ECE216: Digital Electronics Laboratory

Exp 4: Understanding the combinational logic by implementing the boolean function using decoder

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A Decoder is a device which can convert/decode the n-variable input to 2^n o/ps. line

110

Dec

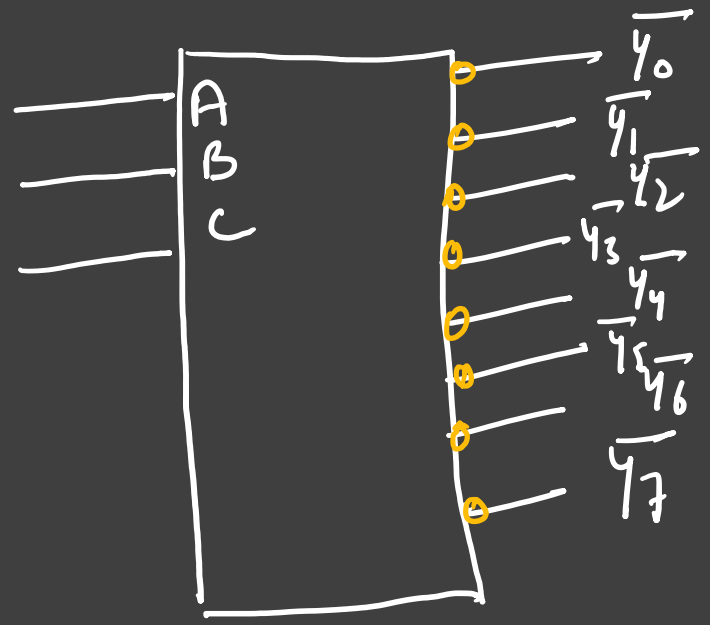
6 note: All to o/ps are active low

Q: How many Variable function can be implemented using $n: 2^n$ decoder

A)

$n : 2^n$

No. of inputs	No. of o/ps
$n=1$	1:2
$n=2$	2:4
$n=3$	3:8
$n=4$	4:16
$n=5$	5:32
⋮	⋮



	C	B	A	$\overline{Y_0}$	$\overline{Y_1}$	$\overline{Y_2}$	$\overline{Y_3}$	$\overline{Y_4}$	$\overline{Y_5}$	$\overline{Y_6}$	$\overline{Y_7}$
0	0	0	0	0	1	1	1	1	1	1	1
1	0	0	1	1	0	1	1	1	1	1	1
4	1	0	0	1	1	1	1	0	1	1	1

Experiment 4

1. Aim: To design a circuit to implement Boolean functions using Decoders.

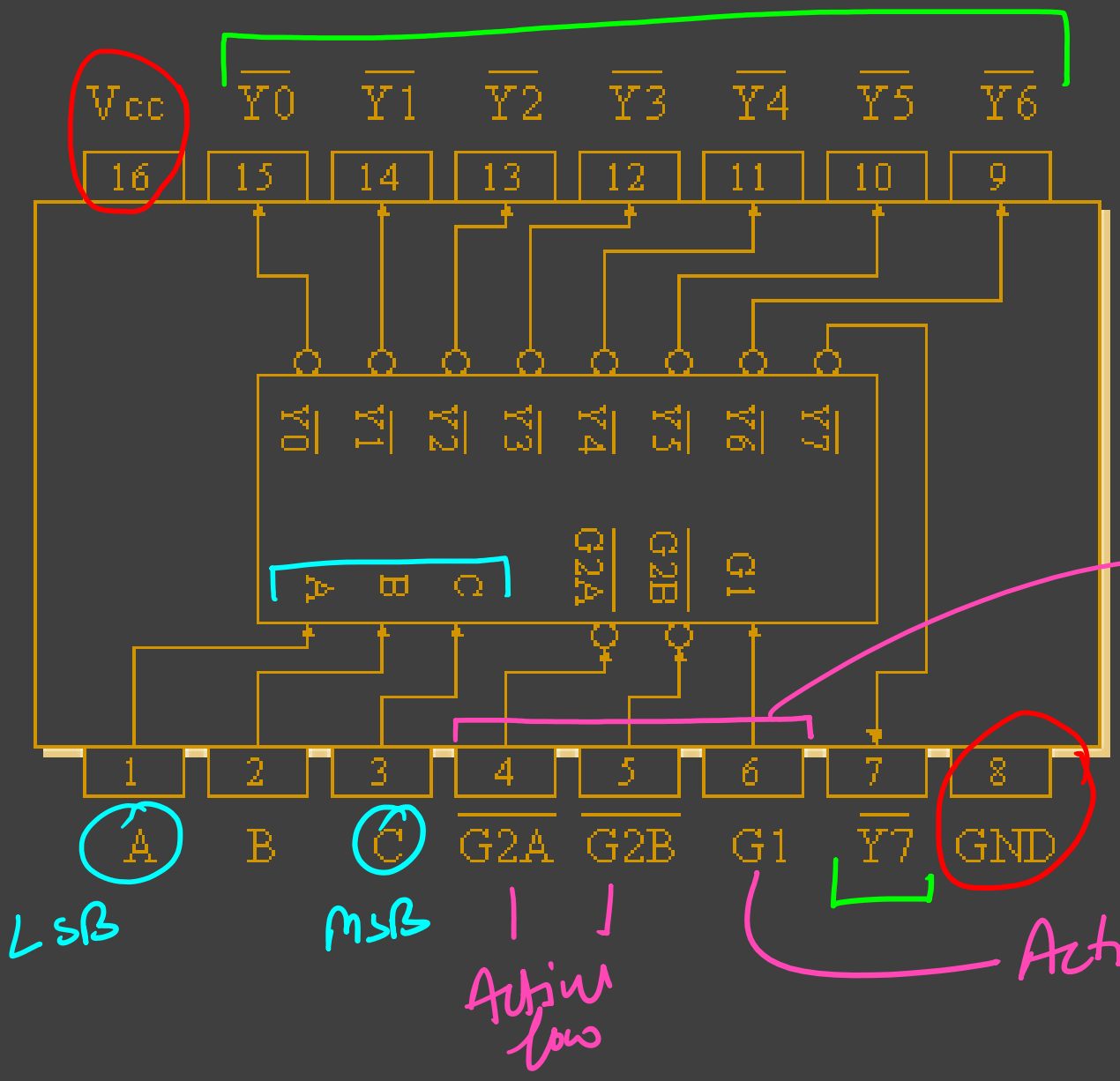
Apparatus required: IC 74138, 7404, 7432, 7400, 7408, 7410 and LEDs.

