North South University

Department of Electrical & Computer Engineering

7 segment Display project CSE231

Project Report

Course name: CSE-231 (Digital Logic Design Lab)

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7-Segment Display

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Abstract:

In this project I made 7-segment display to display "tS2079". At first I made the truth table for the give display values.

Then I used the SOP and POS equation in generalized form. After that I found out the Simplified form of SOP and POS by using K-maps.

Finally I was able to make a circuit in logisim and also varify it.

Introduction:

In this project I made a circuit in logisim. I used 3-input and got the output. $[2^3=8]$.

We give t=000, S=001, 2=010, 0=011, 7=100, 9=101.

I use basic gates to make it and one 7-segment display.

Object:

Our objective for this project is to build a 7-segment display that will display the following "tS2079"

There are mainly 2 parts to this project first is combinational part where we will have to give inputs manually and the second part is sequential part where we no longer have to give input ourselves and it will automatically display our desire output.

We were asked to show the combinational part where

we no longer have to give input manually. The input will be given by a 3-bit counter. ~~with the~~

Theory:

7-segment Display

The 7-segment display, also written as "Seven Segment display", consists of seven LEDs (hence its name) arranged in a rectangular fashion as shown.

Each of the seven LEDs is called a segment forms part of a numerical digit (both decimal and Hex) to be displayed. An additional 8th LED is sometimes used within the same package thus allowing the indicational of a decimal point, (DP) when two or more 7-segment displays are connected together to display numbers greater than ten. Each one of the seven LEDs in this display is given a positional segment with one of its connection pins being brought straight out of the rectangular plastic package. These individually LED

pins are labled from a through to g representing each individuals LED. The other LED pins are connected together and wired to form a common pin.

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Truth table:

	BCD (inputs)			7-segment Display (Outputs)						
	A	B	C	a	b	c	d	e	f	g
0	0	0	0	0	0	0	1	1	1	1
1	0	0	1	1	0	1	1	0	1	1
2	0	1	0	1	1	0	1	1	0	1
3	0	1	1	1	1	1	1	1	1	0
4	1	0	0	1	1	1	0	0	0	0
5	1	0	1	1	1	1	1	0	1	1
	1	1	0	x	x	x	x	x	x	x
	1	1	1	x	x	x	x	x	x	x

Generalized Equation (SOP) :-

$a = A'B'C + A'BC' + A'BC + AB'C' + AB'C$

$b = A'BC' + A'BC + AB'C' + AB'C$

$c = A'B'C + A'BC + AB'C' + AB'C$

$d = A'B'C' + A'B'C + A'BC' + A'BC + AB'C$

$e = A'B'C' + A'BC' + A'BC$

$f = A'B'C' + A'B'C + A'BC + AB'C$

$g = A'B'C' + A'B'C + A'BC' + AB'C$

Generalized Equation (POS) :-

$a = (A+B+C)$

$b = (A+B+C).(A+B+C')$

$c = (A+B+C).(A+B'+C)$

$d = (A'+B+C)$

~~$e = (A+B+C').(A'+B'+C').(A+B'+C)$~~

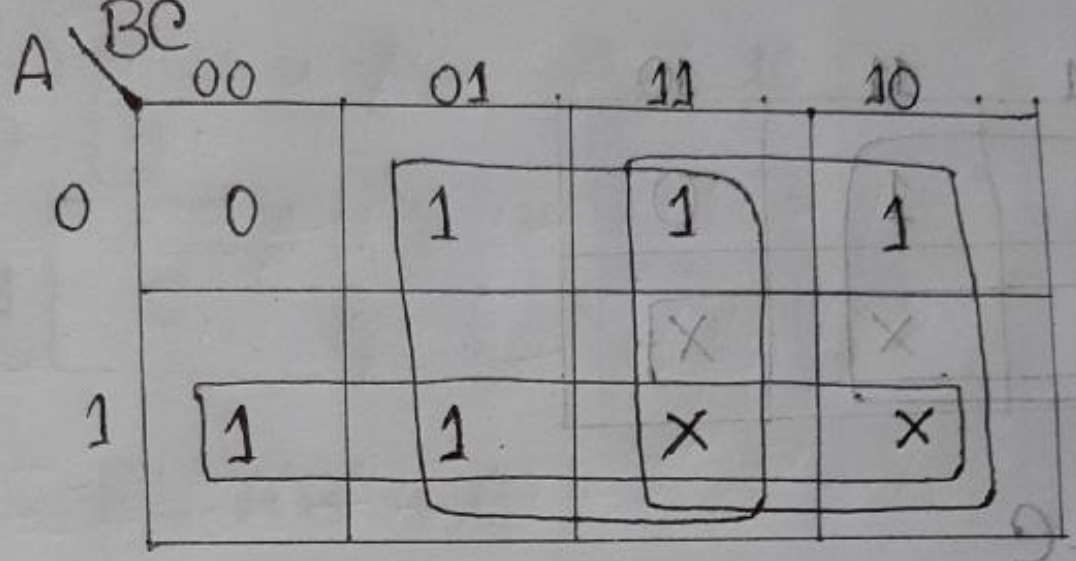
$e = (A+B+C').(A'+B+C).(A'+B+C')$

$$f = (A + B' + C) \cdot (A' + B + C)$$

$$g = (A + B' + C') \cdot (A' + B + C)$$

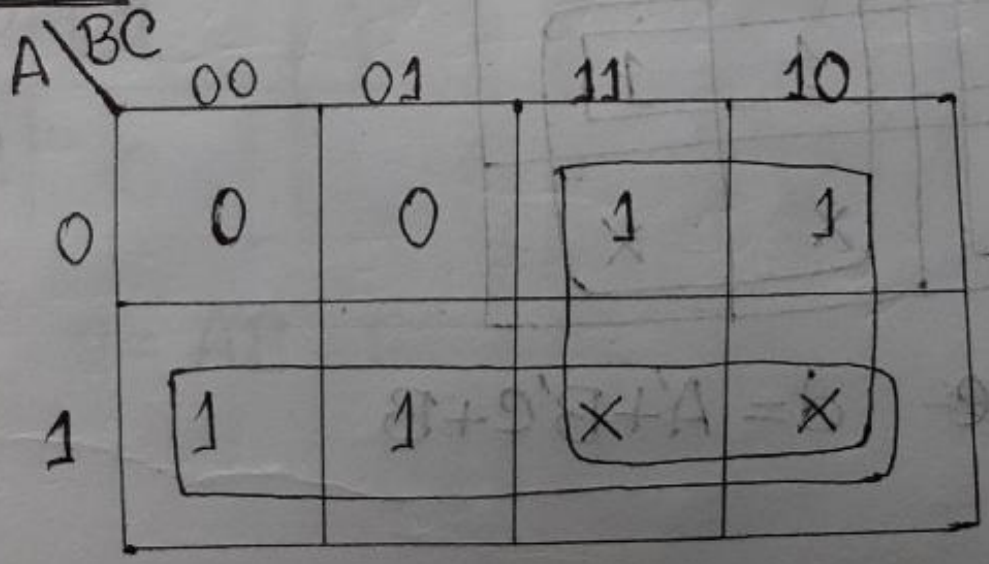
Simplified (SOP)

for a:



$a = A + B + C$

for b:



$b = A + B$

for c:

A \ BC	00	01	11	10
0	1	0	0	1
1	0	0	X	X

$(A+C)=c$

for d:

A \ BC	00	01	11	10
0	0	0	0	0
1	1	0	X	X

$(A'+B+C)=d$

for e:

A \ BC	00	01	11	10
0	0	1	0	0
1	1	1	X	X

$(A'+B).(B+C')=e$

for f:

A \ BC	00	01	11	10
0	0	0	0	(1)
1	(1)	0	X	X

$f = (A + B' + C) . (A' + B + C)$

for g:

A \ BC	00	01	11	10
0	0	0	(1)	0
1	(1)	0	X	X

$g = (A + B' + C') . (A' + B + C)$

Simplified SOP:

$\therefore a = A + B + C$

$b = A + B$

$c = A + C$

$d = A' + B'C + B$

$e = B + A'C'$

$f = A'B' + C$

$g = A'B' + B'C + BC'$

Simplified (POS)

for a:

A \ BC	00	01	11	10
0	(1)	0	0	0
1	0	0	X	X

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

for b:

A \ BC	00	01	11	10
0	1	1	0	0
1	0	0	X	X

$(A+B) = b$

for c:

A \ BC	00	01	11	10
0	1	0	0	1
1	0	0	X	X

$(A+C)=c$

for d:

A \ BC	00	01	11	10
0	0	0	0	0
1	1	0	X	X

$(A'+B+C)=d$

for e:

A \ BC	00	01	11	10
0	0	1	0	0
1	1	1	X	X

$(A'+B).(B+C')=e$

for f:

A \ BC	00	01	11	10
0	0	0	0	(1)
1	(1)	0	X	X

$f = (A + B' + C) . (A' + B + C)$

for g:

A \ BC	00	01	11	10
0	0	0	(1)	0
1	(1)	0	X	X

$g = (A + B' + C') . (A' + B + C)$

Simplified POS:

$a = A+B+C$

$b = A+B$

$c = A+C$

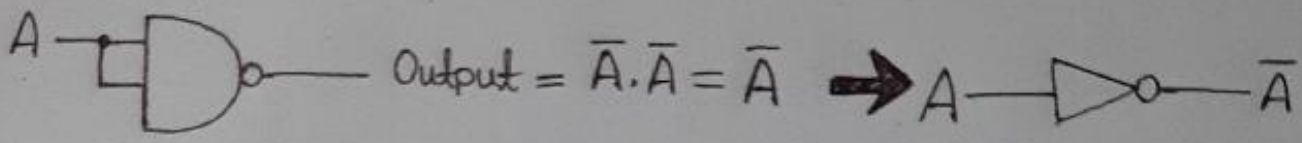
$d = A'+B+C$

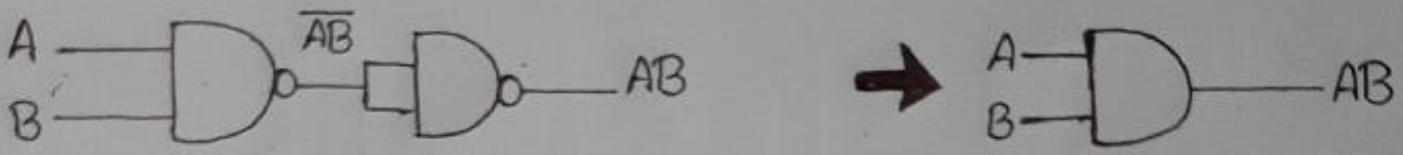
$e = (A'+B).(B+C')$

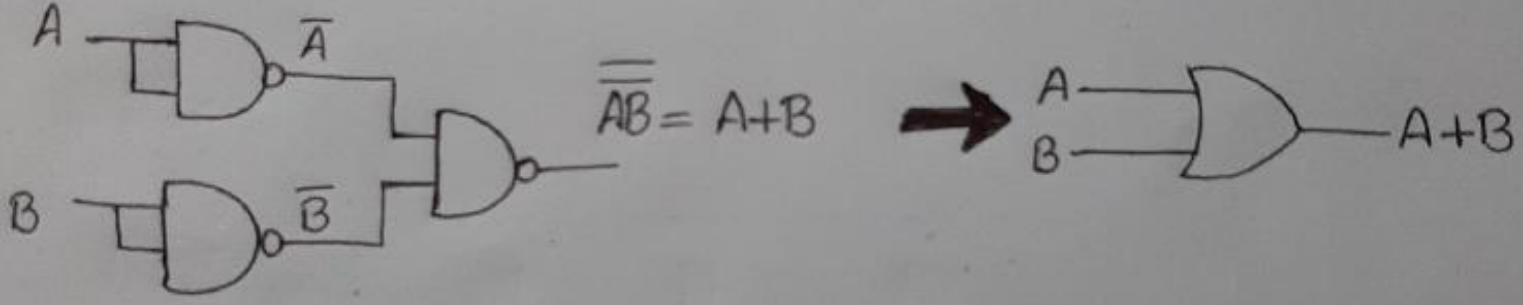
$f = (A+B'+C).(A'+B+C)$

$g = (A+B'+C').(A'+B+C)$

Designed ~~SOP~~ POS with NAND gates







~~MXD~~ MUX 7 Segment Display

for a:

	I_0	I_1	I_2	I_3
$\overline{c}$	0	1	1	X
c	1	1	1	X
	c	1	1	X

for b:

	I_0	I_1	I_2	I_3
$\overline{c}$	0	1	1	X
c	0	1	1	X
	0	1	1	X

for c:

	I_0	I_1	I_2	I_3
$\overline{c}$	0	0	1	X
c	1	1	1	X
	c	c	1	X

for d:

	I_0	I_1	I_2	I_3
$\overline{C}$	1	1	0	X
C	1	1	1	X
	1	1	C	X

for e:

	I_0	I_1	I_2	I_3
$\overline{C}$	1	1	0	X
C	0	1	0	X
	$\overline{C}$	1	0	X

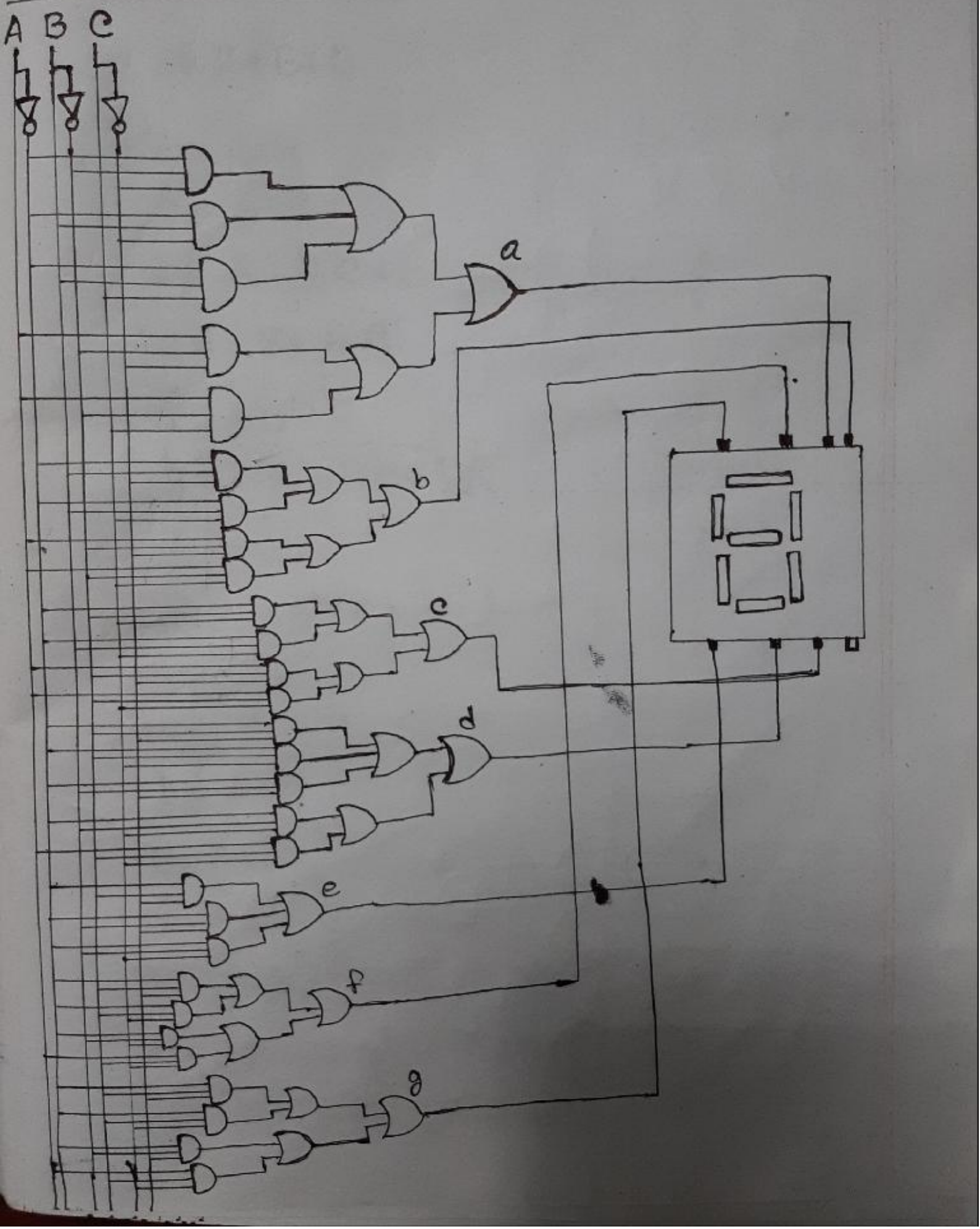
for f:

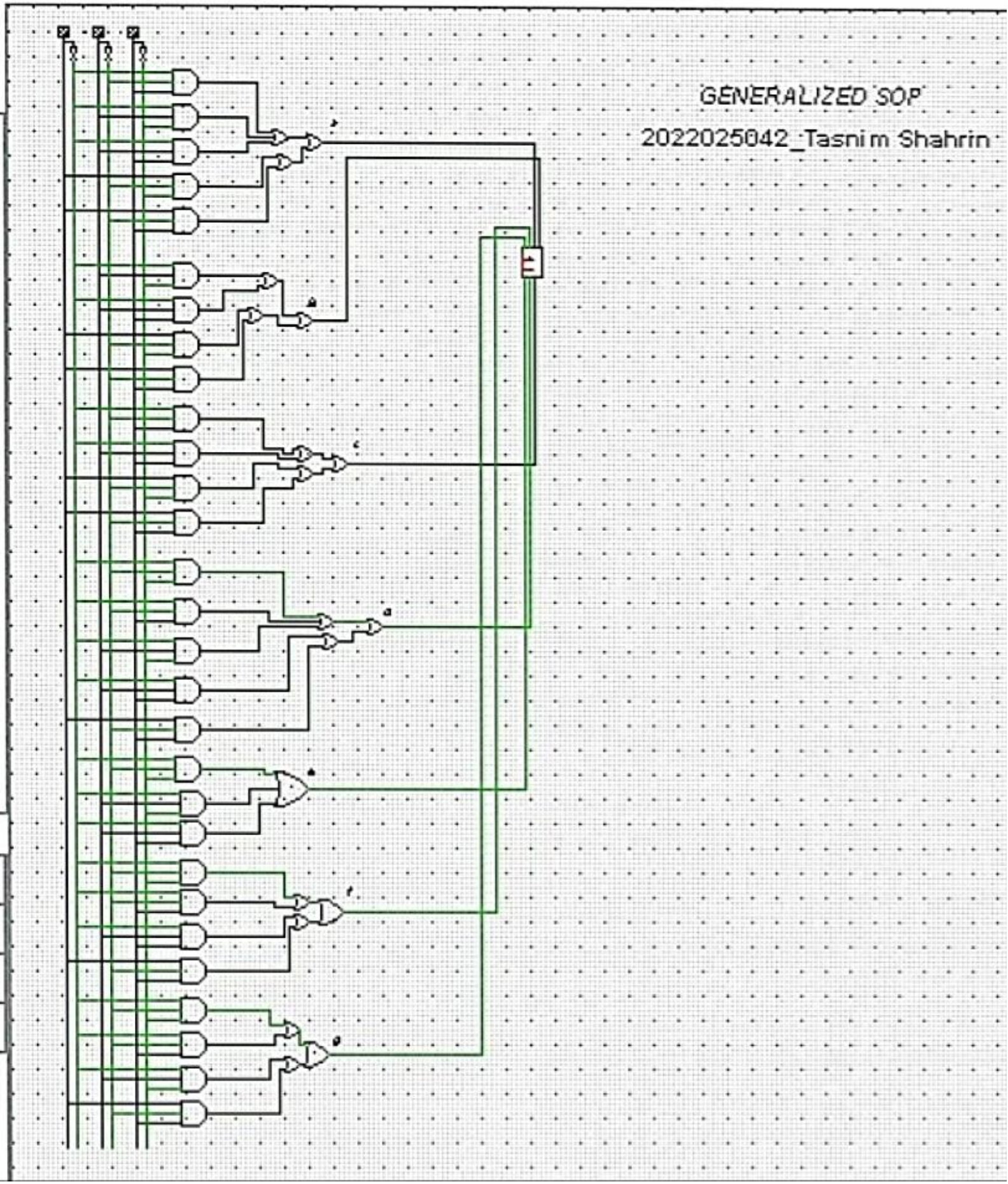
	I_0	I_1	I_2	I_3
$\overline{C}$	1	0	0	X
C	1	1	1	X
	1	C	C	X

