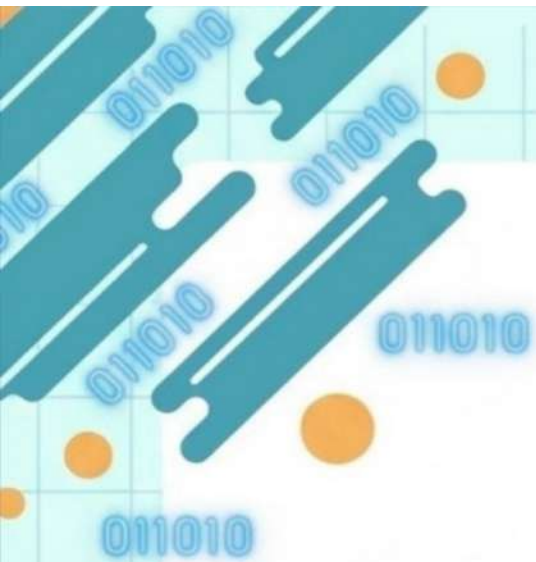
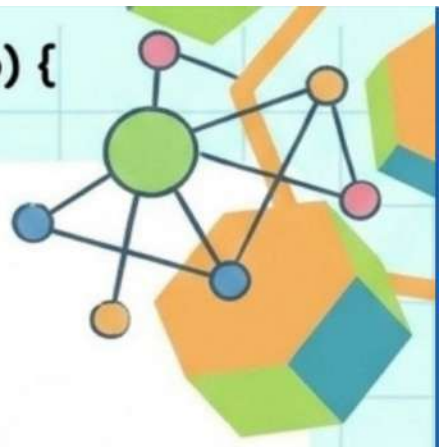
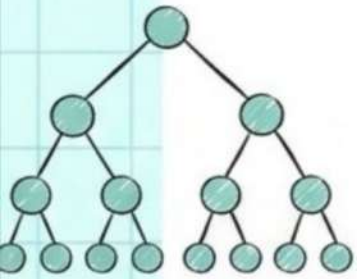
```
function computeSum(a, b) {
   return a + b;
}
```





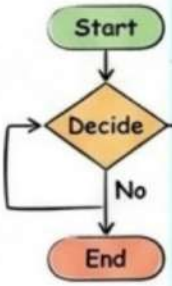




Eng. Hozifa Alqady

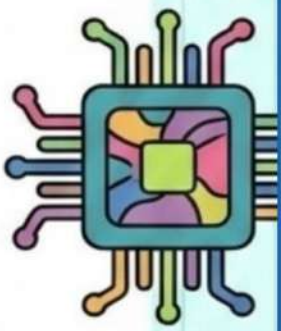
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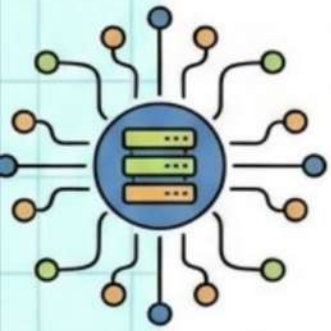
** CE 222 **



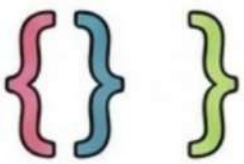








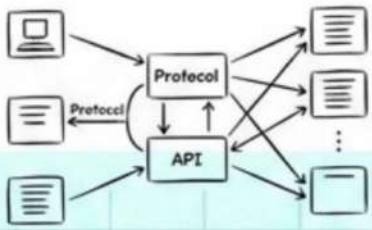






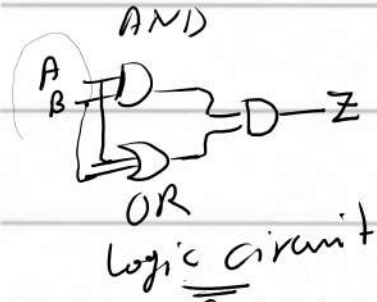








Computer Architecture



Logic circuit

Input ⇒ A, B output Z

$Z = F(A, B)$ Logic Function

① Logic expressions $((A \cdot B) \cdot (A + B)) = Z$

② Truth table

A	B	Z
0	0	
0	1	
1	0	
1	1	

③ K-map

Boolean Algebra over $\{0,1\} \Rightarrow \{B, +, \cdot, \bar{}, 0, 1, =\}$

$B \rightarrow \{0, 1\}$ (set) | + OR | · And | $\bar{}$ Not | = equal

eg:
- = Reflexivity $x = x$
- = symetry $x = y$
- = transitivity $x = y$, $y = z$ ∴ $x = z$

