INDRAPRASTHA INSTITUTE *of*
INFORMATION TECHNOLOGY
DELHI

Department
of
Electronics & Communication Engineering

ECE111|Digital Circuits
Section: B

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Lab_6:

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2.03.22

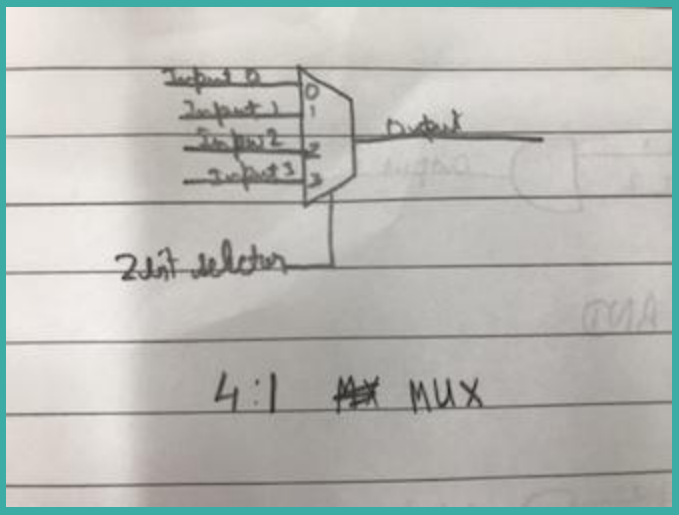
Part A

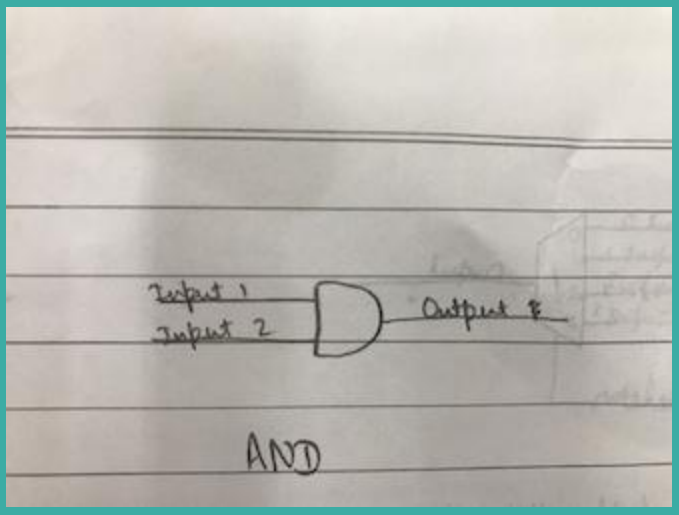
Aim: To decrypt a communication encryption and see it in seven segment display

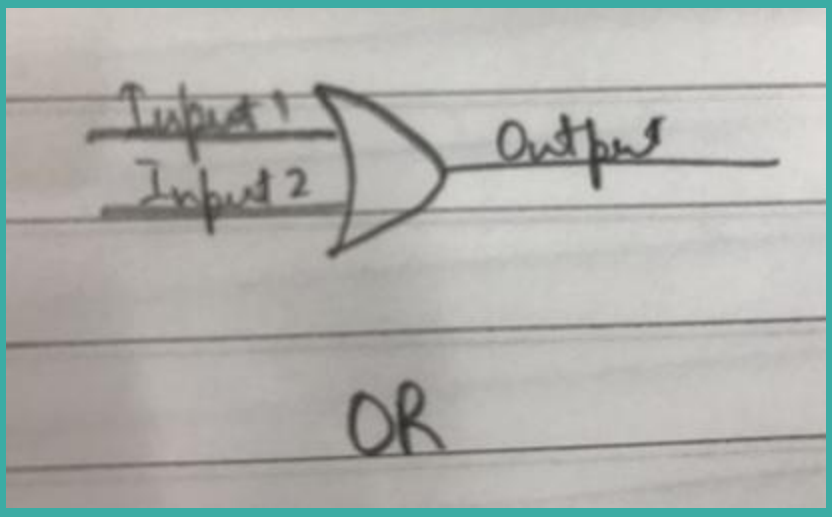
Components/ICs Used: 4x1 MUX, 7 segment display, NAND, NOR, AND, OR, 3-input AND, 4-input OR, 5-input OR gates

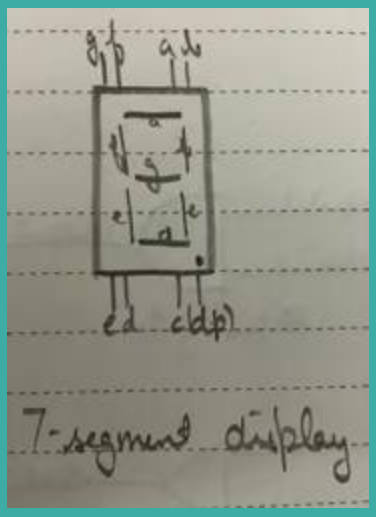
Link of CIRCUITVERSE Workspace:
https://circuitverse.org/simulator/edit/lab06-9d92dd0b-18f1-4079-af76-5af4b7029aba

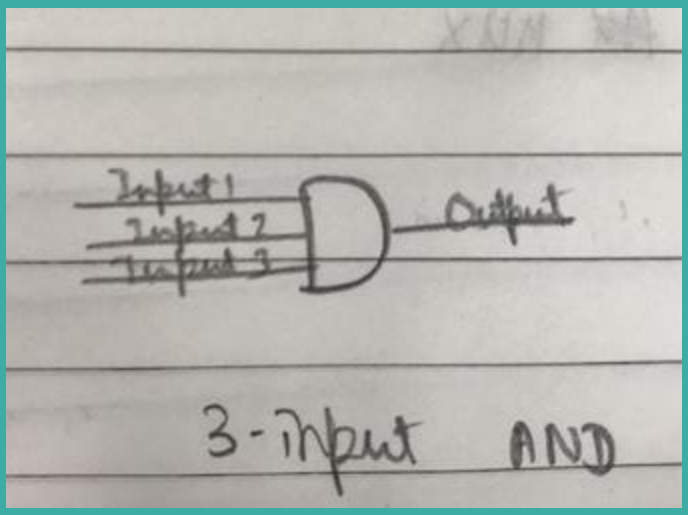
Pin Diagram of the IC:

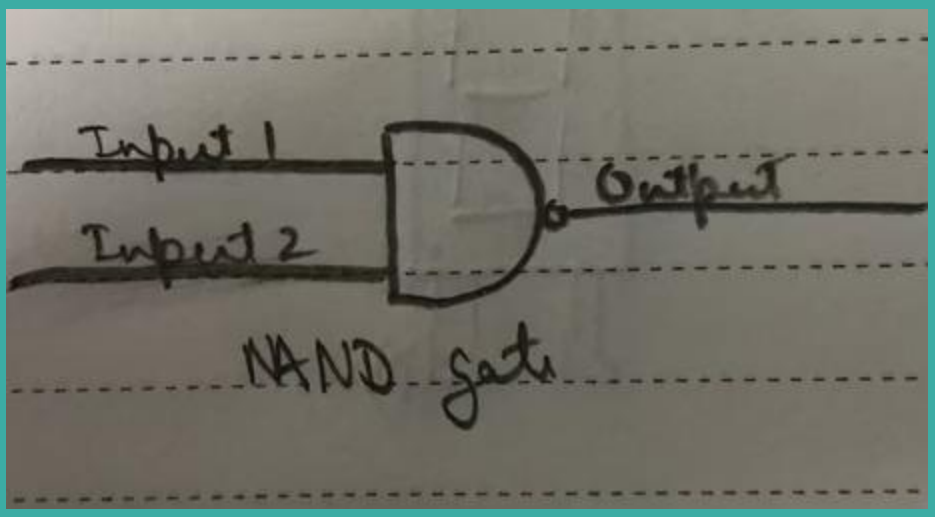


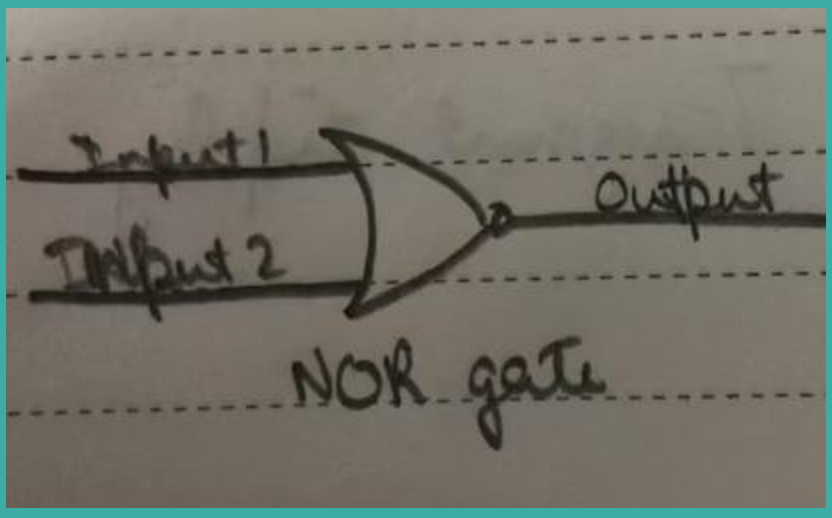


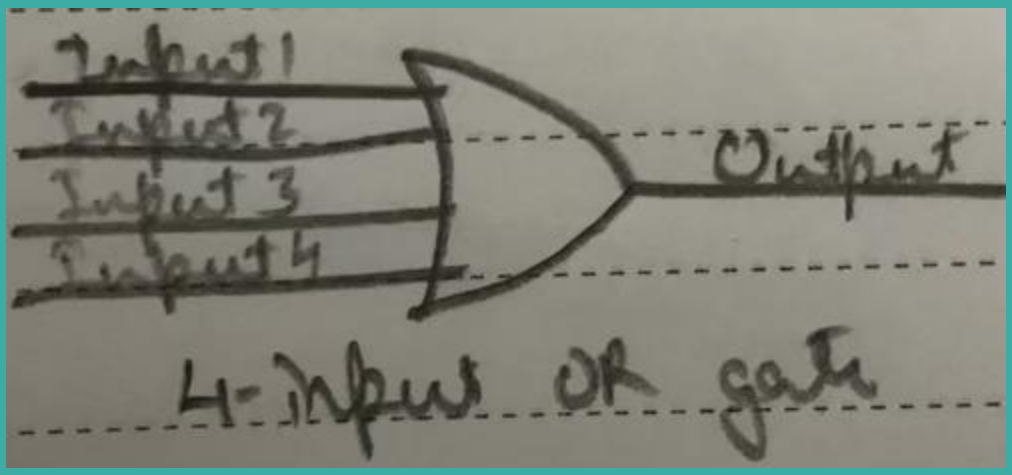


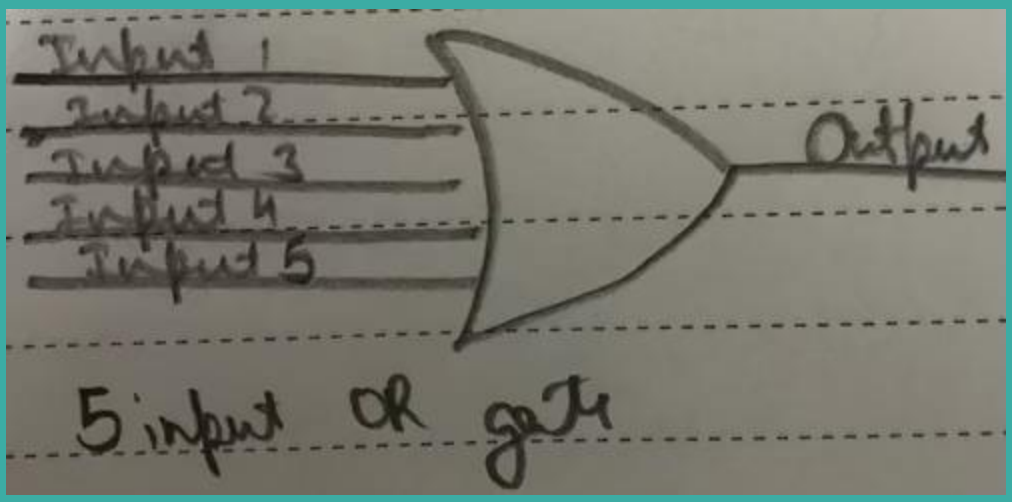



Input 1
Input 2
Input 3
Output
3-Input AND

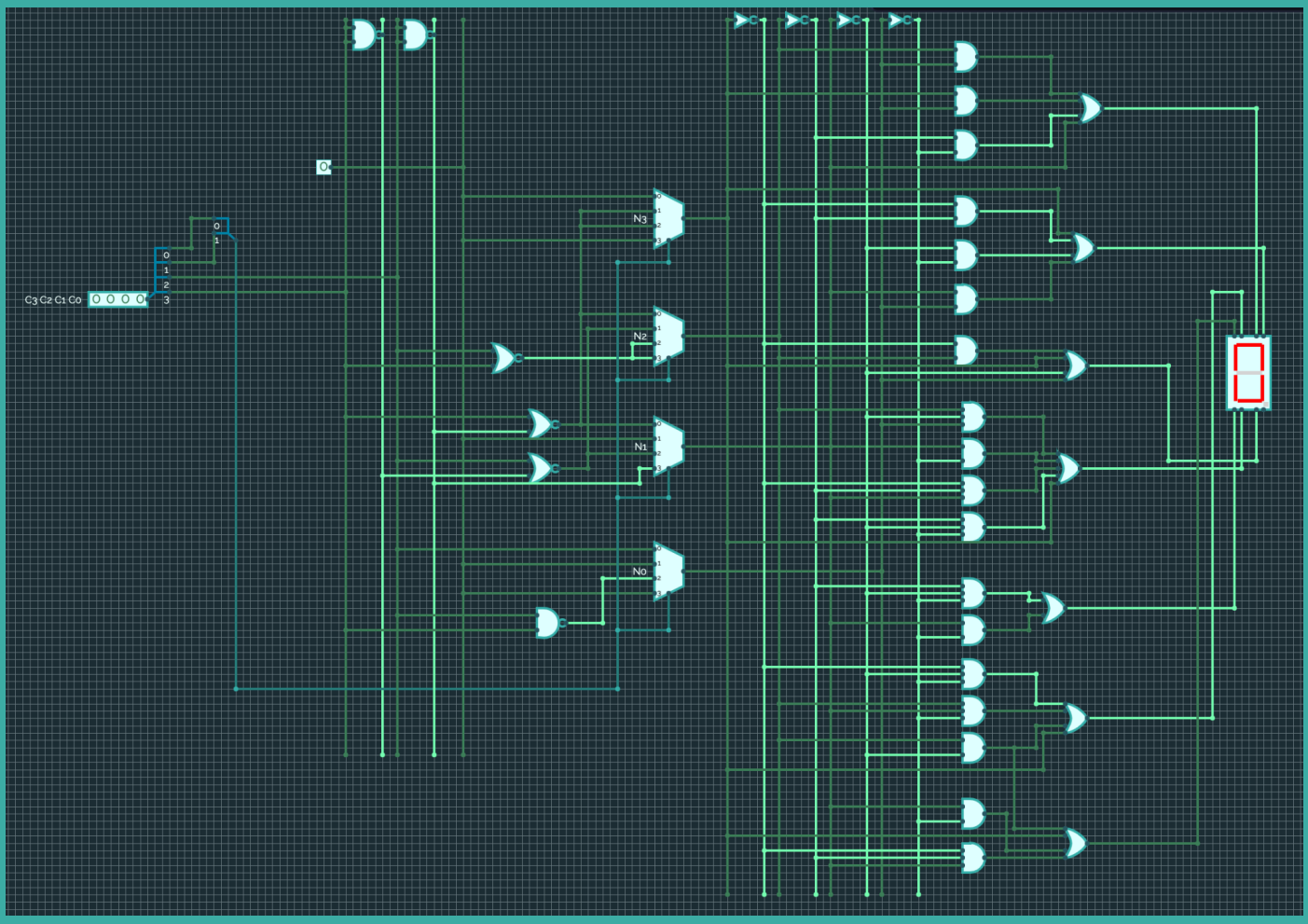