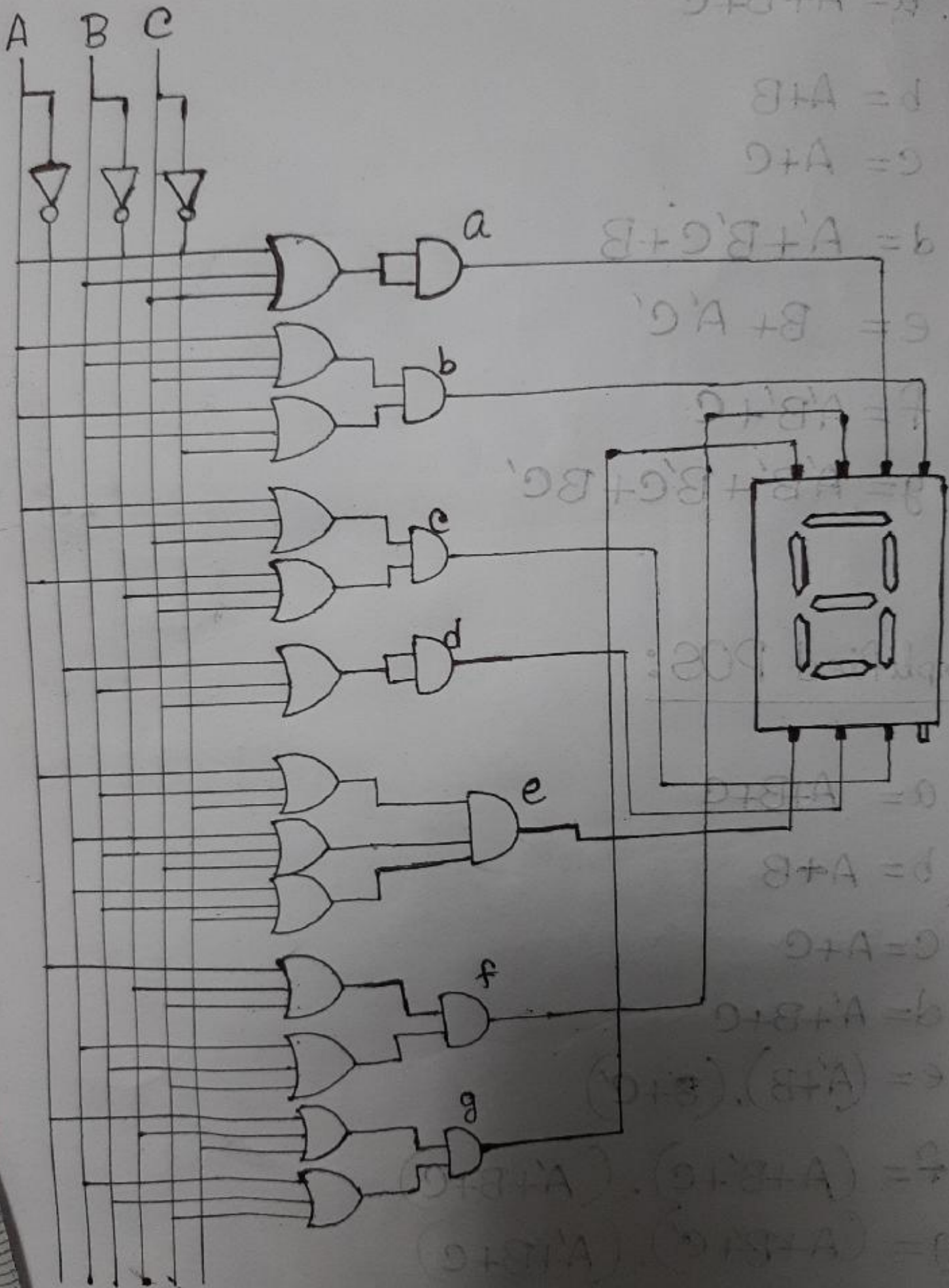
for g:

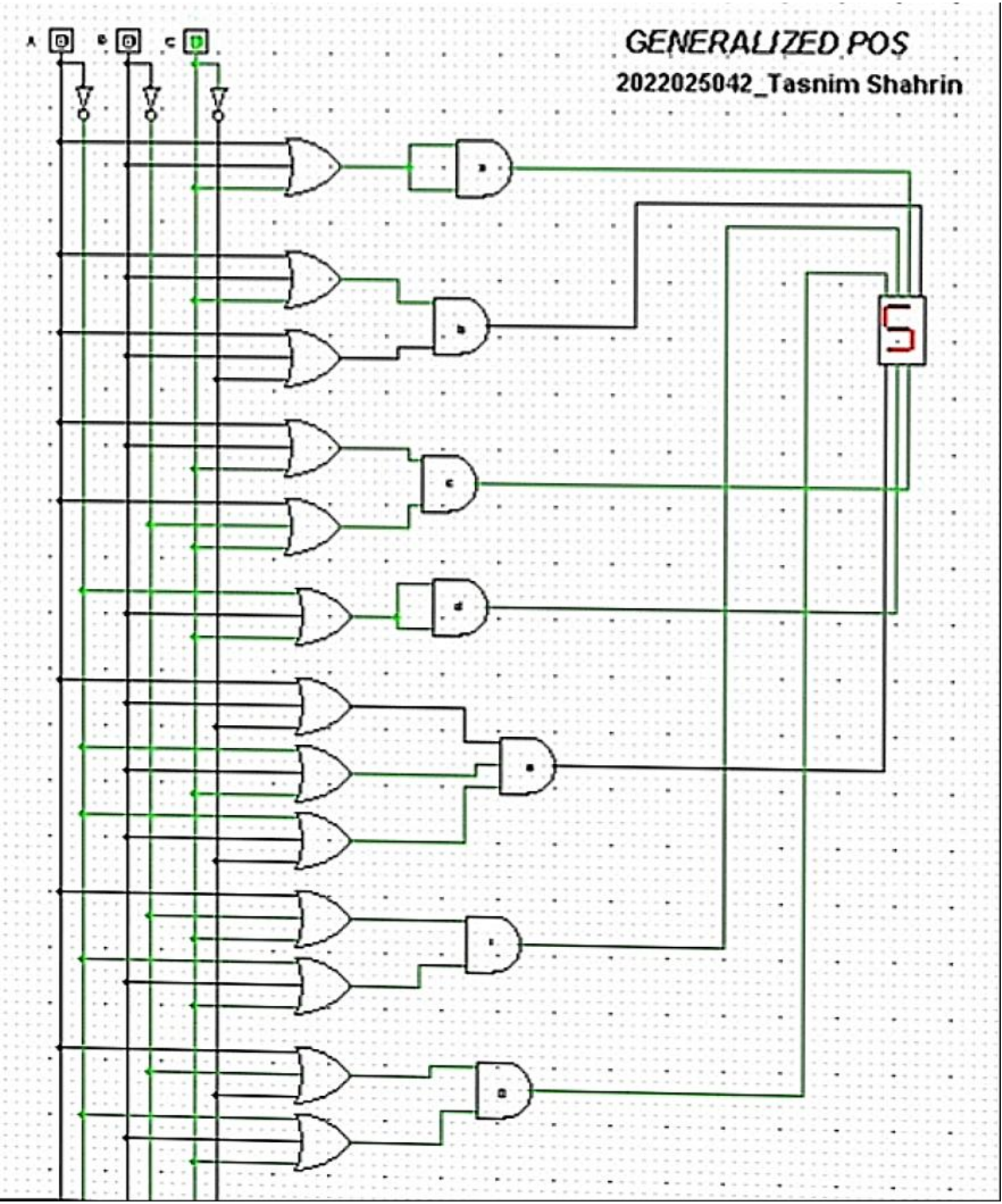
	I_0	I_1	I_2	I_3
$\overline{C}$	1	1	0	X
C	1	0	1	X
	1	$\overline{C}$	C	X