2. Learning Objectives: This experiment enables a student to learn:

How to realize functionality of a 3-to-8-line active low Decoder viz. 74138 IC. That is on setting the two-active low and one active high enable inputs to proper level, one can verify that one and only one of the eight active low outputs is asserted based on the values assigned to three select input.

3. Theory: IC 74138 works as a 3-to-8 active low decoder, based on the values assigned to three select inputs of the three enable inputs, G1 must be made high value while G2A and G2B must be low. The eight active low inputs (Y0 to Y7) correspond to eight max terms (M0 to M7) or in other words, component of the corresponding min terms m0-m7. For example, Y0 = component of C B A = C+B+A.

+Vcc
GND
G1 — Vcc
G2A
G2B — GND



Inputs					Outputs							
ENABLE		SELECT										
G1	G2'	C	B	A	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7
X	H	X	X	X	H	H	H	H	H	H	H	H
L	X	X	X	X	H	H	H	H	H	H	H	H
H	L	L	L	L	L	H	H	H	H	H	H	H
H	L	L	L	H	H	L	H	H	H	H	H	H
H	L	L	H	L	H	H	L	H	H	H	H	H
H	L	L	H	H	H	H	H	L	H	H	H	H
H	L	H	L	L	H	H	H	H	L	H	H	H
H	L	H	L	H	H	H	H	H	H	L	H	H
H	L	H	H	L	H	H	H	H	H	H	L	H
H	L	H	H	H	H	H	H	H	H	H	H	L

