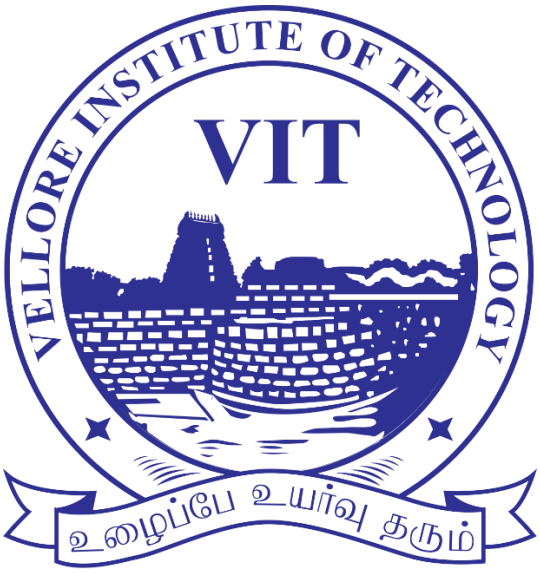

DIGITAL LOGIC AND DESIGN

LAB ASESSMENT – 2

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Teacher: **Sairabanu J.**

Q1) (i)Design Half adder and full adder using Gates.
Ans 1(i))

Truth Tables:

HALF ADDER			
INPUT		OUTPUT	
X	Y	Sum	Carry
0	0	**0**	**0**
0	1	**1**	**0**
1	0	**1**	**0**
1	1	**0**	**1**

FULL ADDER				
INPUT			OUTPUT	
X	Y	Z	Sum	Carry
0	0	0	**0**	**0**
0	0	1	**1**	**0**
0	1	0	**1**	**0**
0	1	1	**1**	**1**
1	0	0	**1**	**0**
1	0	1	**0**	**1**
1	1	0	**0**	**1**
1	1	1	**1**	**1**

EXPRESSIONS:

For Half Adder:

$Sum = \Sigma(1,2) = X'Y + XY' = (X \oplus Y)$

$Carry = X.Y$

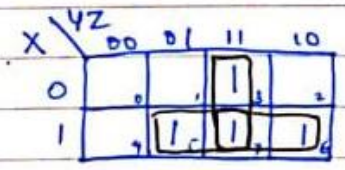
For Full Adder:

$Sum = X'Y'Z + X'.Y.Z' + XY'Z' + XYZ$

$= X'(Y \oplus Z) + X(Y \oplus Z)'$

$= (X \oplus Y \oplus Z)$

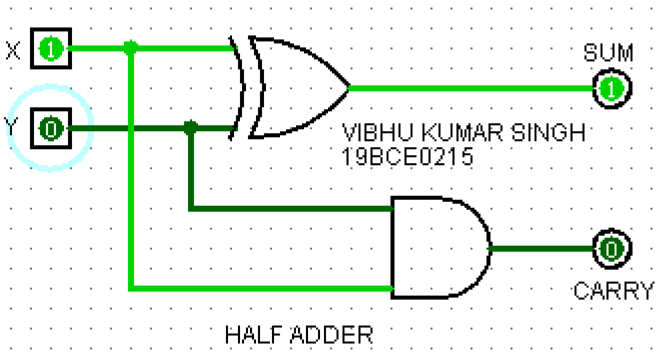
$Carry = \Sigma(3,5,6,7)$

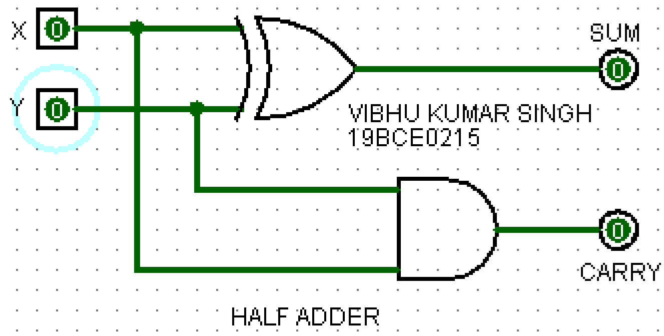


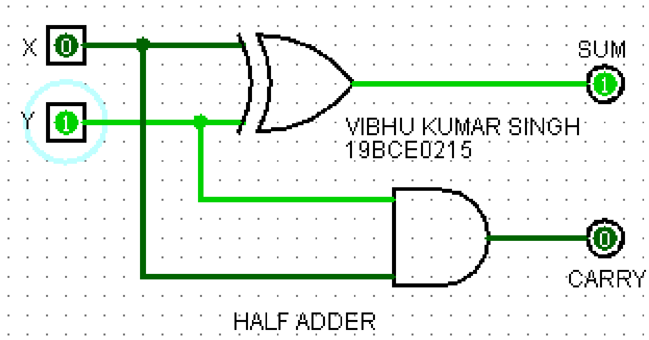
$= XY + YZ + XZ.$

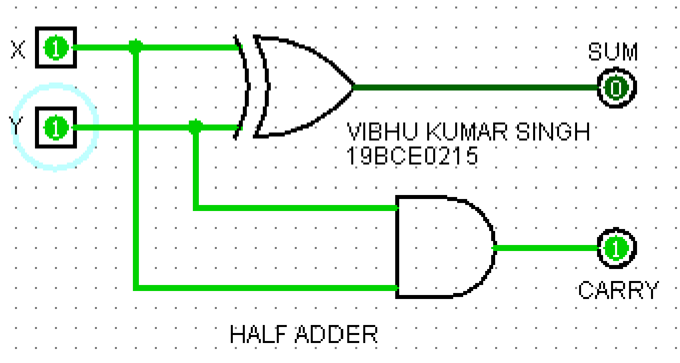
SCREENSHOTS(4 Each):