Input 1
Input 2
Output
NAND gate


Input 1
Output
NOR gate


Input 1
Input 2
Input 3
Input 4
Output
4-input OR gate


Input 1
Input 2
Input 3
Input 4
Input 5
Output
5 input OR gate

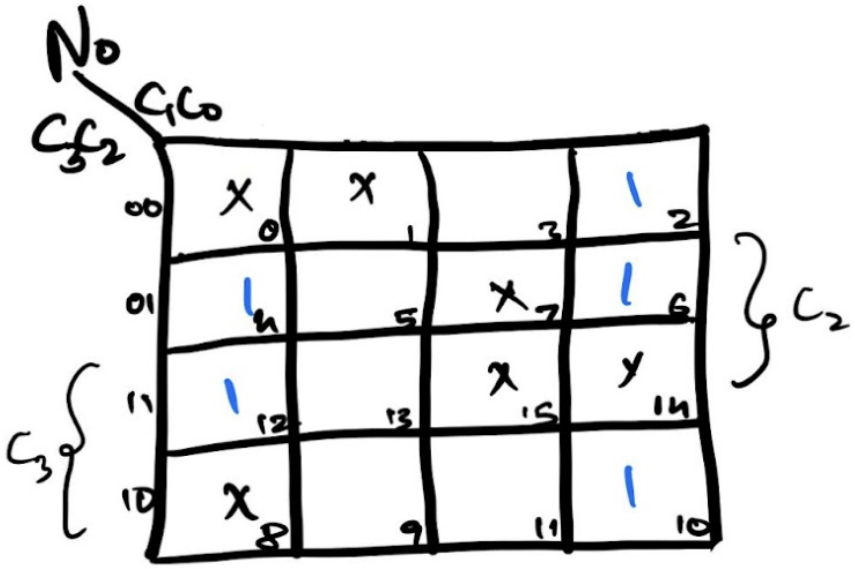
Circuit Diagram:



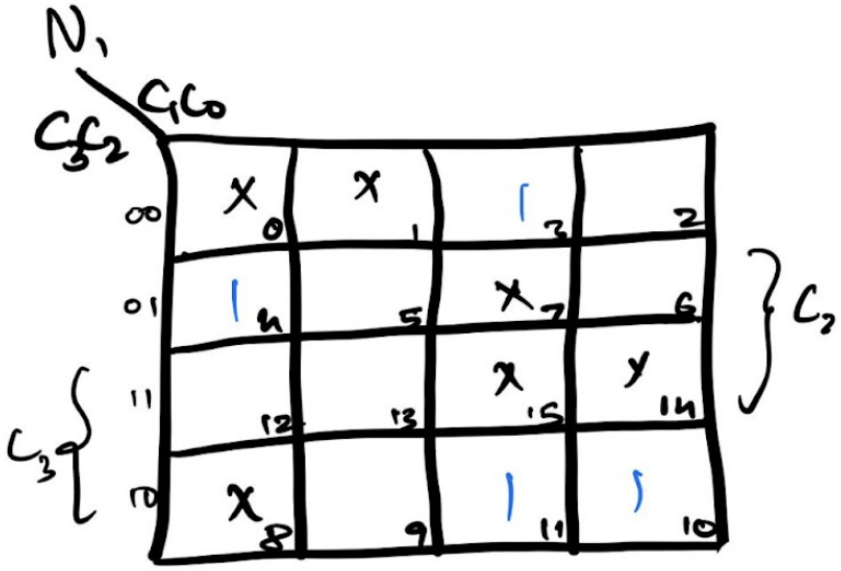
K maps and Truth Table:

$(C_3C_2C_1C_0)_2 = (13-N)_{10} \quad \forall 4 \geq N \geq 0$

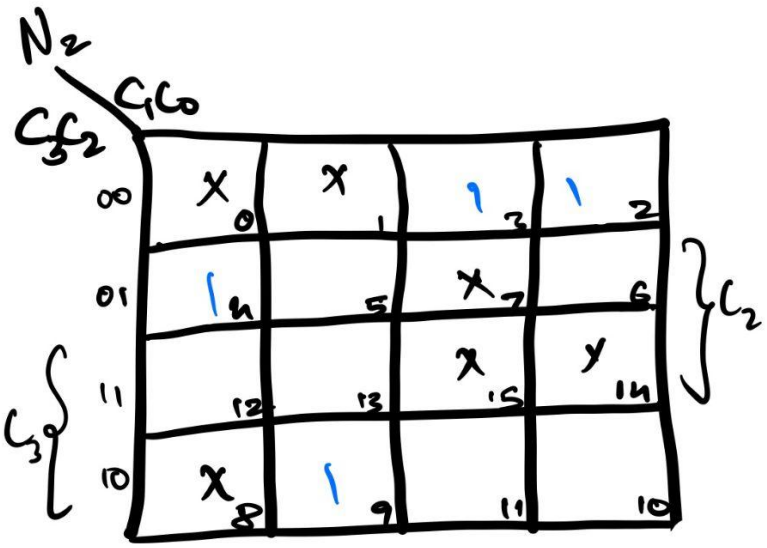
$(C_3C_2C_1C_0)_2 = (N-3)_{10} \quad \forall 9 \geq N \geq 5$



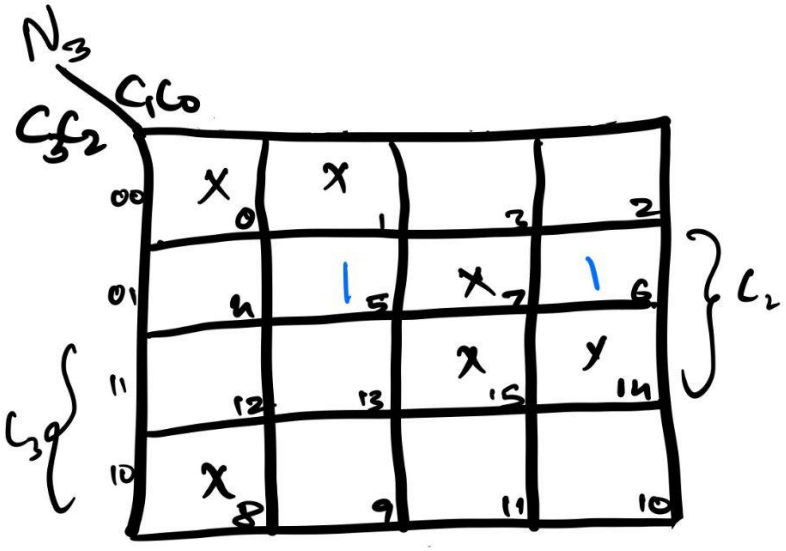
C_1	C_0	N_0
0	0	C_2
0	1	0
1	0	$\bar{C}_3 + \bar{C}_2$
1	1	0



