Date: / / / / التاريخ:

Subject: ..... موضوع الدرس:

K. map

2 variable → 2^2 → 4 Prob.

Truth table

	A	B	f
0 →	0	0	1
1 →	0	1	1
2 →	1	0	0
3 →	1	1	0

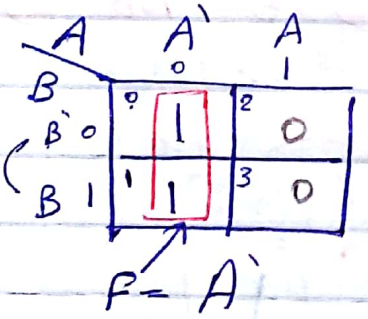
$f = \Sigma m(0,1)$, $f = \Pi(2,3)$

$= A'B' + A'B$

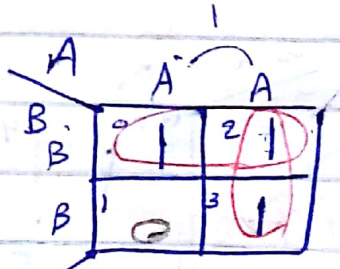
$= A'(\cancel{B' + B})^1$

$= A'$

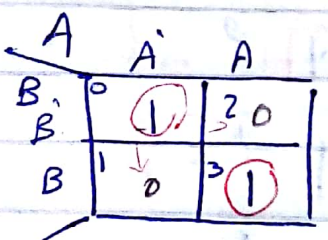
K. map For 2 Var. = 4 Prob.



$F = A'$



$F = B' + A$



$F = A'B' + AB$

$F = B' + AB$

$= B' + A$

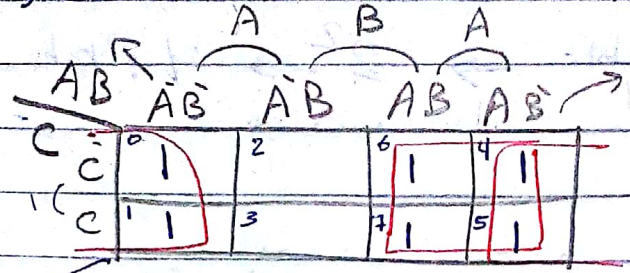
Date: / / التاريخ:

Subject: موضوع الدرس:

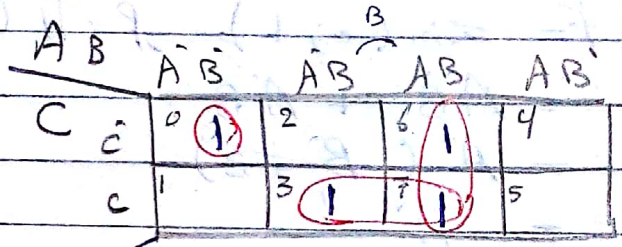
3 variable $\Rightarrow 2^3 \rightarrow$ 8 Prob. $\rightarrow$ 0 : 7

