EGC220
Class Notes
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What does the following binary numbers represent in
- a. Unsigned domain
- b. Signed magnitude
- c. Signed 2's complement

I.   01011101
II. 11011100
III. 11111111

$256-1$

$128\ 64\ 32\ 16\ 8\ 4\ 2\ 1$
$1\ 0\ 0\ 0\ 0\ 0\ 0\ 0$

$128\ 64\ 32\ 16\ 8\ 4\ 2\ 1$
$0\ 1\ 0\ 1\ 1\ 1\ 0\ 1 \rightarrow 93$

a.
$128\ 64\ 32\ 16\ 8\ 4\ 2\ 1$

a. (255)
b. -127
c. -1

$\sim 0000\ 100\ 1$

II. $128\ 64\ 32\ 16\ 8\ 4\ 2\ 1$
$1\ 1\ 0\ 1\ 1\ 1\ 0\ 0$

$S\ 64\ 32\ 16\ 8\ 4\ 2\ 1$
$0\ 1\ 0\ 1\ 1\ 1\ 0\ 1$
$\hookrightarrow + 93$ b.

$+ 93$ c.

a. 220

b. $-S$
-92

$1\ 0\ 1\ 1\ 0\ 0$
$\times\ 64\ 32\ 16\ 8\ 4\ 2\ 1$
c. $0\ 0\ 1\ 0\ 0\ 1\ 0\ 0$
(−36)

10110

a. unsigned.

16 8 4 2 1
10110

$\boxed{22}$

b. Signed.

   I. signed Mag.   10110 → −6

                                            8 4 2 1
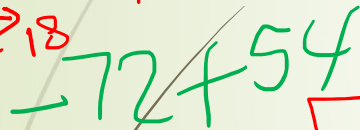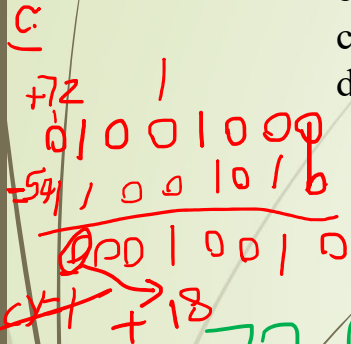
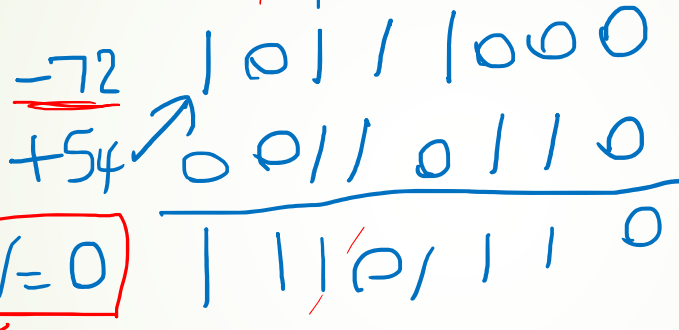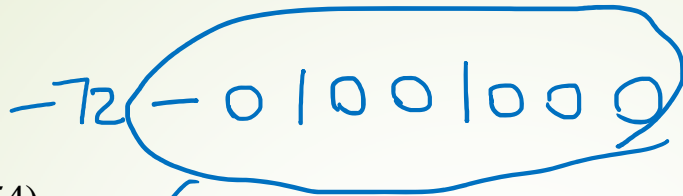   II. signed 2's comp.   10110 $\xrightarrow{2S}$ −01010