Boolean Algebra over vectors

vector $A = (0, 1, 0)$ $B = (1, 0, 1)$ → Vector

$A \vee B = (0 \vee 1, 1 \vee 0, 0 \vee 1) = (1, 1, 1)$

$A \cdot B = (0 \cdot 1, 1 \cdot 0, 0 \cdot 1) = (0, 0, 0)$

$\bar{A} = (\bar{0}, \bar{1}, \bar{0}) = (1, 0, 1)$

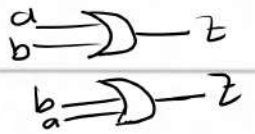
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QUENS

OR

* $a+0 = 0+a = a$

$1+0 = 0+1 = 1$



الاشارة نفس الثانية

* $a+b = b+a$
* $a+(b\cdot c) = (a+b)\cdot(a+c)$
* $a+\bar{a} = 1 \Rightarrow 1+0=1 \Rightarrow 0+1=1$

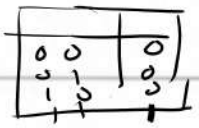
$(a+b)+c = a+(b+c)$

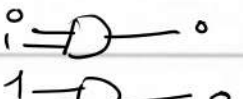
AND

* $a\cdot 1 = 1\cdot a = a$

$1\cdot 1 = 1\cdot 1 = 1$

$0\cdot 1 = 1\cdot 0 = 0$

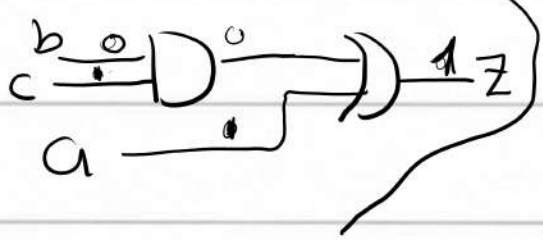


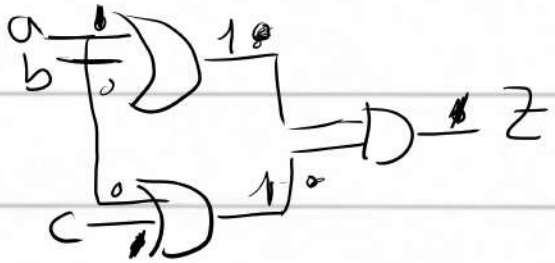


* $a\cdot b = b\cdot a \Rightarrow 0\cdot 1 = 1\cdot 0$
* $a\cdot(b+c) = (a\cdot b)+(a\cdot c)$
* $a\cdot\bar{a} = 0$
* $(a\cdot b)\cdot c = a\cdot(b\cdot c)$

$a+(b\cdot c) = (a+b)\cdot(a+c)$

$Z = a+(b\cdot c)$





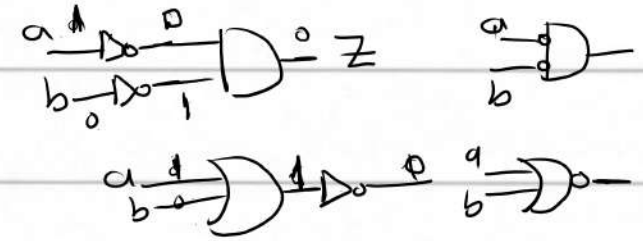
$a=1 \quad b=0, \quad c=1$

a	b	c	$a+(b\cdot c)$	$(a+b)\cdot(a+c)$
0	0	0	0	0
0	0	1		
0	1	0		
0	1	1		
1	0	0	1	1
1	0	1		
1	1	0		
1	1	1		

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Demorgan theorm

$\bar{a} \cdot \bar{b} = \overline{a+b}$ ✓



$\bar{a} + \bar{b} = \overline{a \cdot b}$

a	b	$\bar{a} \cdot \bar{b}$	$\overline{a+b}$
0	0	1	1
0	1	0	0
1	0	0	0
1	1	0	0

AND Gate

a	b	z
0	0	0
0	1	0
1	0	0
1	1	1

NAND Gate

a	b	z
0	0	1
0	1	1
1	0	1
1	1	0

OR Gate

a	b	z
0	0	0
0	1	1
1	0	1
1	1	1

NOR Gate

a	b	z
0	0	1
0	1	0
1	0	0
1	1	0

Inverter

a	z
0	1
1	0

XOR

a	b	z
0	0	0
0	1	1
1	0	1
1	1	0

m	a	b	c	F
m_0	0	0	0	0
m_1	0	0	1	1
m_2	0	1	0	0
m_3	0	1	1	1
m_4	1	0	0	0
m_5	1	0	1	1
m_6	1	1	0	0
m_7	1	1	1	1

