North South University

Department of Electrical & Computer Engineering

Project

Course Code: CSE231

Course Title: Digital Logic Design

Section: 07

Project Name: Display the first 7 digit of the ID using 7 segment display

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Id: 1912374642

Date of Submission: 03/05/21

Submitted To: Md. Shahriar Hussain

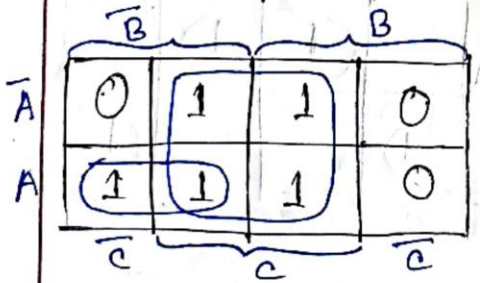
1. Combinational Part

First 7 digits of ID: 1912374

Binary Inputs			Outputs							7 segment Display output
A	B	C	a	b	c	d	e	f	g	
0	0	0	0	1	1	0	0	0	0	1
0	0	1	1	1	1	1	0	1	1	9
0	1	0	0	1	1	0	0	0	0	1
0	1	1	1	1	0	1	1	0	1	2
1	0	0	1	1	1	1	0	0	1	3
1	0	1	1	1	1	0	0	0	0	7
1	1	0	0	1	1	0	0	1	1	4
1	1	1	1	1	1	1	1	1	0	0

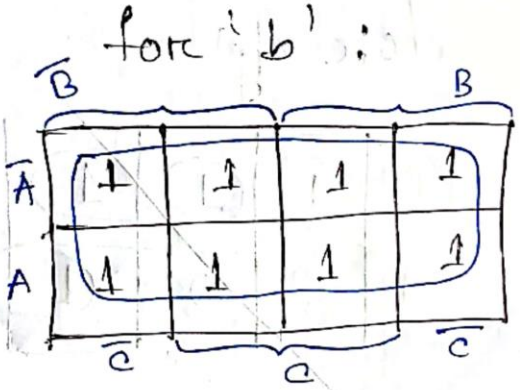
Kmap:

for 'a':



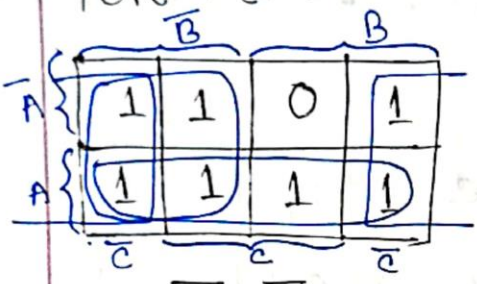
$a = C + A\bar{B}$

for 'b':



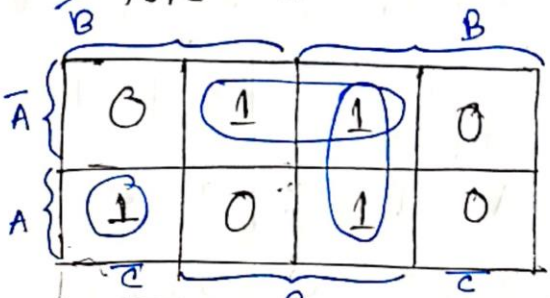
$b = 1$

for 'c':



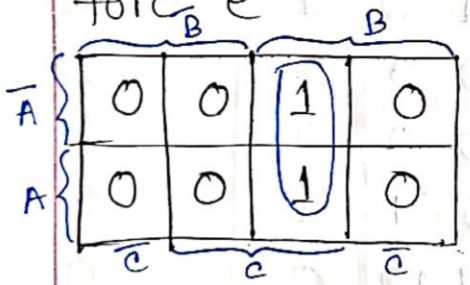
$c = \bar{B} + \bar{C} + A$

for 'd'



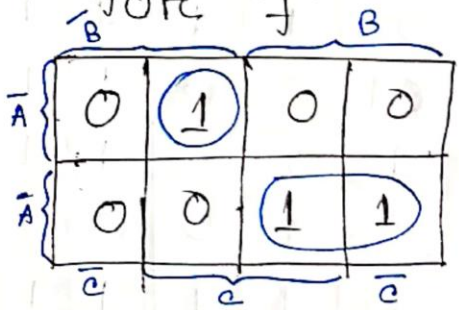
$d = \bar{A}C + \bar{B}C + A\bar{B}\bar{C}$

for 'e'



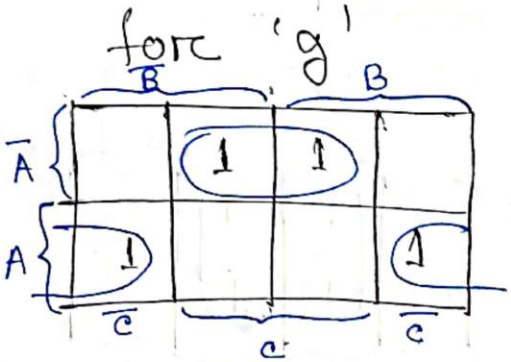
$e = BC$

for 'f'



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

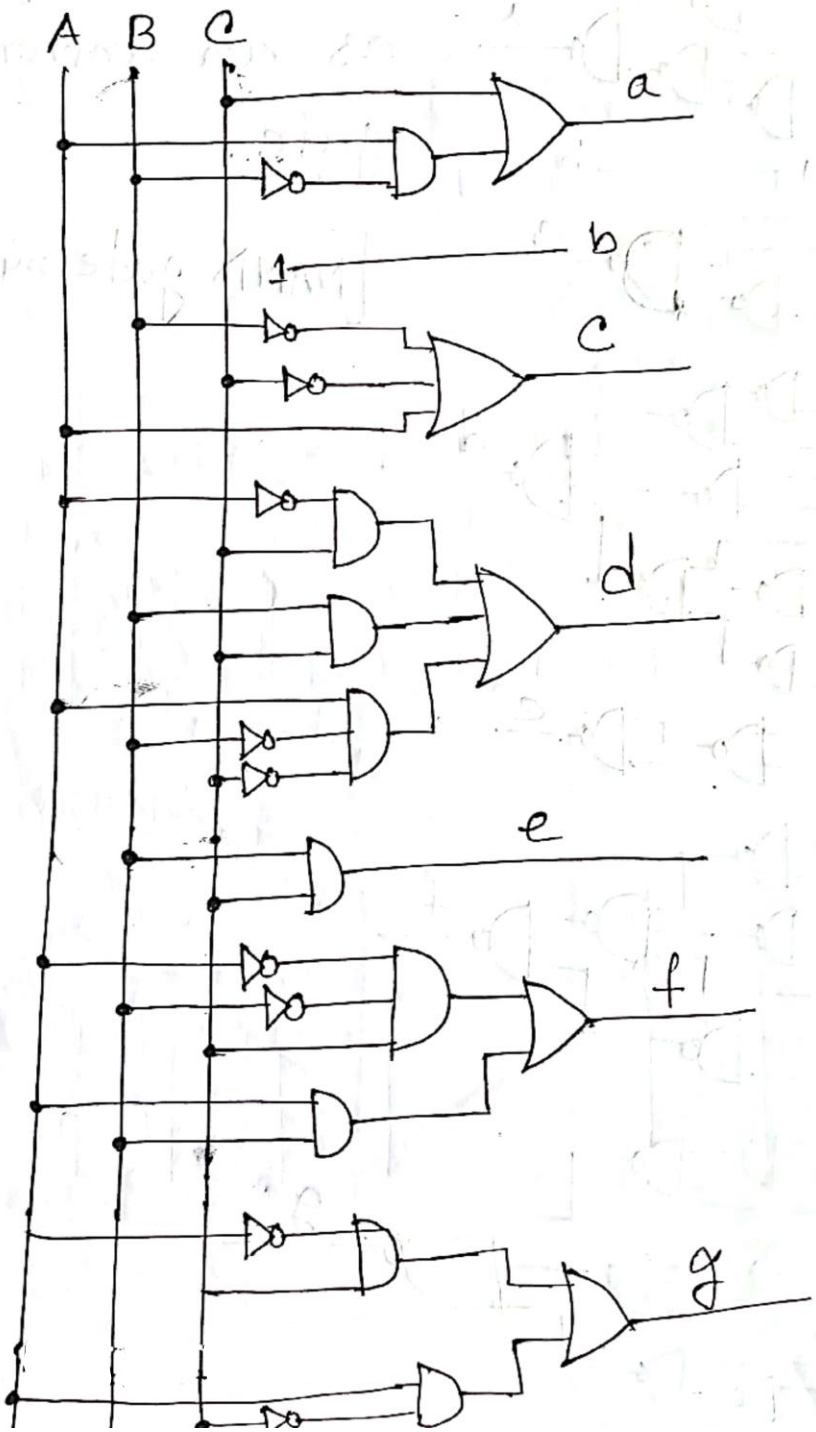
for 'g'



