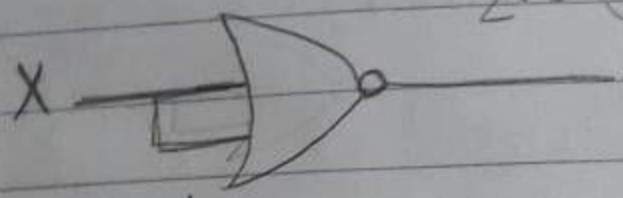
* NOR

1 NOT



NOT using NOR

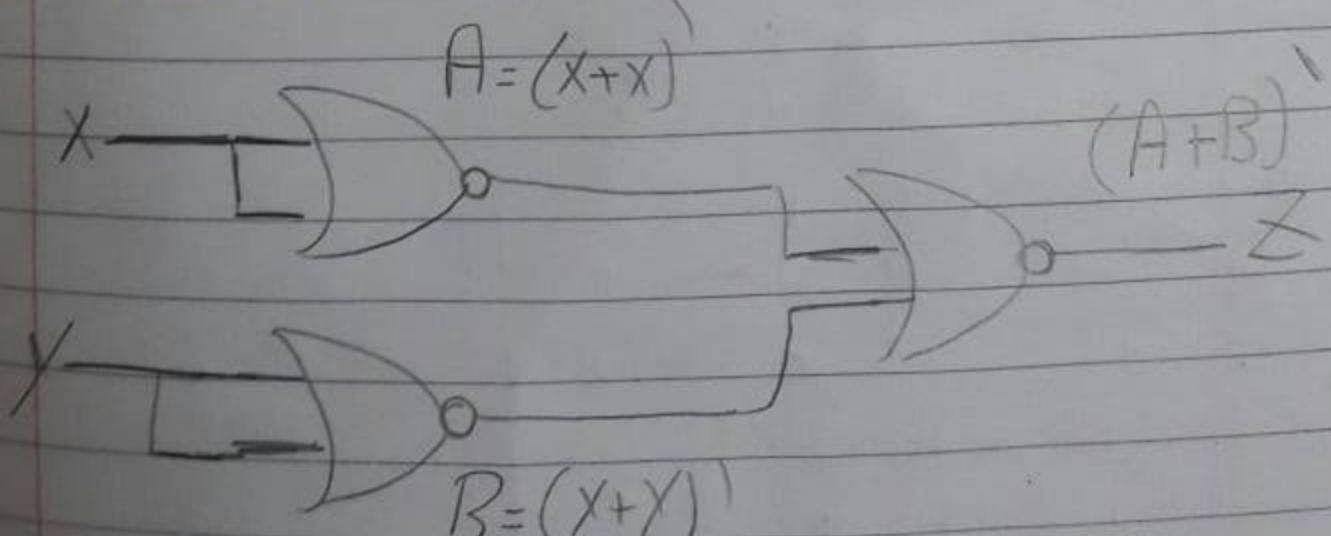
X	Z = (X+X)'
0	(0+0)' = 1
1	(1+1)' = 0

=

NOT

X	Z = X'
0	1
1	0

2 AND



AND using Nor

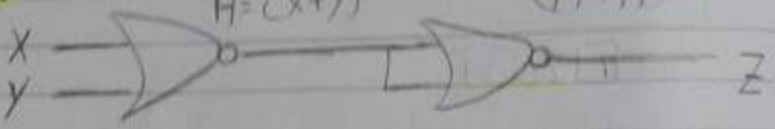
X	Y	$A=(X+X)'$	$B=(Y+Y)'$	$Z=(A+B)'$
0	0	$(0+0)'=1$	$(0+0)'=1$	$(1+1)'=0$
0	1	$(0+0)'=1$	$(1+1)'=0$	$(1+0)'=0$
1	0	$(1+1)'=0$	$(0+0)'=1$	$(0+1)'=0$
1	1	$(1+1)'=0$	$(1+1)'=0$	$(0+0)'=1$

=

AND

X	Y	Z=X.Y
0	0	0
0	1	0
1	0	0
1	1	1

[3] OR



OR using Nor.

X	Y	$A=(X+Y)'$	$Z=(A+A)'$
0	0	$(0+0)'=1$	$(1+1)'=0$
0	1	$(0+1)'=0$	$(0+0)'=1$
1	0	$(1+0)'=0$	$(0+0)'=1$
1	1	$(1+1)'=0$	$(0+0)'=1$

=

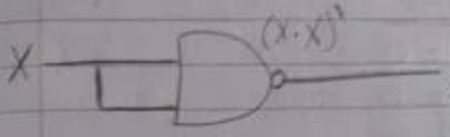
OR

X	Y	Z=X+Y
0	0	0
0	1	1
1	0	1
1	1	1

* NOT Gate Truth Table.

X	Y = X'
0	1
1	0

* NOT Representation using NAND.