minterm

$F = \bar{a}\bar{b}c + \bar{a}bc + a\bar{b}c + abc$ SOP ✓

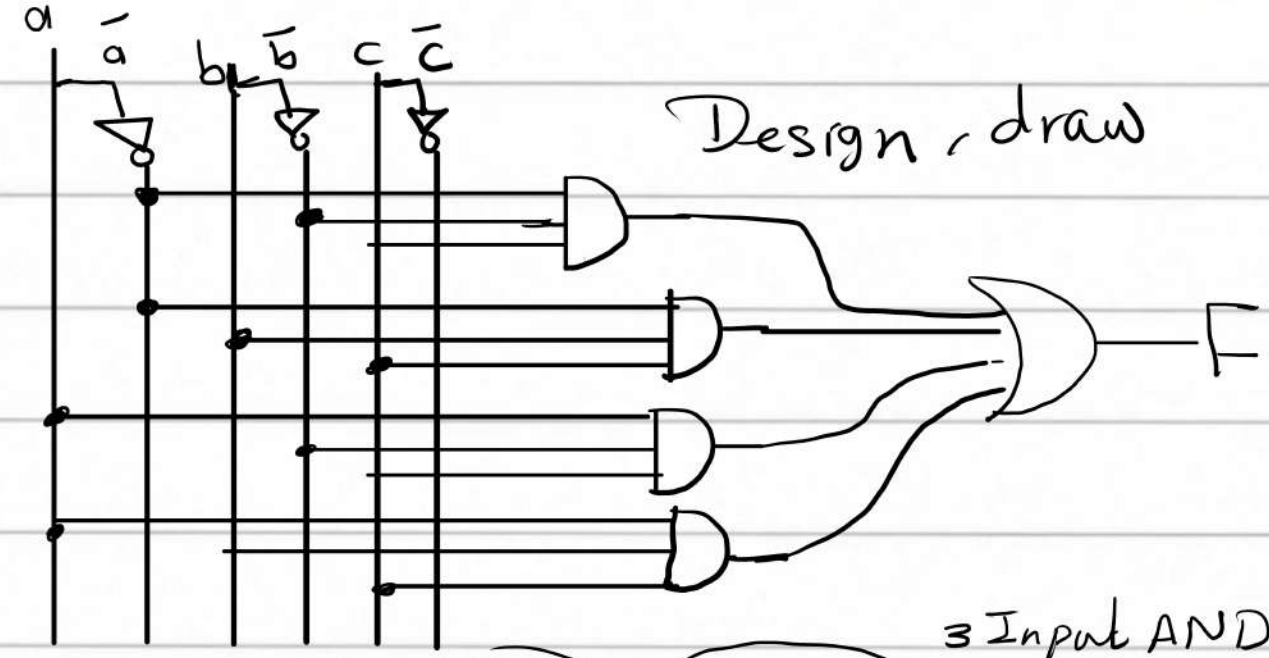
sum of product

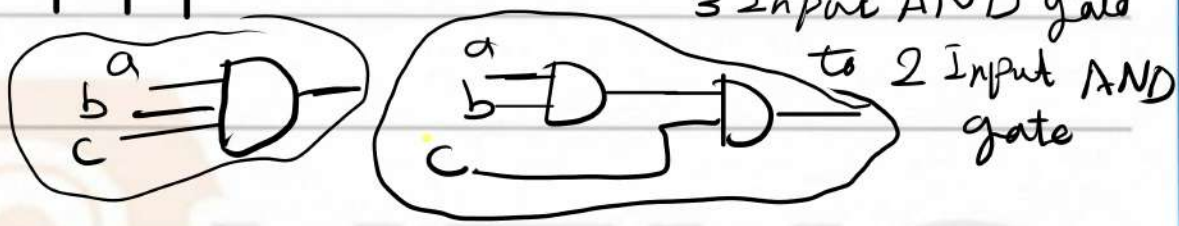
$F = \sum(m_1, m_3, m_5, m_7)$

$F = \sum(1, 3, 5, 7)$

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$F = \bar{a}\bar{b}c + \bar{a}bc + a\bar{b}c + abc$