A, B, C

$F = \Sigma m(0, 1, 4, 5, 6, 7)$



$\rightarrow F = A + B'$



$F = \Sigma m(0, 3, 6, 7)$

A B C

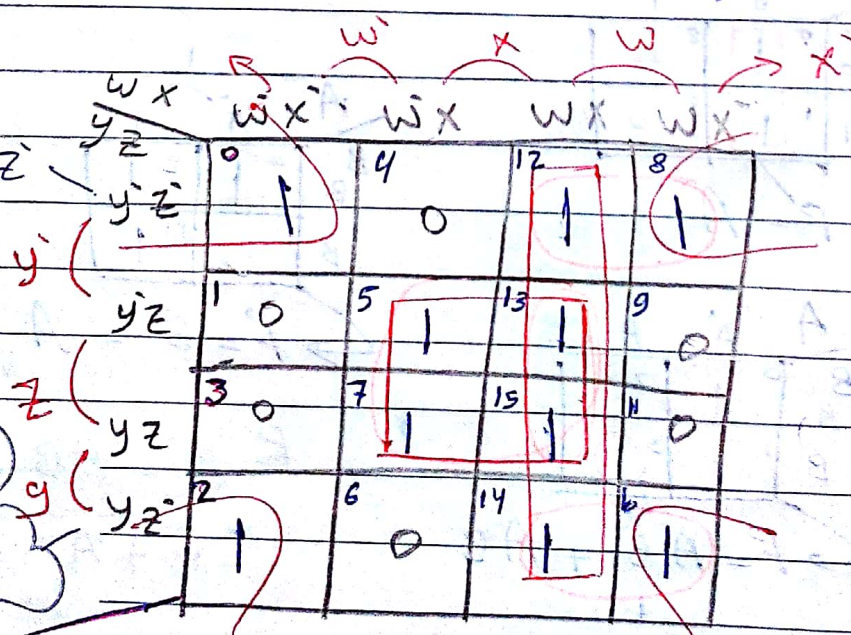
0 0 0

0 0 1

1 1 0

$\rightarrow F = A\bar{B}\bar{C} + BC + AB$

* # of variables $\rightarrow 2^4 \rightarrow$ 16 Prob. $\rightarrow$ 0 : 15



$\rightarrow F = X'Z' + XZ + WX / WZ' \leftarrow$ SoP

$\rightarrow F_1 = X'Z' + XZ + WX$

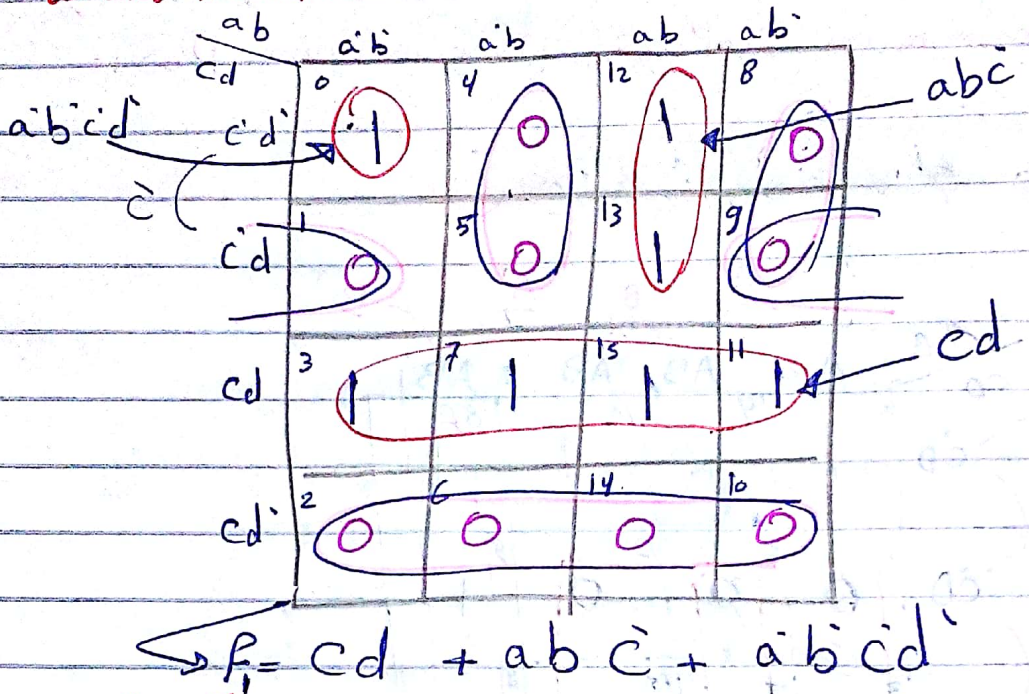
$\rightarrow F_2 = X'Z' + XZ + WZ'$

Date: / /

Subject:

Ex.: Simplify: $F(a,b,c,d) = \sum m(0,3,7,11,12,13,15)$ to the minimum SoP & PoS:.

(1) تشكل للمعادلة



$f_1 = cd + ab\,c' + a'b'c'd'$

SoP:

in PoS

$f' = cd' + a'b\,c' + b'c'd + ab'c' / ab'd'$

$(f')' = (c'+d)(a+b'+c)(b+c+d')(a'+b+c) / (a'+b+d)$

$f_2 = (c'+d)(a'+b'+c)(b+c+d')(a'+b+c)$

$f_3 = (c'+d)(a+b'+c)(b+c+d')(a'+b+d)$

16, 8, 4, 2, 1

Date: / /

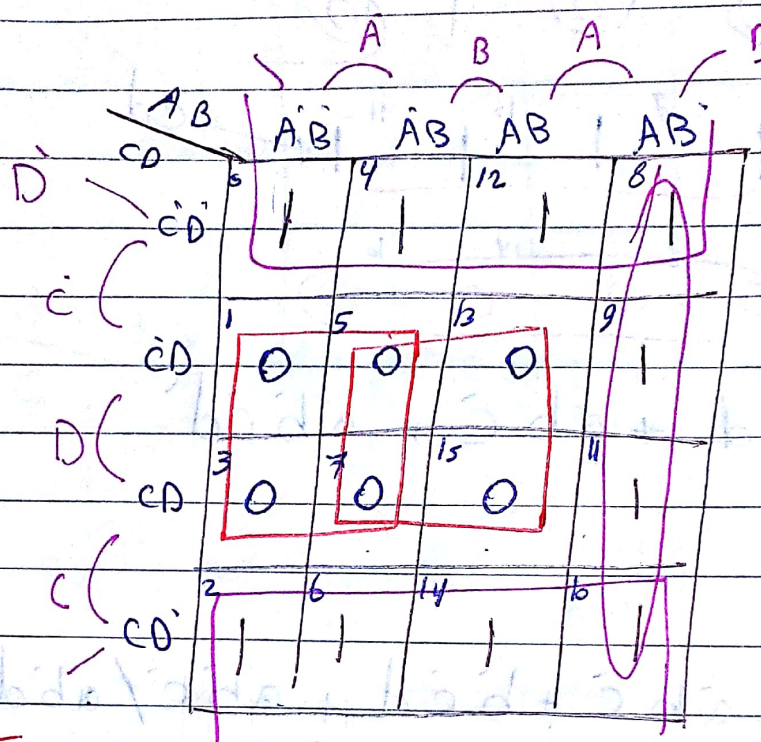
Subject: تشكل المعادلة (x) أصفار

EX:

* Simplify: $f(A,B,C,D) = \Pi(1,3,5,7,13,15)$

To the minimum SoP & the minimum PoS:-

4 Var. → A, B, C, D.



* The minimum SoP:-

$f = D' + AB'$

$f = D' + AB'D$

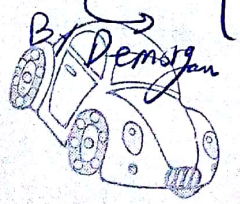
$= (D' + AB')(D' + D)$

* The minimum PoS:-

$f' = A'D + BD$

$(f')' = (A'D + BD)'$

$f = (A + D')(B' + D')$



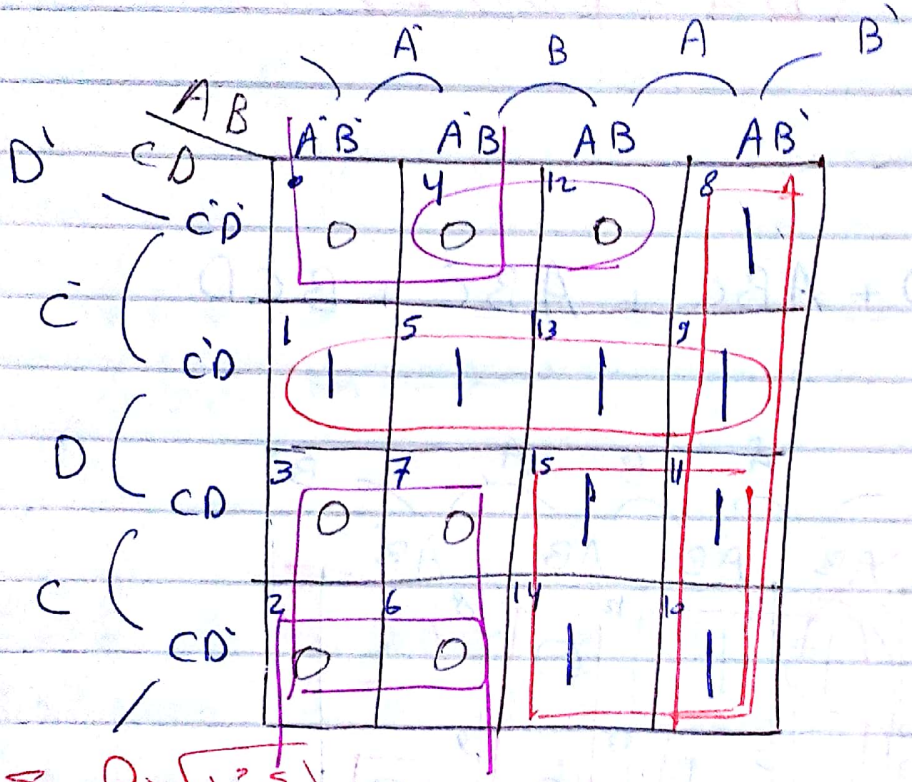
Subject:

Ex:

Simplify..

$$F(A,B,C,D) = A\bar{C}\bar{D} + \bar{C}D + A\bar{B} + ABCD$$

To the minimum SoP form & PoS form..



* SoP: 1's

$$F = \bar{C}D + A\bar{B} + AC$$

* PoS: → 0's

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

$$(\bar{F})' = (\bar{A}C + \bar{A}\bar{D} + B\bar{C}\bar{D})'$$

$$F = (A + \bar{C})(A + D)(\bar{B} + C + D)$$

Ex: Simplify:-

تكمل المعادلة رقم (٤)

$f(A,B,C,D) = (A' + B + D')(A' + B' + C')(A' + B' + C)(B' + C + D') \rightarrow$ To SoP & PoS.

PoS

ANS.

$f' = AB'D + ABC + ABC' + BCD$

AB \ CD	A'B'	A'B	AB	AB'
C'D'	0: 1	4: 1	12: 0	8: 1
C'D	1: 1	5: 1	13: 0	9: 0
CD	3: 1	7: 0	15: 0	11: 0
CD'	2: 1	6: 1	14: 0	10: 1

* **SoP:**

$\hookrightarrow f = A'B' + A'C' + B'D' + A'CD'$

* **PoS:**

$\hookrightarrow f' = AB + AD + BCD$

$\hookrightarrow (f')' = (A' + B')(A' + D')(B' + C' + D')$

$\nearrow$ f in PoS.

Subject: ..... موضوع الدرس: .....

① ⇒ $f = \Sigma m(\_, \ldots)$ ↵ 1's on K.map

② ⇒ $f = \Pi(\ldots)$ ↵ 0's on K.map.

③ ⇒ $f =$ ___ + ___ + ___ + ___

1's on K.map.

④ ⇒ $f = (+\,+)(+\,+)(+\,+)$

↳ $f' =$ ___ + ___ + ___

↳ 0's on K.map.

⇒ Find the minterms of the following Boolean expressions by first plotting each fun. in a map, then simplify them.

$f = \ldots$

⇒ Simplify the following fun. to SoP (or) PoS

⇒ Convert the following boolean function from SoP form to a Simplified PoS form.

$f =$ ___ + ___ + ___

Date: / / التاريخ: / /

Subject: موضوع الدرس:

K.map With don't Cares.

