rising clock edge and the  $20^{th}$ ,  $19^{th}$ ,  $18^{th}$  and  $17^{th}$  bits from right correspond to the select input to the multiplexer (to maintain the same refresh rate for display as done in the last lab). To handle the rotation we chose the  $28^{th}$  and  $27^{th}$  bits from right to rotate the switch inputs in cyclic order i.e., rotation will be  $2^8$  times slower than refresh rate and hence it will be easily to detect for the human eye to see the rotating displays.

## 2.1 Details of FSM Used

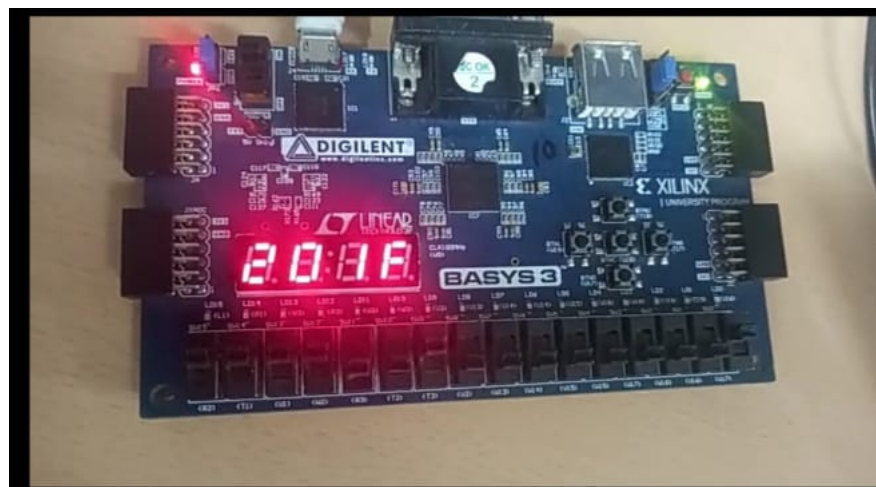
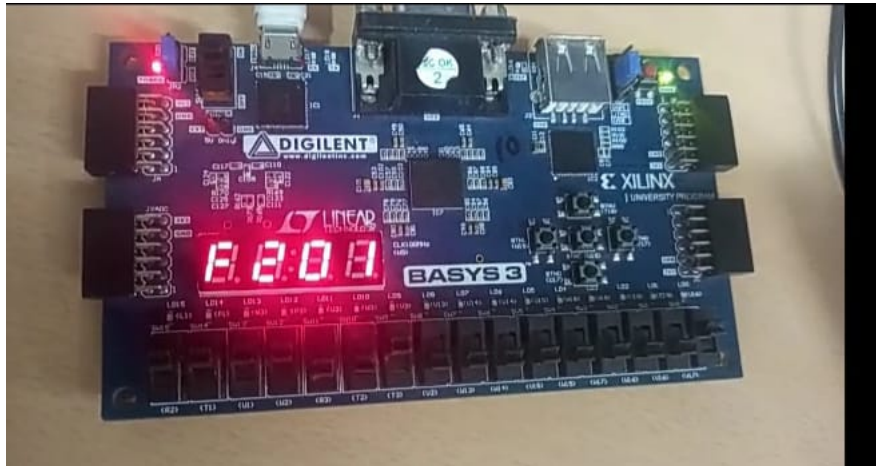


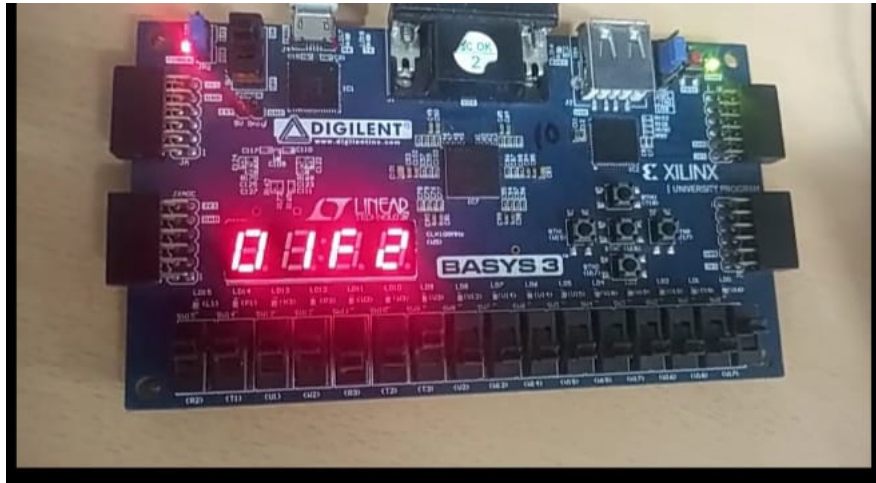
We can see that the FSM we used consists of three states A,B,C. Initially,the display will be in State-A when there is nothing displayed on the anode.As soon as we press the button,the display goes into state-B,where the number on switches is displayed and all the displays are at equal brightness of level-4.Now if we press the button corresponding to display,the state changes to state-C where on changing the switch values,the brightness values get changed with the displaying values remaining constant.As soon as we come back to state-B,the new values(corresponding to current switches) are displayed with the new brightness values set in state-C.If we press reset,we go back to state-A.