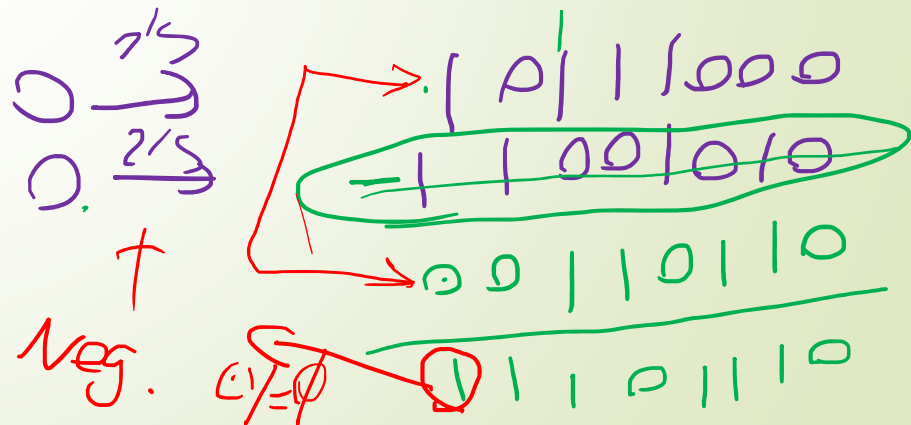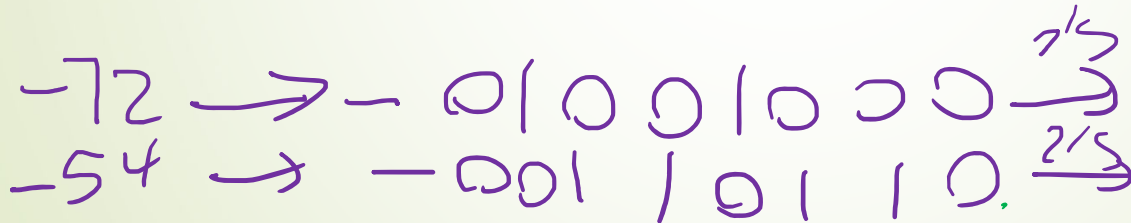   −10

How many bits

1. Perform the following operations in binary. Assume signed 2's complement notation.
   a. 54 + 72
   b. 54 − 72
   c. 72 − 54
   d. (−72) − (−54)

-72 $(-0100100 0)$

$2's$ 1 1
-72 $1011 1000$
$+54$ $0011 0110$
$CY=0$ $111 0/ 11$ 0 $1's$

c.
$+72$ 1
01001000
-54 $1001011 0$
$0 00100 10$
$CY+ +18$
$-72+54$

S 64 32 16 8 4 2 1
$+54$ 0 0 1 1 0 1 1 0
$+72$ 0 1 0 0 1 0 0 0
$+126$ 0 1 1 1 1 1 1 0
    +

$- 00 01 0 010$
-18

d.
$-72 \rightarrow - 0100100 0 \xrightarrow{2's}$
$-54 \rightarrow - 001 1011 0. \xrightarrow{2's}$
$+$
Neg. $CY=0$

$1 01 1000$
-11001010
$001 10110$
$01 1 01110$

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$\bar{X}$

$D.\bar{X}$

D

$\bar{X}$

$D\bar{X}$

A

$A + D\bar{X}$
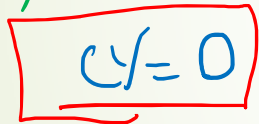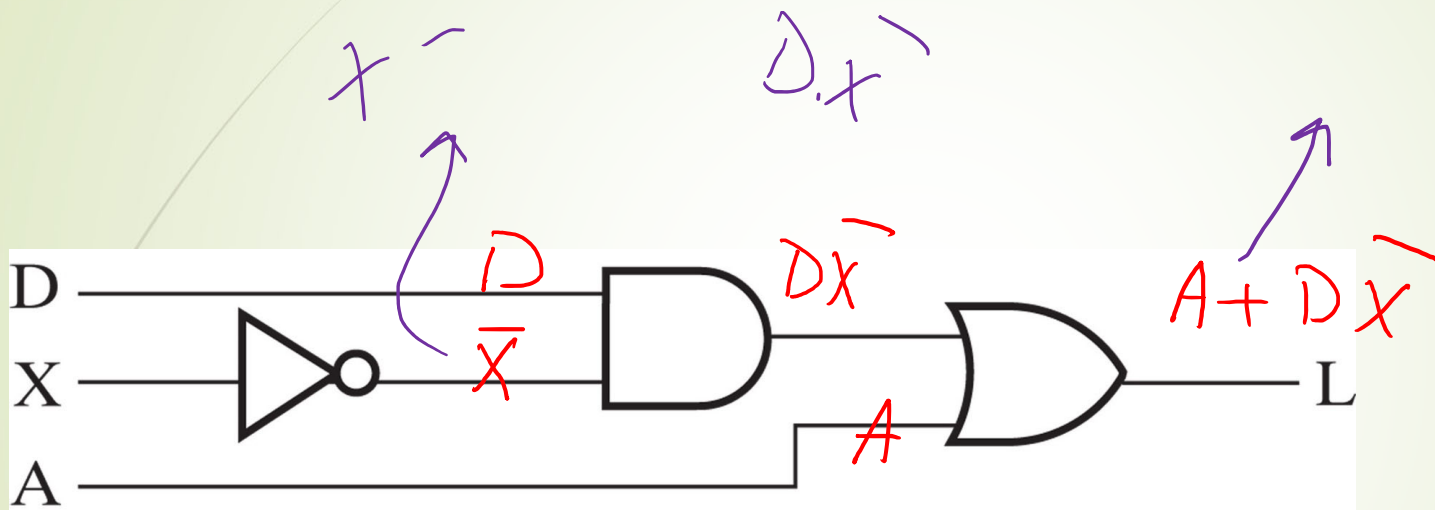
TABLE 2-5
Truth Table for the Function $L = D\overline{X} + \overline{A}$