X	X	Y = (X·X)'
0	0	1
1	1	0

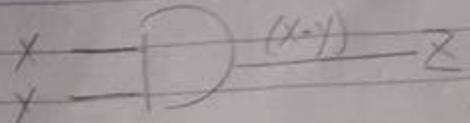
=

X	Y = X'
0	1
1	0

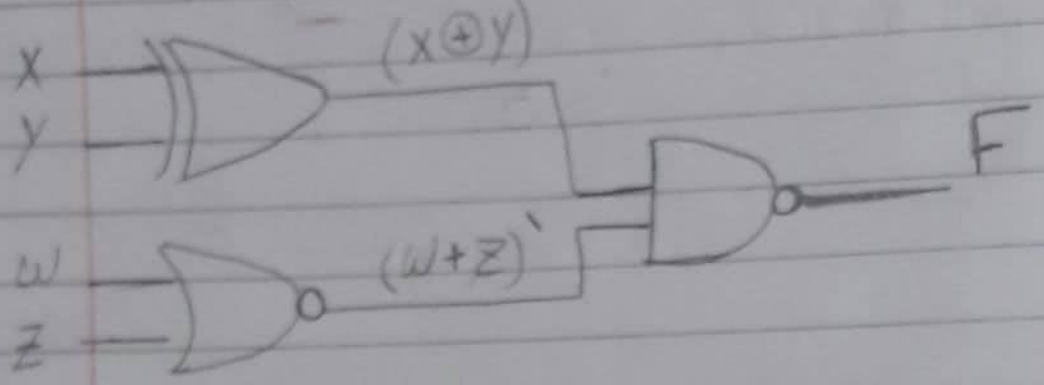
2) AND

1) AND Truth Table.

X	Y	Z = (X·Y)
0	0	0
0	1	0
1	0	0
1	1	1



[2] Find The Expression & Truth Table For The Circuit in the Fig [1]



1) Expression:

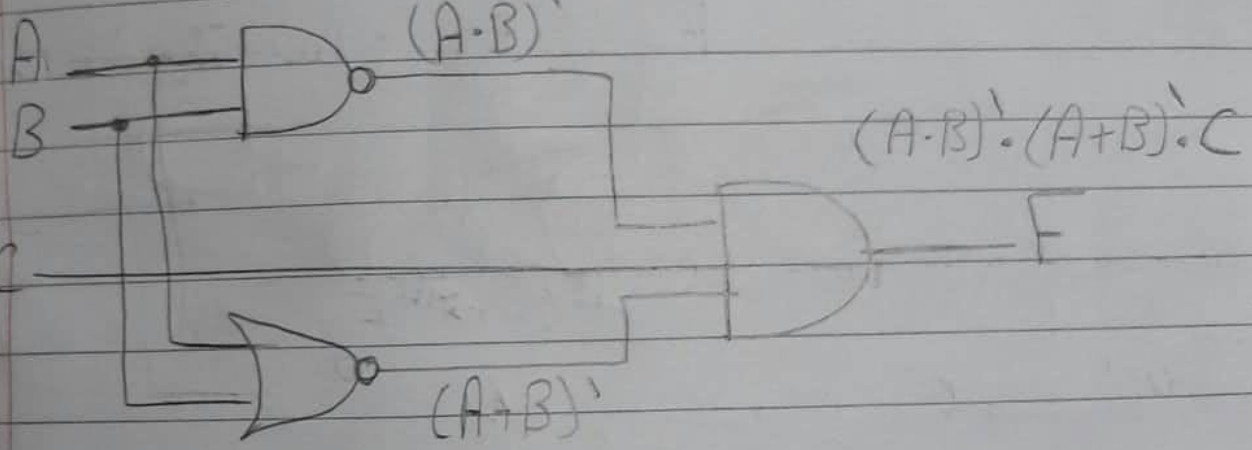
$$F = \left((X \oplus Y) \cdot (W + Z)'\right)' \quad [1]$$

2) Truth Table:

X	Y	W	Z	(X⊕Y)	(W+Z)'	F = ((X⊕Y)·(W+Z)')'
0	0	0	0	0	1	1
0	0	0	1	0	0	1
0	0	1	0	0	0	1
0	0	1	1	0	0	1
0	1	0	0	1	1	0
0	1	0	1	1	0	1
0	1	1	0	1	0	1
0	1	1	1	1	0	1
1	0	0	0	1	1	0
1	0	0	1	1	0	1
1	0	1	0	1	0	1
1	0	1	1	1	0	1

X	Y	W	Z	$(X \oplus Y)$	$(W+Z)'$	$F = ((X \oplus Y) \cdot (W+Z)')'$
	0	0	0	1	1	0
	0	0	1	1	0	1
	0	1	0	1	0	1
	0	1	1	1	0	1
	0					

[3] Find The Expression & The Truth Table For The Circuit in The Fig

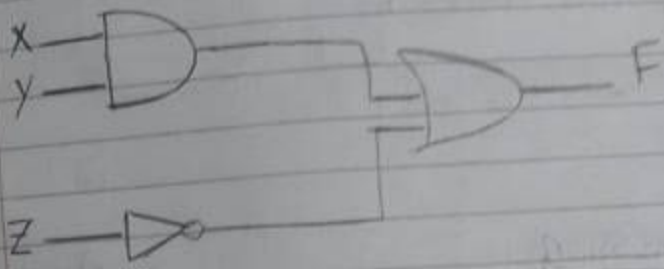


$$F = [(AB)' \cdot (A+B)' \cdot C]$$

A	B	C	$(AB)'$	$(A+B)'$	$F = [(AB)'(A+B)'C]$
0	0	0	1	1	0
0	0	1	1	1	1
0	1	0	1	0	0
0	1	1	1	0	0
1	0	0	1	0	0
1	0	1	1	0	0
1	1	0	0	0	0
1	1	1	0	0	0

Examples:

1. Find The The Expression & The Truth Table For The Circuits in the Fig



1. Expression:

$$F = (XY) + Z'$$

* عدد الاحتمالات.
2^n ← عدد الـ Inputs
$n = 3$
$= 2^3 = 8$
$(0 \rightarrow 7)$

2. Truth Table:

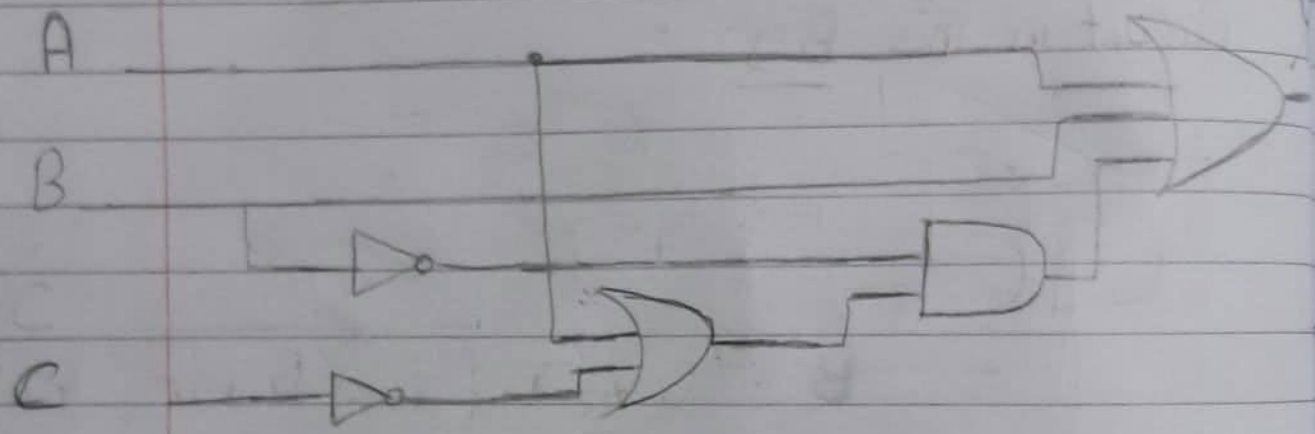
X	Y	Z	X.Y	Z'	F = (XY) + Z'
0	0	0	0	1	1
0	0	1	0	0	0
0	1	0	0	1	1
0	1	1	0	0	0
1	0	0	0	1	1
1	0	1	0	0	0
1	1	0	1	1	1
1	1	1	1	0	1

Ch 2

Boolean Algebra & Logic Gates

[13] Draw Logic Diagram to implement The Following Boolean Expression:

(a) $Y = A + B + B'(A + C')$

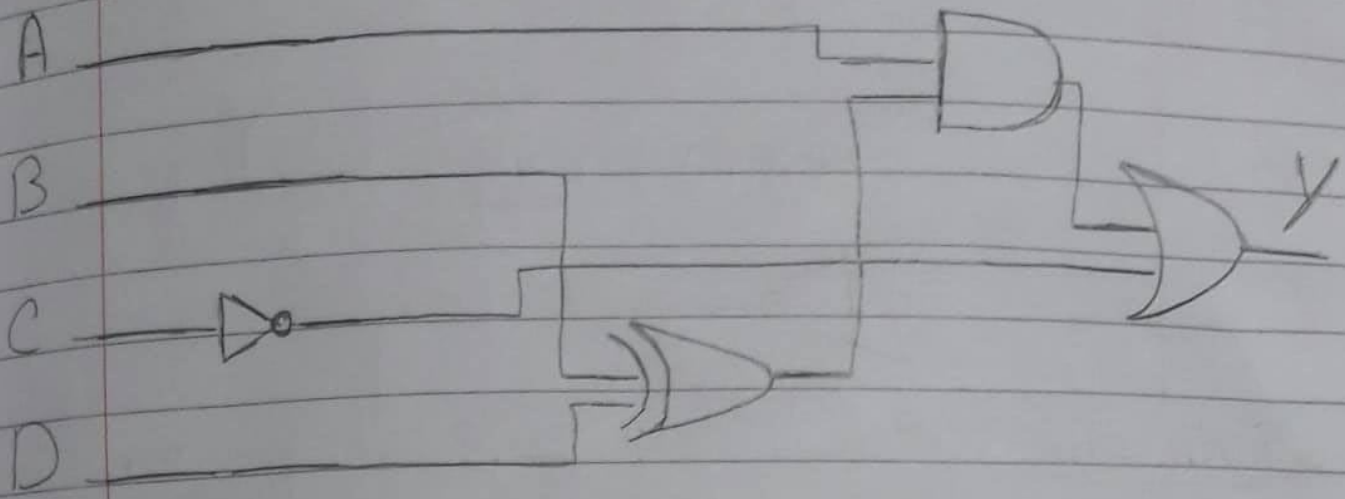


Truth Table:

3 Inputs $2^3 = 8$,

A	B	C	B'	C'	(A+C')	B'(A+C')	Y = (A+B+B'(A
0	0	0	1	1	1	1	1
0	0	0	1	1	1	1	1
0	0	1	1	0	0	0	0
0	0	1	1	0	0	0	0
0	1	0	0	1	1	0	1
0	1	0	0	1	1	0	1
0	1	1	0	0	0	0	1
0	1	1	0	0	0	0	1