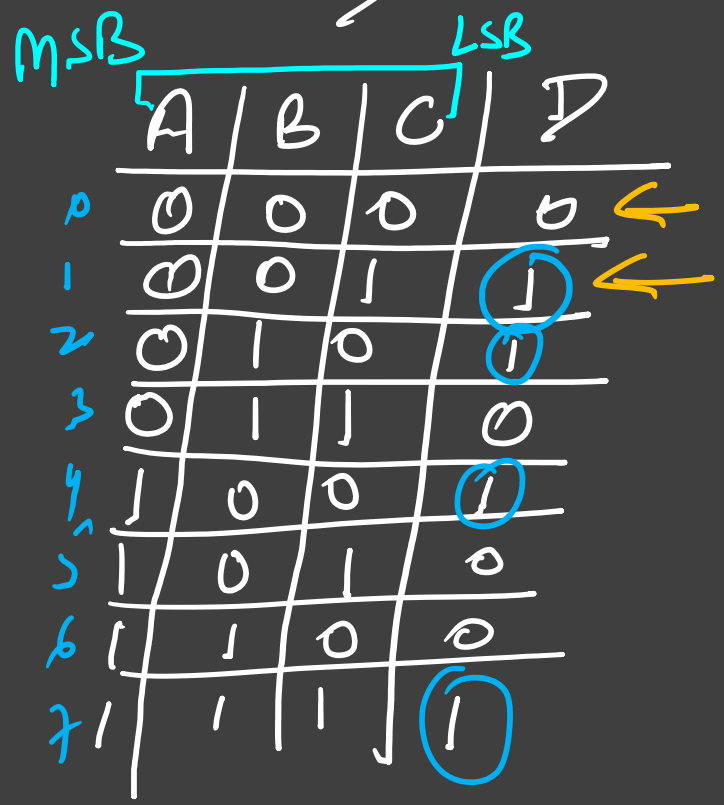
$\overline{G2A}$
$\overline{G2B}$

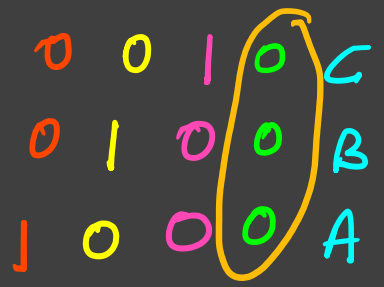
H- high (1)
L- low (0)
X- Don't care

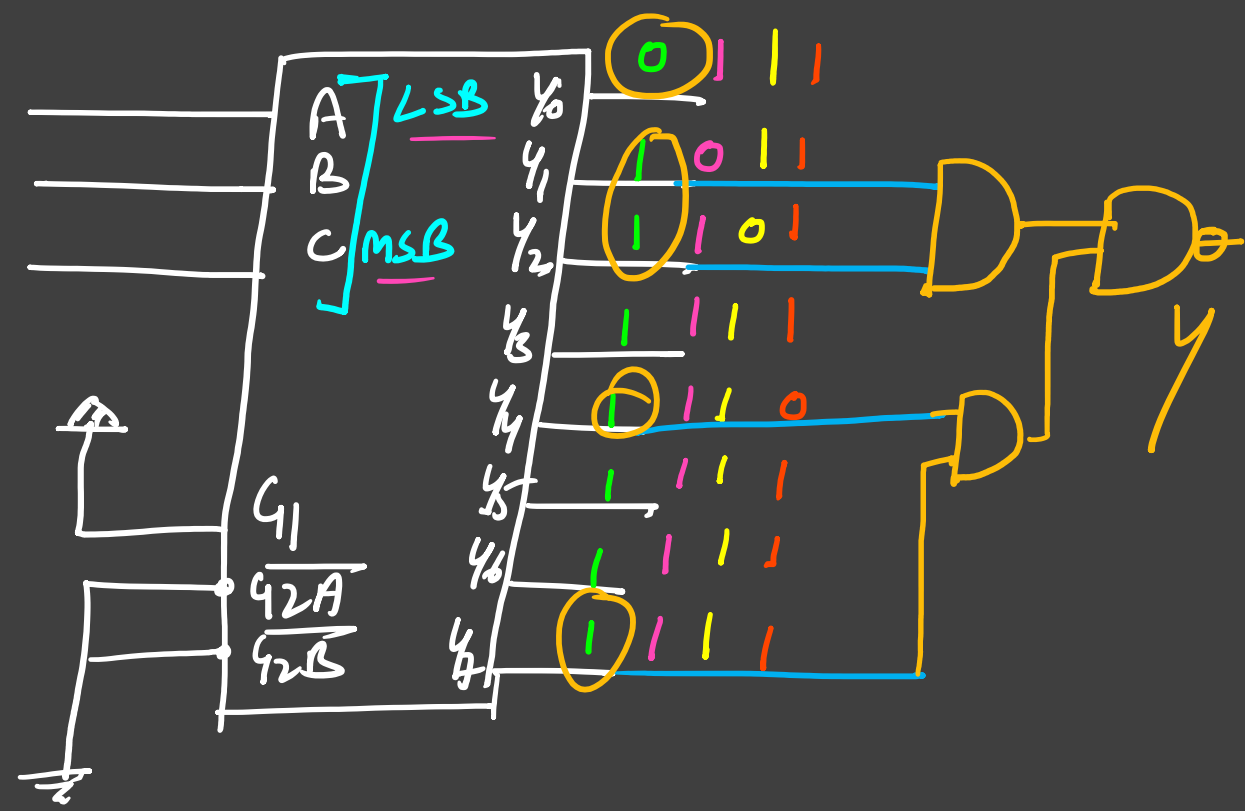
Understanding the combinational logic by implementing the boolean function using decoder

Ex Diffn of full subtr

$D = A \oplus B \oplus C = \Sigma m(1,2,4,7)$







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U2:A
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U2:B
74LS08