Generalized equation SOP

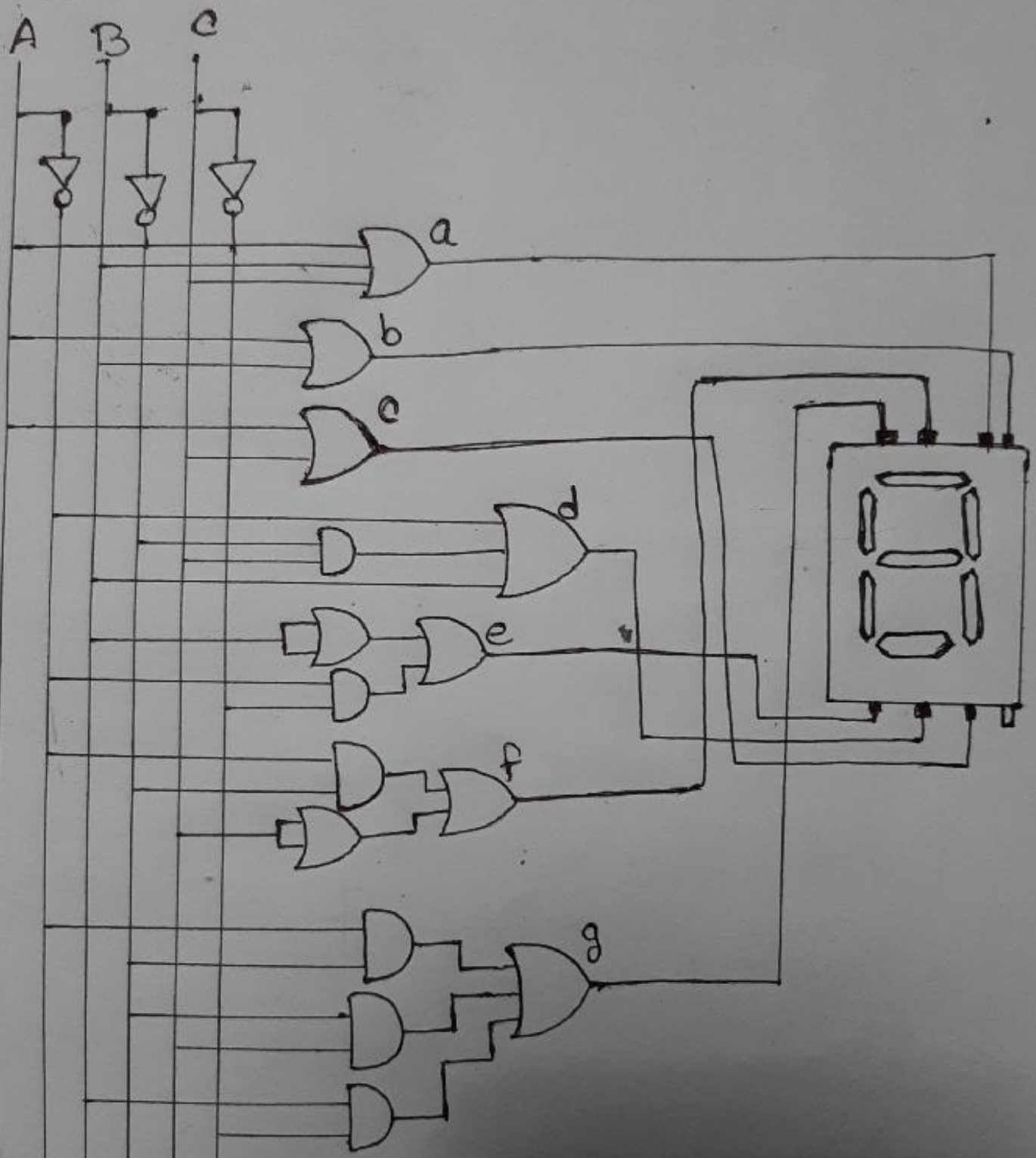


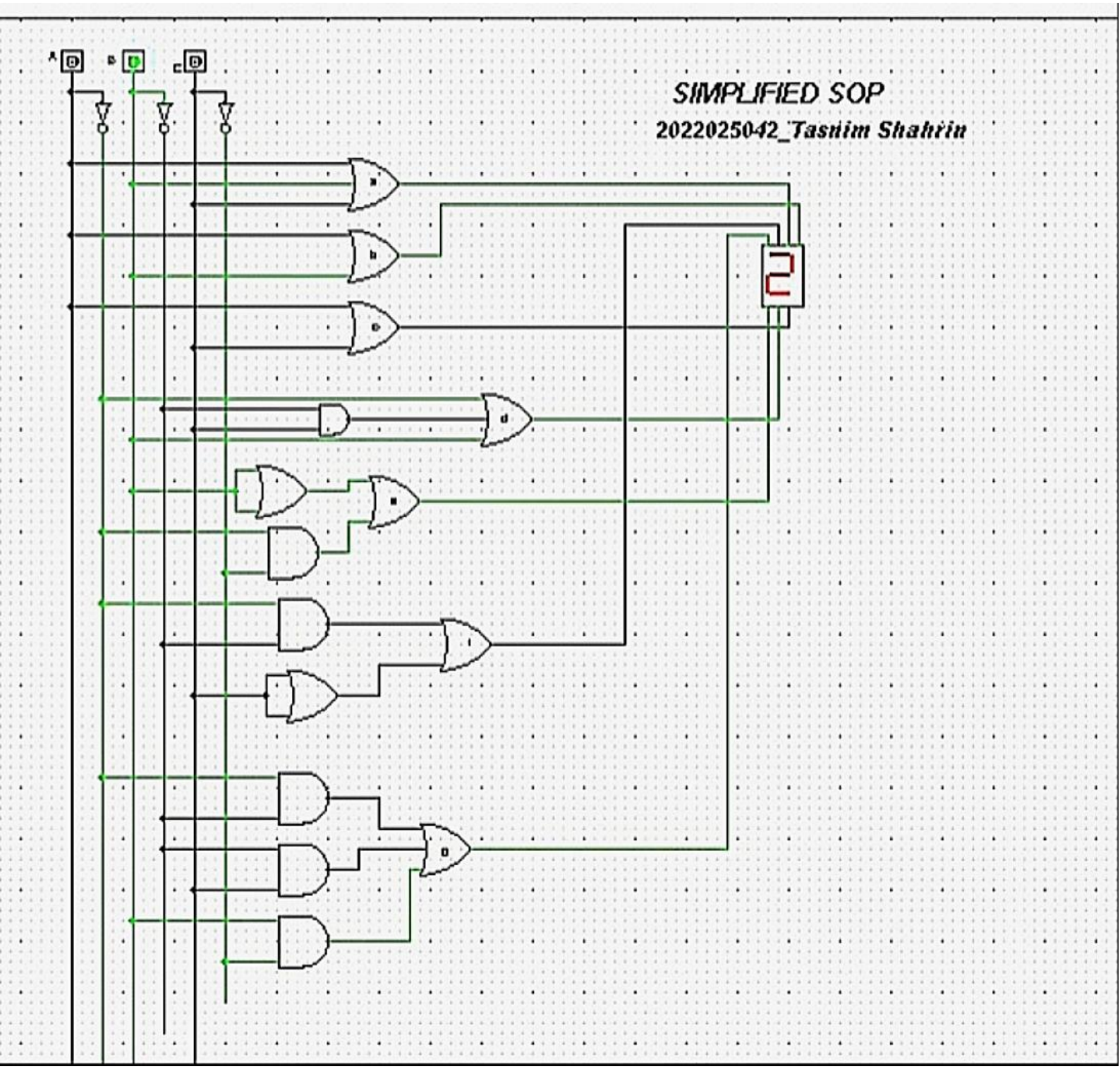

GENERALIZED SOP
2022025042_Tasnim Shahrin


A
B
C
a
b
c
d
e
f
g

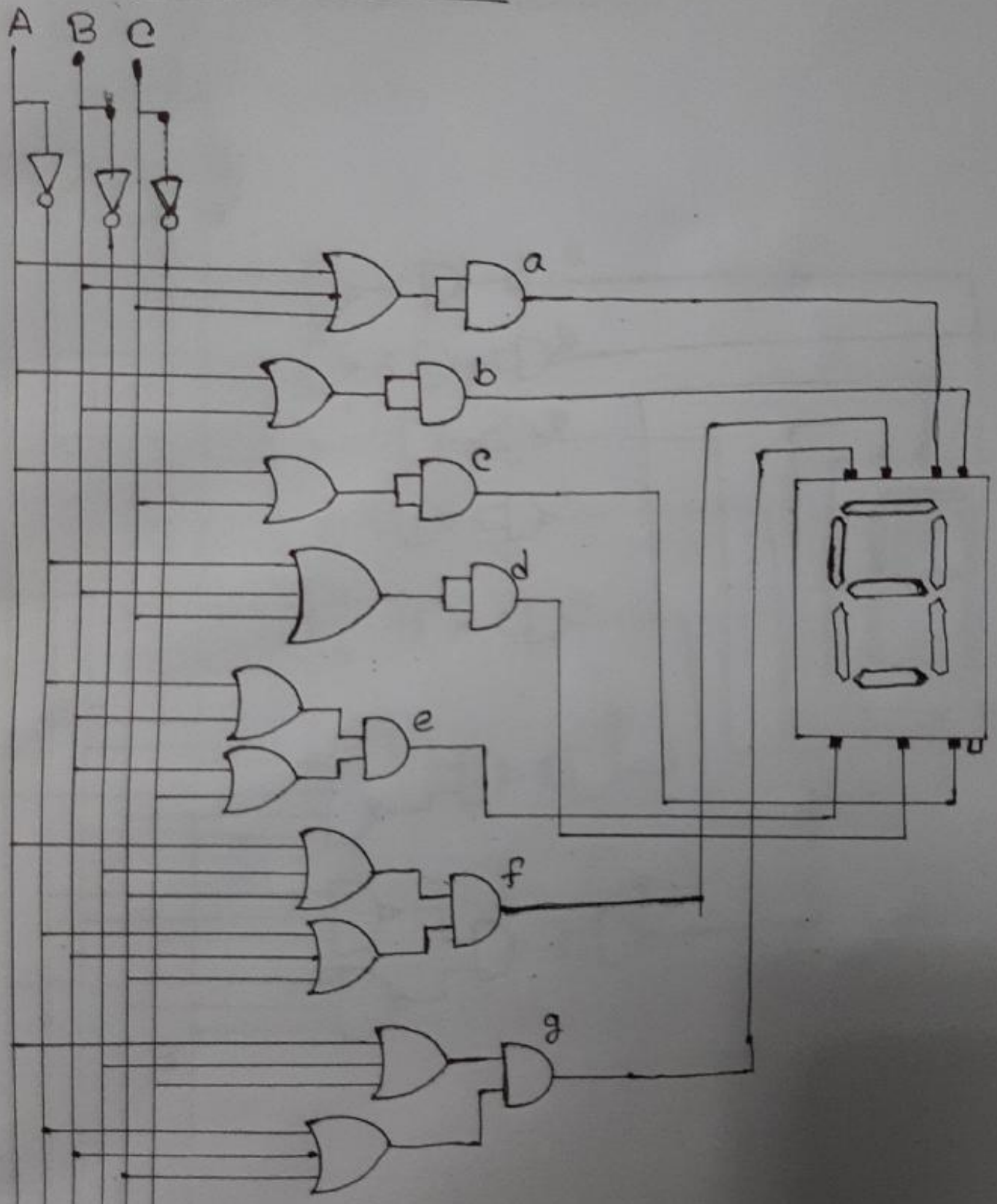

GENERALIZED POS
2022025042_Tasnim Shahrin
A
B
C
5

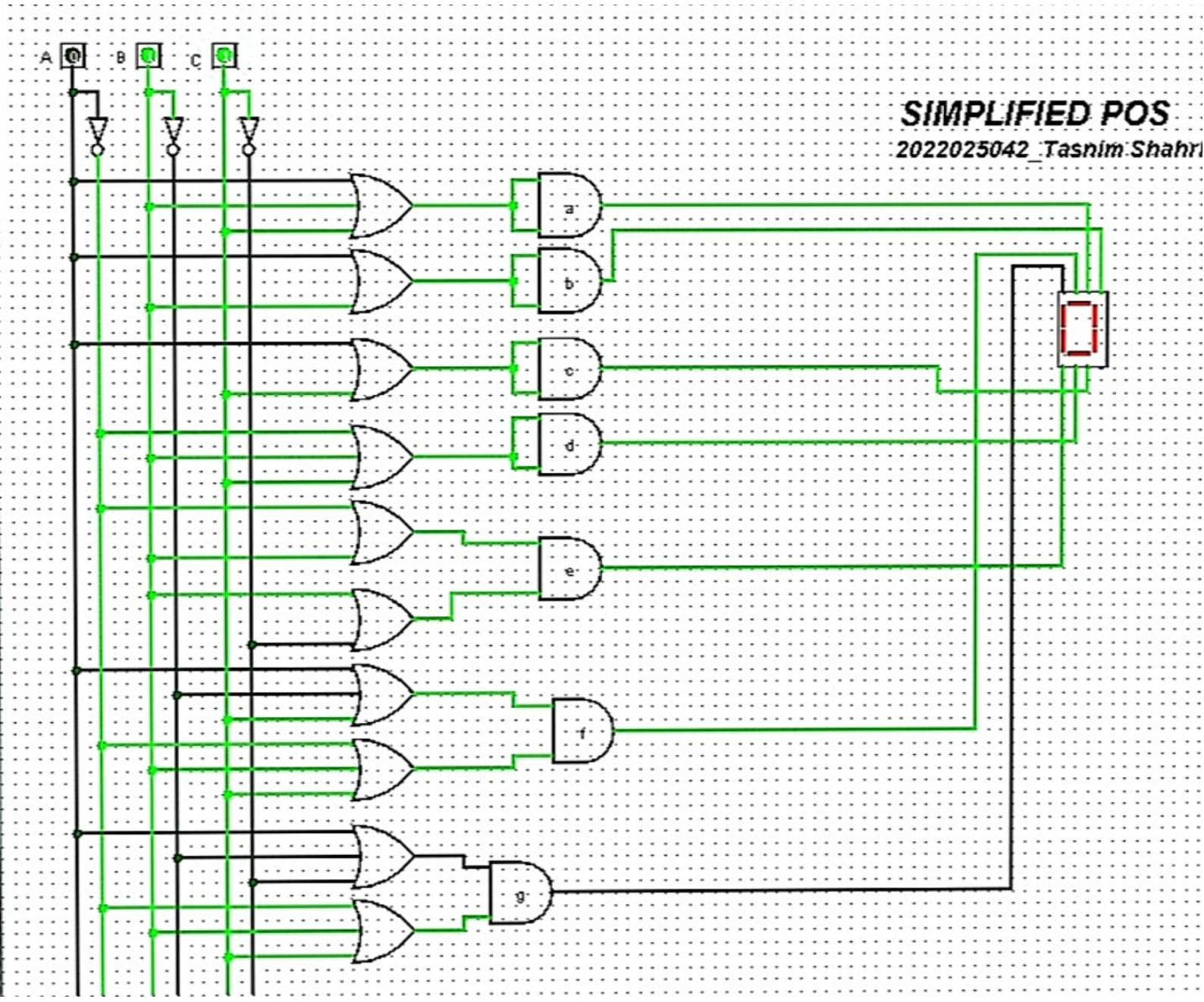
Simplified SOP



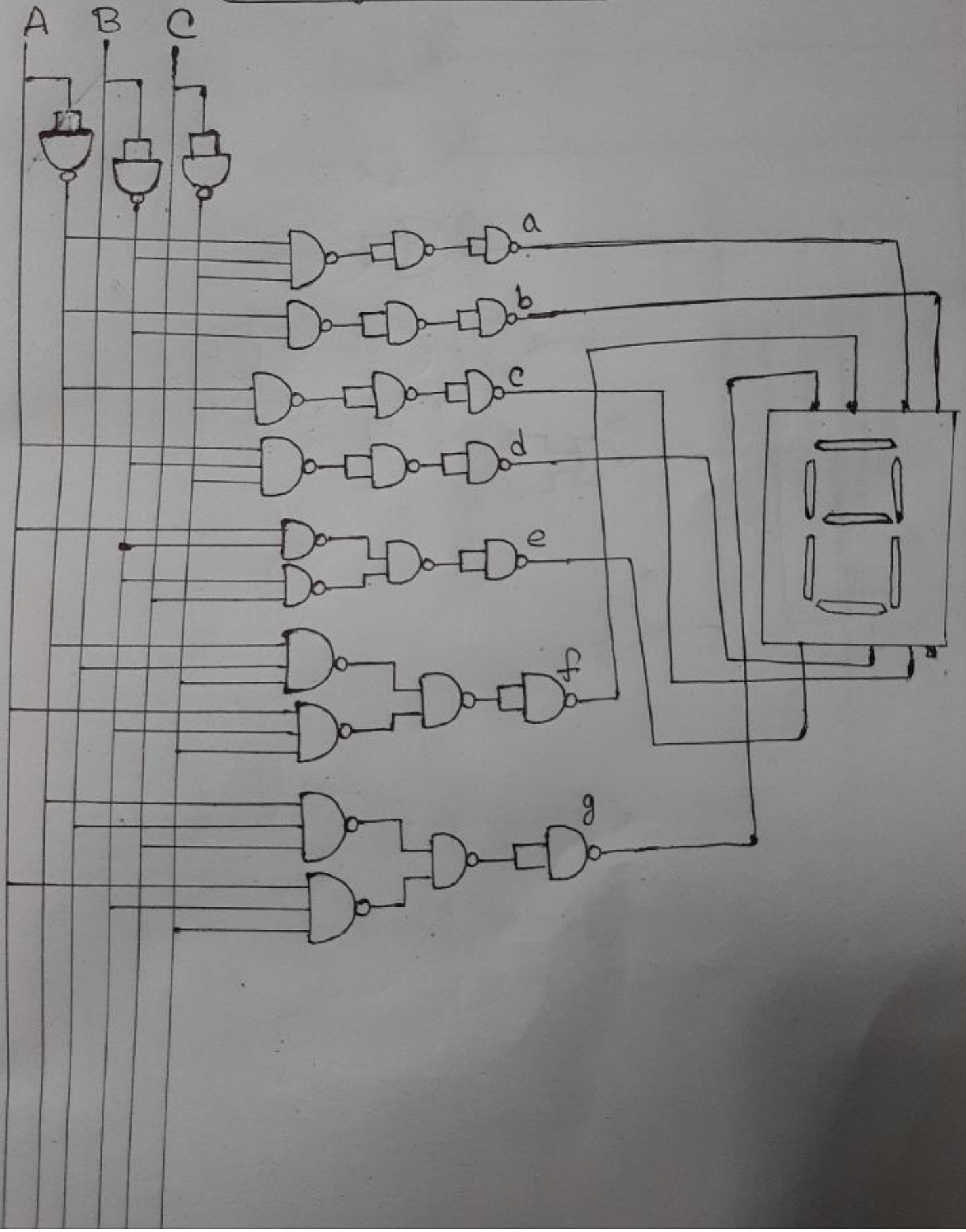

SIMPLIFIED SOP
2022025042_Tasnim Shahrin

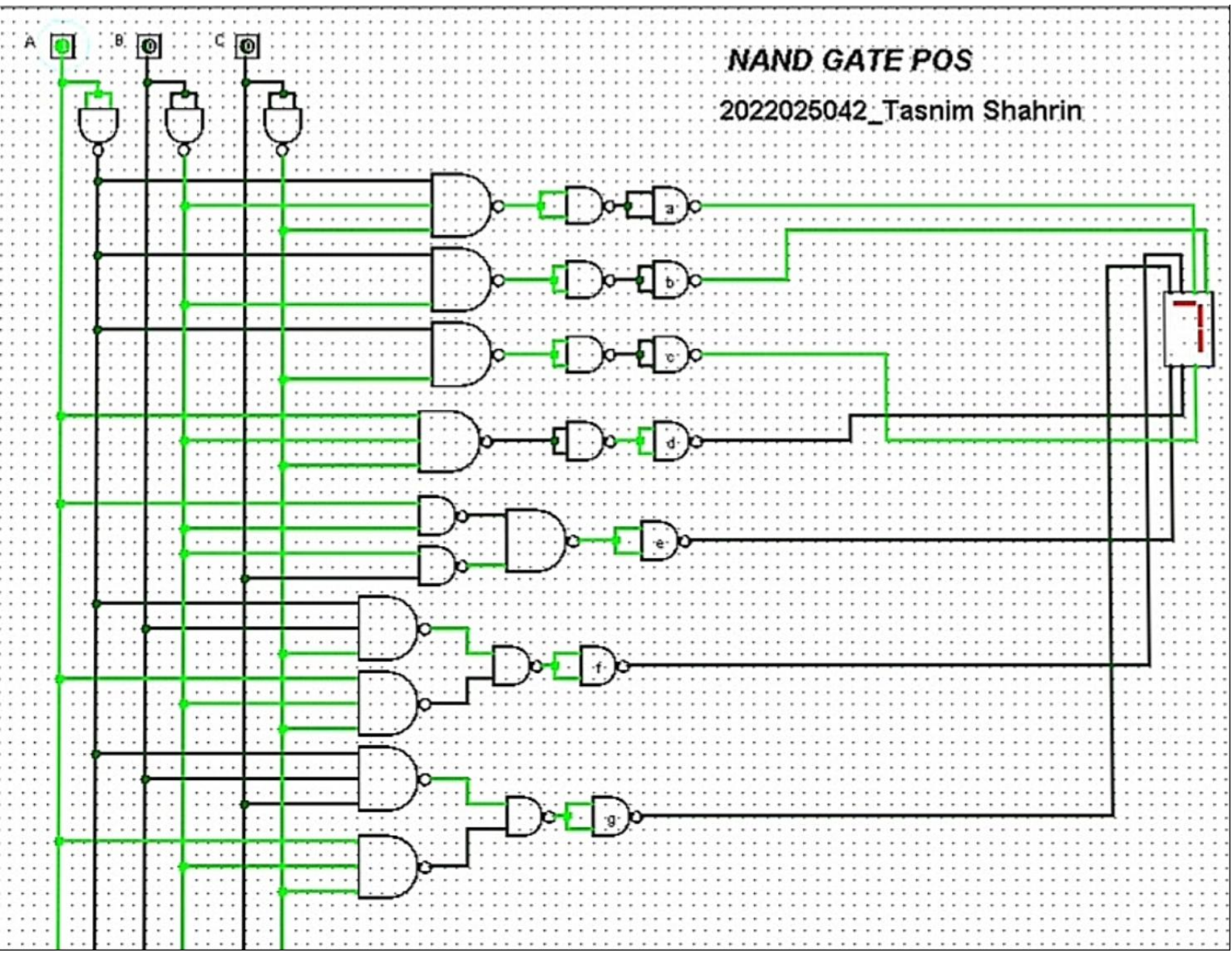
Simplified ~~SOP~~ POS



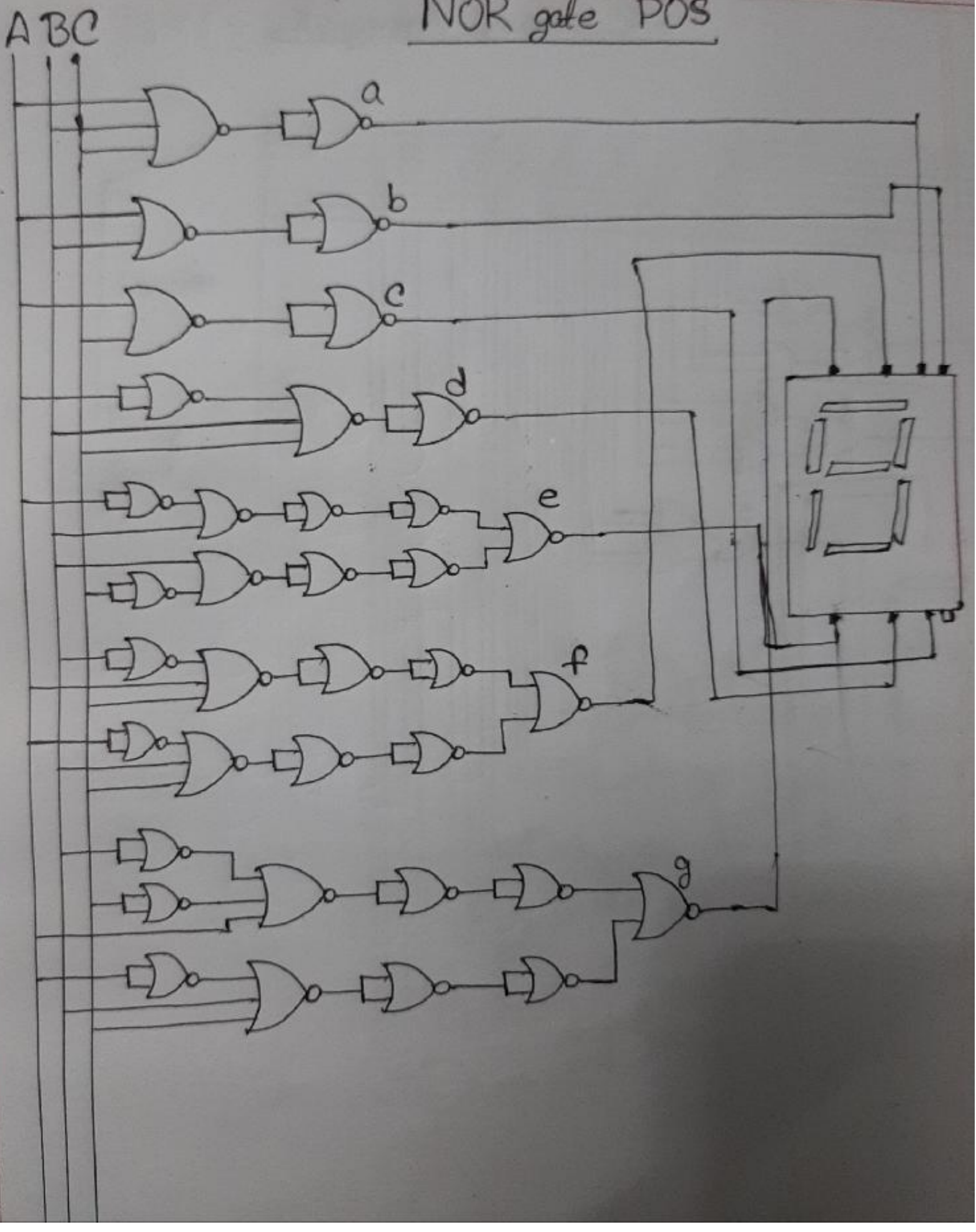

A
B
C