## 2.2 Initial Display as soon as switched on



## 2.3 Snaps of Rotation in State-B

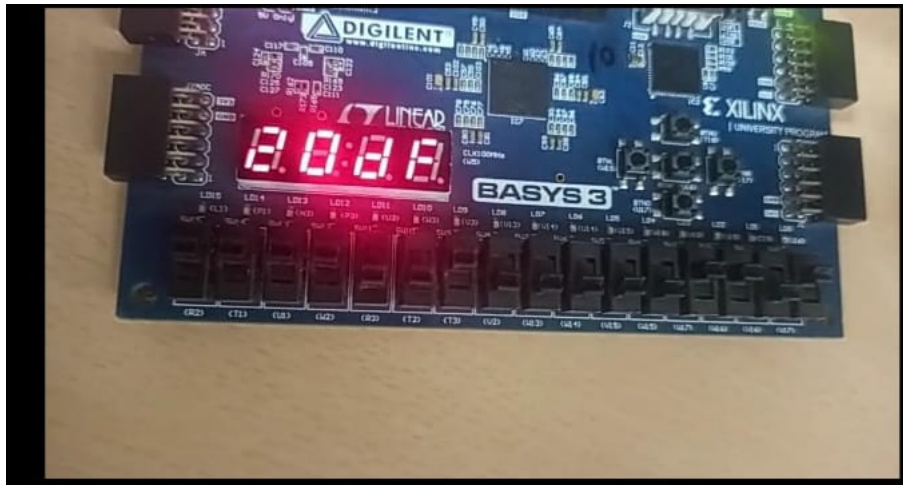
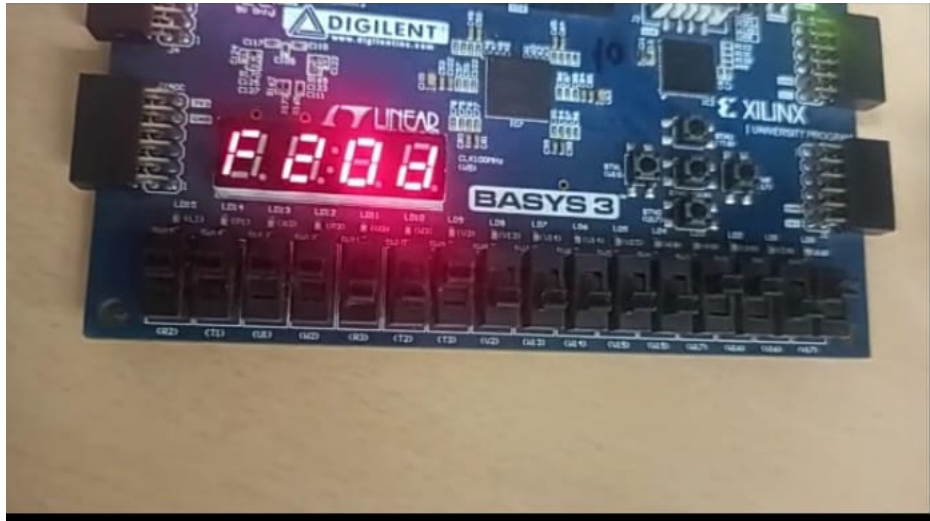