Ex1)

Simplify:. $F(x,y,z) = \Sigma(0,1,4,5,6)$ → 1's

$d(x,y,z) = \Sigma(2,3,7)$ → x

	xy	$x\bar{y}$	$\bar{x}y$	$\bar{x}\bar{y}$
z	0	2	6	4
	1	X	1	1
$\bar{z}$	1	3	7	5
	1	X	X	1

→ $F = 1$

Ex2)

Simplify: $F(A,B,C,D) = \Sigma(2,4,7,10,12)$

$d(A,B,C,D) = \Sigma(0,6,8)$

to SoP form

AB / CD	$A\bar{B}$	$\bar{A}B$	AB	$A\bar{B}$
$C\bar{D}$	0 X	4 1	12 1	8 X
$\bar{C}\bar{D}$	1	5	13	9
$\bar{C}D$	3	7 1	15	11
CD	2 1	6 X	14	10 1
$C\bar{D}$				

→ $F = C\bar{D} + B\bar{D} + \bar{A}BC$

to pos form

AB / CD	$A\bar{B}$	$\bar{A}B$	AB	$A\bar{B}$
$C\bar{D}$	X			X
$\bar{C}\bar{D}$	0	0	0	0
$\bar{C}D$	0		0	0
CD		X	0	
$C\bar{D}$				

→ $\bar{F} = C\bar{D} + B\bar{D} + A\bar{B}C$

→ $F = (C+\bar{D})(B+\bar{D})(\bar{A}+B+\bar{C})$

Date: / /

التاريخ: / /

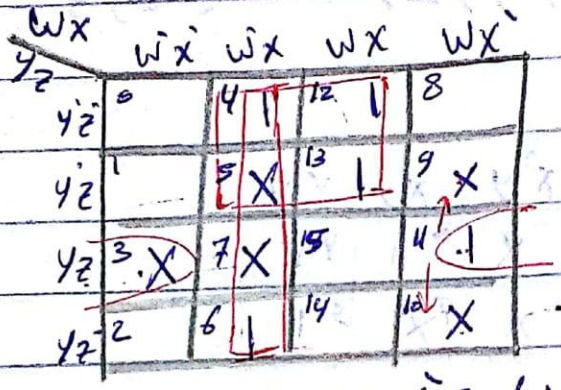
Subject: .....

موضوع الدرس: .....

EX3:

Simplify:-

$$F(w,x,y,z) = \Sigma m(4,6,11,12,13) + \Sigma d(3,5,7,9,10)$$

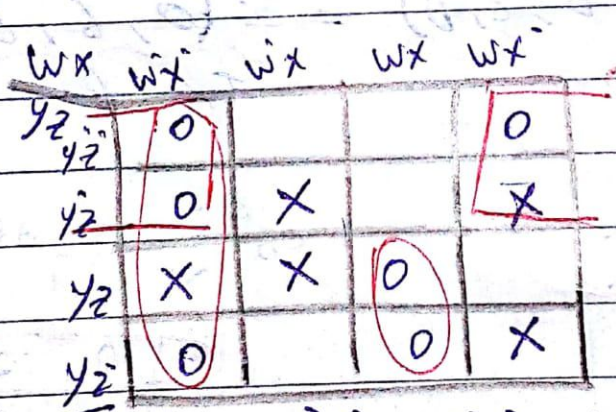


$\hookrightarrow F = wx + xy + wxz / wxy / xyz$

$\hookrightarrow f_1 = wx + xy + wxz$

$f_2 = wx + xy + wxy$

$f_3 = wx + xy + xyz$



$\hookrightarrow f' = wx + xy + wxy$

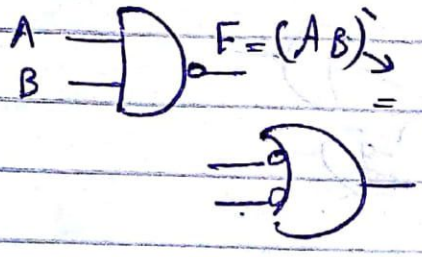
$\hookrightarrow f = (w+x)(x+y)(w+x+y)$

*two level NAND must be SoP.
*two level NOR must be PoS

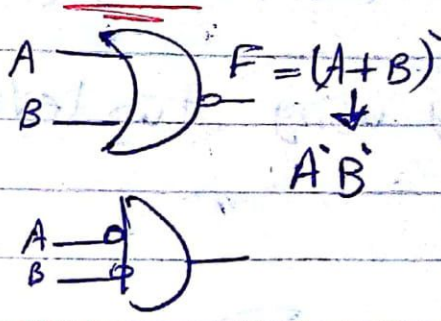
Date: / /
Subject:
التاريخ: / /
موضوع الدرس:

*Logic Diagrams :-

NAND:



NOR:

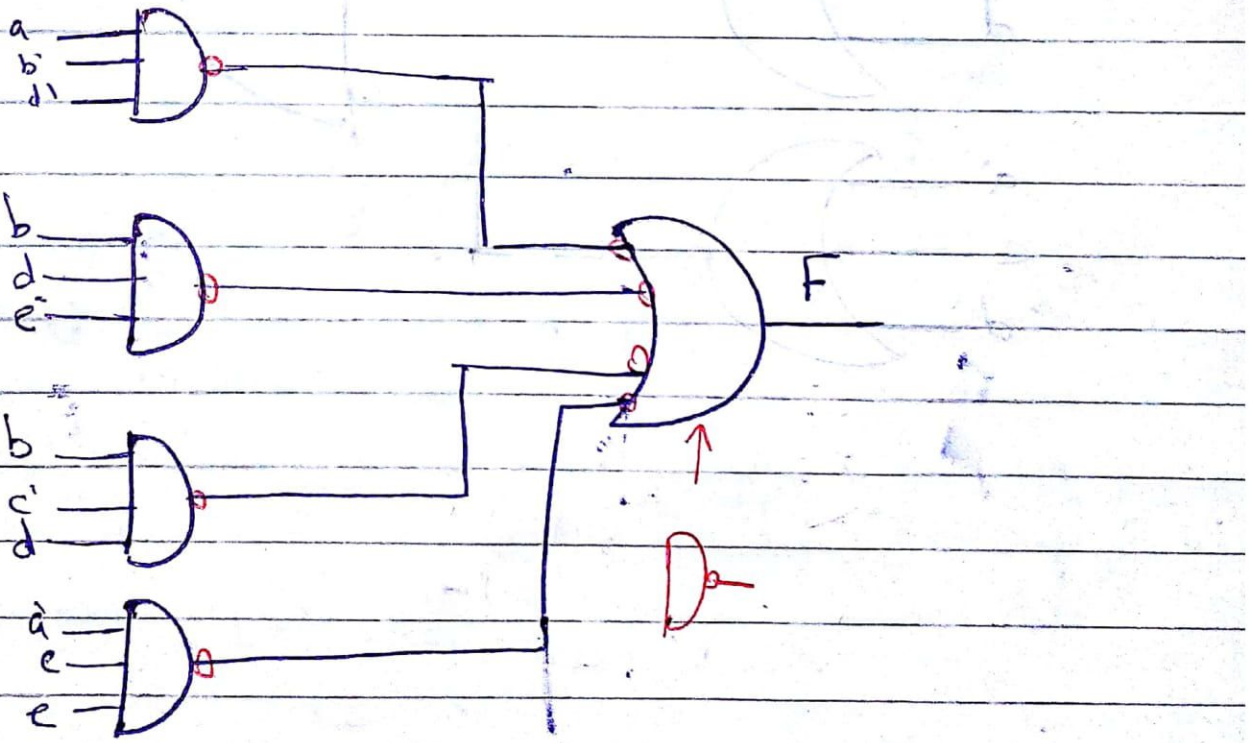


Ex1 :-

Show the block diagram of :-

$F = ab'd' + bde' + bcd + a'ce$

by using two level NAND

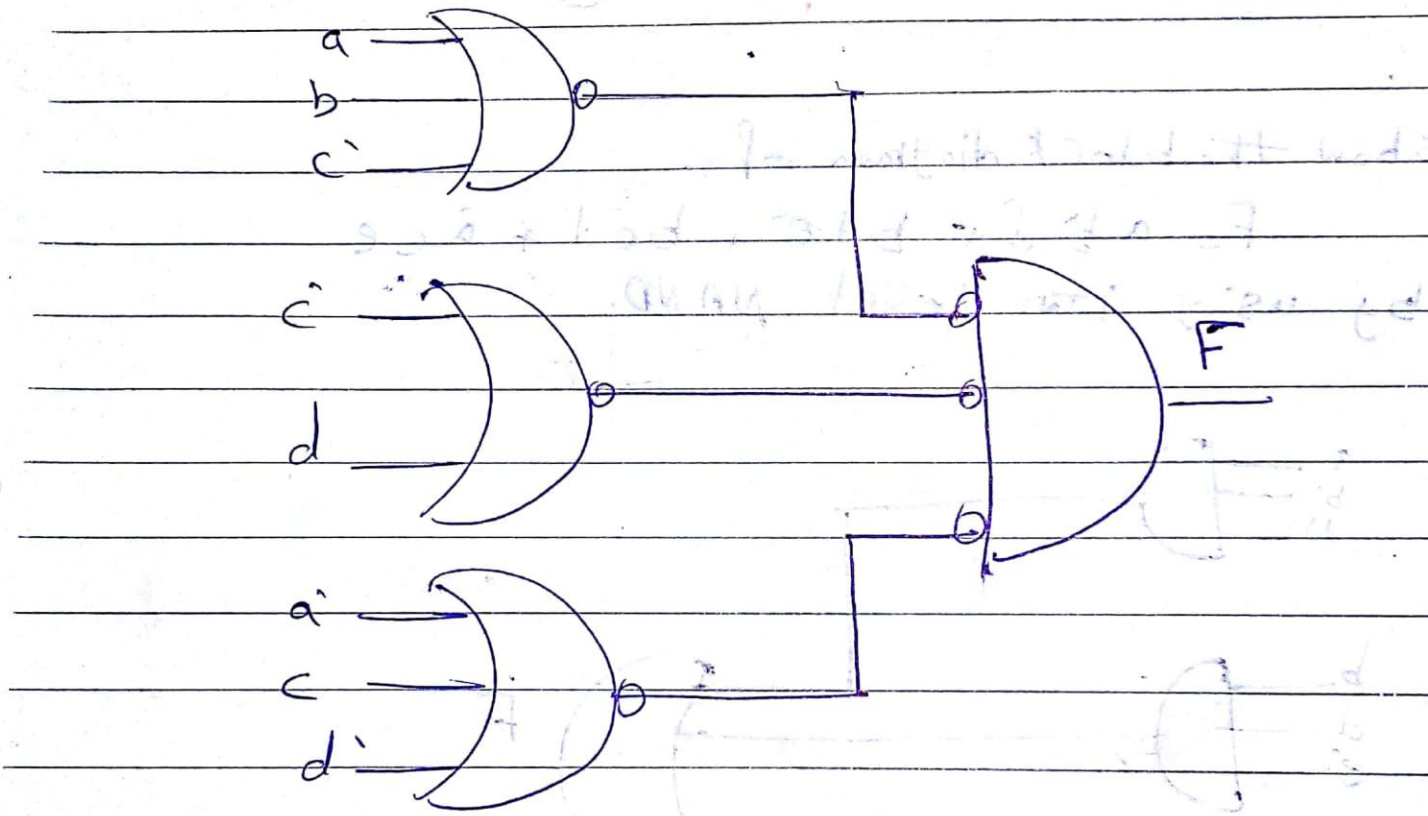


Ex2

↳ Show the block diagram of :

$F = (a + b + \bar{c})(\bar{c} + d)(\bar{a} + c + \bar{d})$ ← POS.