D	X	$\overline{X}$	A	$D\overline{X}$	$D\overline{X} + \overline{A}$	$L = D\overline{X} + \overline{A}$
0	0	1	0	0	1	0
0	0	1	1	0	0	1
0	1	0	0	0	1	0
0	1	0	1	0	1	1
1	0	1	0	1	1	1
1	0	1	1	1	1	1
1	1	0	0	0	1	0
1	1	0	1	0	0	1

(handwritten annotations)

AND OR

$Y = 4X2 + 5$

$4X\frac{1}{2} + 5$

'S

$X \to \overline{X}$

$A \to \overline{A}$

$D\overline{X}$
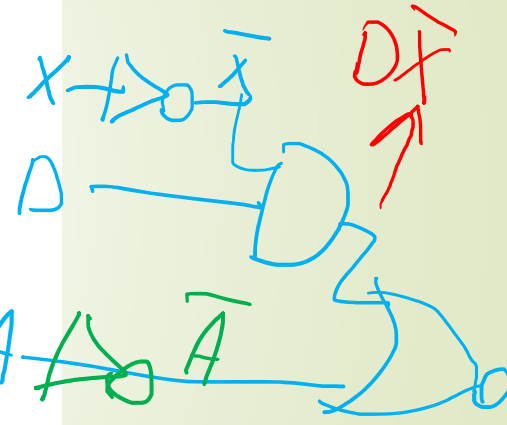
NOR → OR & NOT
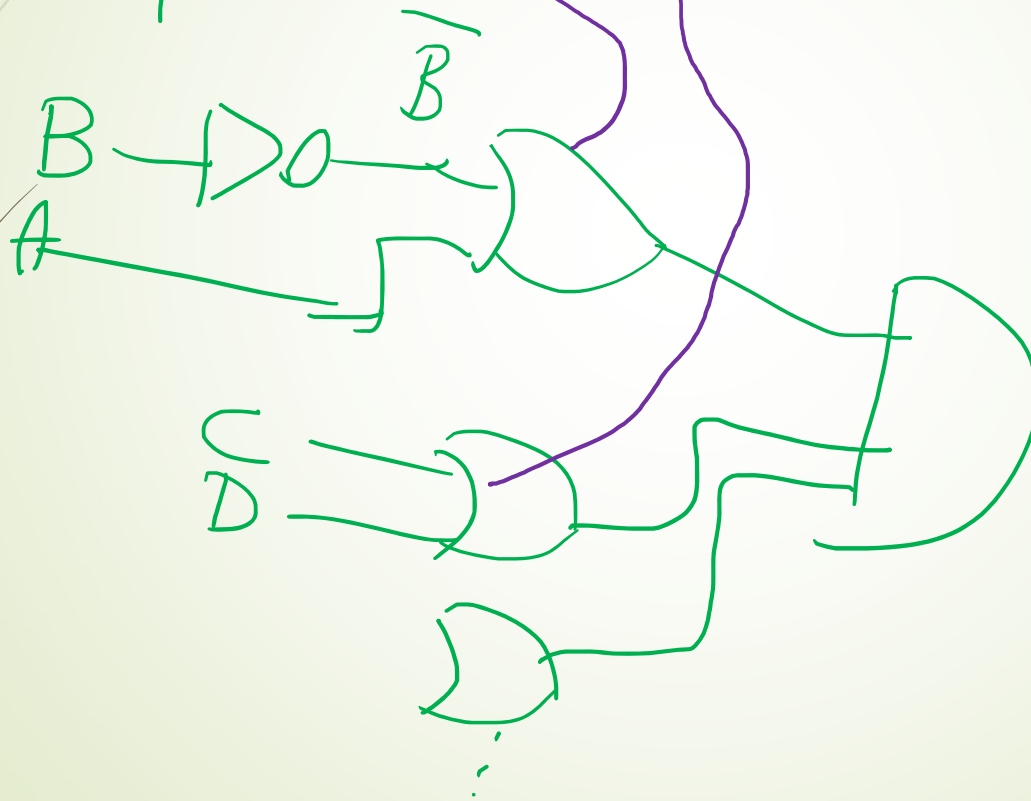
TABLE 1-5
American Standard Code for Information Interchange (ASCII)

