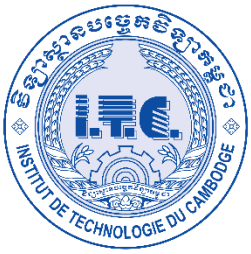

Institute of Technology of Cambodia

Telecommunication and Network

Computer Architecture

TP 03

Name	ID	Score
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Lecture: Course: Mr.CHUN Thavorac
TP: Mr.OL Phearun

Academic Year: 2023-2024

Exercises

1. Use identifies of Boolean algebra to simply the following logic expression:

a) f=$a\bar{b}c + \overline{abc}$

b) f=$\bar{b}(ac + \bar{a} \cdot \bar{c})$

c) f=ab$\bar{c}$+a$\bar{b}$ $\bar{c}$+$\bar{a}$b$\bar{c}$

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

e) f=(a+$\bar{b}$+a$\bar{b}$) $\bar{c}$

f) f=a$\bar{b}$ $\bar{c}$+a$\bar{b}$ $\bar{c}$ $\bar{d}$+a$\bar{c}$

2. After simplify please draw the circuit from above logic expression

3. Find the logic function from table below karnaugh table and draw circuit:

F1(a,b,c,d) = ?

cd \ ab	00	01	11	10
00	1	1	1	1
01	0	0	0	0
11	0	0	0	0
10	1	1	1	1

cd \ ab	00	01	11	10
00	1	0	0	1
01	0	0	0	1
11	1	1	0	0
10	1	1	0	1

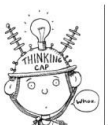
F2(a,b,c,d) = ?

F3(a,b,c,d) = ?

cd \ ab	00	01	11	10
00	0	0	1	1
01	0	1	1	0
11	1	0	0	1
10	0	1	0	1

bd \ a	0	1
00	1	1
01	0	1
11	1	1
10	1	1

F4(a,b,c,d) = ?

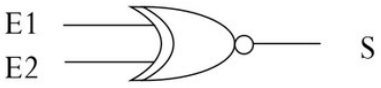


4. build XOR and XNOR gates using AND, OR, NOT gate.

E1	E2	S
0	0	0
0	1	1
1	0	1
1	1	0

Truth table for XOR gate

$$s = f(E1, E2) = (\overline{E1}\,.\,E2) + (E1.\overline{E2})$$



E1	E2	S
0	0	1
0	1	0
1	0	0
1	1	1

Truth table for XNOR gate

$s = f(E1, E2) = ?$

Answer

1. Use identifies of Boolean algebra to simply the following logic expression:

a) f = $a\overline{b}c + \overline{abc}$

= $a\overline{b}c + \overline{b} + \overline{ac}$ (De Morgan's law)

= $\overline{b}$(ac + 1) + $\overline{ac}$

= $\overline{b} + \overline{ac}$ (Domination law)

b) f = $\overline{b}(ac + \overline{a} \cdot \overline{c})$

= $\overline{b}$ac + $\overline{b} \cdot \overline{a} \cdot \overline{c}$ (Absorption law)

= $\overline{b}$ac + $\overline{(b + a + c)}$ (De Morgan's law)

c) f = ab$\overline{c}$+a$\overline{b}\,\overline{c}$+$\overline{a}b\overline{c}$

= $\overline{c}$(ab + a$\overline{b}$ + $\overline{a}$b)

= $\overline{c}$(a(b + $\overline{b}$) + $\overline{a}$b)

= $\overline{c}$(a + $\overline{a}$b) (Unit property)

= $\overline{c}$a + $\overline{a}$b$\overline{c}$ (Absorption law)

d) f = ($\overline{a}$+$\overline{b}$)+($\overline{a}$+b)

= $\overline{(ab)} + (\overline{a} + b)$ (De Morgan's law)

e) f = (a+$\overline{b}$+a$\overline{b}$) $\overline{c}$

= $\overline{c}(a(\overline{b} + 1) + \overline{b})$

= $\overline{c}(a + \overline{b})$ (Domination law)

= $\overline{c}a + \overline{c}\overline{b}$ (Distributive law)