$g = \bar{A}C + A\bar{C}$

ⓐ Normal gates

ⓐ **Basic gates / Normal gates:**



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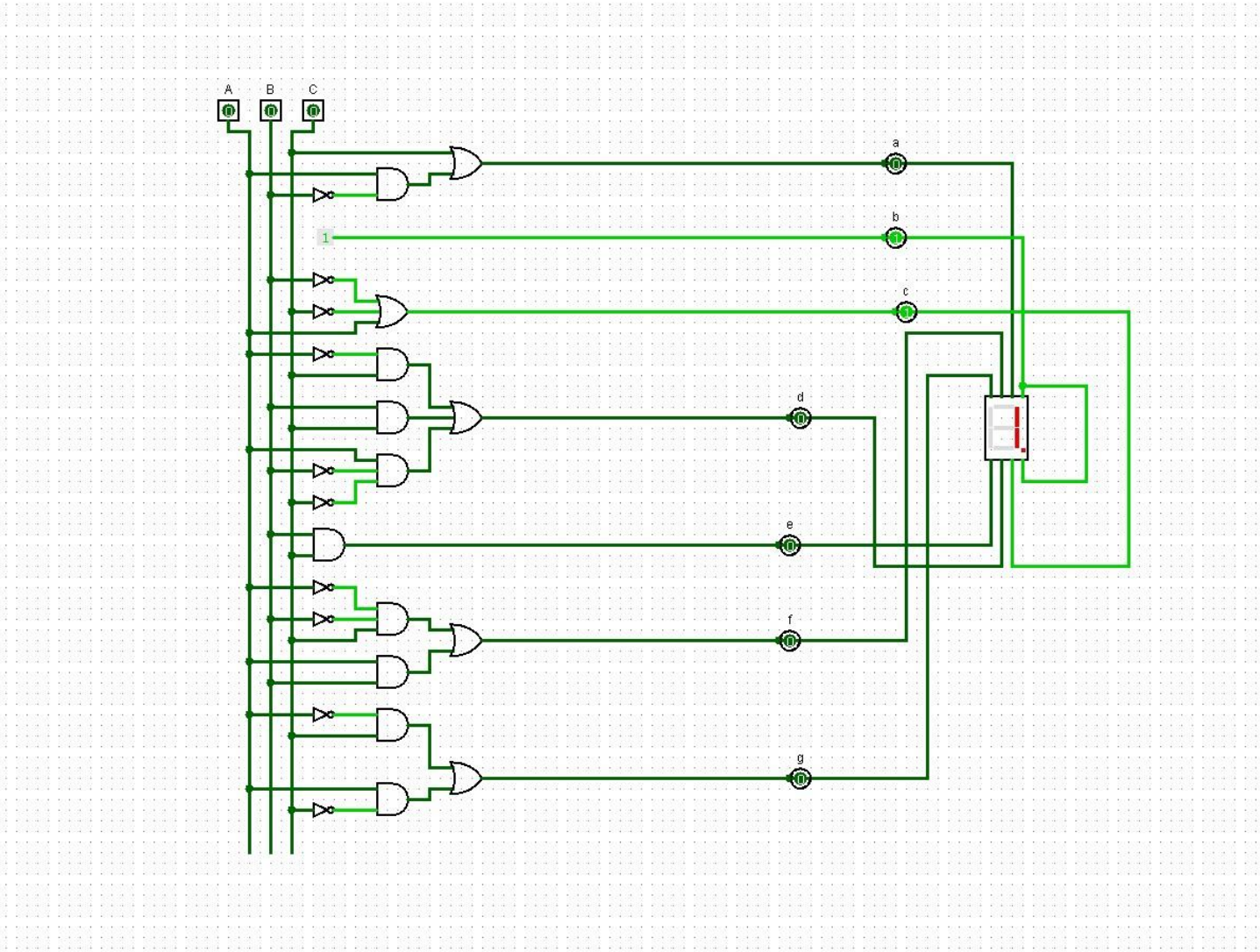


(b) Universal gate

$\therefore a = c + A\bar{B}$

$\Rightarrow \bar{a} = \overline{c + A\bar{B}}$

$\Rightarrow a = \overline{\bar{c} \cdot A\bar{B}}$

$\therefore c = \bar{B} + \bar{c} + A$

$\Rightarrow \bar{c} = \overline{\bar{B} + \bar{c} + A}$

$\Rightarrow C = \overline{\bar{B} \cdot \bar{c} \cdot \bar{A}} = B \cdot c \cdot \bar{A}$

$\therefore d = \bar{A}c + Bc + A\bar{B}\bar{c}$

$\Rightarrow \bar{d} = \overline{\bar{A}c + Bc + A\bar{B}\bar{c}}$

$\Rightarrow d = \overline{\bar{A}c} \cdot \overline{Bc} \cdot \overline{A\bar{B}\bar{c}}$