$B_4B_3B_2B_1$	$B_7B_6B_5$							
	000	001	010	011	100	101	110	111
0000	NULL	DLE	SP	0	@	P	`	p
0001	SOH	DC1	!	1	A	Q	a	q
0010	STX	DC2	"	2	B	R	b	r
0011	ETX	DC3	#	3	C	S	c	s
0100	EOT	DC4	$	4	D	T	d	t
0101	ENQ	NAK	%	5	E	U	e	u
0110	ACK	SYN	&	6	F	V	f	v
0111	BEL	ETB	'	7	G	W	g	w
1000	BS	CAN	(	8	H	X	h	x
1001	HT	EM	)	9	I	Y	i	y
1010	LF	SUB	*	:	J	Z	j	z
1011	VT	ESC	+	;	K	[	k	{
1100	FF	FS	,	<	L	\	l	|
1101	CR	GS	-	=	M	]	m	}
1110	SO	RS	.	>	N	^	n	~
1111	SI	US	/	?	O	_	o	DEL

2. Decide the following ASCII code

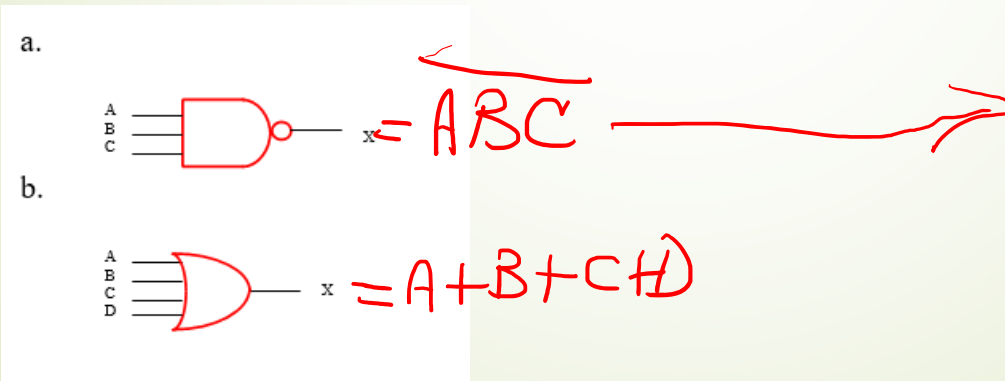1000010 1101001 1101100 1101100 1000111 1100001 1110100 1100101 1110011