[b] $Y = A(B \oplus D) + C'$

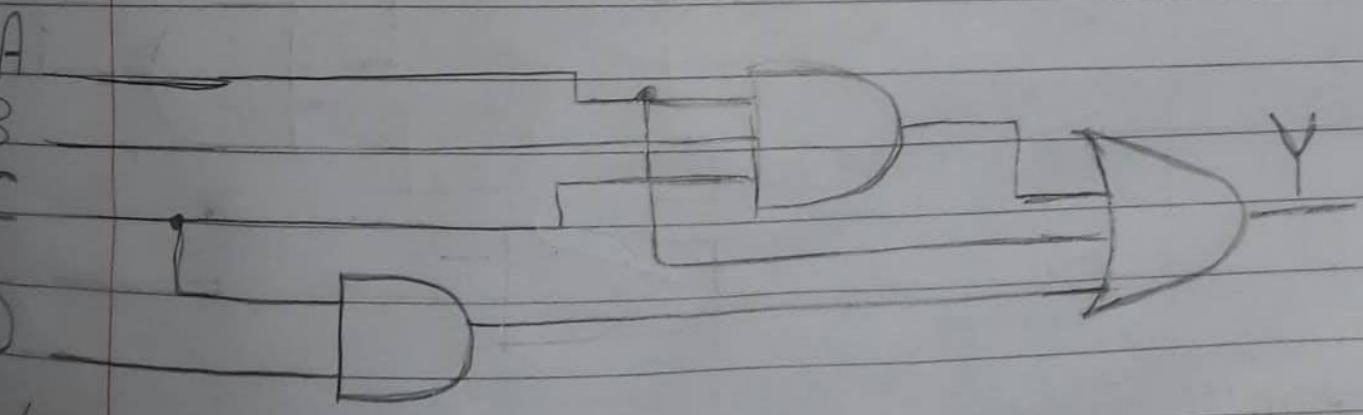


* Truth table:

4 Inputs = $2^4 = 16$

A	B	C	D	C'	$B \oplus D$	$A(B \oplus D)'$	$Y = A(B \oplus D) + C'$

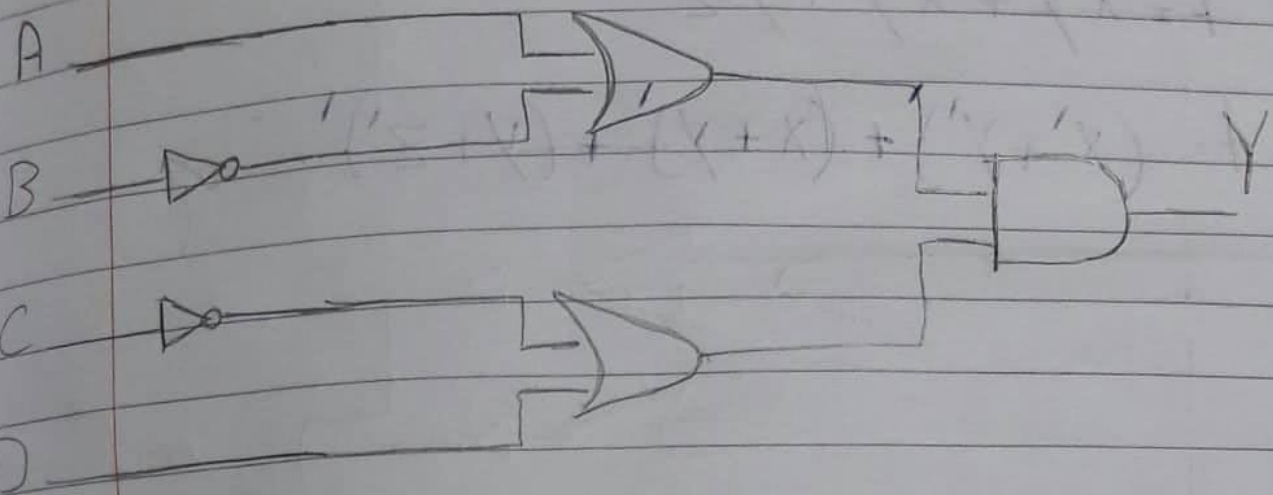
[C] $Y = A + CD + ABC$



* Truth Table 4 Inputs = 16

A	B	C	D	C.D	ABC	$Y = A + CD + ABC$

[13] $Y = [(A+B')(C'+D)]$



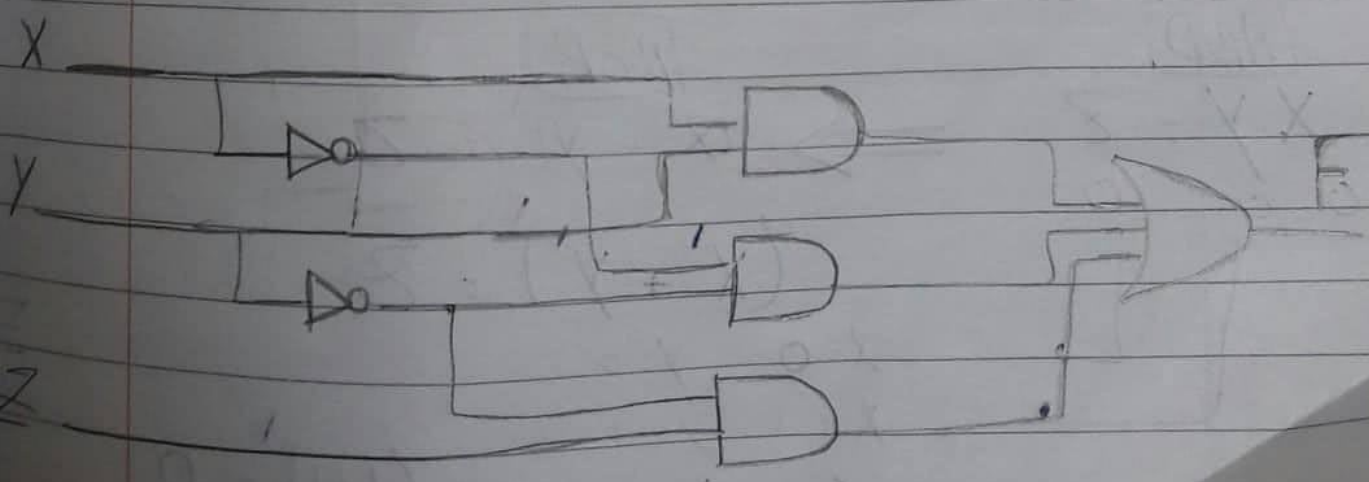
* Truth Table

A	B	C	D	B'	C'	(A+B')	(C'+D)	Y=(A+B')(C'+D)