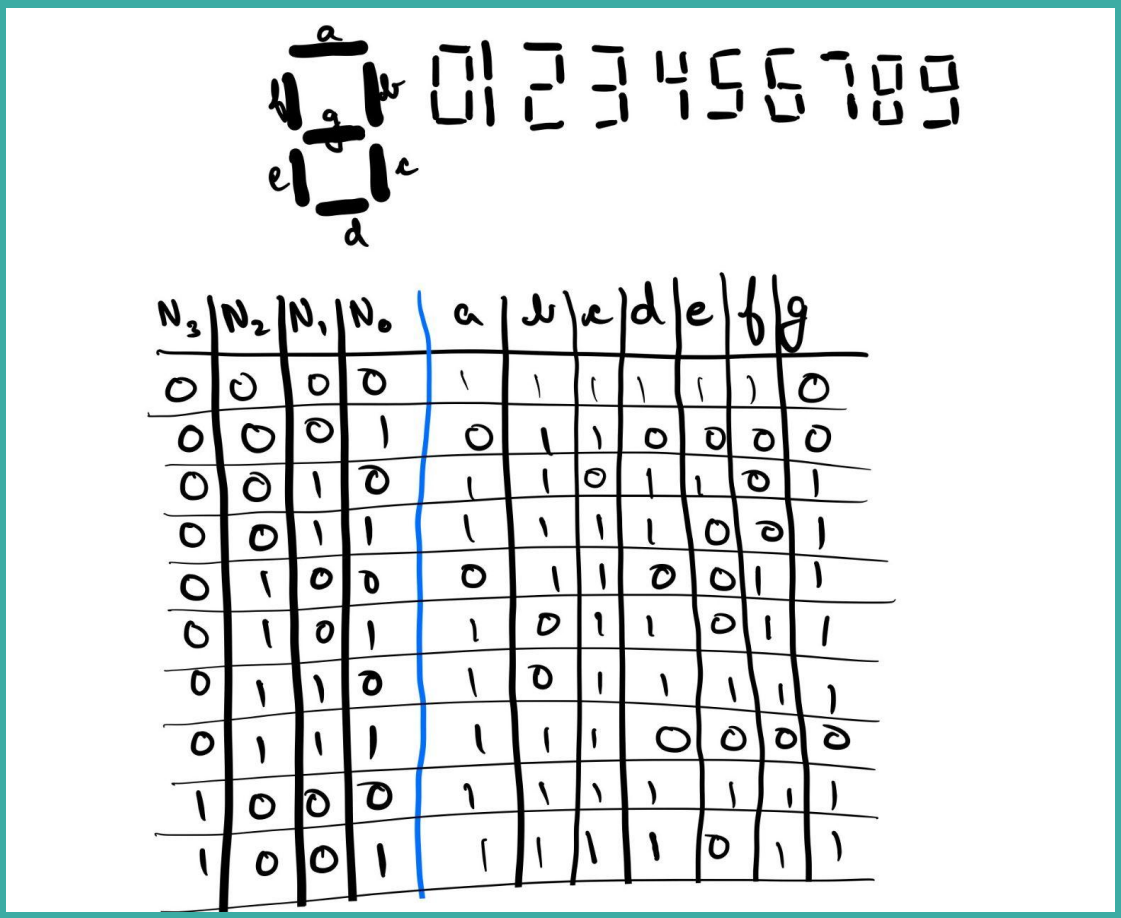
C_1	C_0	N_1
0	0	$\bar{C}_3 C_2$
0	1	0
1	0	$C_3 \bar{C}_2$
1	1	$\bar{C}_2$



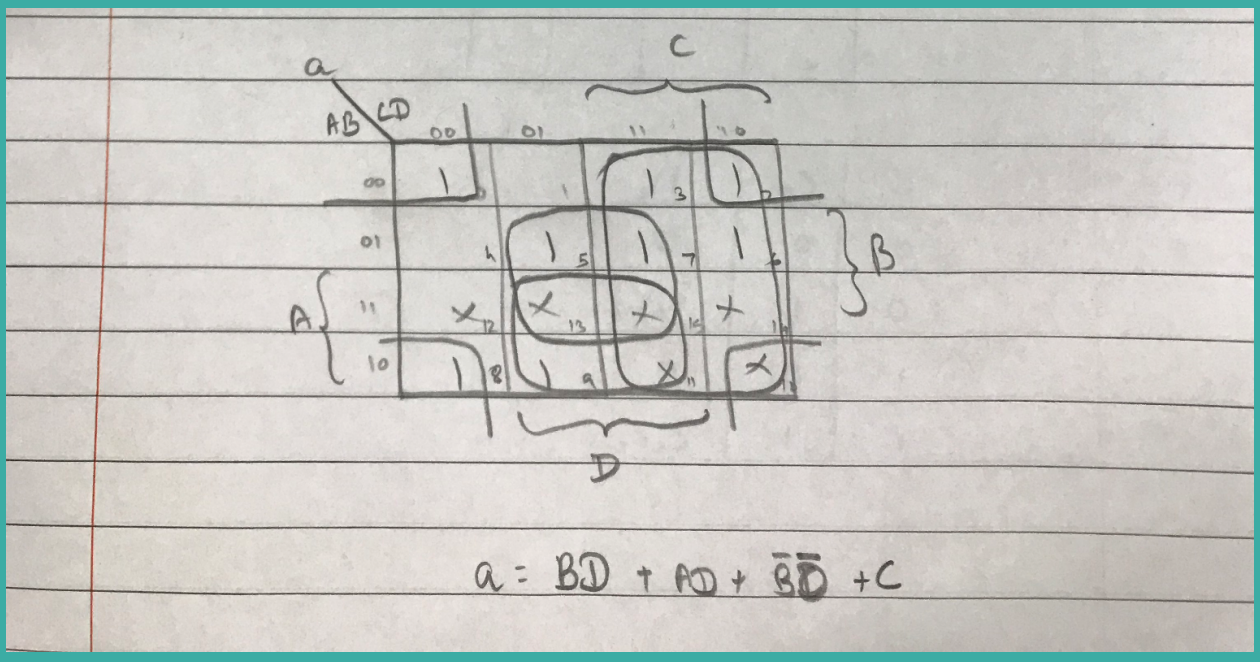
C_1	C_0	N_2
0	0	$\bar{C}_3 C_2$
0	1	$C_3 \bar{C}_2$
1	0	$\bar{C}_3 \bar{C}_2$
1	1	$\bar{C}_3 \bar{C}_2$