$\therefore e = Bc$

$\Rightarrow \bar{e} = \overline{Bc}$

$\Rightarrow e = \overline{\bar{B}c}$

$\therefore f = \bar{A}\bar{B}c + AB$

$\Rightarrow \bar{f} = \overline{\bar{A}\bar{B}c + AB}$

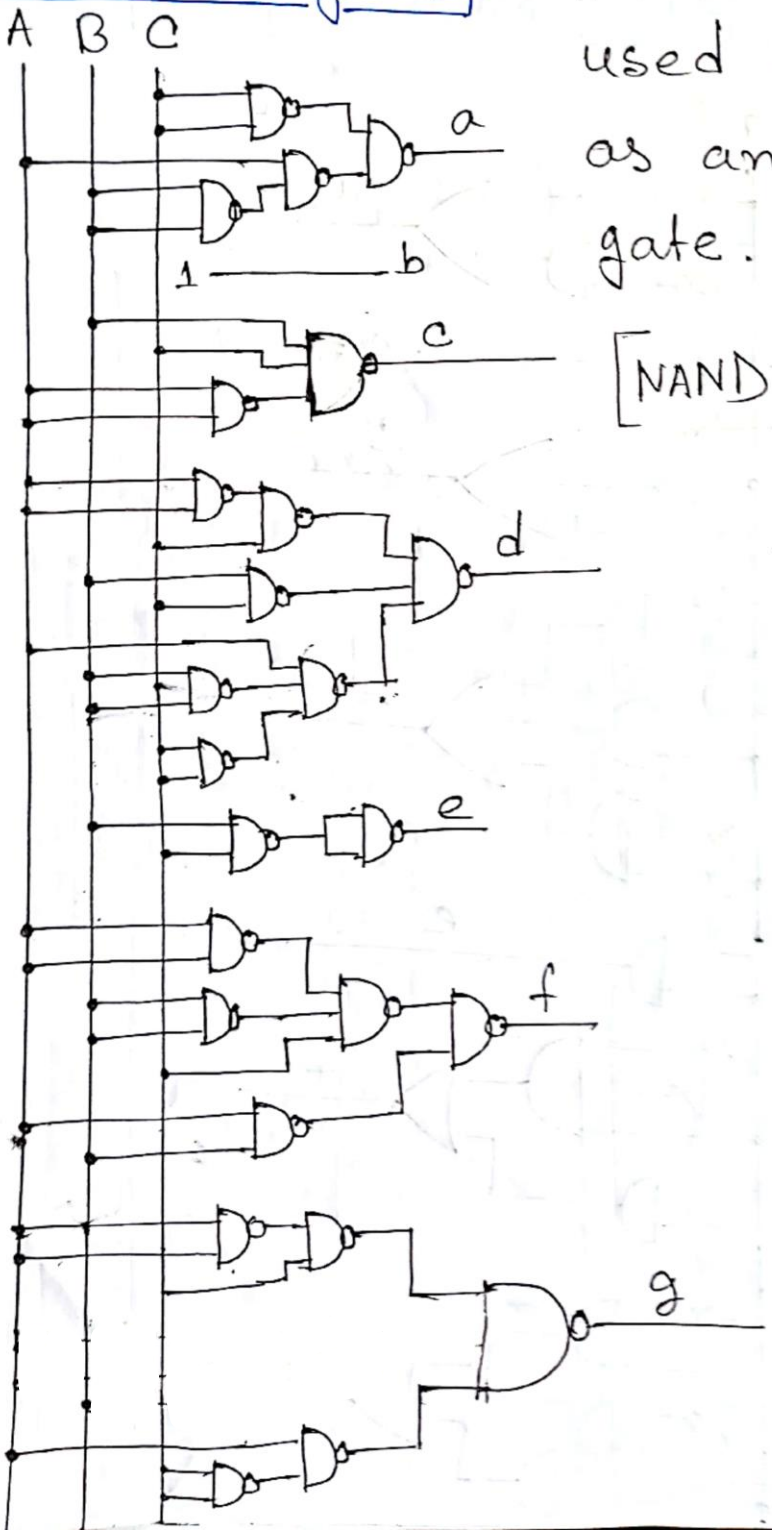
$\Rightarrow f = \overline{\bar{A}\bar{B}c} \cdot \overline{AB}$

$\therefore g = \bar{A}c + A\bar{c}$

$\Rightarrow \bar{g} = \overline{\bar{A}c + A\bar{c}}$

$\Rightarrow g = \overline{\bar{A}c} \cdot \overline{A\bar{c}}$

(b) **Univer-sal gates:**



Here g have used NAND gate as an universal gate.

[NAND gate minimized]

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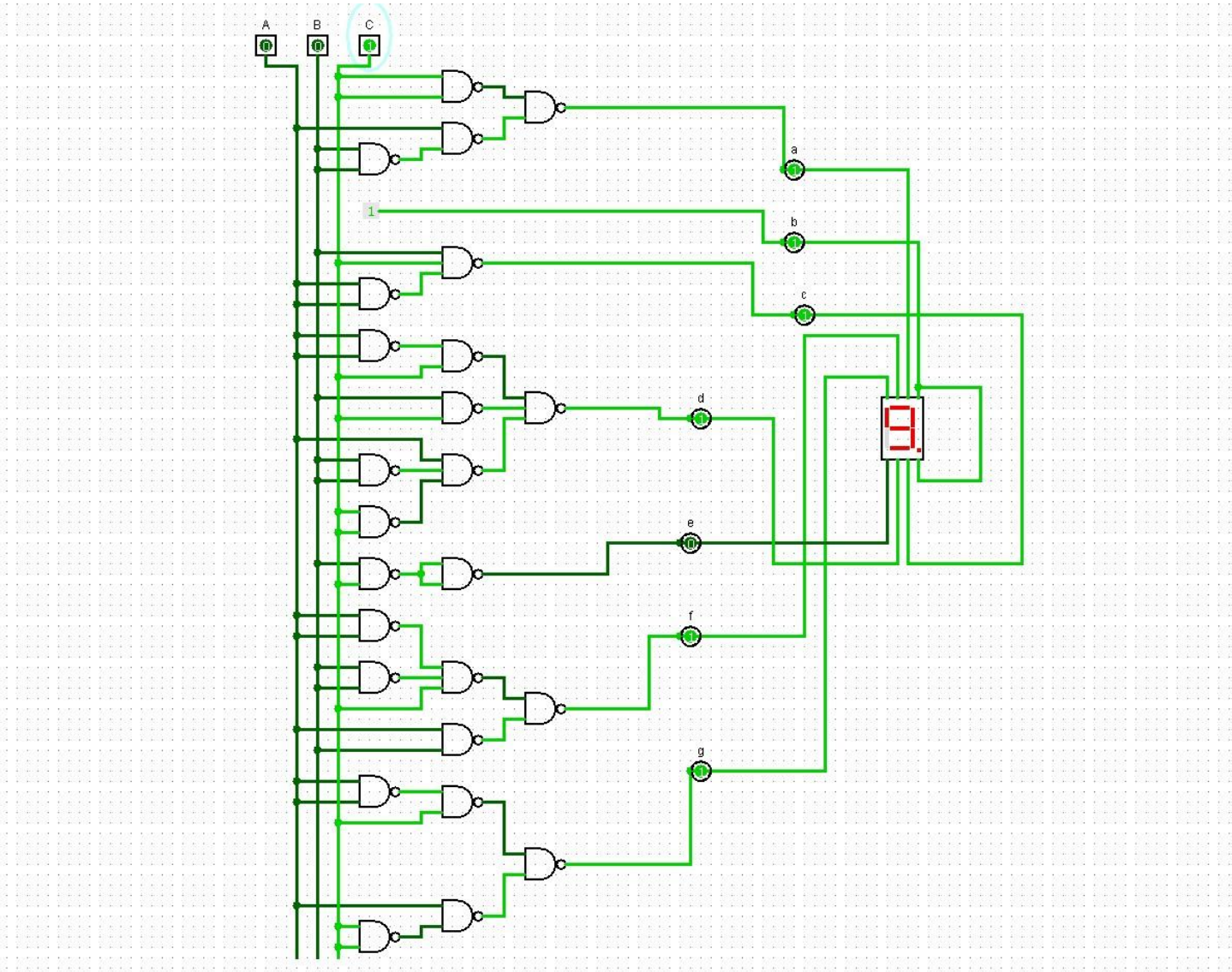


© Decoder

© Decoder:

Here, $a = \sum (1, 3, 4, 5, 7)$

$b = 1$

$c = \sum (0, 1, 2, 4, 5, 6, 7)$

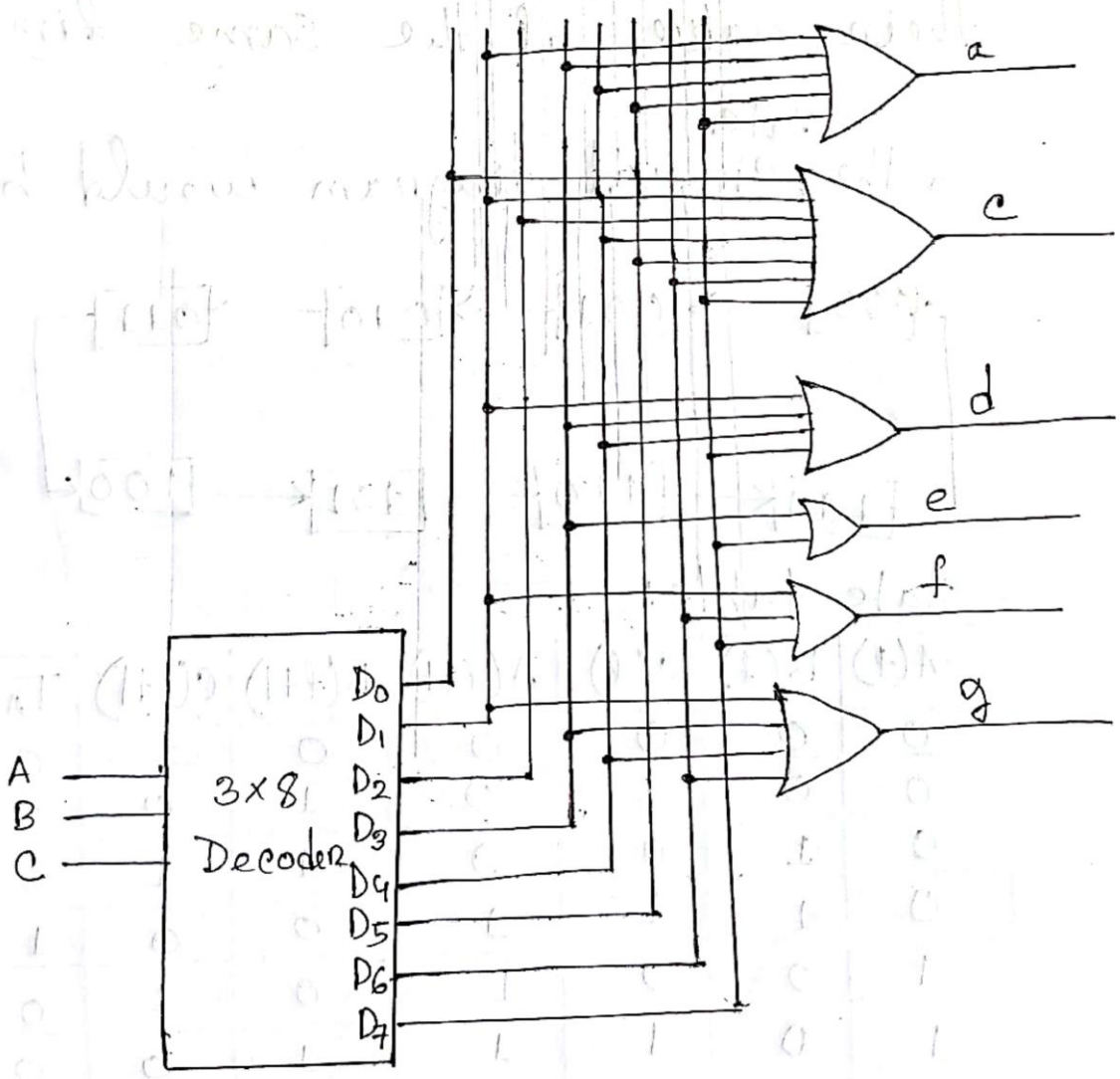
$d = \sum (1, 3, 4, 7)$

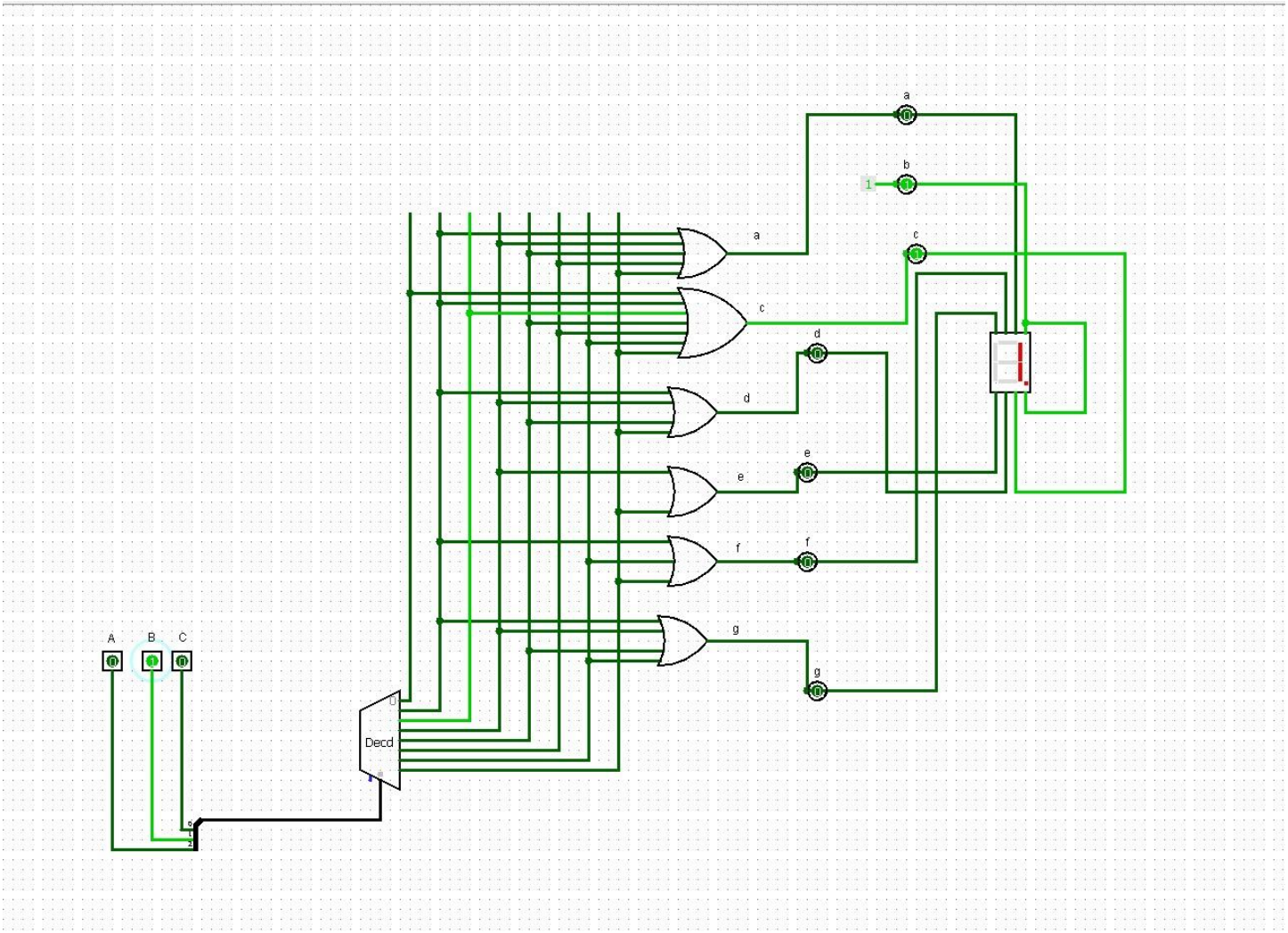
$e = \sum (3, 7)$

$f = \sum (1, 6, 7)$; $g = \sum (1, 3, 4, 6)$

[∴ I have used Truth table to find the minterms of a, c, d, e, f]

Implementation of the Decoder




A
B
C
Decd
a
b
c
d
e
f
g

ⓓ Mux

ⓓ **Mux:**

Let A and B be select bits.