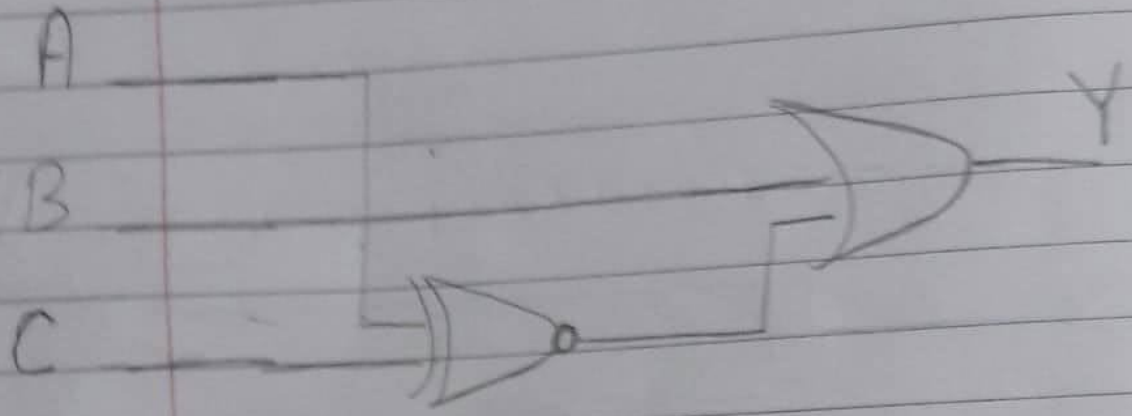
[14] Implement The Boolean Function:

$$F = xy + x'y' + y'z'$$

a) With AND, OR & inverter Gates



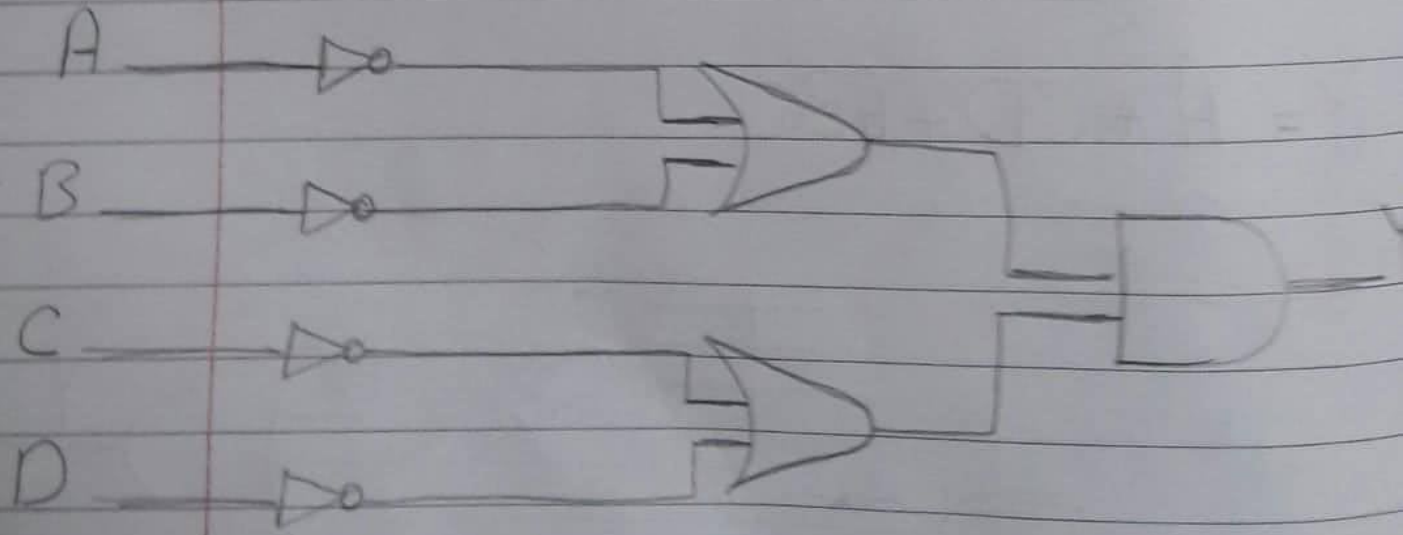
[d] $Y = (A \oplus C)' + B$



★ Truth Table

A	B	C	$(A \oplus C)'$	$Y = (A+C)' + B$

[e] $Y = (A' + B')(C' + D')$



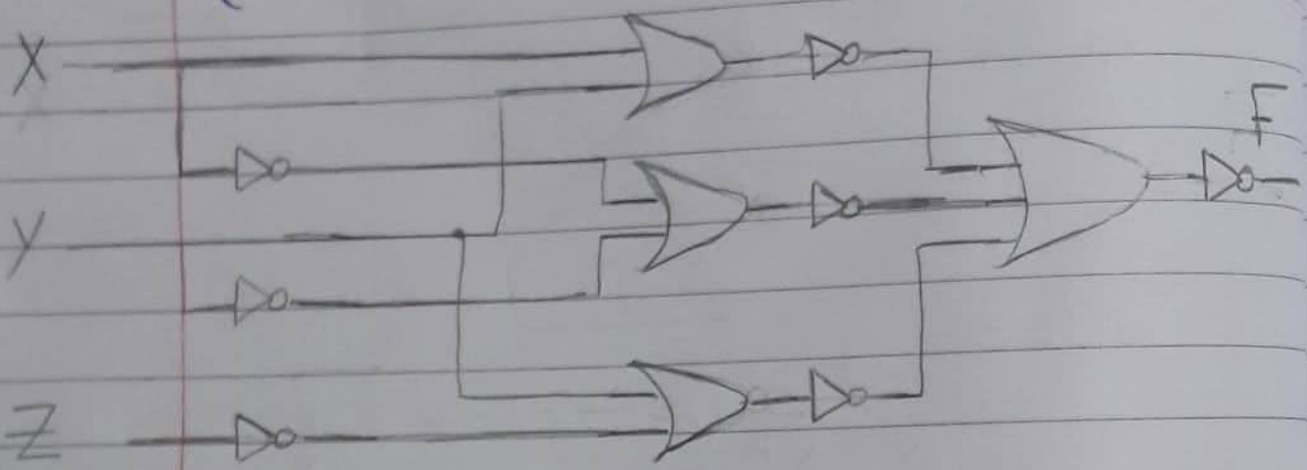
★ Truth Table

A	B	C	D	A'	B'	C'	D'	(A'+B')	(C'+D')	Y=

(b) With OR & inverter Gates

$F = xy + x'y' + y'z$

$F = (x'+y')' + (x+y)' + (y+z')'$



AND

X	Y	Z = XY
0	0	0
0	1	0
1	0	0
1	1	1

NOR

X	Y	Z = (X+Y)'
0	0	1
0	1	0
1	0	0
1	1	0

AND

$XY = Z$

0 0 0

NOR

$(x+y)' = z$

$(x'+y')' = z$

$x = 0 \quad y = 0$

$x' = 1 \quad y = 1$

$(1+1) = 1 \Rightarrow (1+1)' = 0$

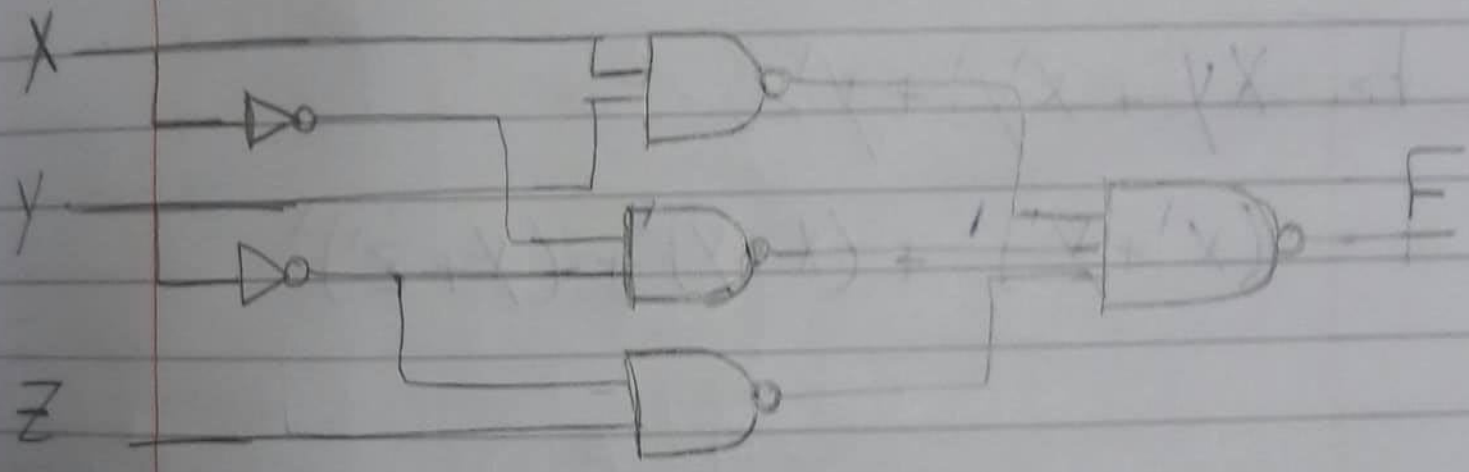
(c) NAND & inverter Gates.