= $\overline{c}a + \overline{(c + d)}$ (De Morgan's law)

f) f = a$\overline{b}$ $\overline{c}$+a$\overline{b}$ $\overline{c}$ $\overline{d}$+a$\overline{c}$

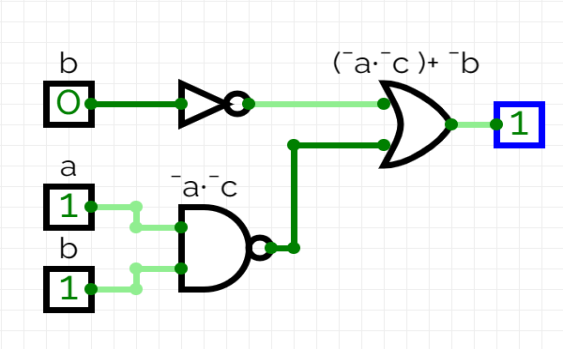
= $\overline{c}a(\overline{b} + \overline{b}\,\overline{d} + 1)$

= $\overline{c}a(\overline{b}(1 + \overline{d}) + 1)$

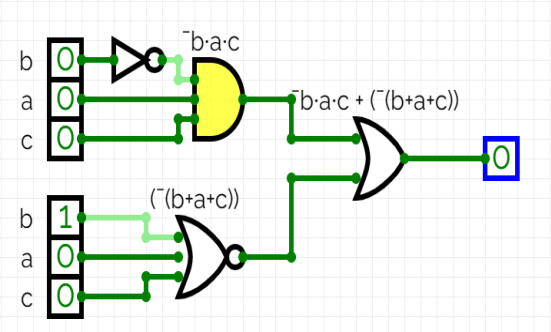
$= \bar{c}a$ (Domination law)

2. After simplify please draw the circuit from above logic expression:

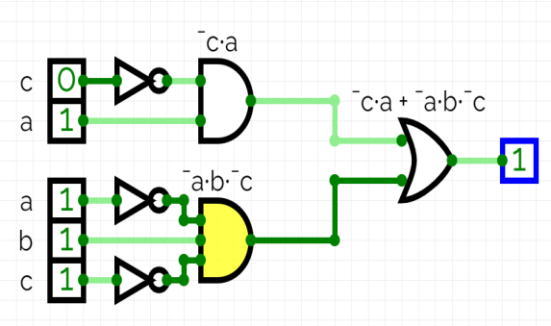
a) f = $\bar{b} + \overline{ac}$



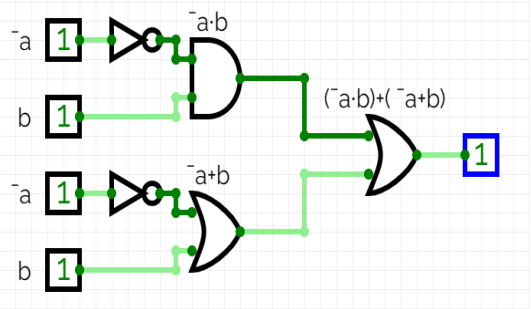
b) = $\bar{b}$ac + $(\overline{b + a + c})$



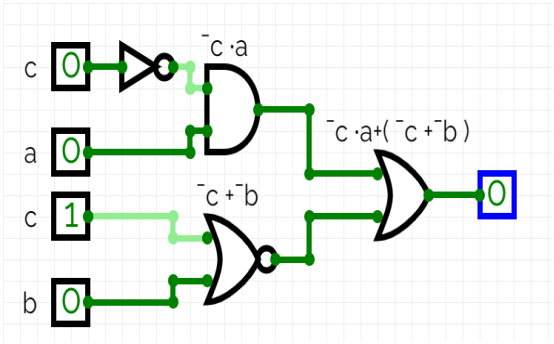
c) = $\bar{c}$a + $\bar{a}$b$\bar{c}$



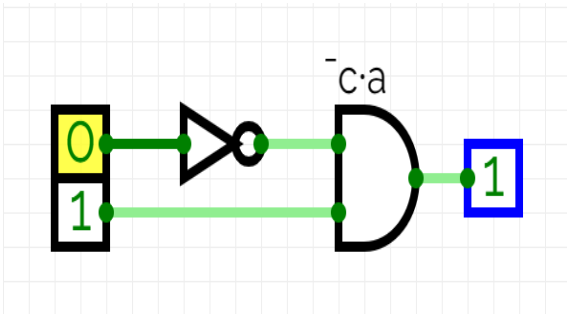
d) f = $(\overline{a\bar{b}}) + (\bar{a} + b)$