BillGates

3. Convert 134_{10} to BCD code

8421
000100110100 $\neq$ 134_{10}
  1   3   4

84 21
9 $\leftrightarrow$ 1001

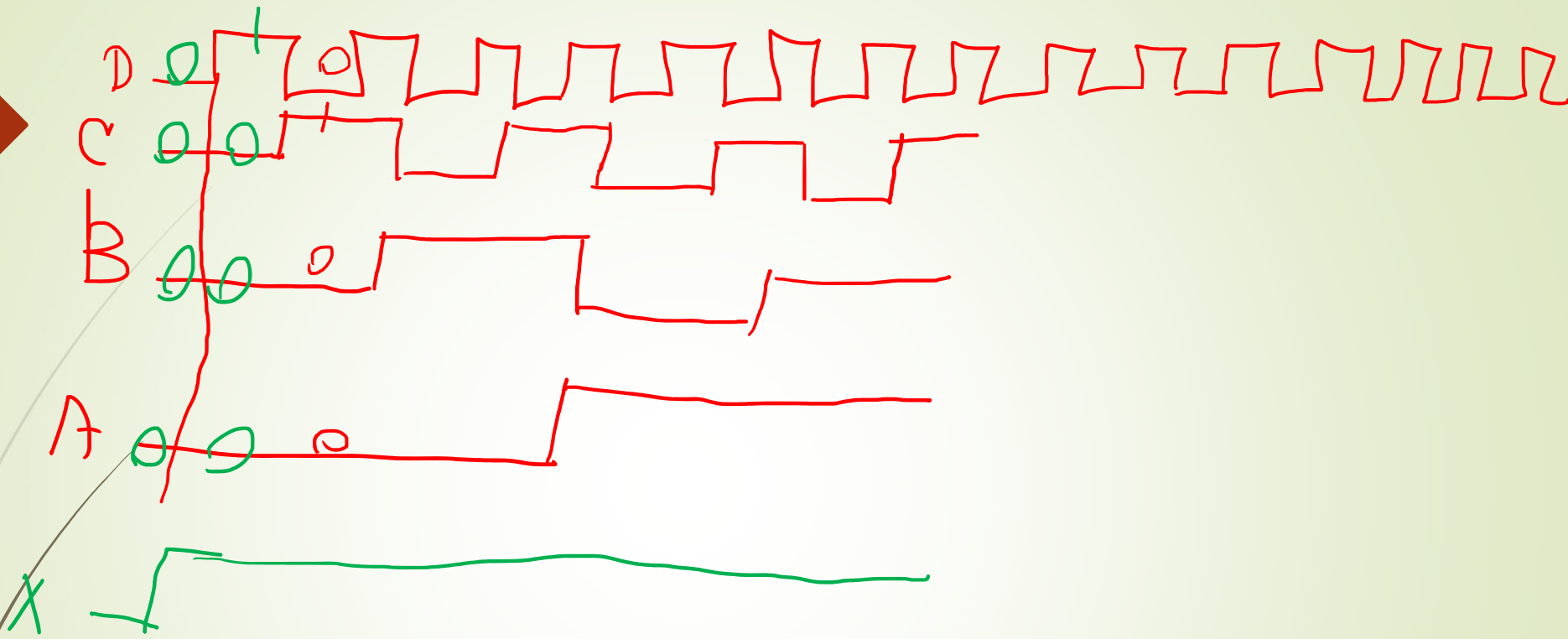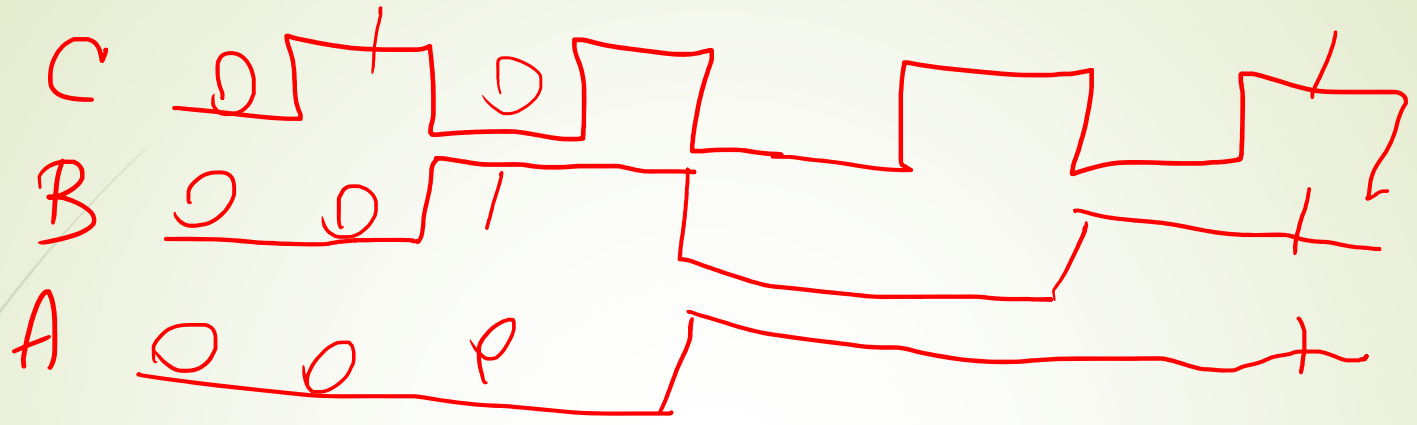4. By means of truth table and waveform determine the outputs of the circuit