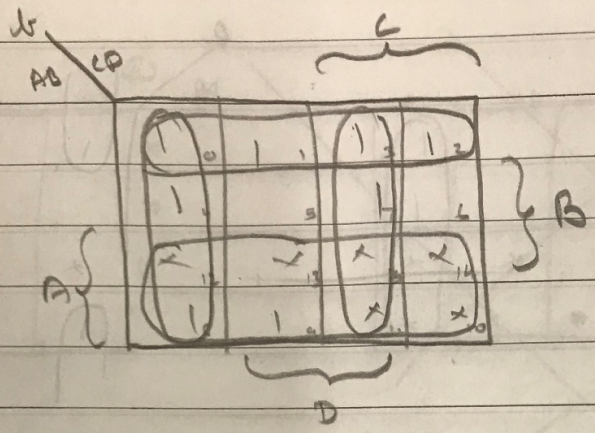


C_1	C_0	N_3
0	0	0
0	1	$\bar{L}_3 L_2$
1	0	$\bar{L}_3 L_2$
1	1	0

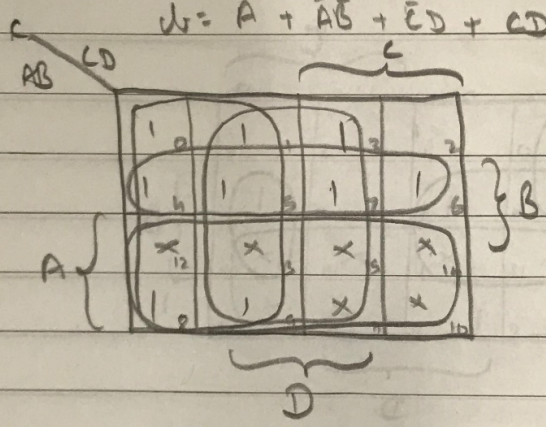


N_3	N_2	N_1	N_0	a	b	c	d	e	f	g
0	0	0	0	1	1	1	1	1	1	0
0	0	0	1	0	1	1	0	0	0	0
0	0	1	0	1	1	0	1	1	0	1
0	0	1	1	1	1	1	1	0	0	1
0	1	0	0	0	1	1	0	0	1	1
0	1	0	1	1	0	1	1	0	1	1
0	1	1	0	1	0	1	1	1	1	1
0	1	1	1	1	1	1	0	0	0	0
1	0	0	0	1	1	1	1	1	1	1
1	0	0	1	1	1	1	1	0	1	1

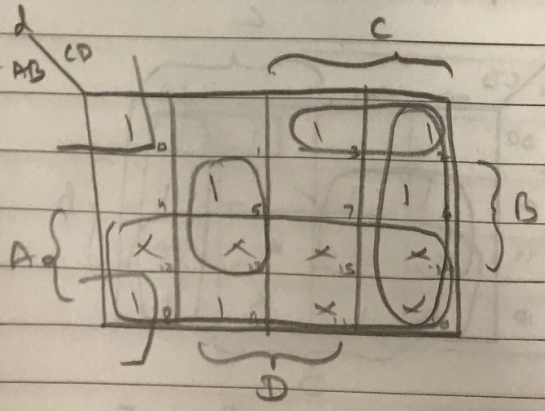




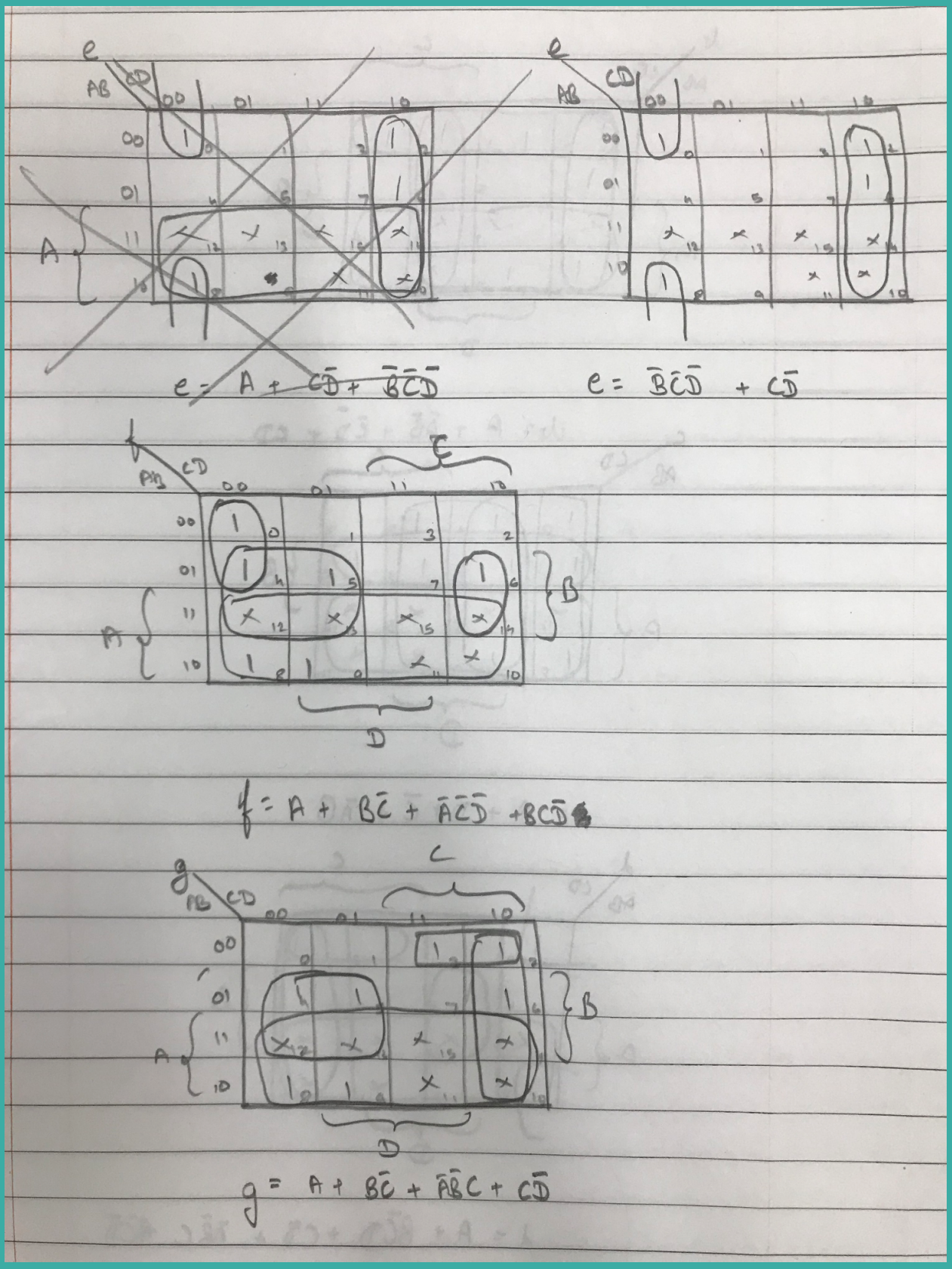
$b = A + \bar{A}\bar{B} + \bar{C}\bar{D} + CD$