HALF ADDER:

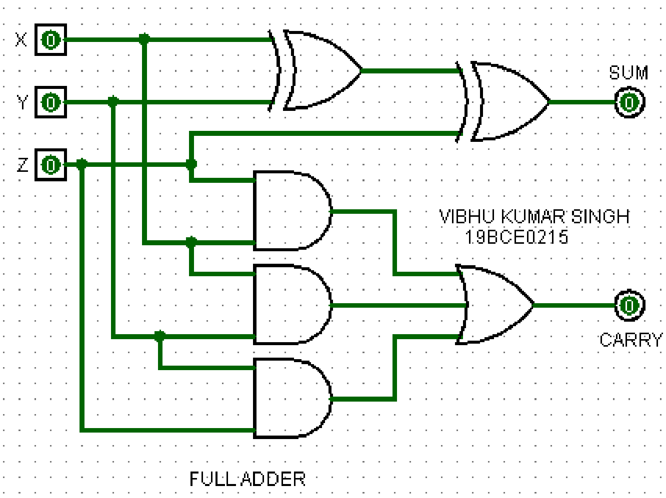


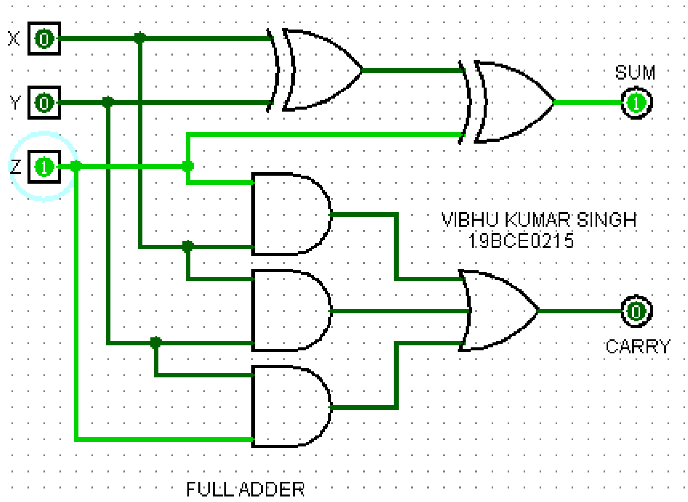


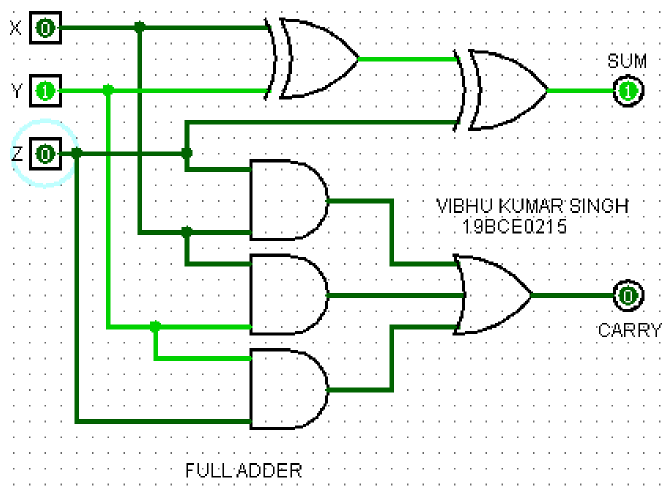


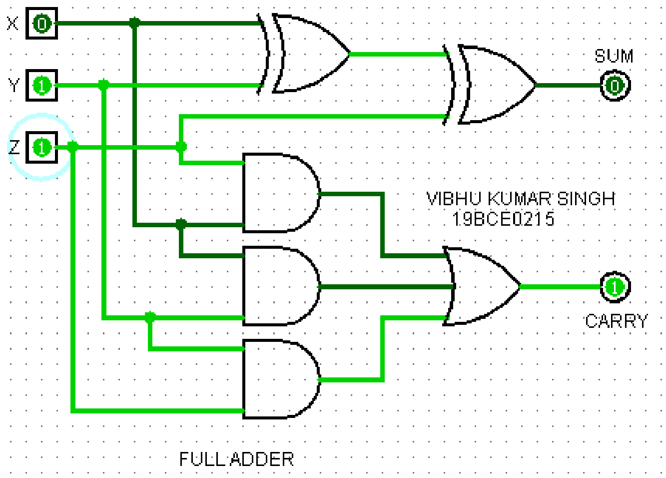


FULL ADDER:









Q1)(ii) Design a full adder using two half adders.(Gates and Half adder IC)
Ans 1(ii))

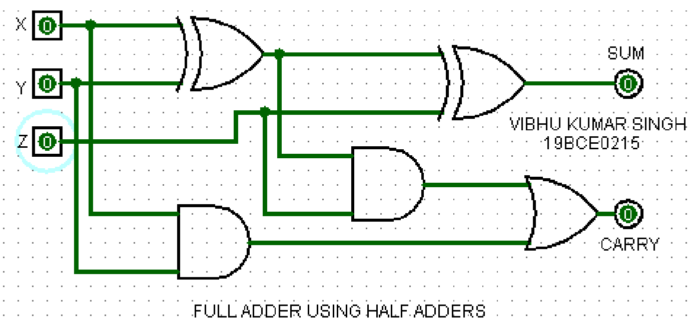
Truth Tables:

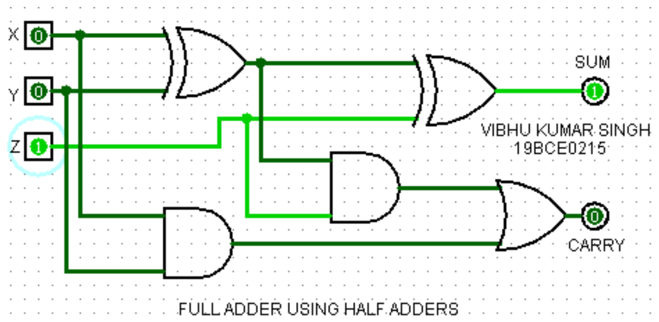
HALF ADDER			
INPUT		OUTPUT	
X	Y	Sum	Carry
0	0	**0**	**0**
0	1	**1**	**0**
1	0	**1**	**0**
1	1	**1**	**1**

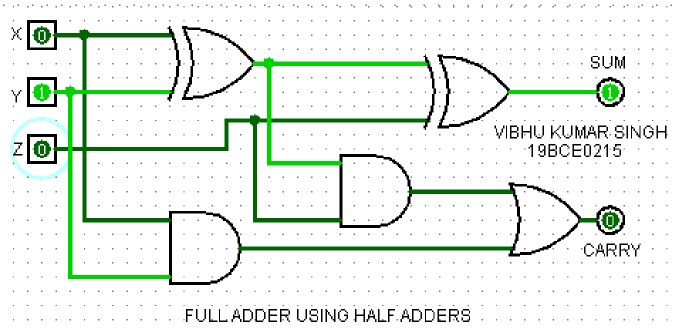
FULL ADDER				
INPUT			OUTPUT	
X	Y	Y	Sum	Carry
0	0	0	**0**	**0**
0	0	1	**1**	**0**
0	1	0	**1**	**0**
0	1	1	**1**	**1**
1	0	0	**1**	**0**
1	0	1	**0**	**1**
1	1	0	**0**	**1**
1	1	1	**1**	**1**

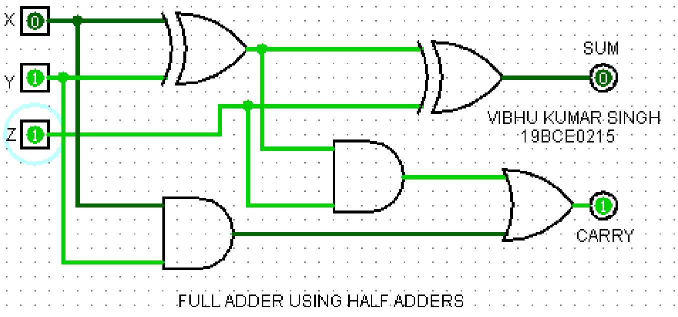
<u>SCREENSHOTS(4 Each):</u>

USING GATES:

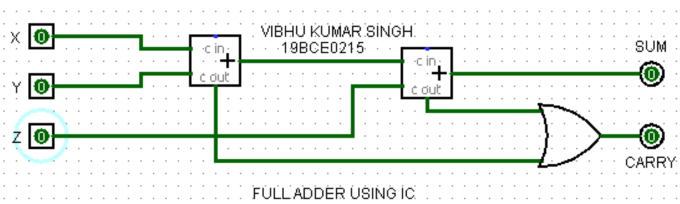


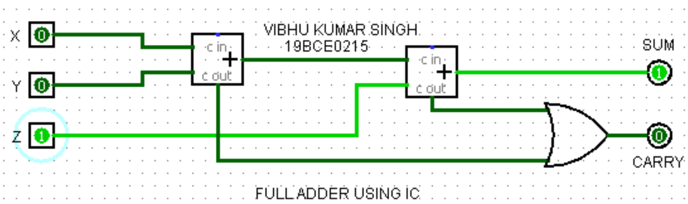


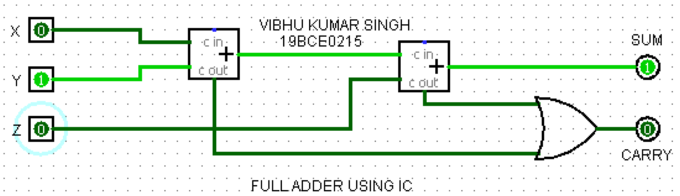


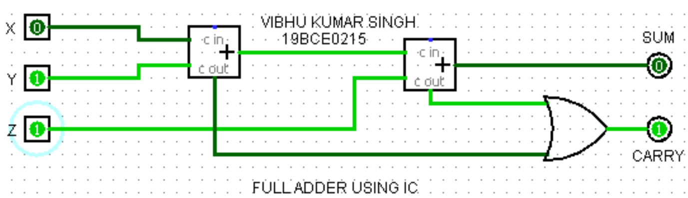


USING IC:









Q1)(iii) Design Half subtractor and Full Subtractor using Gates.
Ans 1(iii))

Truth Tables:

HALF SUBTRACTOR			
INPUT		OUTPUT	
X	Y	Difference	Borrow
0	0	**0**	**0**
0	1	**1**	**1**
1	0	**1**	**0**
1	1	**0**	**0**

FULL SUBTRACTOR				
INPUT			OUTPUT	
X	Y	Z	Difference	Borrow
0	0	0	**0**	**0**
0	0	1	**1**	**1**
0	1	0	**1**	**1**
0	1	1	**0**	**1**
1	0	0	**1**	**0**
1	0	1	**0**	**0**
1	1	0	**0**	**0**
1	1	1	**1**	**1**

EXPRESSIONS:

For Half Subtractor :

Difference = $\Sigma(1,2) = X'Y + XY' = (X \oplus Y)$

Borrow = $X'.Y$

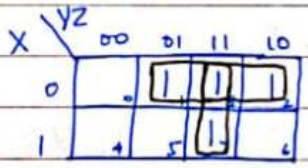
For Full Subtractor :

Difference = $X'Y'Z + X'YZ' + XZZ' + XYZ$

$= X'(Y \oplus Z) + X(Y \oplus Z)'$

$= (X \oplus Y \oplus Z)$

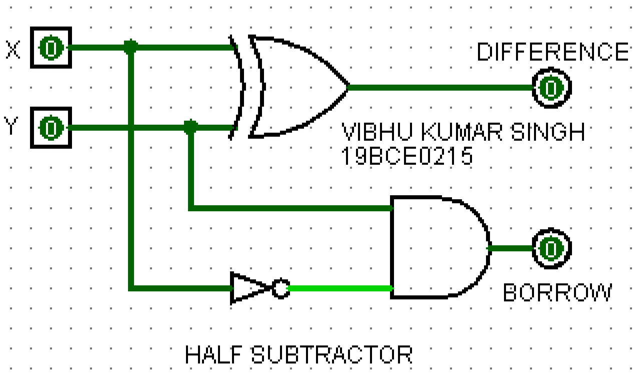
Borrow = $\Sigma(1,2,3,7)$

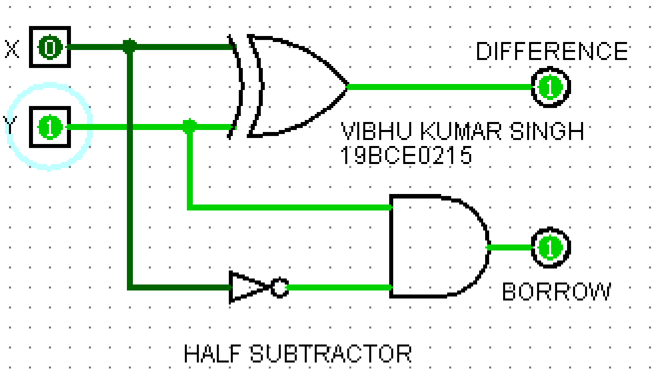


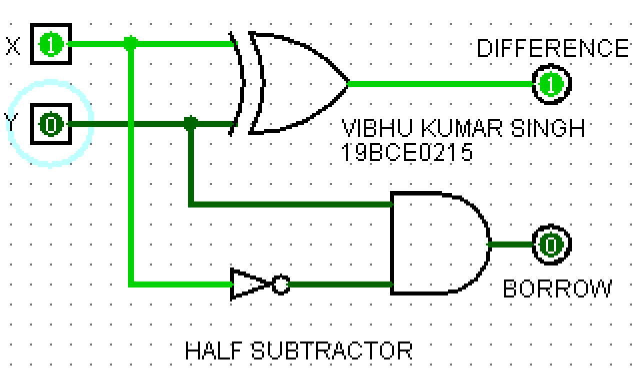
$= X'Z + X'Y + YZ$

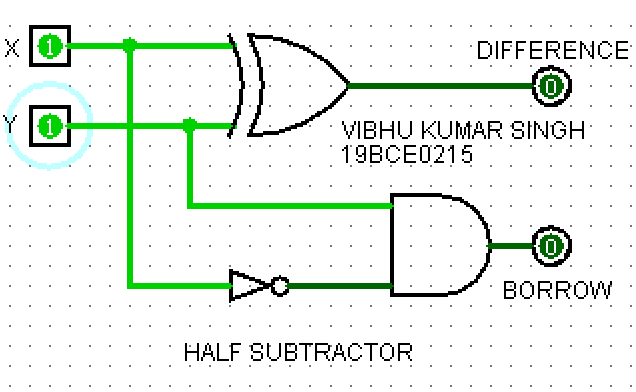
SCREENSHOTS(4 Each):

HALF SUBTRACTOR:

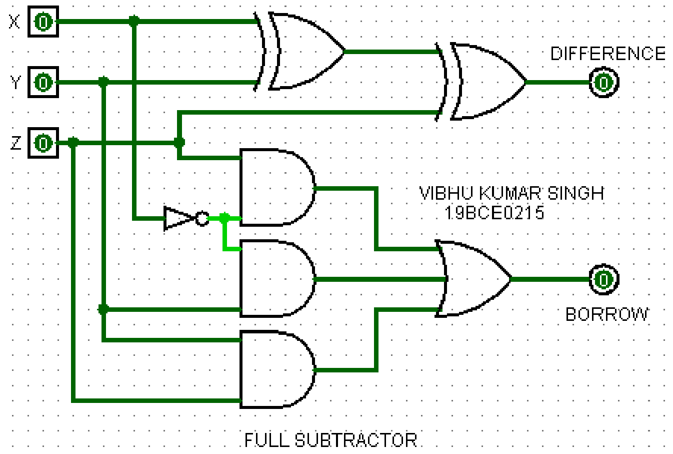


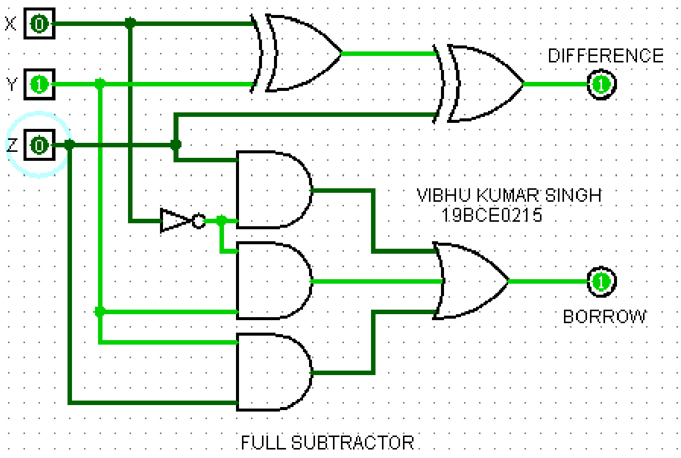


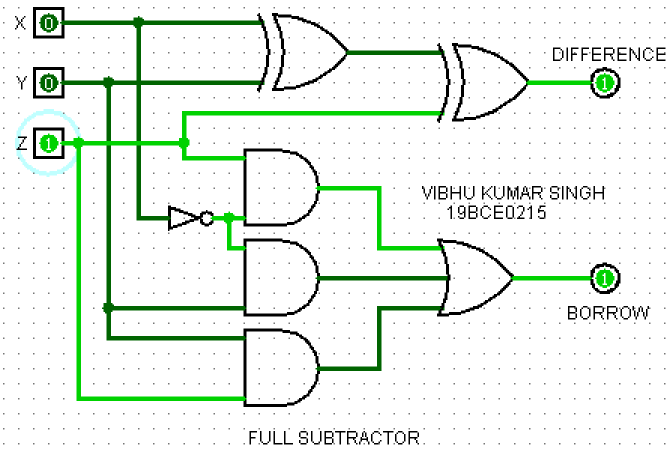


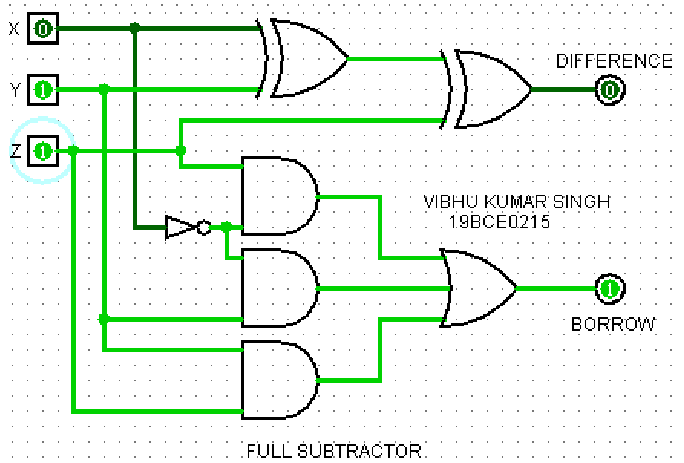


FULL SUBTRACTOR:









Q1)(iv) Design a full subtractor using two half subtractors.(Gates and Half Subtractor IC)

Ans 1(iv))

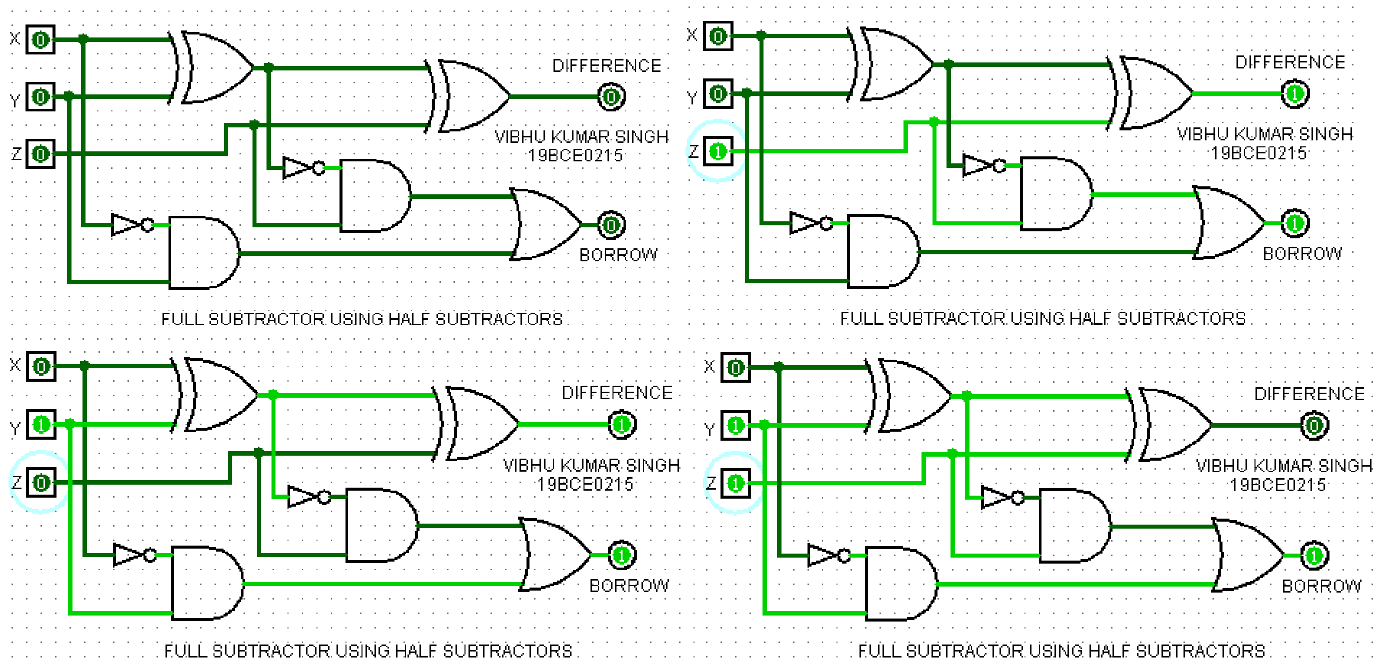
Truth Tables:

HALF SUBTRACTOR			
INPUT		OUTPUT	
X	Y	Difference	Borrow
0	0	**0**	**0**
0	1	**1**	**1**
1	0	**1**	**0**
1	1	**0**	**0**

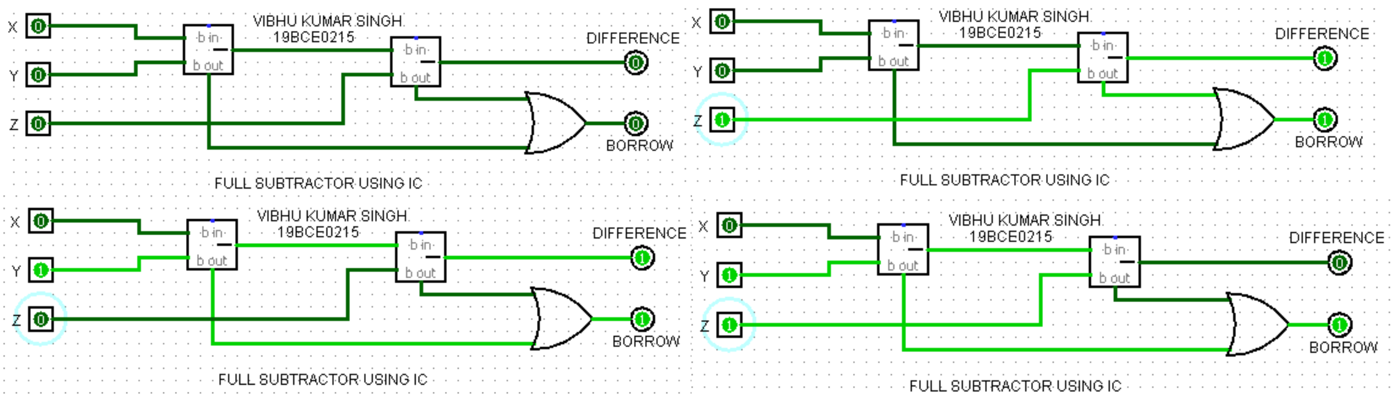
FULL ADDER				
INPUT			OUTPUT	
X	Y	Z	Sum	Carry
0	0	0	**0**	**0**
0	0	1	**1**	**0**
0	1	0	**1**	**0**
0	1	1	**1**	**1**
1	0	0	**1**	**0**
1	0	1	**0**	**1**
1	1	0	**0**	**1**
1	1	1	**1**	**1**

<u>SCREENSHOTS(4 Each):</u>

USING GATES:



USING IC:



Q2)(i) Design a combinational circuit which converts 2 4 2 1 code to 8 4 -2 -1 code.

Ans 2(i))