a.

A
B
C

$x = \overline{ABC}$

b.

A
B
C
D

$x = A+B+C+D$

X=

A	B	C		$\overline{A}$ B C	$A\overline{B}C$
0	0	0	0		1
0	0	1	0		1
0	1	0	0		1
0	1	1	0		1
1	0	0	0		1
1	0	1	0		1
1	1	0	0		1
1	1	1	1		0

A	B	C	D	X
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1
1	0	1	0	1
1	1	1		)

A	B	C	D	X
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	)

4

5. Write the Boolean expression of the following circuit:
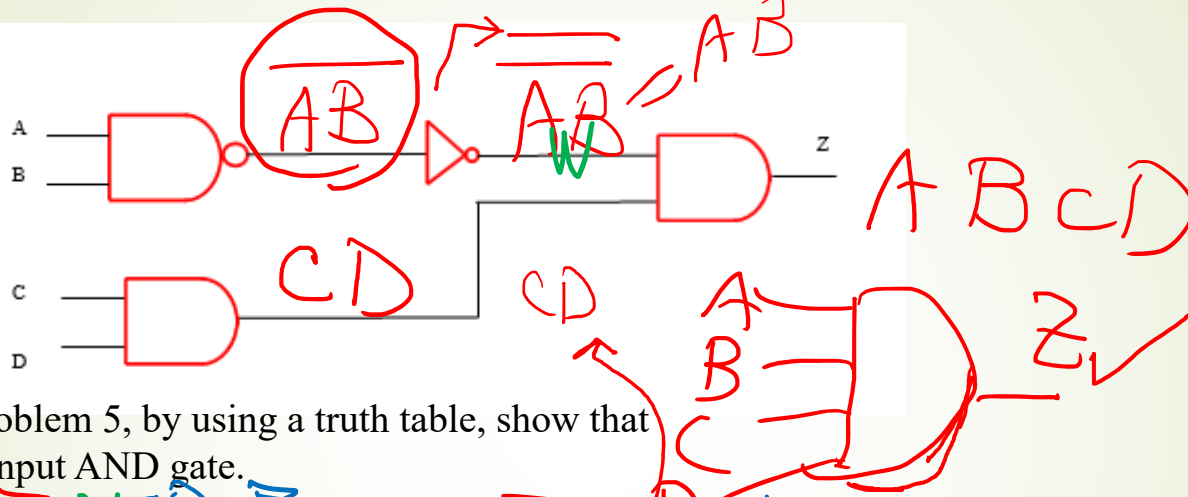
6. For the circuit in Problem 5, by using a truth table, show that it is equivalent to a 4 input AND gate.

7. Draw the logic circuit realization of the following Boolean expression as stated. Do not simplify!

$$Y = f(A, B, C) = \overline{(A + B)}(\overline{B} + C)$$