e) $\overline{c}a + (\overline{c+d})$



f) f = $\overline{c}a$



3. Find the logic function from table below karnaugh table and draw circuit:

cd \ ab	00	01	11	10
00	1	1	1	1
01	0	0	0	0
11	0	0	0	0
10	1	1	1	1

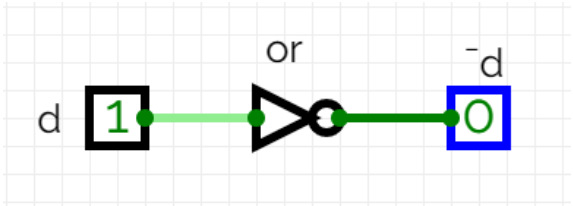
F(a,b,c,d)= $\overline{b}\overline{c}\overline{d} + b\overline{c}\overline{d} + \overline{b}c\overline{d} + bc\overline{d}$

$= \overline{c}\overline{d}(\overline{b}+b) + c\overline{d}(\overline{b}+b)$

$= \overline{c}\overline{d} + c\overline{d}$ (Unit property)

$= \overline{d}(\overline{c} + c)$

$= \overline{d}$ (Unit property)



cd \ ab	00	01	11	10
00	1	0	0	1
01	0	0	0	1
11	1	1	0	0
10	1	1	0	1

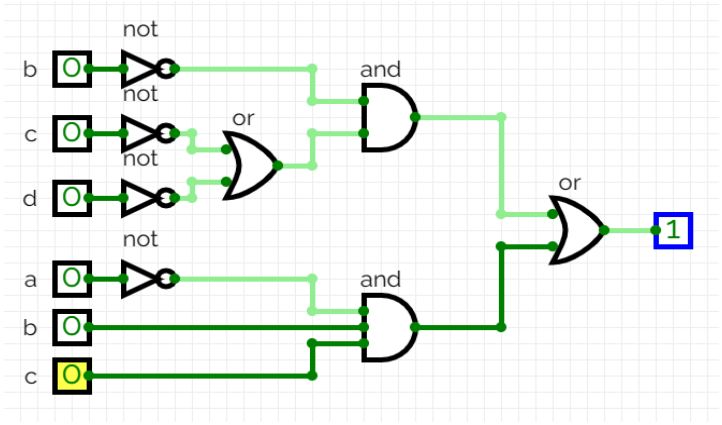
F2(a,b,c,d) = ?

F2(a,b,c,d)= $\bar{b}\bar{c}\bar{d} + a\bar{b}\bar{c} + \bar{b}c\bar{d} + \bar{a}\bar{b}c + \bar{a}bc$

$= \bar{b}\ \bar{d}(\bar{c}+c) + \bar{b}\bar{c}(\bar{a}+a) + \bar{a}bc$

$= \bar{b}\ \bar{d} + \bar{b}\bar{c} + \bar{a}bc$ (Unit property)