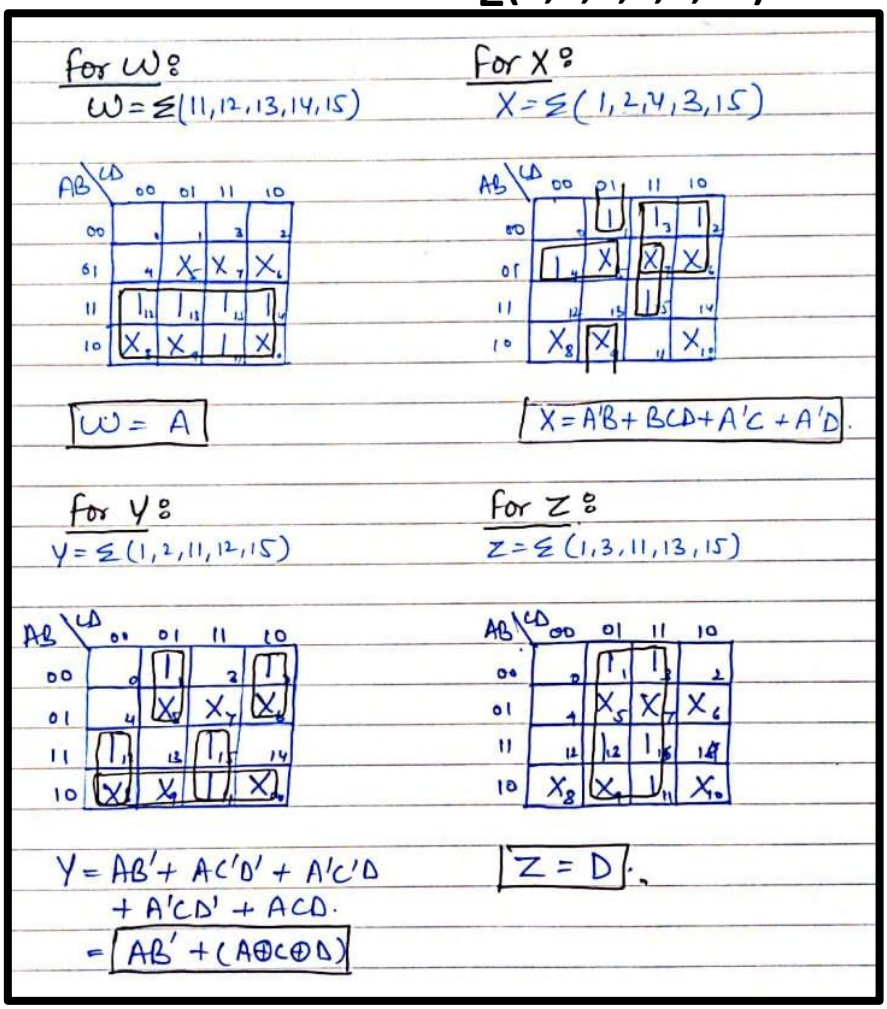
Truth Table:

Decimal digits	2	4	2	1	Minterms
	A	B	C	D	
0	0	0	0	0	[0]
1	0	0	0	1	[1]
2	0	0	1	0	[2]
3	0	0	1	1	[3]
4	0	1	0	0	[4]
5	1	0	1	1	[11]
6	1	1	0	0	[12]
7	1	1	0	1	[13]
8	1	1	1	0	[14]
9	1	1	1	1	[15]

8	4	-2	-1
W	**X**	**Y**	**Z**
0	0	0	0
0	1	1	1
0	1	1	0
0	1	0	1
0	1	0	0
1	0	1	1
1	0	1	0
1	0	0	1
1	0	0	0
1	1	1	1

EXPRESSIONS:

Don't care terms: ∑(5,6,7,8,9,10)