U3:A
74LS00

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09:59
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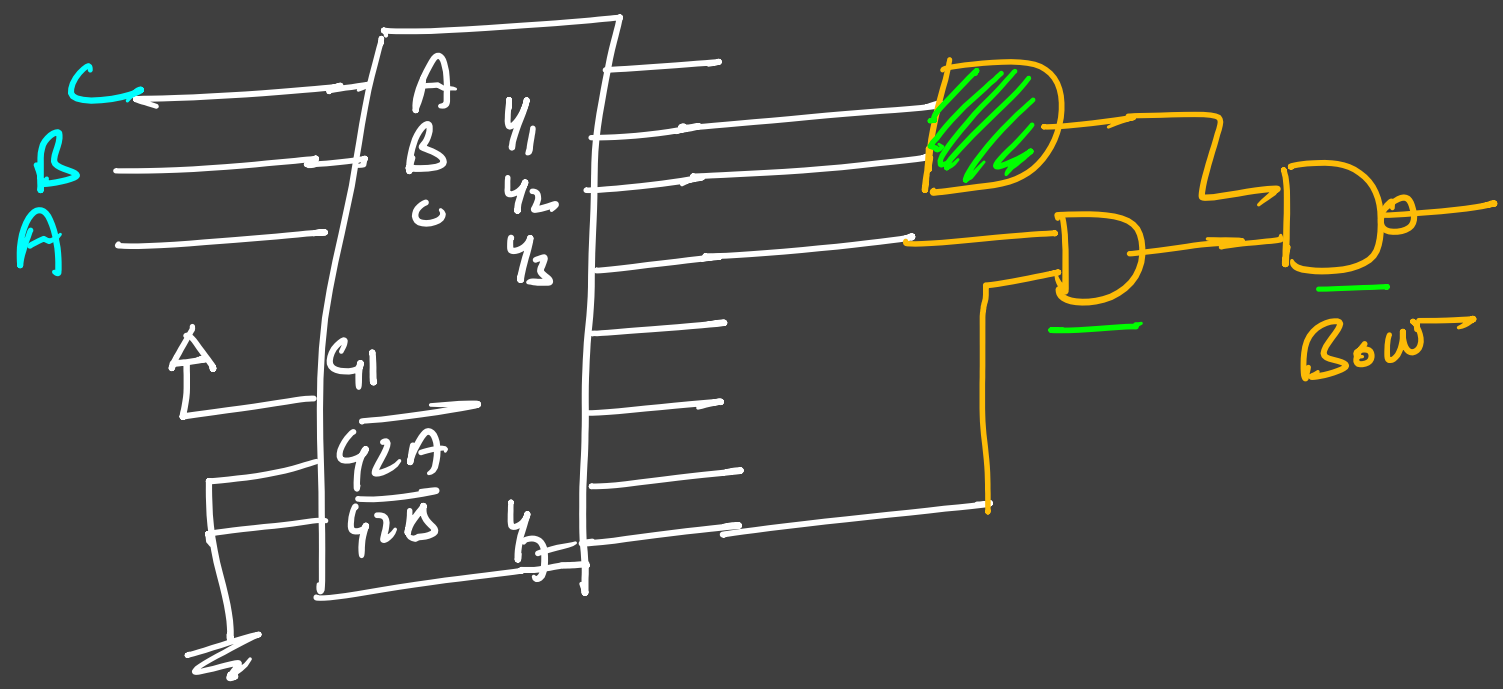
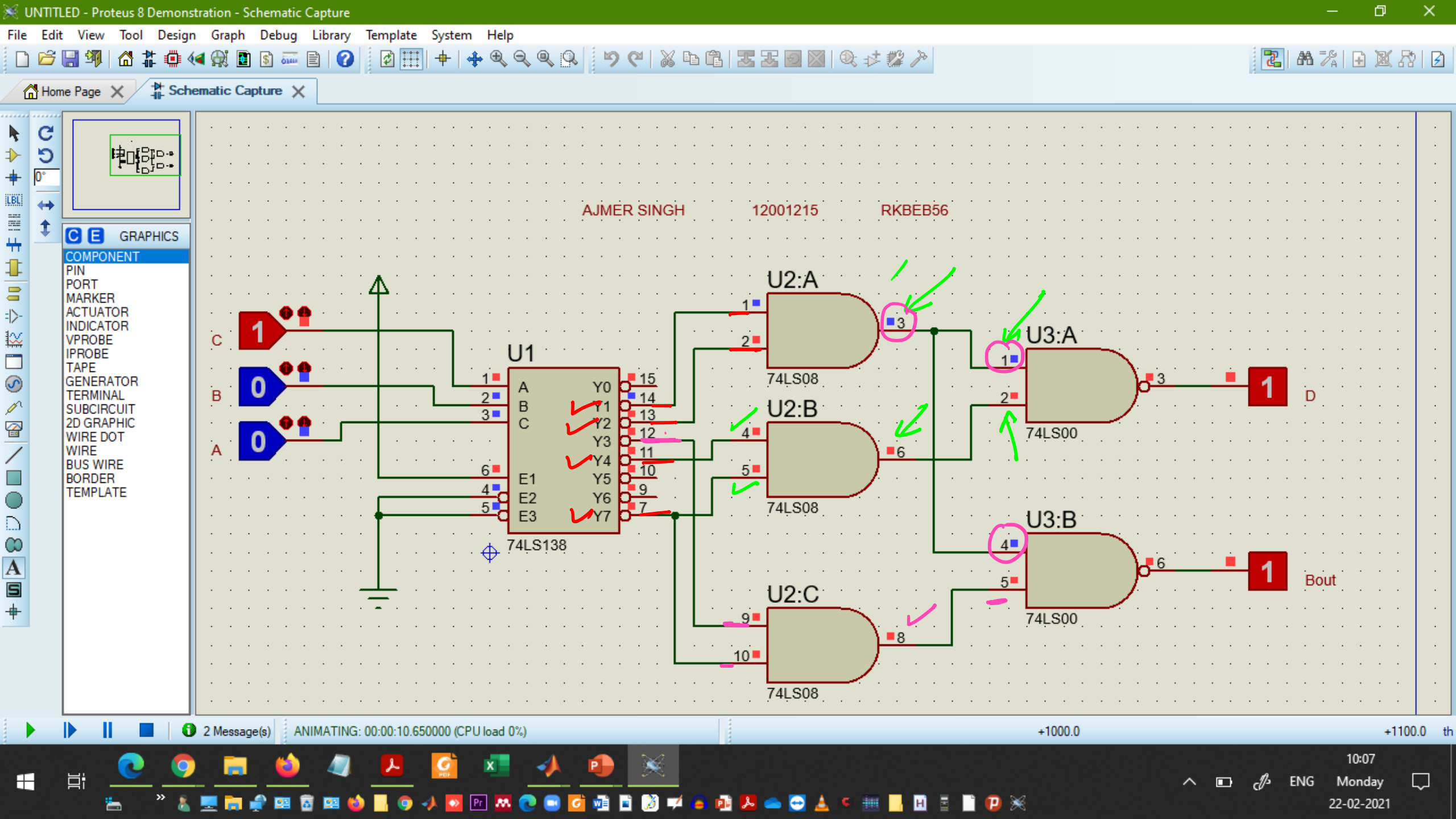
Ex Borrow of full Subtr