$\therefore a = \sum(1, 3, 4, 5, 7)$

	I_0	I_1	I_2	I_3
$\bar{c}$	m_0	m_2	m_4	m_6
c	m_1	m_3	m_5	m_7
	c	c	1	c

$\therefore b = 1$

$\therefore d = \sum(1, 3, 4, 7)$

	I_0	I_1	I_2	I_3
$\bar{c}$	m_0	m_2	m_4	m_6
c	m_1	m_3	m_5	m_7
	c	c	$\bar{c}$	c

$\therefore e = \sum(3, 7)$

	I_0	I_1	I_2	I_3
$\bar{c}$	m_0	m_2	m_4	m_6
c	m_1	m_3	m_5	m_7
	0	c	0	c

$\therefore c = \sum(0, 1, 2, 4, 5, 6, 7)$

	I_0	I_1	I_2	I_3
$\bar{c}$	m_0	m_1	m_4	m_6
c	m_1	m_3	m_5	m_7
	1	$\bar{c}$	1	1

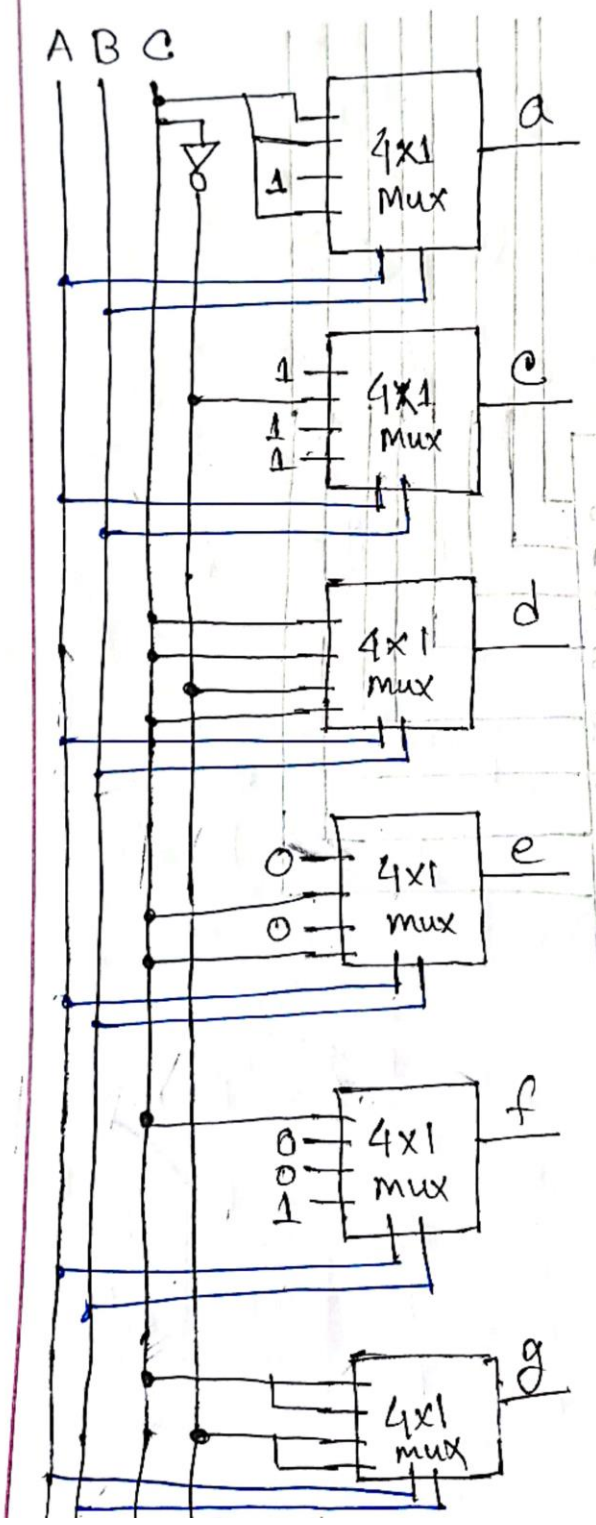
$\therefore f = \sum(1, 6, 7)$

	I_0	I_1	I_2	I_3
$\bar{c}$	m_0	m_2	m_4	m_6
c	m_1	m_3	m_5	m_7
	c	0	0	1

$\therefore g = \sum(1, 3, 4, 6)$

	I_0	I_1	I_2	I_3
$\bar{c}$	m_0	m_2	m_4	m_6
c	m_1	m_3	m_5	m_7
	c	c	$\bar{c}$	c

Implementation of the Mux:



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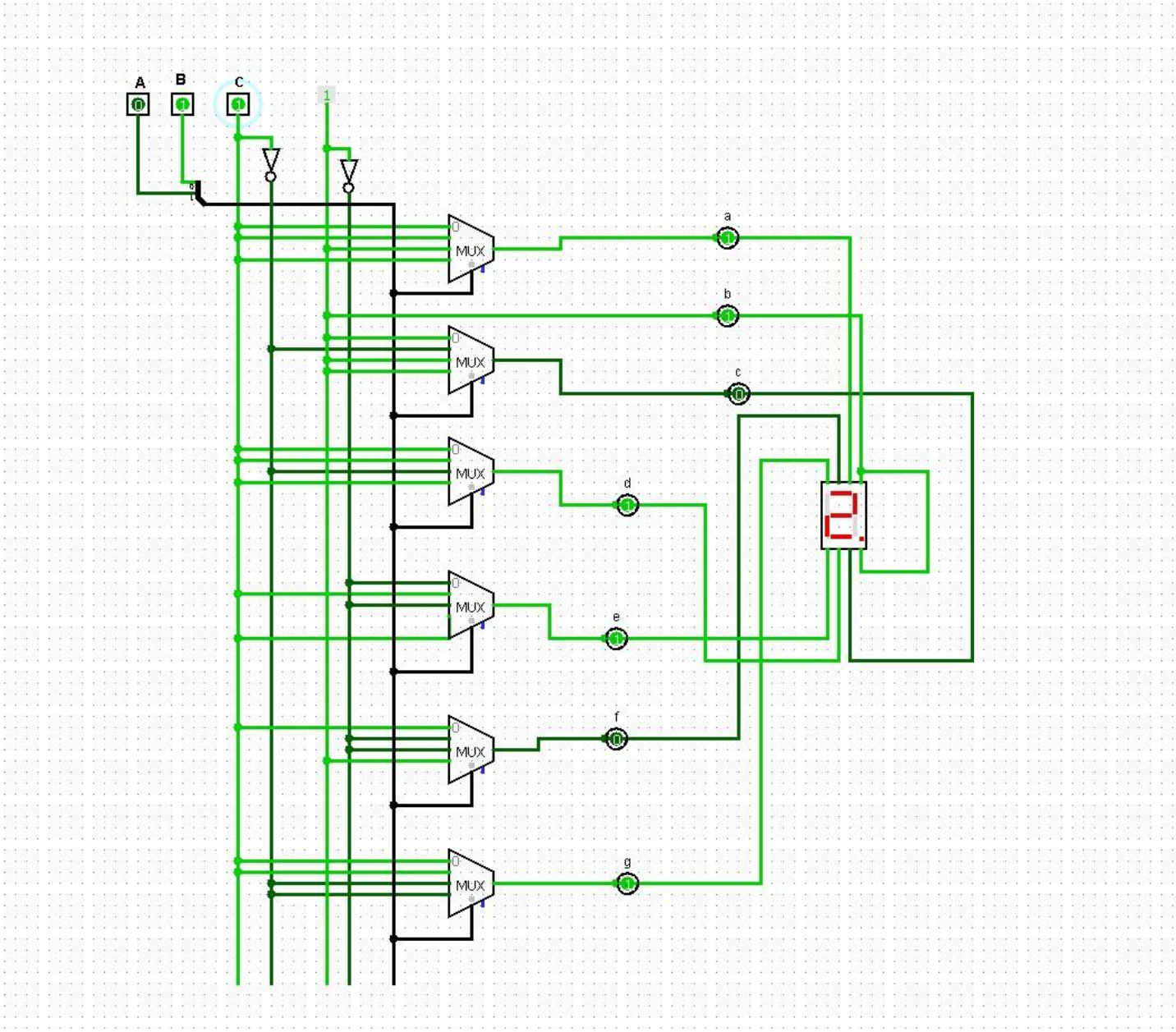
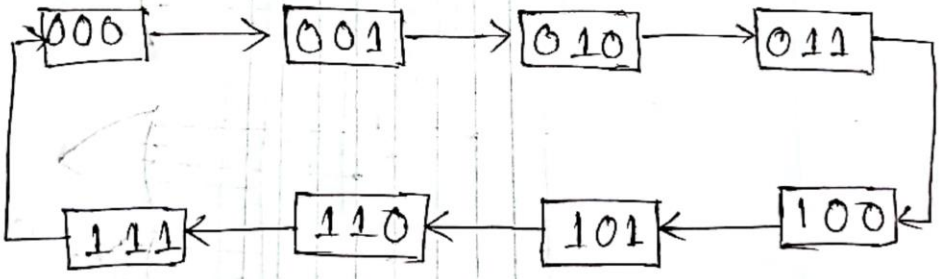


2. Sequential Part

Here, I have used Sequential synchronous counter because in synchronous counter all the flipflop will change their value at the same time.

So the state ~~circuit~~ diagram would be

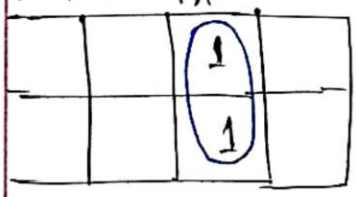


State table:

A(t)	B(t)	C(t)	A(t+1)	B(t+1)	C(t+1)	T_A	T_B	T_C
0	0	0	0	0	1	0	0	1
0	0	1	0	1	0	0	1	1
0	1	0	0	1	1	0	0	1
0	1	1	1	0	0	1	1	1
1	0	0	1	0	1	0	0	1
1	0	1	1	1	0	0	1	1
1	1	0	1	1	1	0	0	1
1	1	1	0	0	0	1	1	1

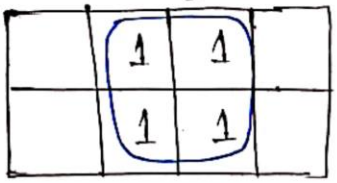
kmap :