$F = xy + x'y' + y'z$

$F = [(xy)' (x'y')' (y'z)']'$

X Y → X X → $((xy)')' = xy$

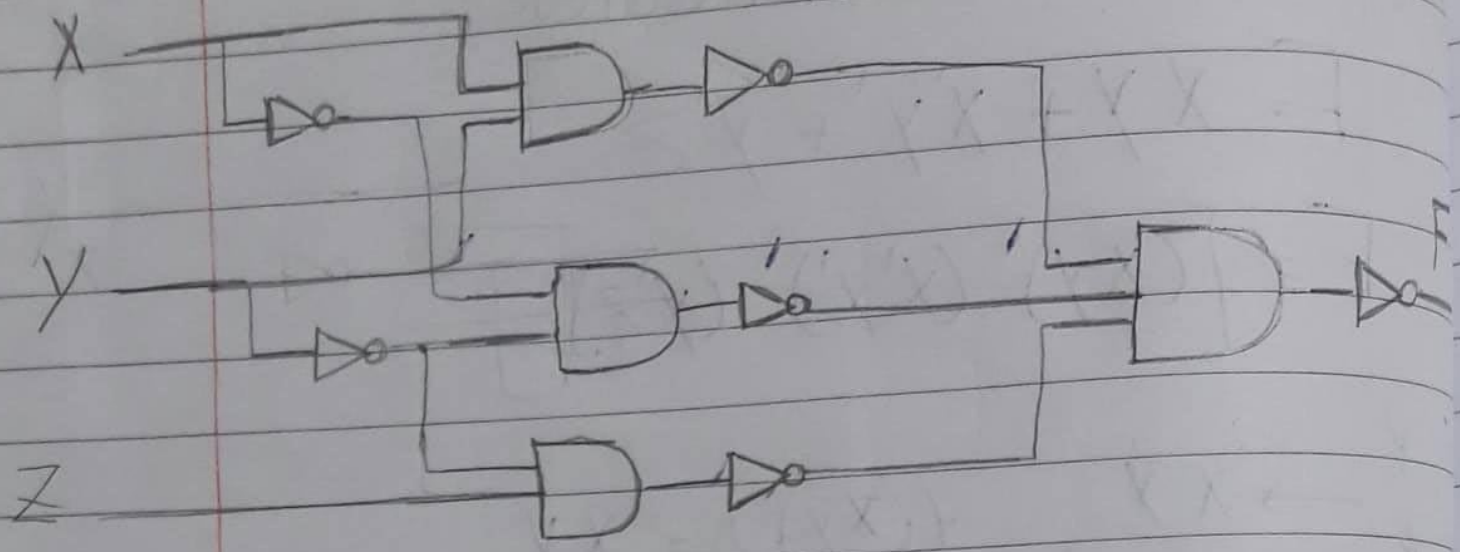
0 0 0 0



(d) With AND & inverter Gates.

