Digital Electronics Circuits lab
Lab Experiment:4

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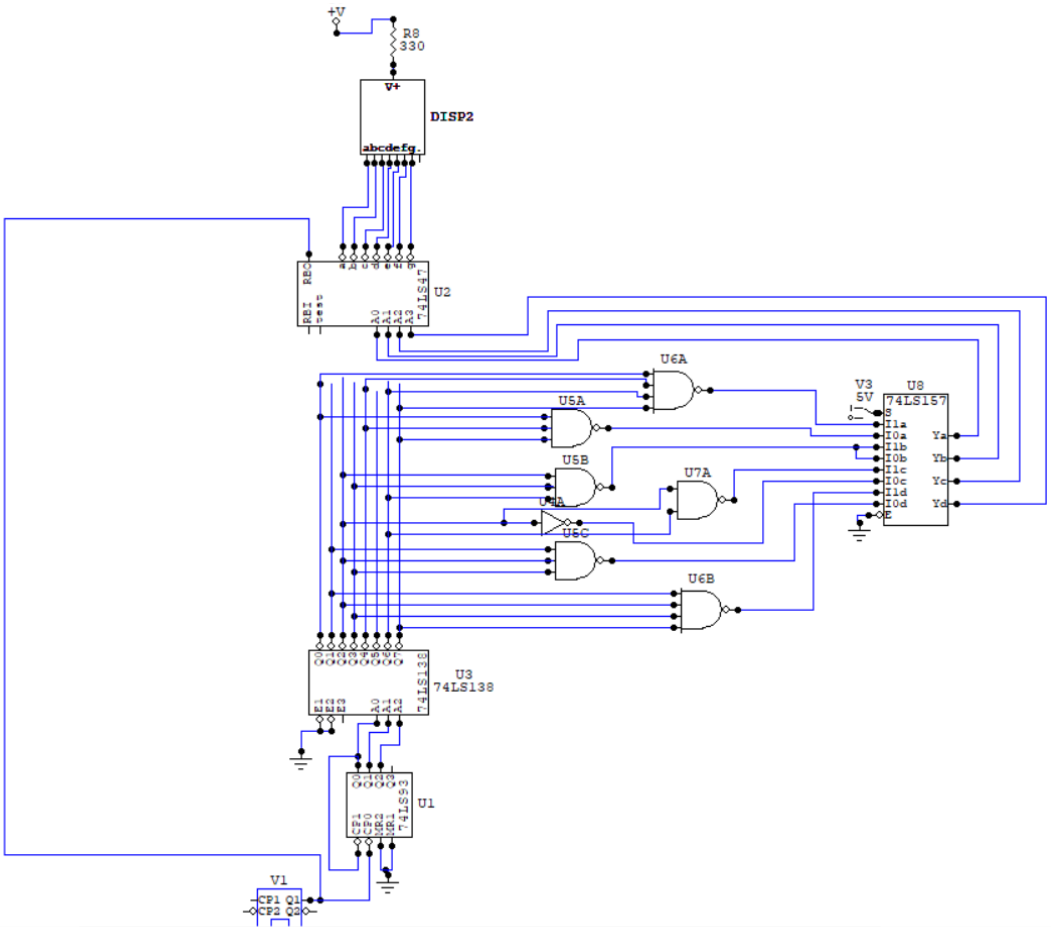
Roll No:18EC10021

AIM: To display the two roll numbers using the 7-segment display,IC 74138(Decoder),IC 7493(counter) and IC74157 (multiplexer).

Circuit:Digital circuit for displaying the roll numbers:-
For logic “0” at select 18EC1021 displays.
For logic “1” at select 18EC1079 displays.



Result:

Link for the above circuit:
https://drive.google.com/file/d/1Yp_RQIPDkUnnk2ooGqdEmyvsdtqXKfLp/view?usp=sharing

Link for the simulation output of the above circuit:
https://drive.google.com/file/d/1vKwadJWLmOY1IM8SyTAK7SUw0pBHDBpa/view?usp=sharing

Calculations:

For Display no.:-18EC1079

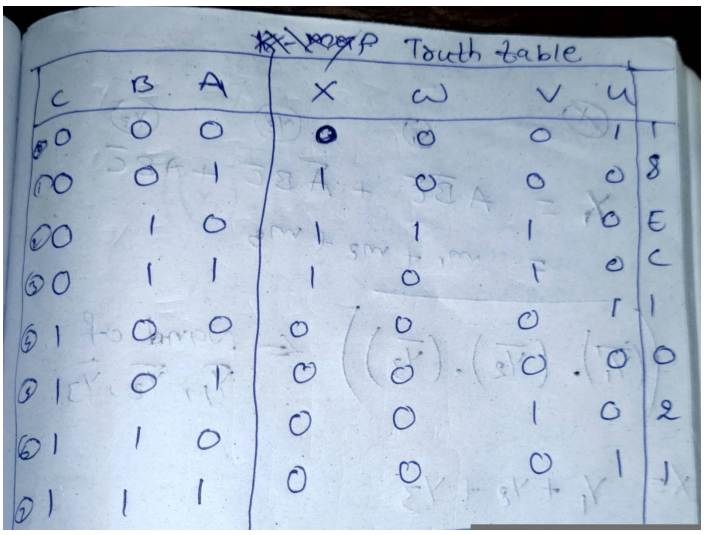
Truth table:

Input from counter			Input to IC 7447				Roll No. 1	Input to IC 7447				Roll No. 2
Q_2	Q_1	Q_0	A_3	A_2	A_1	A_0		A_3	A_2	A_1	A_0	
0	0	0	0	0	0	1	1	0	0	0	1	1
0	0	1	1	0	0	0	8	1	0	0	0	8
0	1	0	1	1	1	0	E	1	1	1	0	E
0	1	1	1	0	1	0	C	1	0	1	0	C
1	0	0	0	0	0	1	1	0	0	0	1	1
1	0	1	0	0	0	0	0	0	0	0	0	0
1	1	0	0	1	1	1	7	0	0	1	0	2
1	1	1	1	0	0	1	9	0	0	0	1	1

Taking $m_0, m_1, \ldots\ldots, m7$ as minterms and $y_0, y_1, \ldots\ldots, y_7$ as outputs of IC 74138

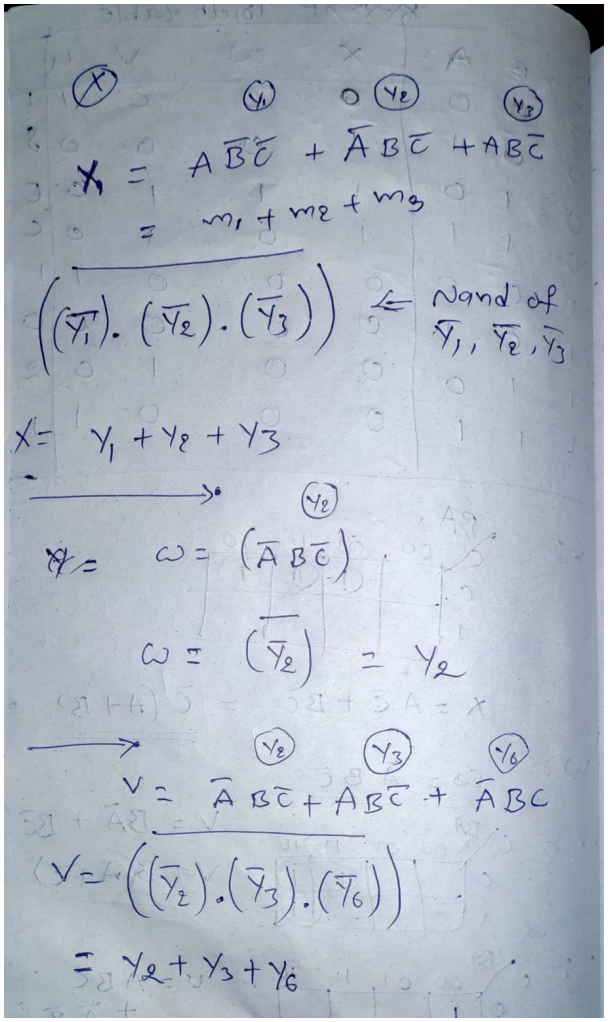
A3 = m1+m2+m3+m7 = y1'+y2'+y3'+y7' = (y1.y2.y3.y7)' (By DeMorgan Law)
A2 = m2+m6 = y2'+y6' = (y2.y6)'
A1 = m2+m3+m6 = y2'+y3'+y6' = (y2.y3.y6)'
A0 = m0+m4+m6+m7 = y0'+y4'+y6'+y7' = (y0.y4.y6.y7)'