SIMPLIFIED POS
2022025042_Tasnim Shahri
a
b
c
d
e
f
g

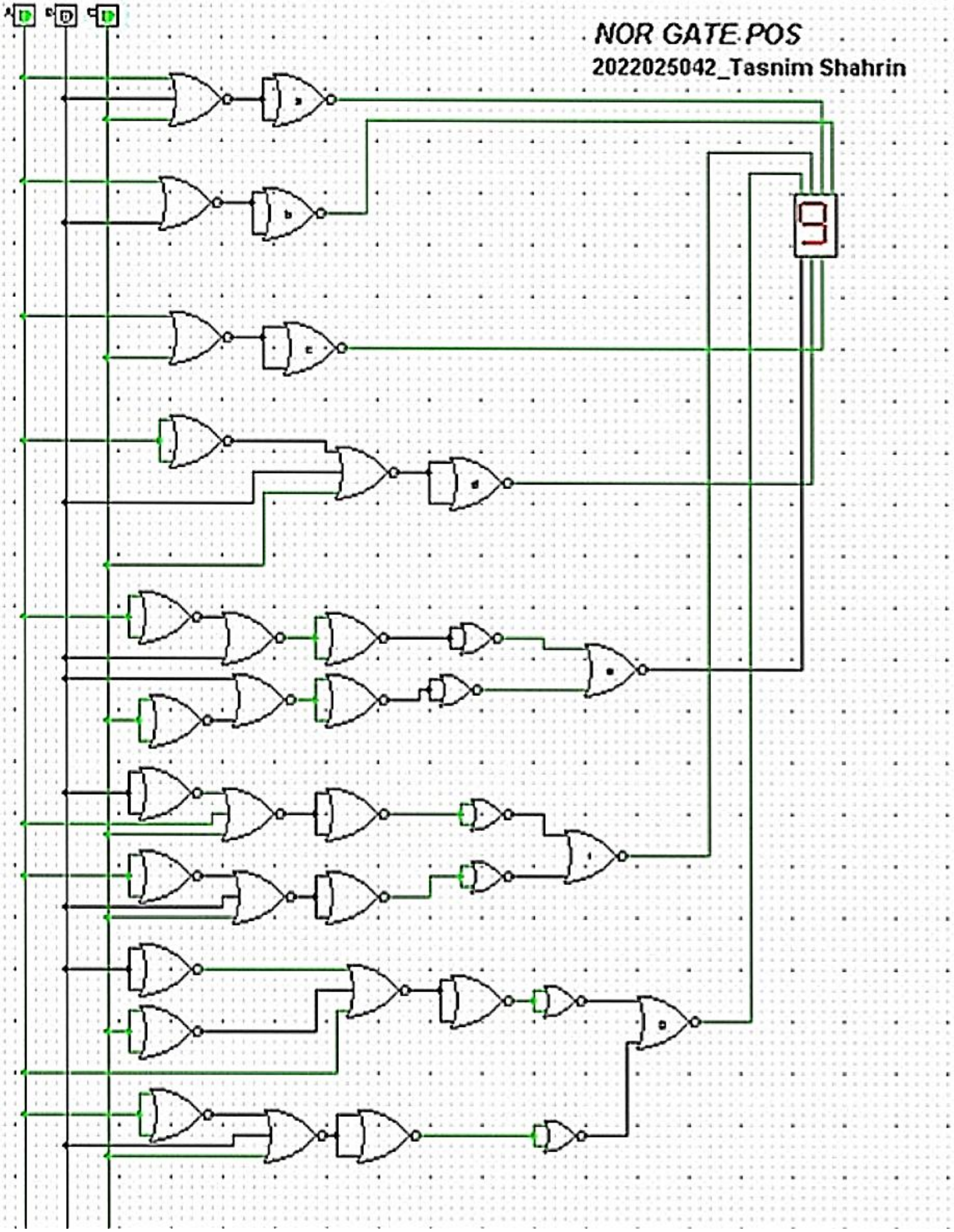
NAND gate POS



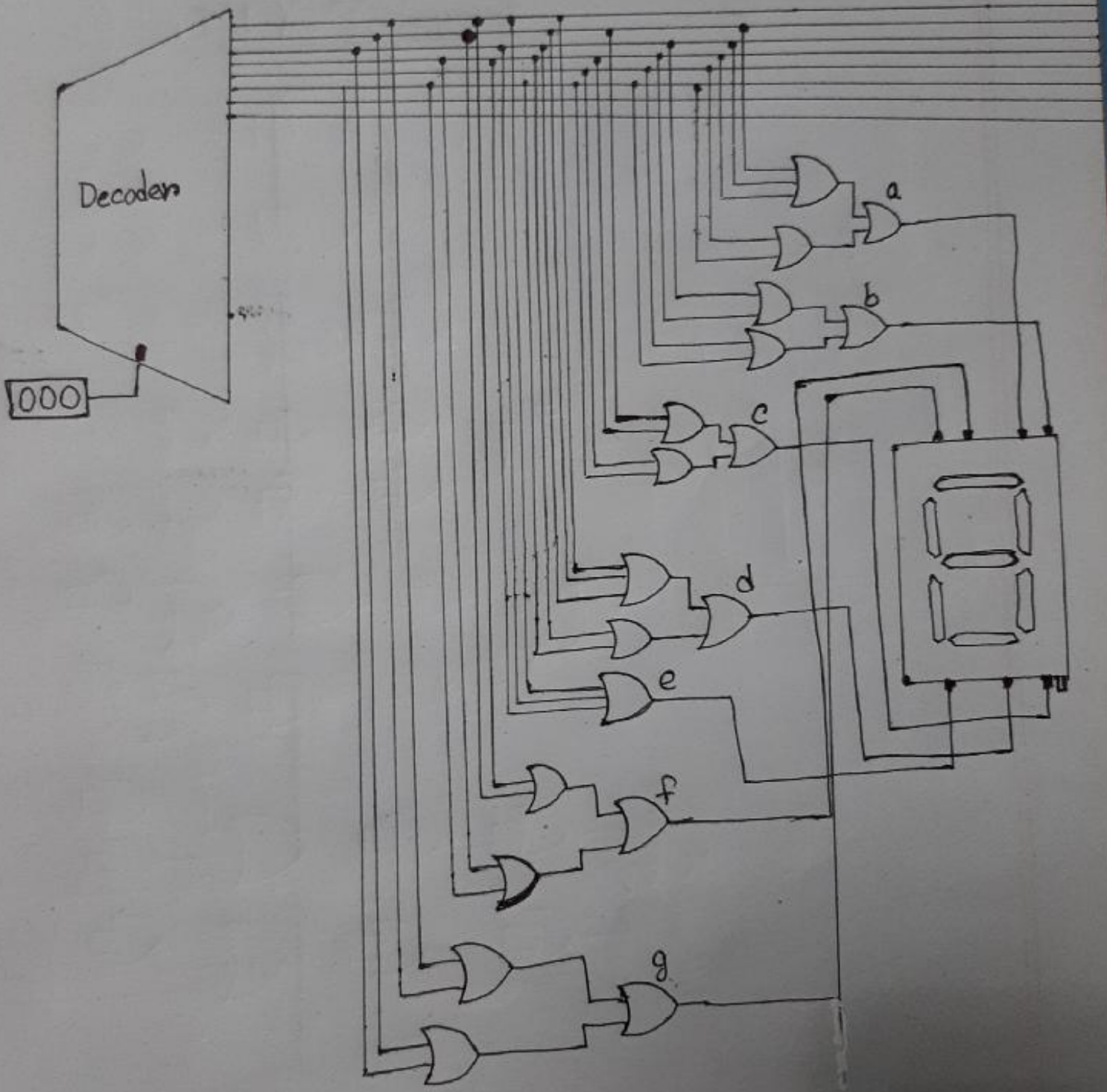

A
B
C
NAND GATE POS
2022025042_Tasnim Shahrin
a
b
c
d
e
f
g

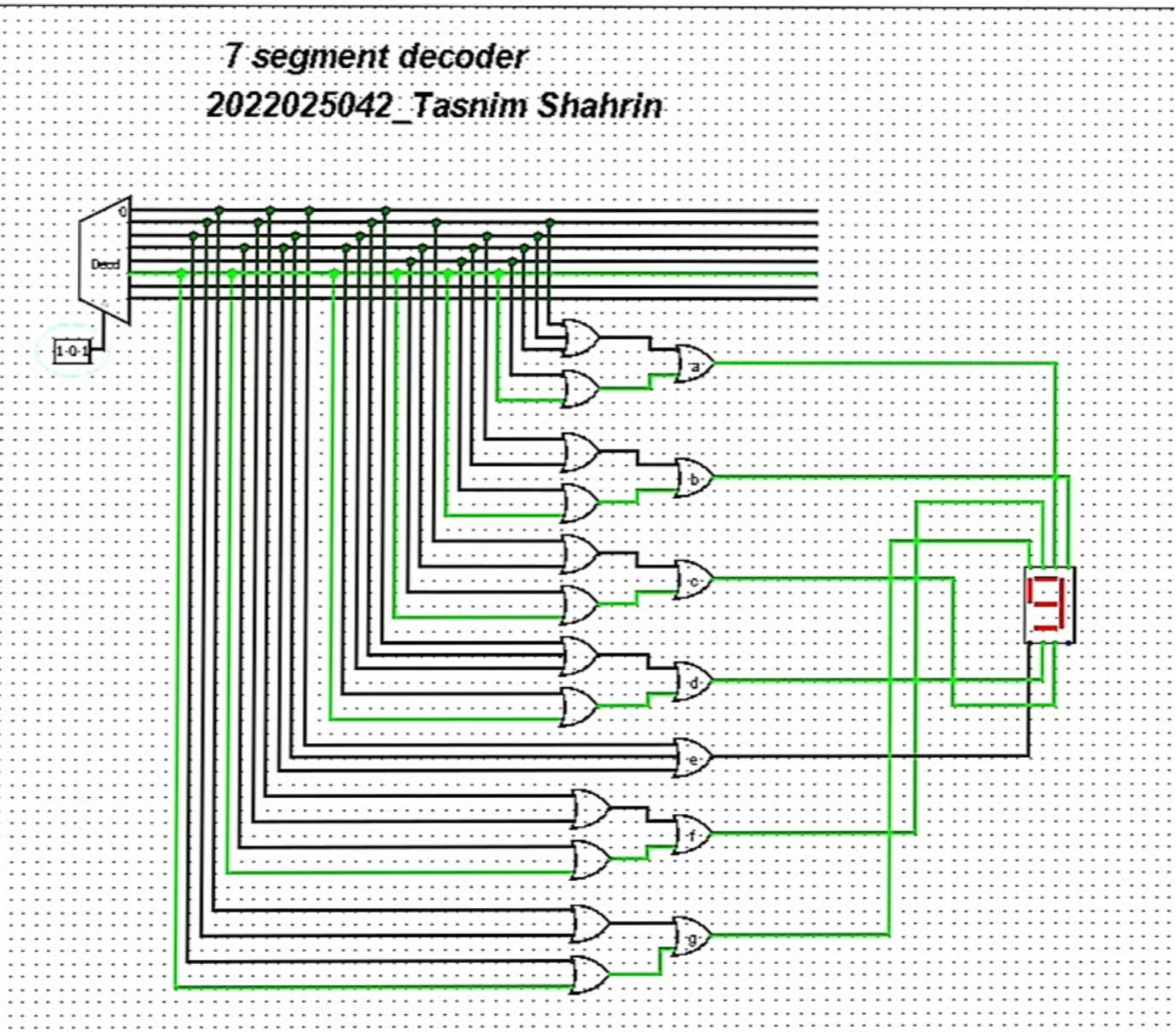
NOR gate POS

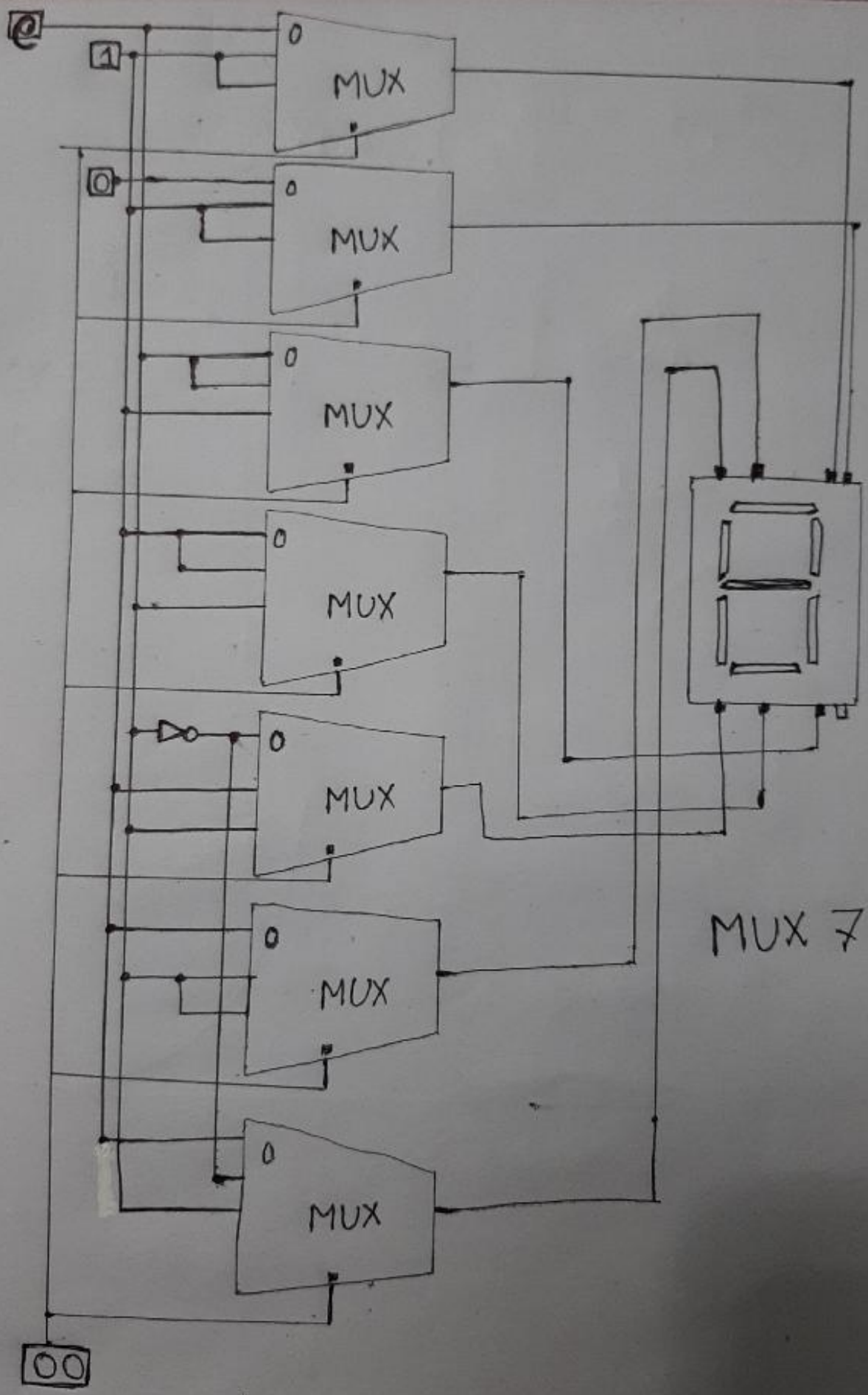



NOR GATE POS
2022025042_Tasnim Shahrin
9

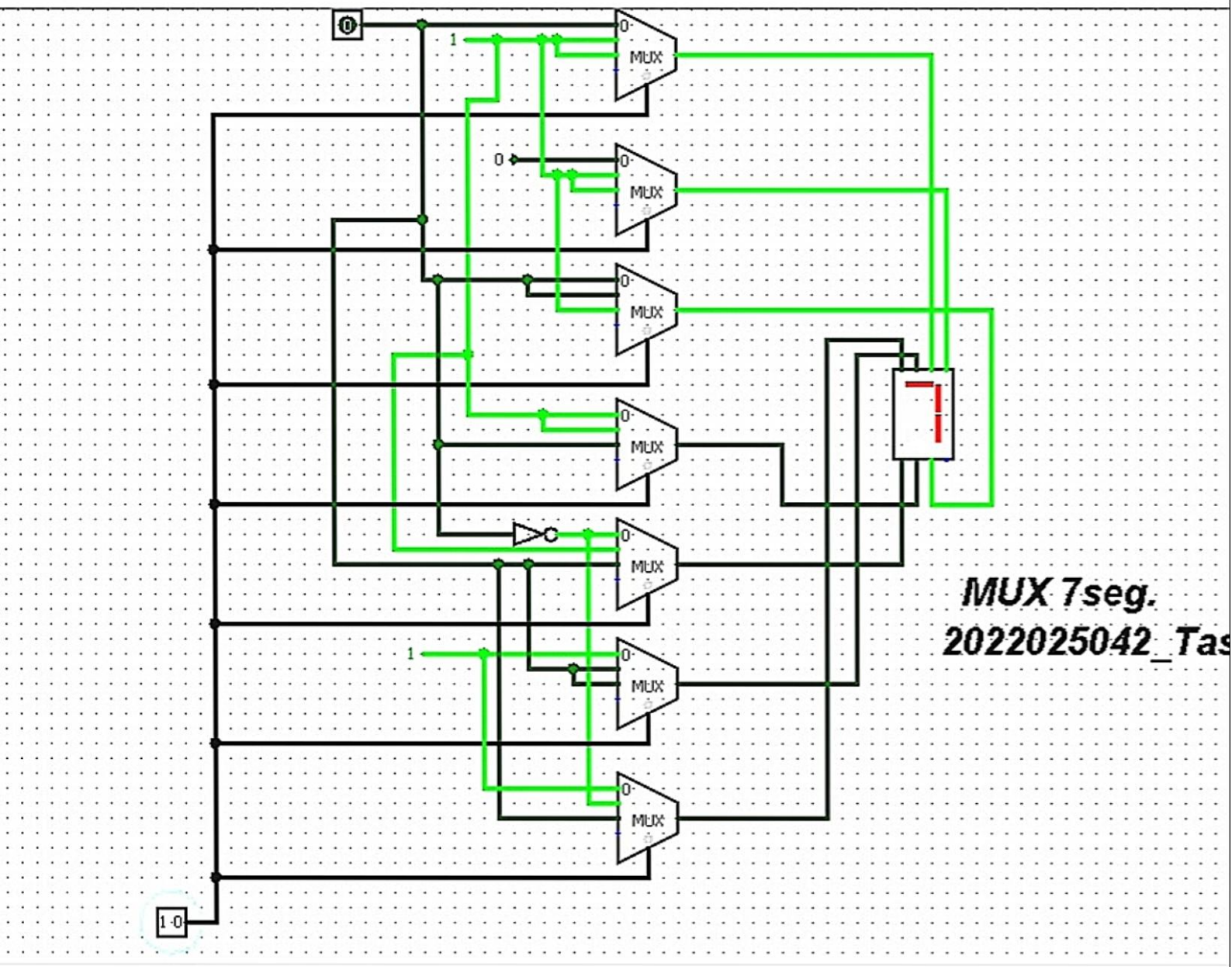
7 Segment Decoder




7 segment decoder
2022025042_Tasnim Shahrin
0
Decd
1-0-1
a
b
c
d
e
f
g



MUX 7 Segment


MUX
MUX
MUX
MUX
MUX