for T_A



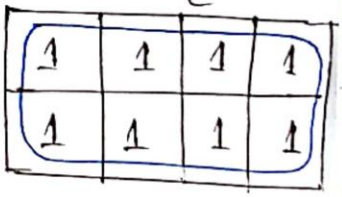
$\therefore T_A = B(t)\, e(t)$

for T_B

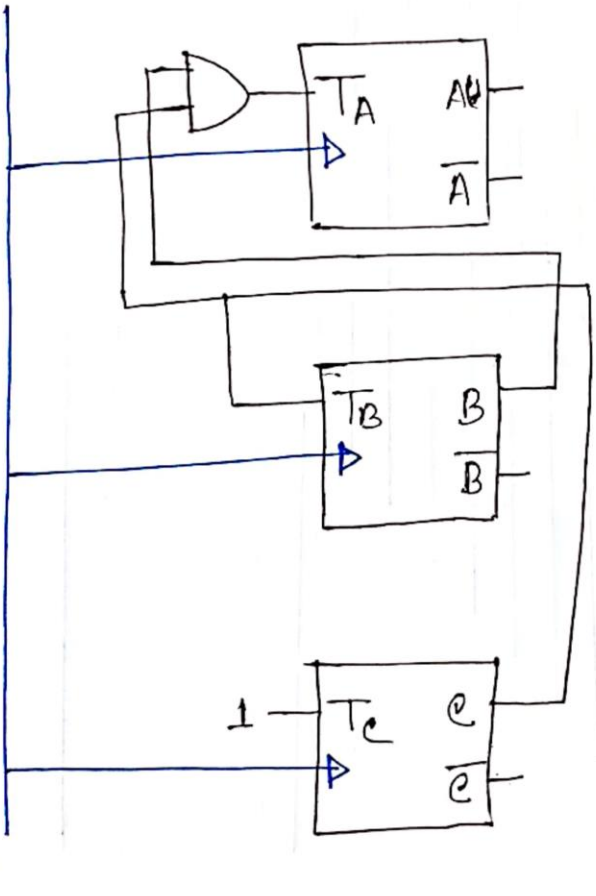


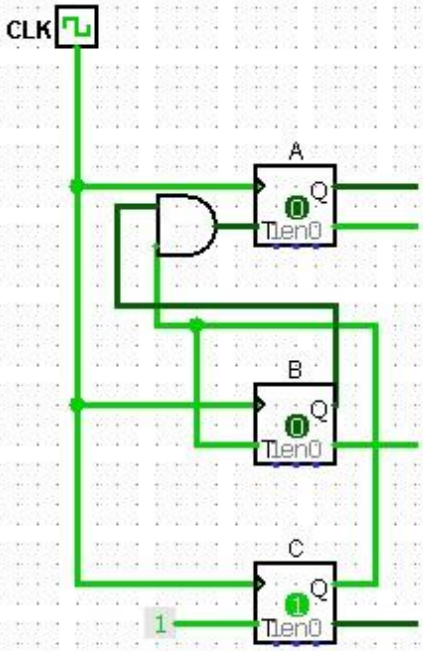
$\therefore T_B = e(t)$

for T_e



$\therefore T_e = 1$





A Synchronous Counter Using T Flip-Flop