For Display no.:-18EC1021



Truth table

C	B	A	X	W	V	U	
0	0	0	0	0	0	1	1
0	0	1	1	0	0	0	8
0	1	0	1	1	1	0	E
0	1	1	1	0	1	0	C
1	0	0	0	0	0	1	1
1	0	1	0	0	0	0	0
1	1	0	0	0	1	0	2
1	1	1	0	0	0	1	1



(X) (Y1) (Y2) (Y3)

$X = A\bar{B}\bar{C} + \bar{A}B\bar{C} + AB\bar{C}$

$= m_1 + m_2 + m_3$

$\overline{\left(\left(\overline{Y_1}\right).\left(\overline{Y_2}\right).\left(\overline{Y_3}\right)\right)}$ ← Nand of $\overline{Y_1}, \overline{Y_2}, \overline{Y_3}$

$X = Y_1 + Y_2 + Y_3$

(Y2)

$W = \left(\bar{A}B\bar{C}\right)$

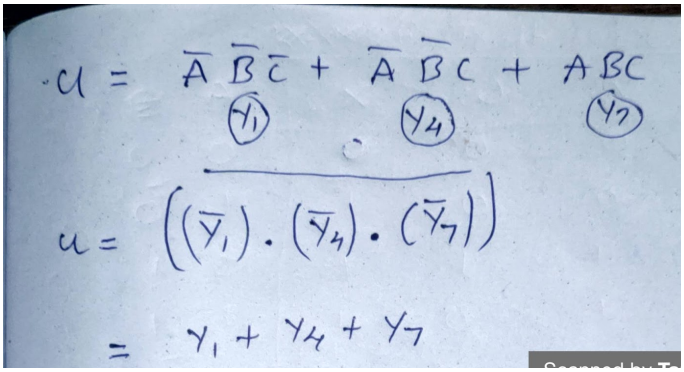
$W = \overline{\left(\overline{Y_2}\right)} = Y_2$

(Y2) (Y3) (Y6)

$V = \bar{A}B\bar{C} + AB\bar{C} + \bar{A}BC$

$V = \overline{\left(\left(\overline{Y_2}\right).\left(\overline{Y_3}\right).\left(\overline{Y_6}\right)\right)}$

$= Y_2 + Y_3 + Y_6$



Observations & Discussion:

- It is the extension for the experiment.3,In the experiment 4 circuit we will be adding the two circuits of experiment 3,and we try to display the two roll no's using the same circuit with the help of multiplexer.
- From the output of 7493 we will be considering the a0,a1,a2 outputs which gives the values range from 000 to 111(8 different outputs),leaving aside the a3 output.
- For each value in these 8 outputs we will assign the 8 digit roll no's as given in the above figures of calculation.
- IC 74318 a 3-to-8 decoder takes the 3-input from IC 7490 and generates a 8-bit output which are compliments of each minterm.
- In IC 74138 as E_1,E_2 are Enable(Active low)inputs,if we give high level to any one of them we will be getting high level at all the 8 outputs,similarly when we give low level to the E_3 we will be getting high level at all the 8 outputs as it is a Enable(Active high)input,so we ground E_1,E_2 and left E_3 as high to get the correct output from the decoder.
- For each roll no. We draw a truth table for A,B,C and each function X,W,V,U to find all the minterms for each function so that correspondingly we can take outputs for each function from the IC 74138(Decoder).
- Where,A:Q_0,B:Q_1,C:Q_2
  X:A_3,W:A_2,V:A_1,U:A_0
- We have to minimise the number of logic gates to be used for each function(X,W,V,U),so the best way to minimise the number is just using a nand gate as we will be getting (minterm)' from the decoder,so by passing those required minterms to the nand gate will gives the sum of those minterms(using De-morgan's Law).
- Multiplexer is used to select the roll number which is to be displayed at the 7-segment display,in my circuit i had given 18EC1021 at I_0 and 18EC1079 at I_1 so, as we connect select(S) to low,I_0 gets activated and similarly I_1 gets activated when select(S) is high i.e.,it acts like a switch.

- I had connected the RBO to pulse to show the blink between 2 displaying digits,this happens because when the clock pulse is in low level then RBO also becomes low which triggers the IC 7447 to give all the outputs off i.e.,no LED blows which is displayed as blink.