$$B_{out} = \overline{A \oplus B}\, C + \bar{A} B = \sum m(1,2,3,7)$$

	A	B	C	Bout
0	0	0	0	0
1	0	0	1	1
2	0	1	0	1
3	0	1	1	1
4	1	0	0	0
5	1	0	1	0
6	1	1	0	0
7	1	1	1	1

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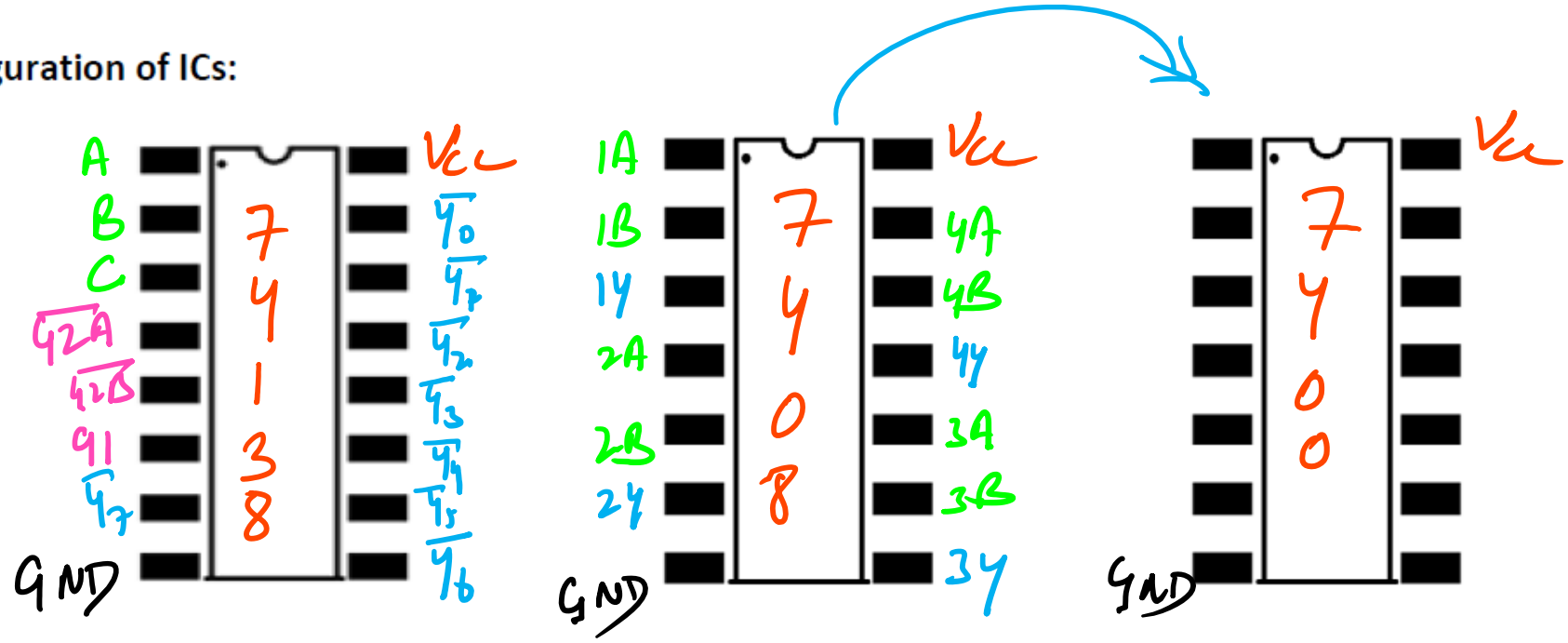
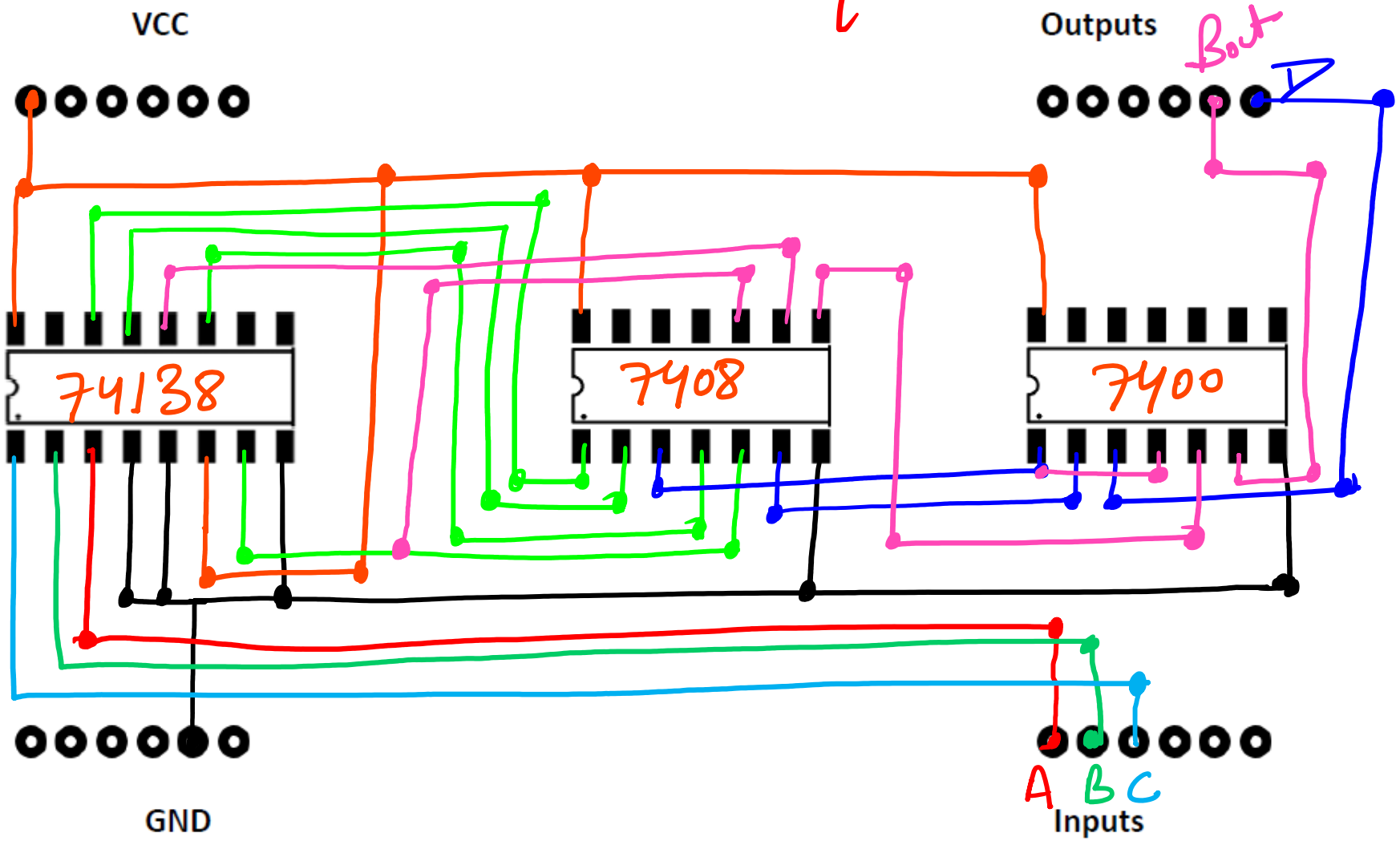
Pin configuration of ICs:



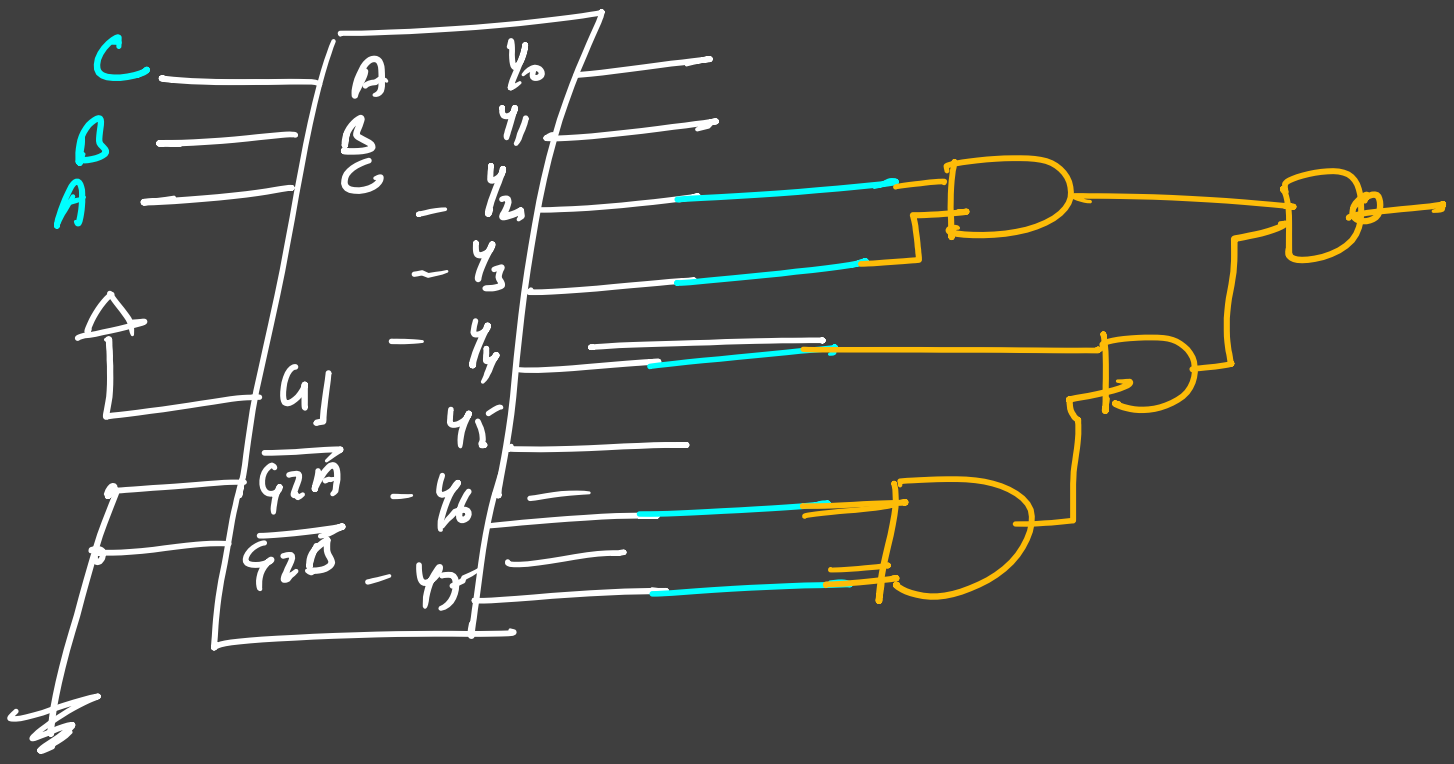
Draw Bread Board Connection diagram: full Subtractor using Decoder 3:8 (74138)