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



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


e
AB
CD
A
$e = A + C\bar{D} + \bar{B}\bar{C}\bar{D}$
$e = \bar{B}\bar{C}\bar{D} + C\bar{D}$
f
E
B
D
$f = A + B\bar{C} + \bar{A}\bar{C}\bar{D} + B\bar{C}\bar{D}$
g
C
B
D
$g = A + B\bar{C} + \bar{A}\bar{B}C + C\bar{D}$

Observations/Results: The decoded message is shown in the seven segment display

Application: To see the encoded message on the seven segment display

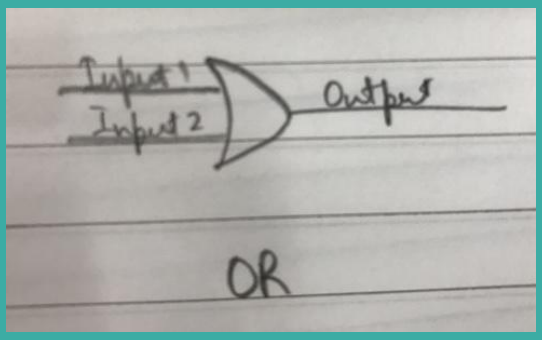
Part B

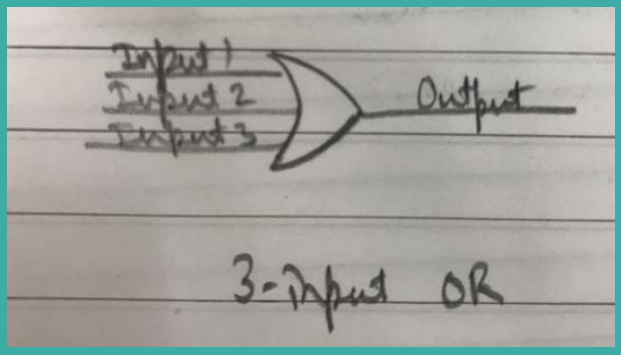
Aim: To create a circuit to divide two numbers and get the quotient and remainder

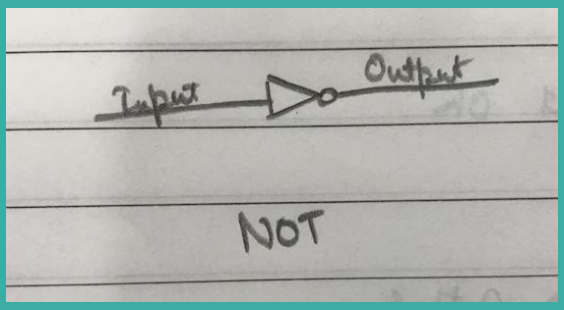
Components/ICs Used: Input, Output, AND, OR, NOT, Gate, splitter, 4:1 MUX

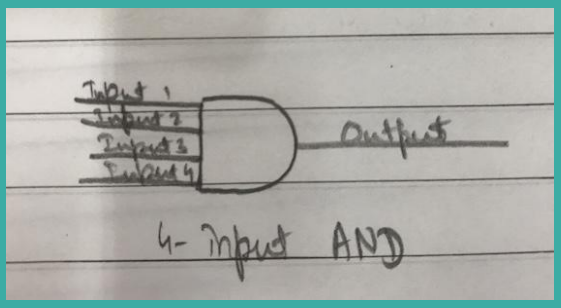
Link of Circuitverse Workspace:
https://circuitverse.org/simulator/edit/lab06-9d92dd0b-18f1-4079-af76-5af4b7029aba

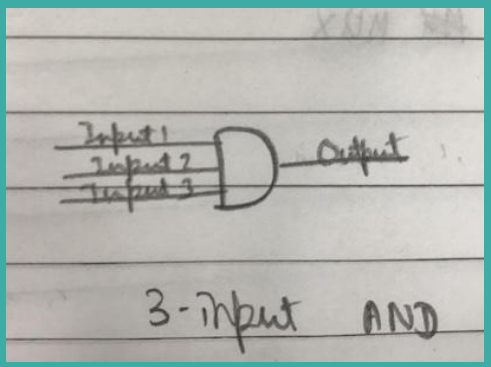
Pin Diagram of the IC:

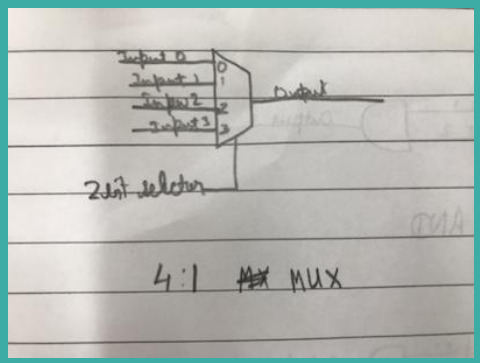




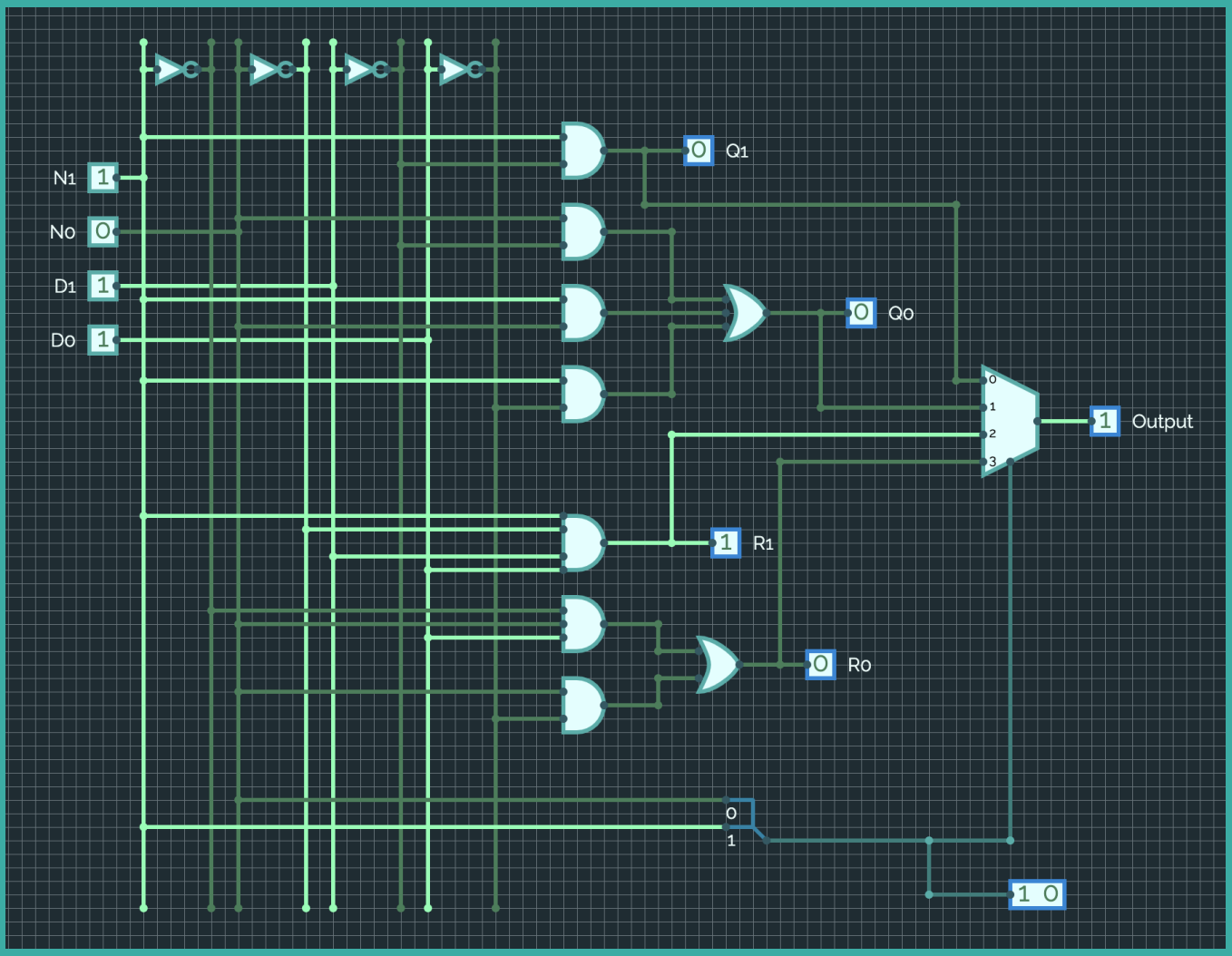








Circuit Diagram:

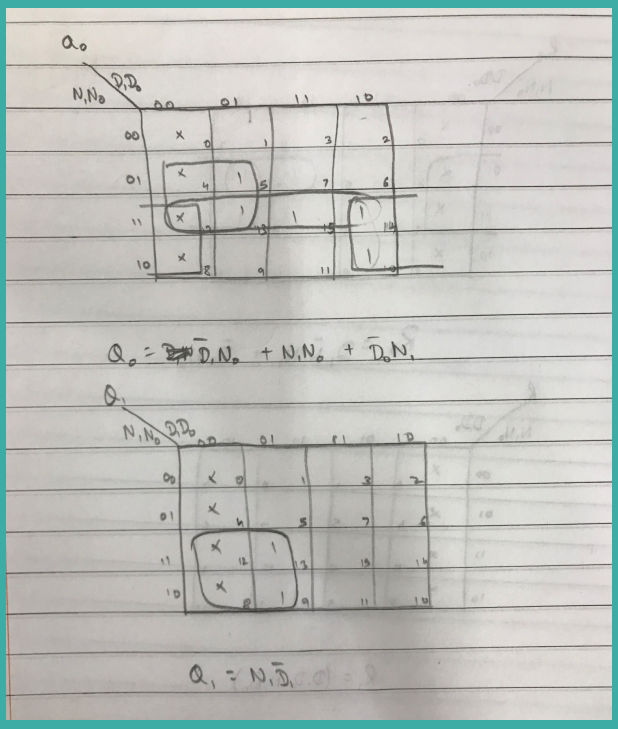


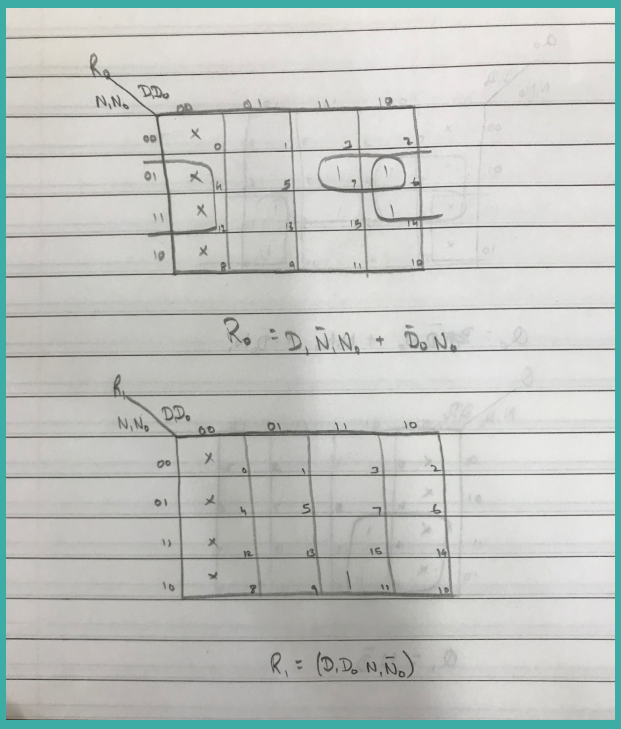
Truth Table:

4-Bit

N1	N0	D1	D0	Q1	Q0	R1	R0
0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0
0	0	1	0	0	0	0	0
0	0	1	1	0	0	0	0
0	1	0	0	0	0	0	0
0	1	0	1	0	1	0	0
0	1	1	0	0	0	0	1
0	1	1	1	0	0	0	1
1	0	0	0	0	0	0	0
1	0	0	1	1	0	0	0
1	0	1	0	0	1	0	0
1	0	1	1	0	0	1	0
1	1	0	0	0	0	0	0
1	1	0	1	1	1	0	0
1	1	1	0	0	1	0	1
1	1	1	1	0	1	0	0

K maps:





Observations/Results: Got the quotient and remainder after dividing two 2-bit binary numbers

Application: Dividing two 2-bit binary numbers