$= \bar{b}\,(\bar{d} + \bar{c}) + \bar{a}\,bc$

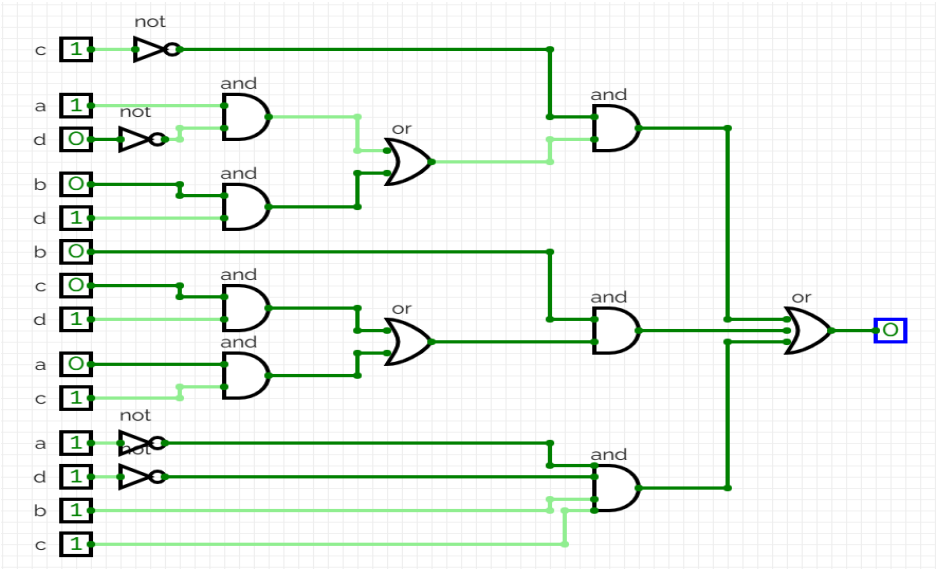


cd \ ab	00	01	11	10
00	0	0	1	1
01	0	1	1	0
11	1	0	0	1
10	0	1	0	1

F3(a,b,c,d) = ?

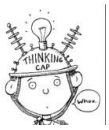
f3(a,b,c,d) = $a\bar{c}\,\bar{d} + b\bar{c}\,d + \bar{b}\,cd + a\bar{b}\,c + \bar{a}\,bc\bar{d}$

$= \bar{c}\,(a\bar{d} + bd) + \bar{b}\,(cd + ac) + \bar{a}\,\bar{d}\,bc$



bd \ a	0	1
00	1	1
01	0	1
11	1	1
10	1	1

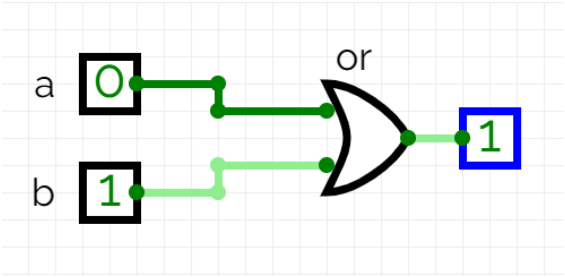
F4(a,b,c,d) = ?



F4(a,b,c,d) = a + $\overline{b}$ a + ba + b$\overline{a}$

= a(1 + a) + b(a + $\overline{a}$)

= a + b (Domination law) (Unit property)



4. build XOR and XNOR gates using AND, OR, NOT gate.

E1	E2	S
0	0	0
0	1	1
1	0	1
1	1	0

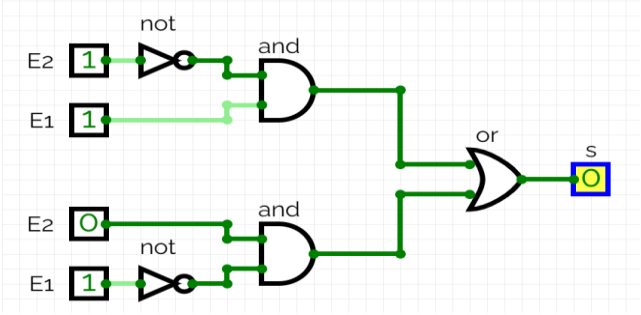
Truth table for XOR gate

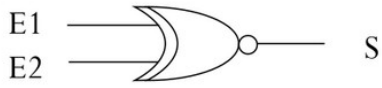
$$s = f(E1, E2) = (\overline{E1}\,.E2) + (E1.\overline{E2})$$

E1	E2	s
0	1	1
1	0	1

E2 \ E1	0	1
0	0	1
1	1	0

S = f(E1,E2) = (E1· $\overline{E2}$)+($\overline{E1}$ ·E2)





E1	E2	S
0	0	1
0	1	0
1	0	0
1	1	1

Truth table for XNOR gate

$s = f(E1, E2) = ?$

E1	E2	s
0	0	1
1	1	1

E1 / E2	0	1
0	1	0
1	0	1

s = f(E1,E2) = $\overline{E1} \cdot \overline{E2}$ + E1· E2