↳ by using Two level NOR



Date: / /

Subject:

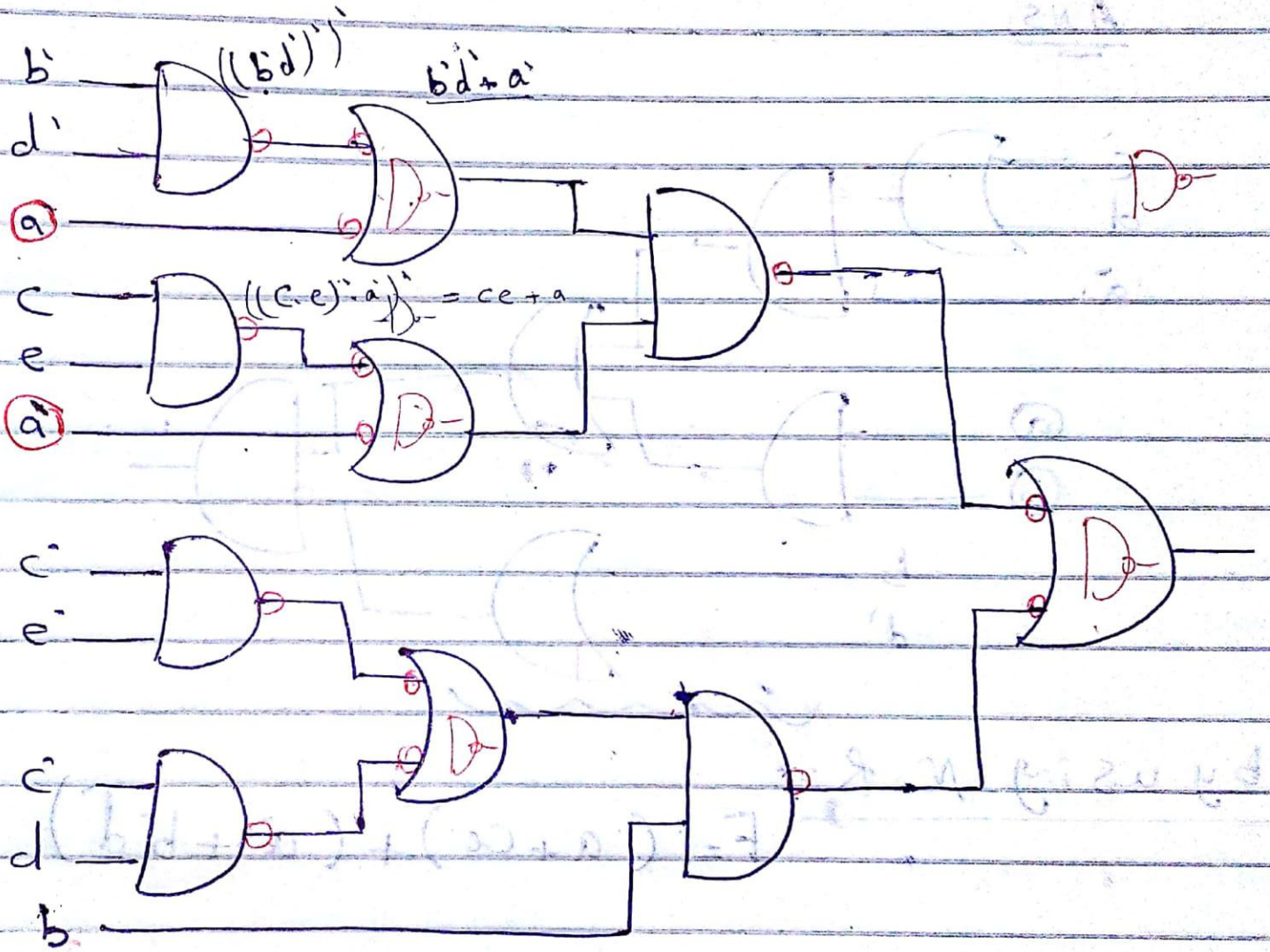
b — b̀ (All Variable available) a, à, b, b̀

Ex 3:

Show the block diagram of:

$$F = b(c\grave{d} + c\grave{e}) + (a + ce)\cdot(\grave{a} + b\grave{d})$$

↳ using Multilevel NAND.