MUX
MUX
MUX 7seg.
2022025042_Tas

Discussion:

In this project ~~we~~ I made 7-segment display to display "tS2079".

At first ~~we~~ I made the truth table. By using the truth table ~~we~~ I got SOP and POS equations. I draw the circuits of SOP and POS in the generialized and simplified from.

I also did K-maps for SOP and POS. By the K-maps we got the simplified form. The simplifie form ~~is t~~ made the circuit quite simple and short.

After ~~that~~ ~~we~~ I use the 3 to 8 line decoder, and 4:1 MUX. and use the same truth table to display 7-segment "tS2079".

I also draw and simulate the simplification form of SOP and POS by using NAND and NOR gates.

I draw and simulate the sequential circuit with combinational circuit. I use JK flip-flop to make the input automated.

Typically for a standard red colored 7-segment display, Each LED segment can draw about 15 mA to illuminated connectly, So on a 5V digital logic circuit, the value of the current limiting register would be about 200Ω(5V-2V)/15 or 220 Ω to the nearest higher preffered value. So, to understand how the segments of the display are connected to a 220Ω current limiting register considers the circuit below.

Conclusion:

This project was good opportunity for all of us to learn how the system works and learn the theory as well. We also faced a lot of problems which taught us what kind to problems can be faced while building a 7-segment display. We had problems mostly with lack of knowledge on how to build everything but with a great deal of time spent on it together we figured it out eventually.