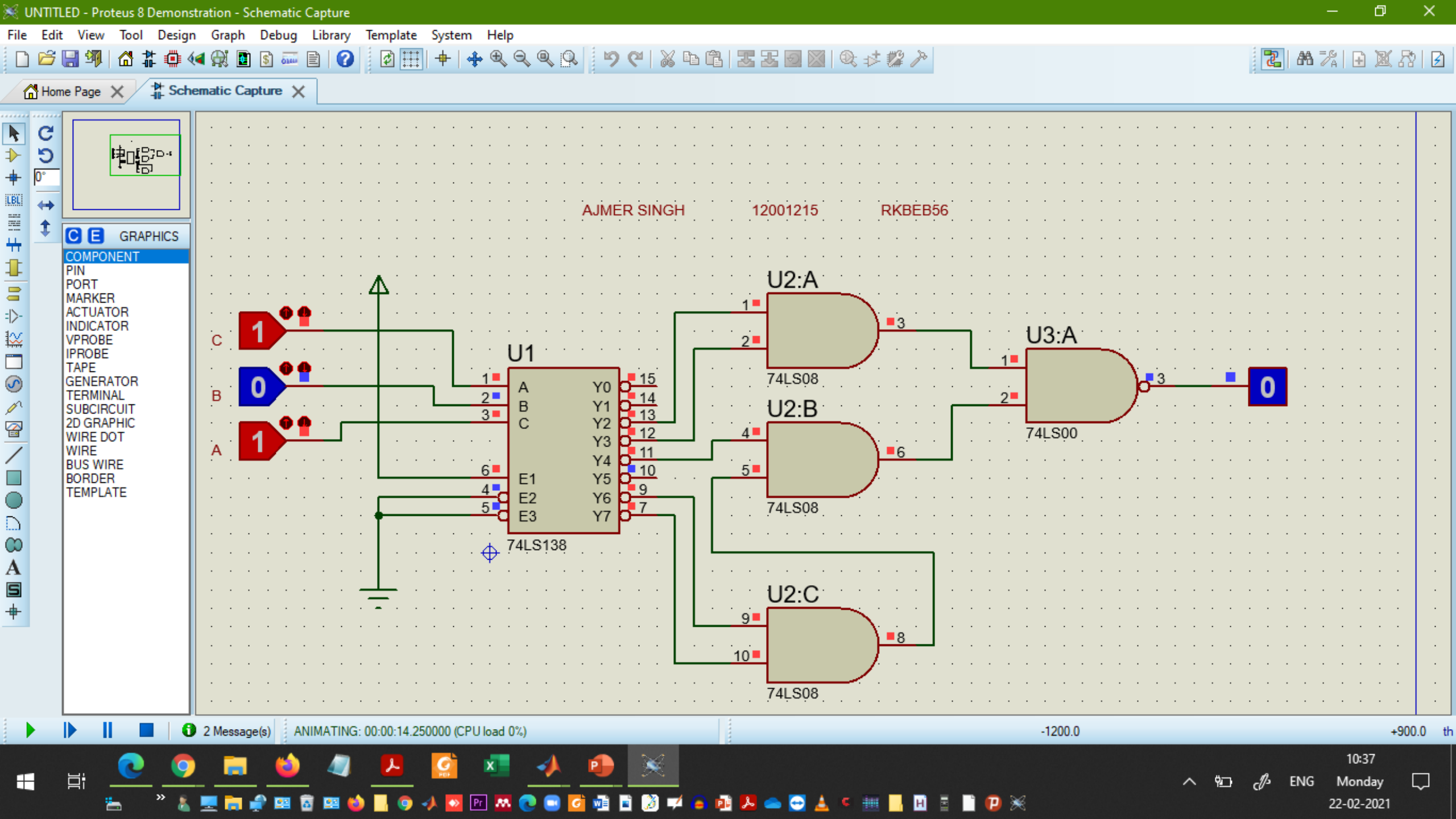


Ex Implement the following Boolean fun. using 3:8 decoder

$$Y = \Pi M(0,1,5) = \Sigma m(2,3,4,6,7)$$

	A	B	C	Y
0	0	0	0	0
1	0	0	1	0
2	0	1	0	1
3	0	1	1	1
4	1	0	0	1
5	1	0	1	0
6	1	1	0	1
7	1	1	1	1

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2 Message(s)
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Ex Implement the following fn.

H.W

$$Y = \prod M(0, 2, 5, 6, 7)$$