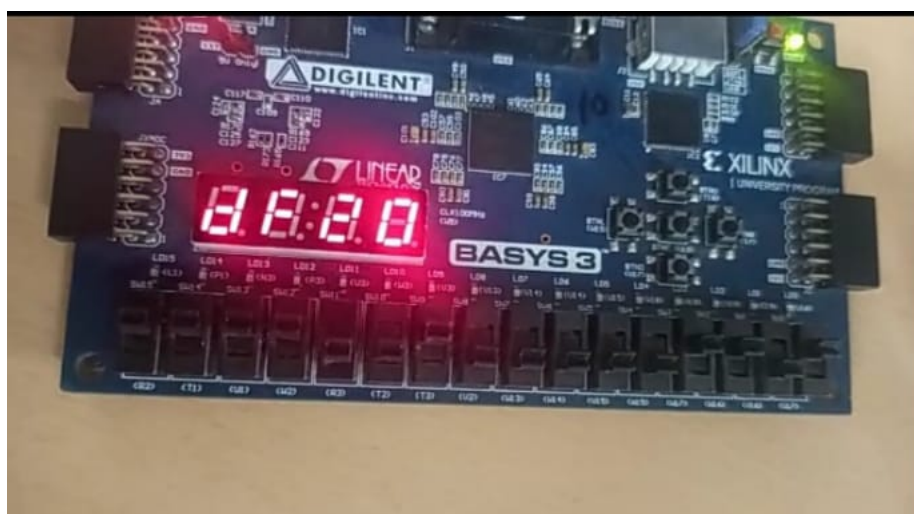
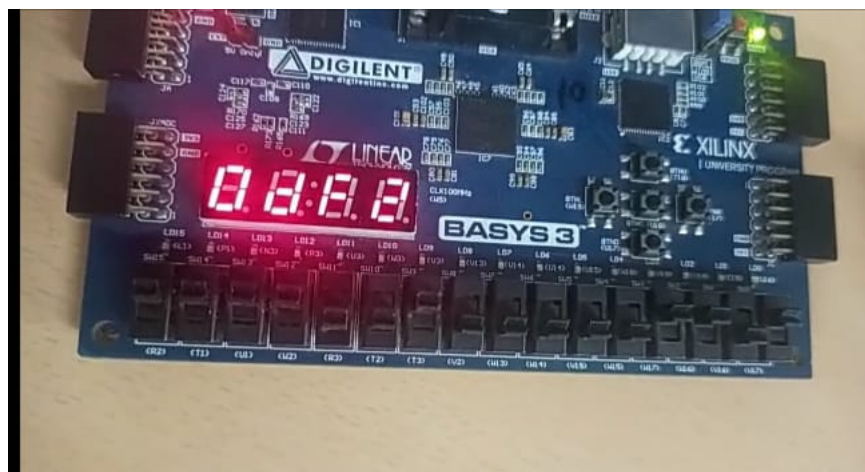
Snapshots for initial input 1111 0010 0000 0001=F201



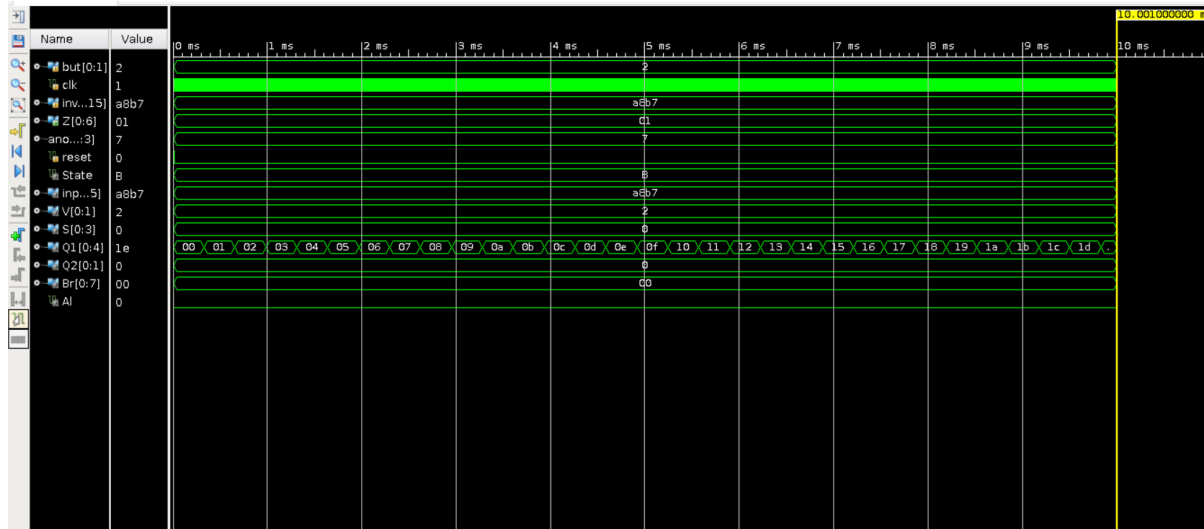
## 2.4 Snaps of Rotation in State-C







## 2.5 Waveform Obtained



## 2.6 Utilization Report

Site Type	Used	Utility %
LUT as Logic	64	0.31%
LUT as Memory	0	0%
Register as Flip Flop	34	0.08%
Register as Latch	35	0.08%
DSP	0	0%
BRAM	0	0%