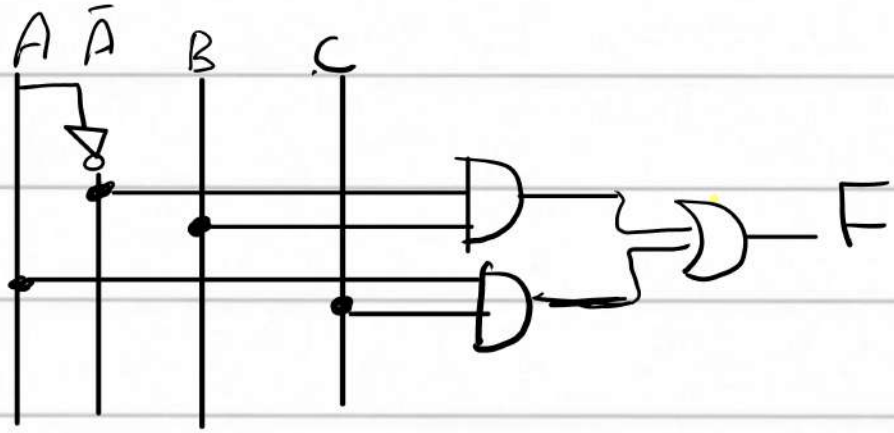


Simplification using boolean algebra

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

$F = \bar{A}B(C+\bar{C})^{1} + AC(B+\bar{B})^{1}$

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



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K-Map

Grouping rules

① التجميع افقي او رأسي التجميع افقي او رأسي

② عدد المربعات = 2^{n} او مضاعفاتها (1 2 4 8 16 ...)

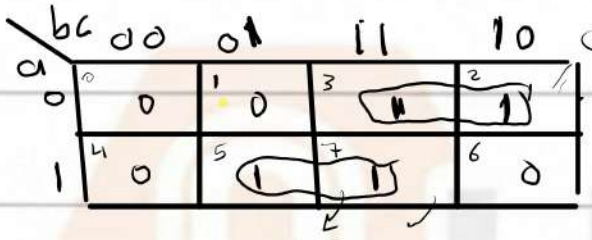
③ عدد المربعات داخل المجموعه يكون كبير قدر الإمكان

④ عدد المجموعات يكون قليل قدر الإمكان

⑤ يجوز ان تتداخل المجموعات

⑥ يجوز ربط الاطراف

abc minterms



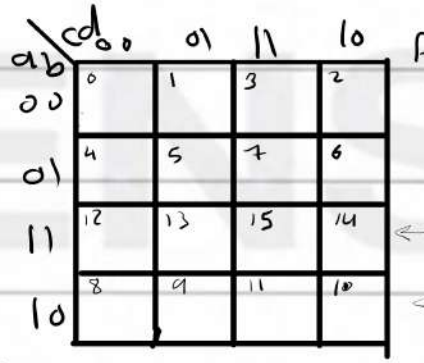
m	a	b	c	F
m	0	0	0	0
m1	0	0	1	0
m2	0	1	0	1
m3	0	1	1	1
m4	1	0	0	0
m5	1	0	1	1
m6	1	1	0	1
m7	1	1	1	1

$F = \sum(2,3,5,7)$

$G_1 = \bar{a}b$

$G_2 = ac$

$F = \bar{a}b + ac$



	a	b	c	d	F
m0	0	0	0	0	1
m1	0	0	0	1	0
m2	0	0	1	0	1
m3	0	0	1	1	0
m4	0	1	0	0	0
m5	0	1	0	1	1
m6	0	1	1	0	1
m7	0	1	1	1	1
m8	1	0	0	0	1
m9	1	0	0	1	0
m10	1	0	1	0	1
m11	1	0	1	1	0
m12	1	1	0	0	0
m13	1	1	0	1	1
m14	1	1	1	0	1
m15	1	1	1	1	1

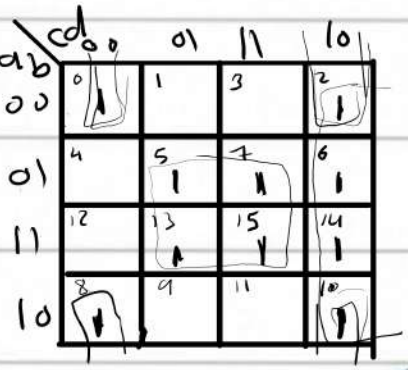
$F = \sum(0,2,5,6,7,8,10,13,14,15)$

$G_1 = bd$

$G_2 = cd$

$G_3 = \bar{b}\bar{d}$

$F = bd + cd + \bar{b}\bar{d}$



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