Date: / /

Subject:

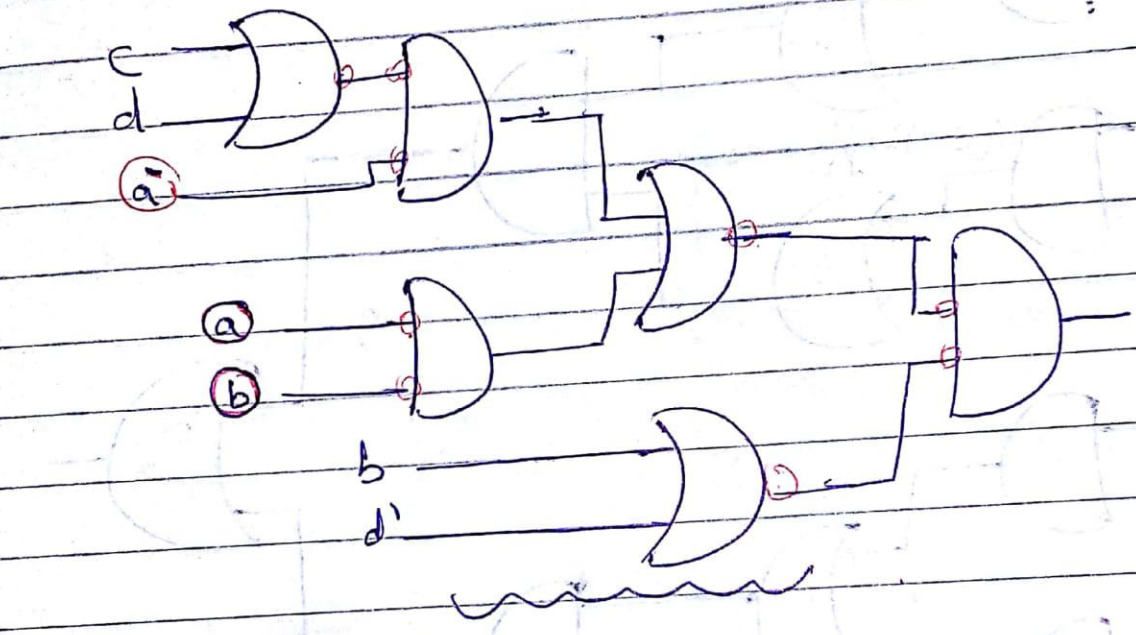
موضوع الدرس: .....

EX4:

by using multi level NOR:

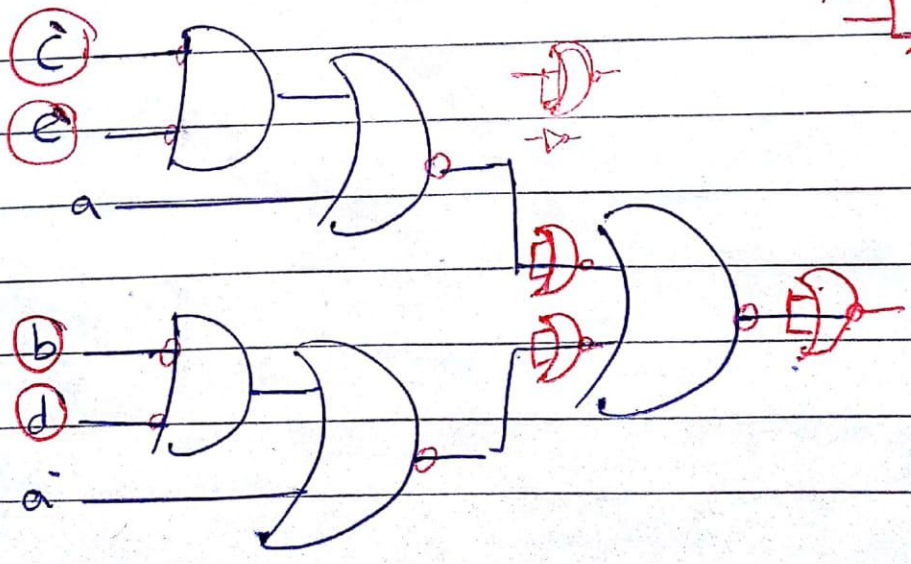
$$F = [a\bar{b} + a(c+d)] \cdot (b + \bar{d})$$

ANS:



by using NOR:

$$F = (a + ce) + (\bar{a} + b\bar{d})$$



EX:

Given the function, (assume all variables are available both complemented and uncomplemented)

$$F = a'b' + \grave{a}c + ab'$$

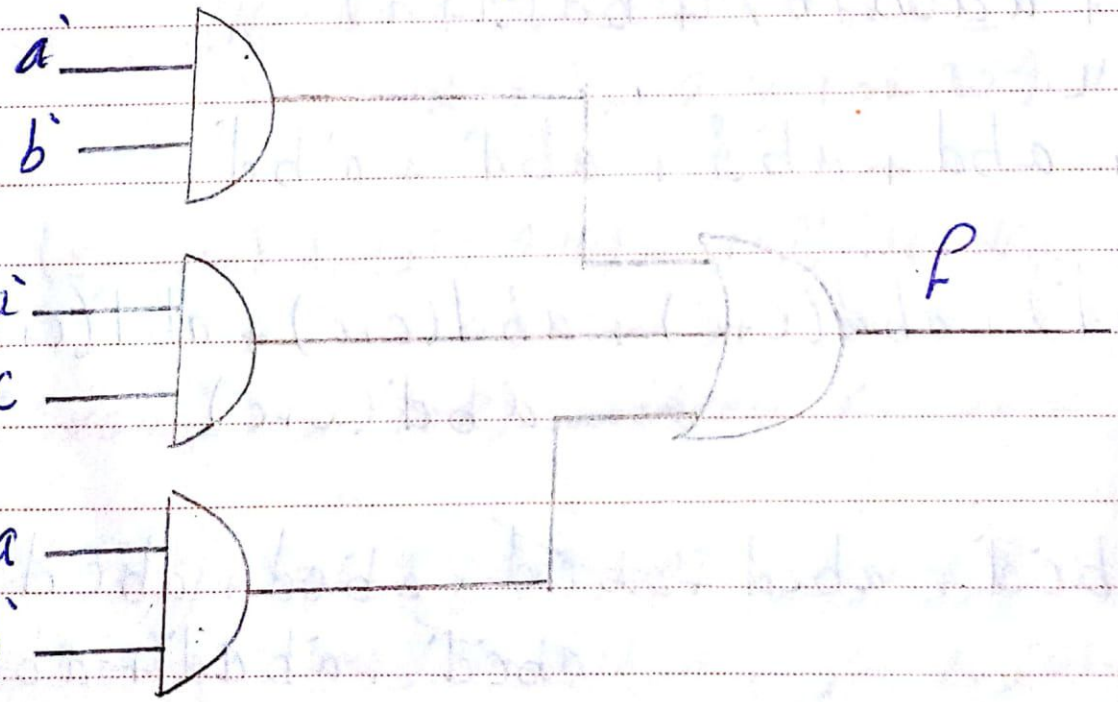
a) Show a block diagram for a two level implementation of F using AND and OR gates.

b) Show a block diagram for an implementation of F using only NAND gates.

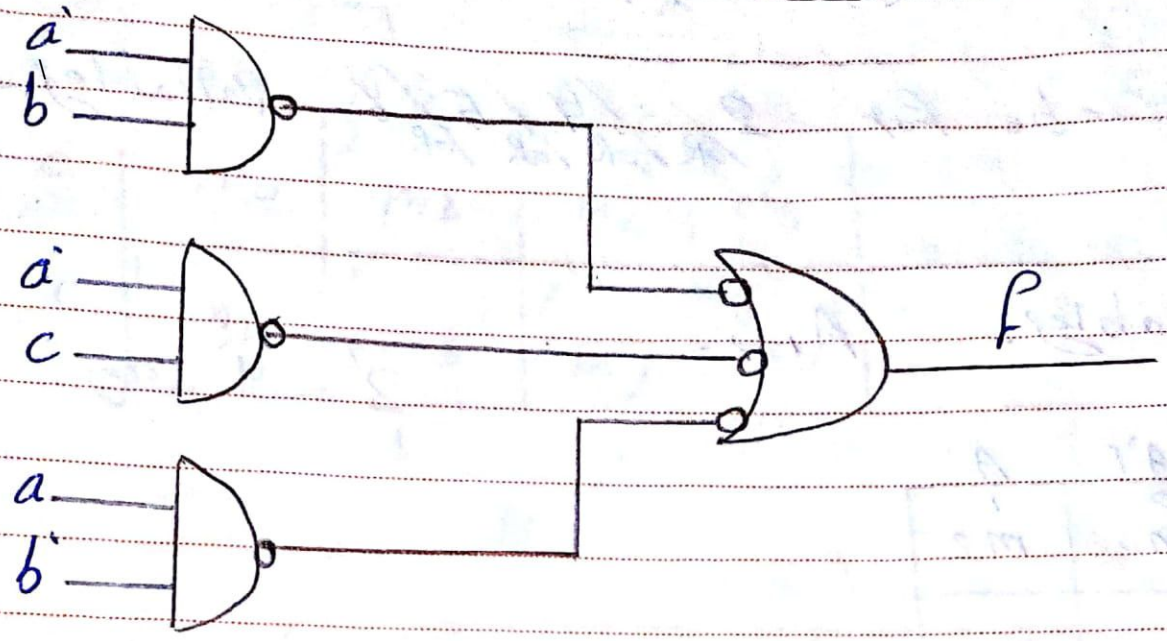
c) Expand F to Sum of minterms, eliminate any duplication

Solution:

a) The Block diagram by AND, OR.



b) The Block diagram by NAND :-



c) The Expanding of $f = a'b' + a'c + ab'$

(a, b, c)

$f = a'b'(c + c') + a'c(b + b') + ab'(c + c')$

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

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