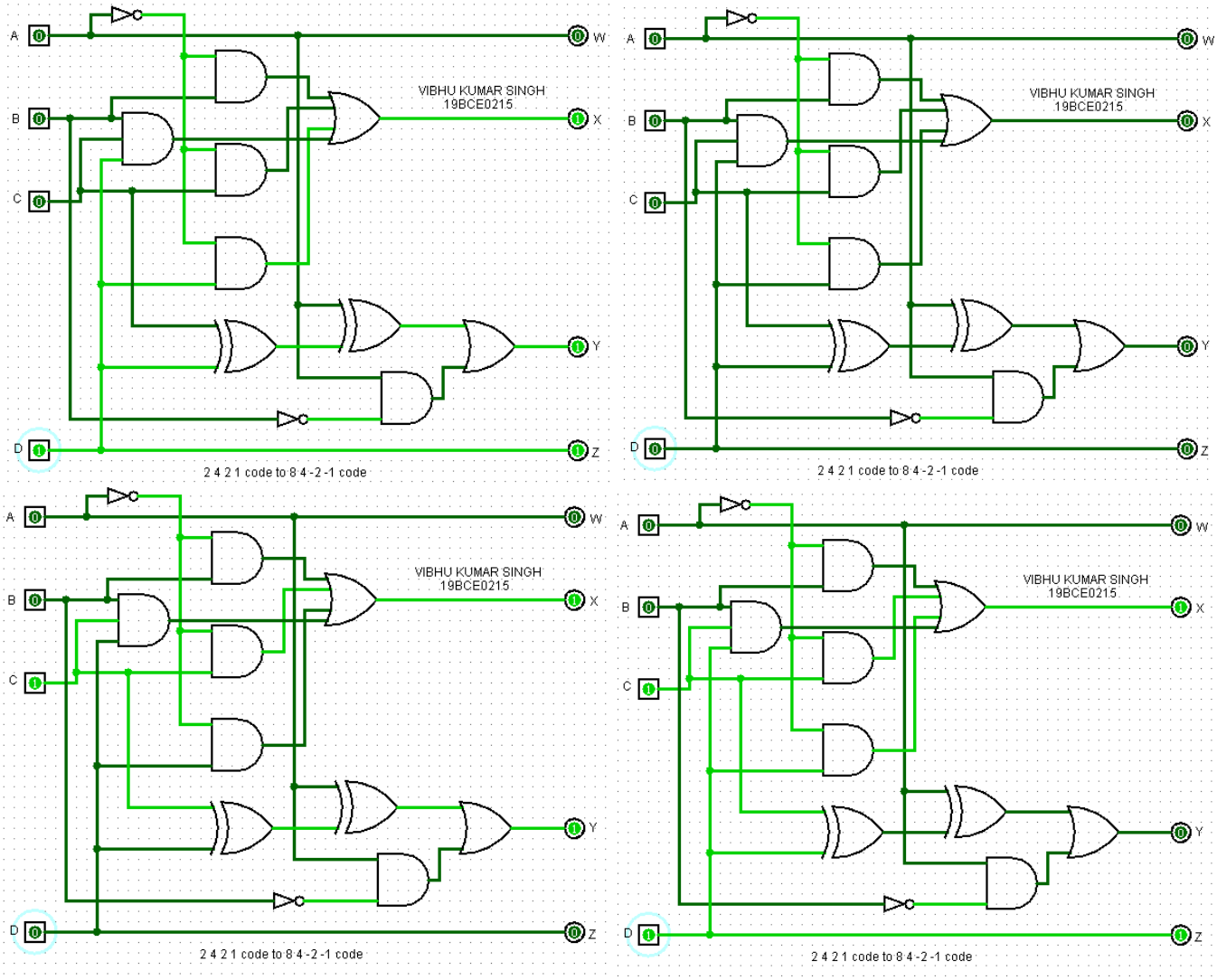
W=A

X=A'.B+A'.D+A'.C+B.C.D

Y=A.B'+(A⊕C⊕D)

Z=D

SCREENSHOTS(4):



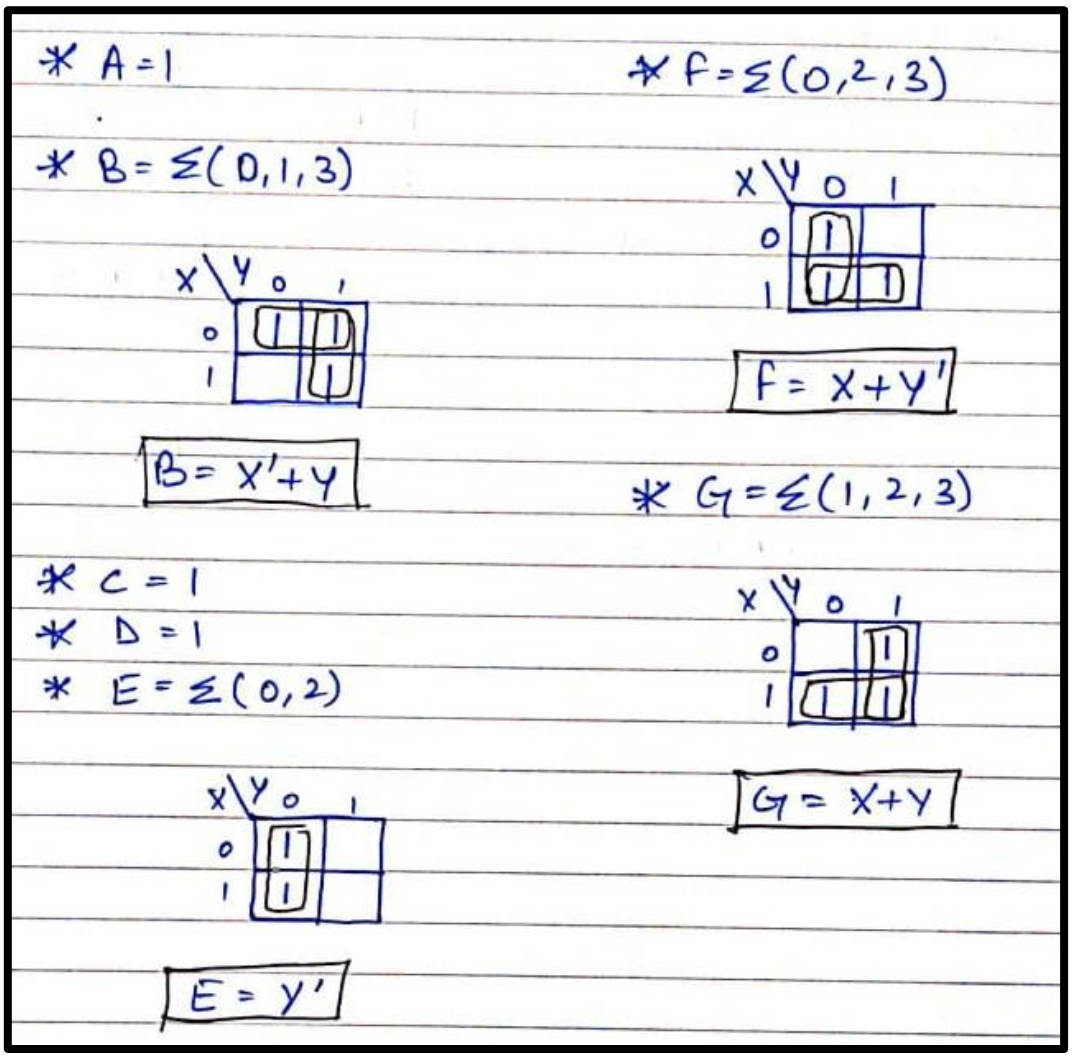
Q2)(ii) Design a circuit to display thrice of a number on seven segment display (Consider maximum input number to be 2 bit)

Ans 2(ii))

Truth Table:

Inputs		Multiplier	Outputs						
X	**Y**		**A**	**B**	**C**	**D**	**E**	**F**	**G**
0	0	0	1	1	1	1	1	1	0
0	1	3	1	1	1	1	0	0	1
1	0	6	1	0	1	1	1	1	1
1	1	9	1	1	1	1	0	1	1

EXPRESSIONS:



SCREENSHOTS(4):