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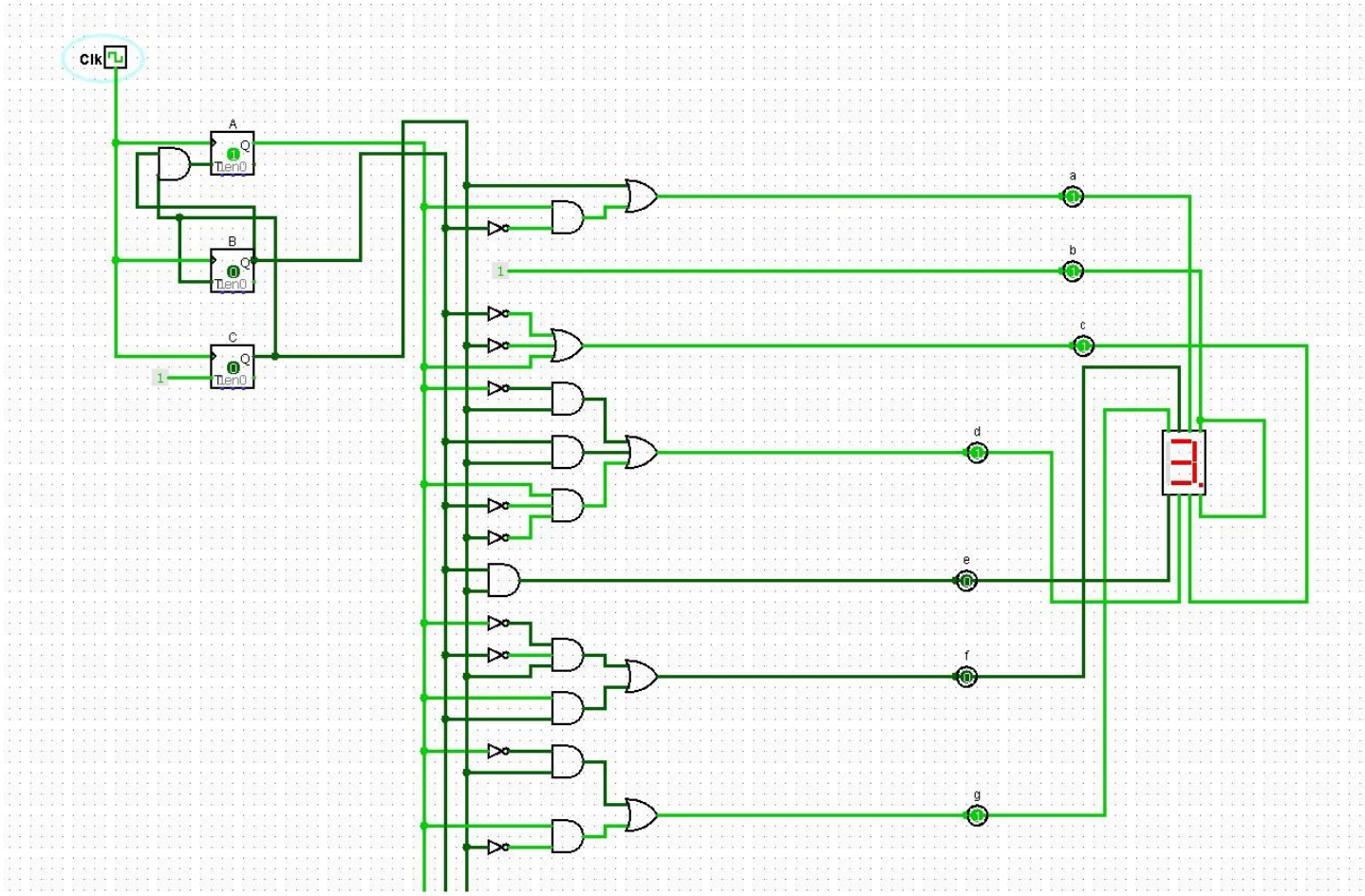
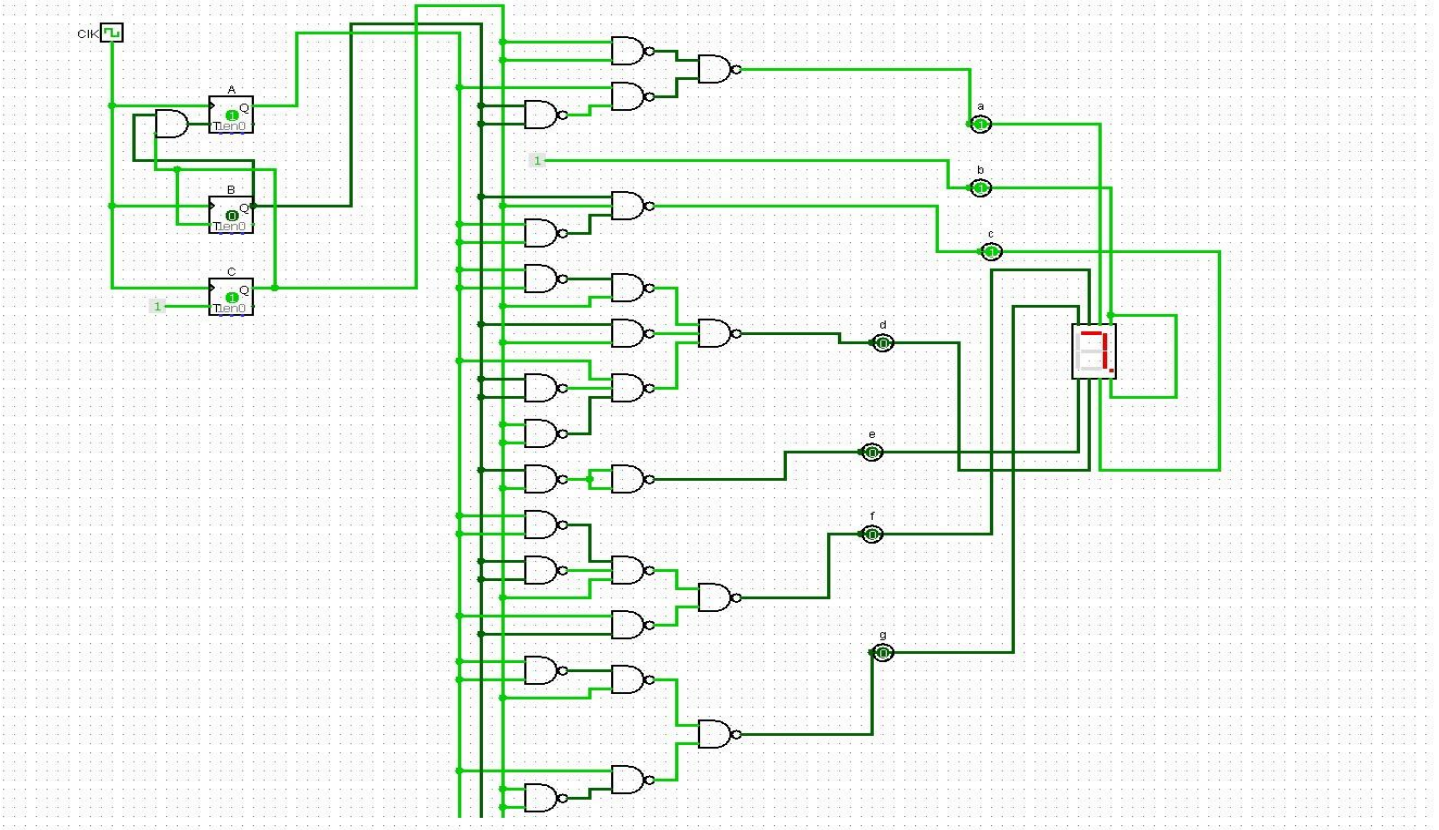
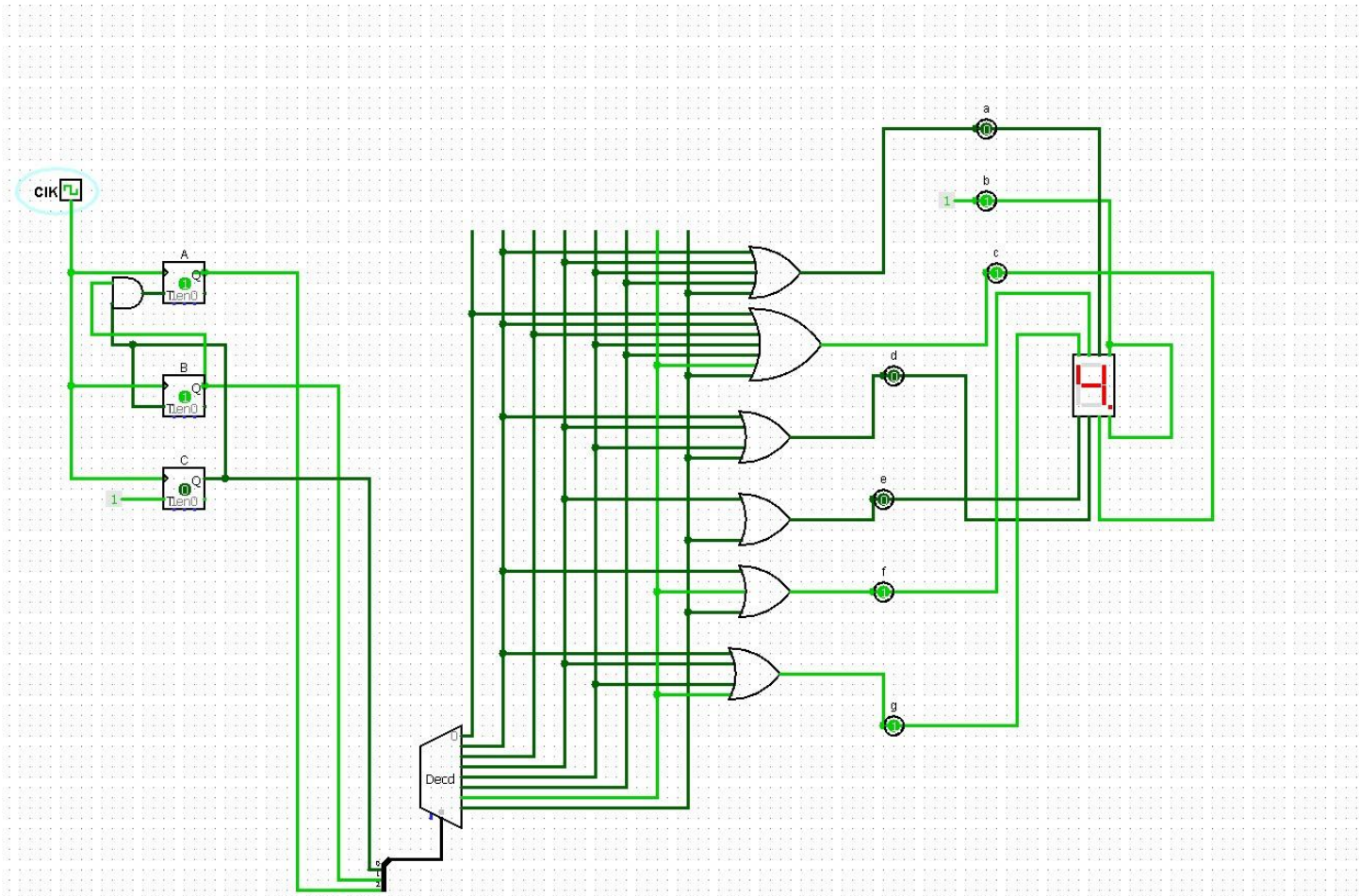
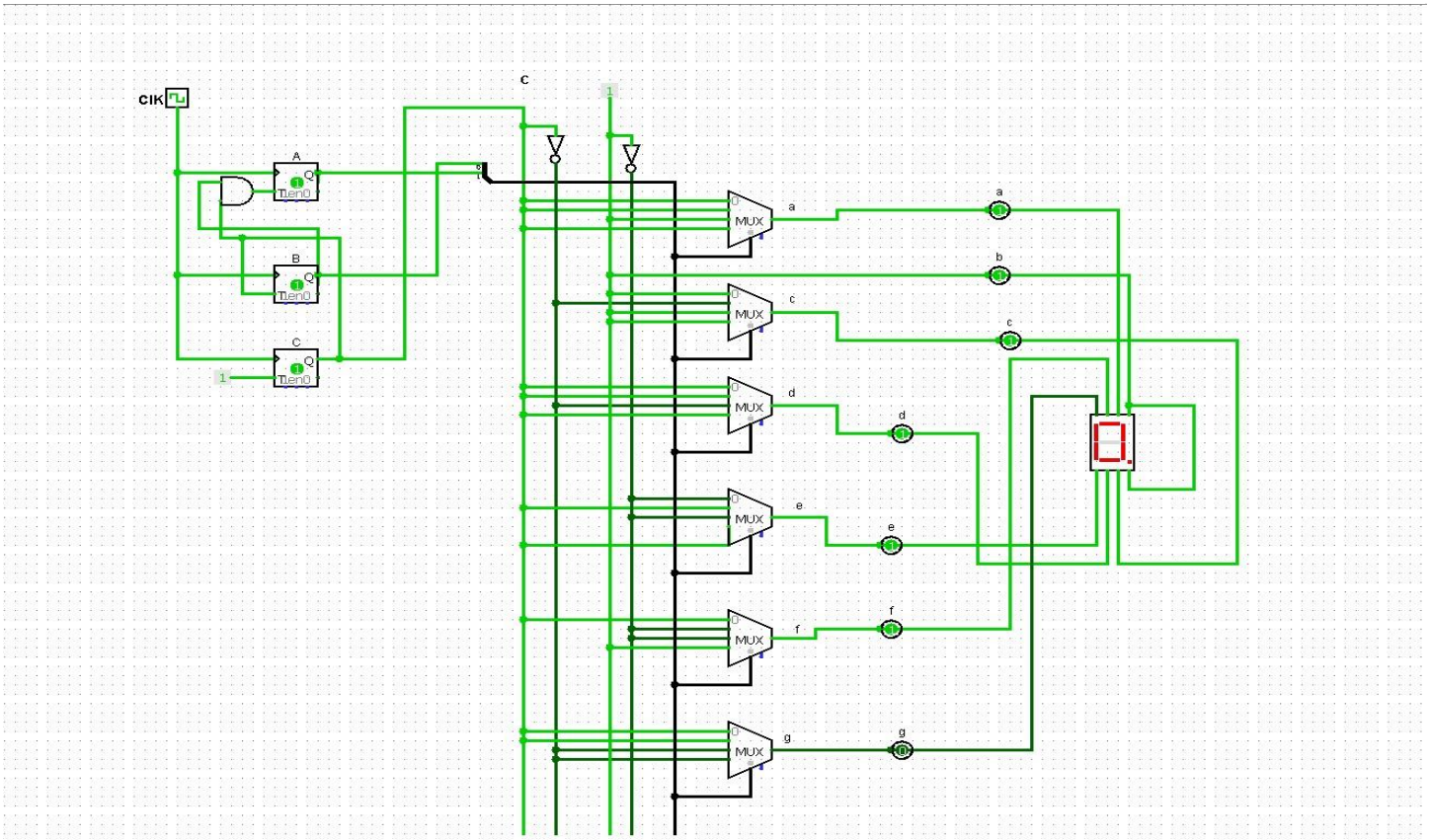





CIK
A
B
C
Decd
a
b
c
d
e
f
g


CIK
c
A
B
C
MUX
a
b
c
d
e
f
g