$F = xy + x'y' + y'z$

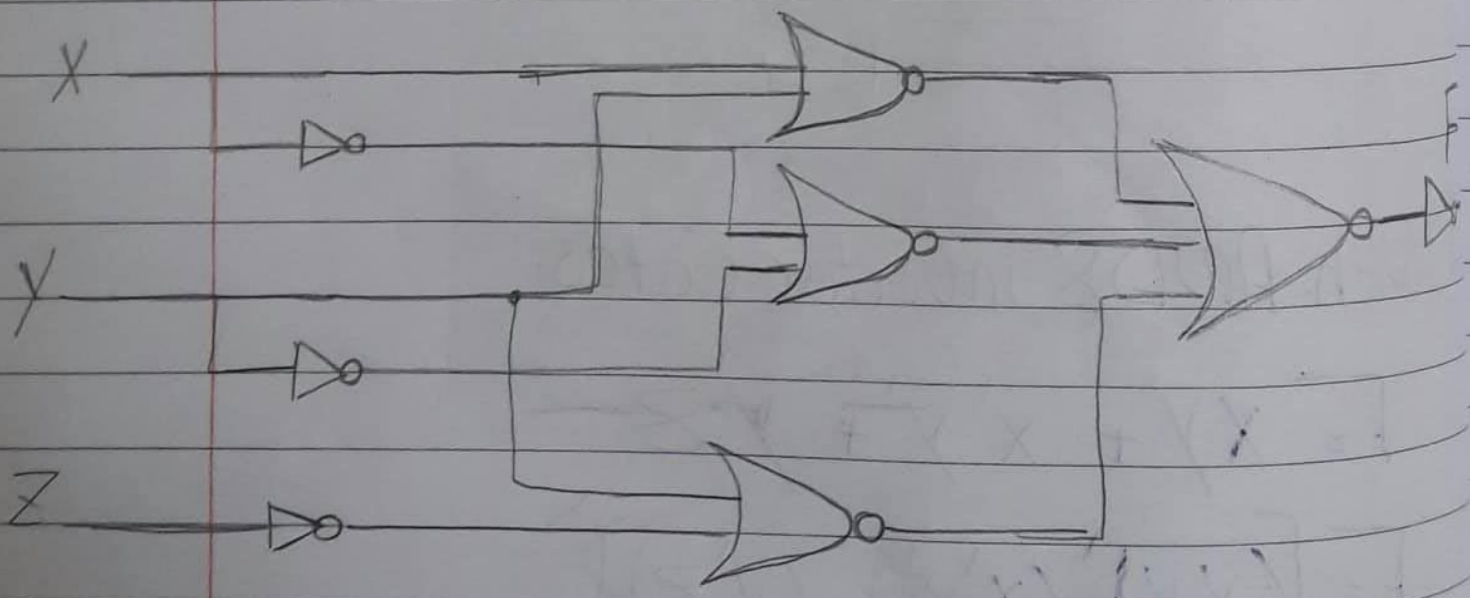
$F = [(xy)' (x'y')' (y'z)]'$



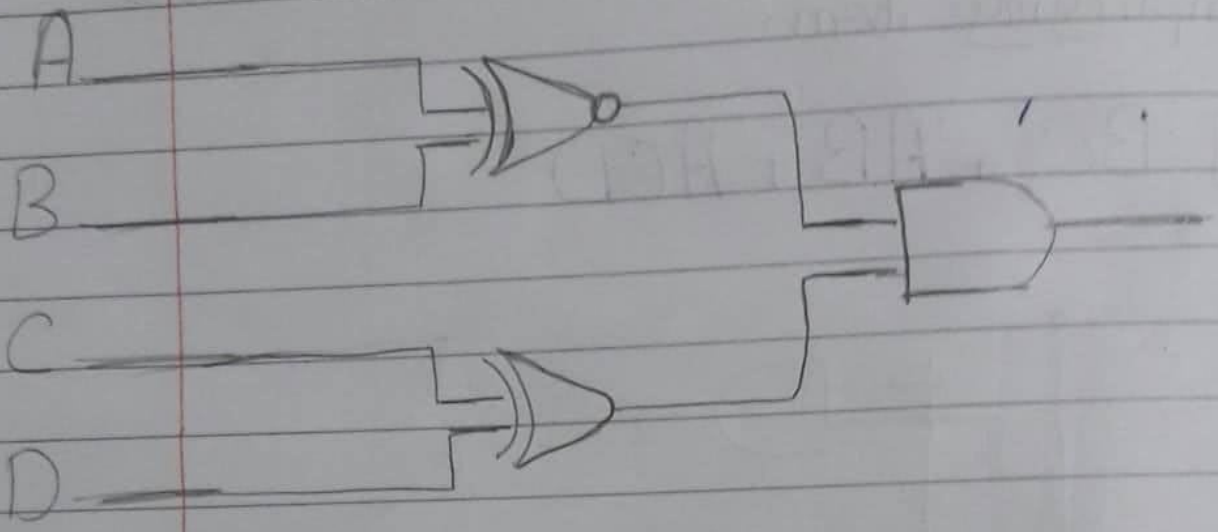
(c) With Nor & inverter Gates:

$$F = xy + x'y' + y'z$$

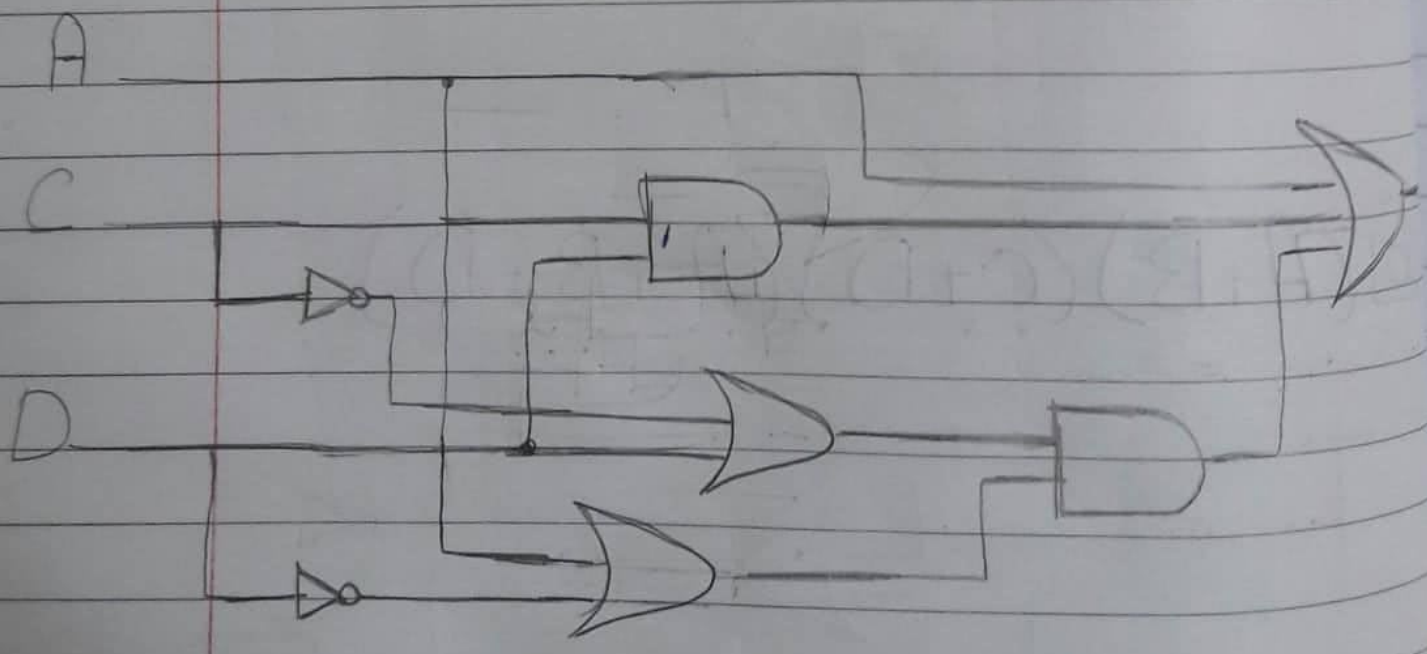
$$F = (x'+y')' + (x+y)' + (y+z')'$$



[c] $(AB + A'B')(CD' + C'D)$



[d] $A + CD + (A + D')(C' + D)$



27 Write The Boolean Expression (Equation) & Draw The logic Diagram of The Circuit Whose outputs are Defined by The Following Truth Table.

F_1	F_2	a	b	c
1	0	0	0	0
0	0	0	0	1
0	1	0	1	0
1	1	0	1	1
0	1	1	0	0
0	1	1	0	1
1	1	1	1	0
1	0	1	1	1

$F_1 = a'b'c' + a'bc + ab c' + abc$

$F_2 = a'bc' + a'bc + ab'c' + ab'c + abc'$