Next Topic:

Compact Truth Table Representation

min terms	a	b	f
$a'b'$	0	0	0
$a'b$	0	1	1
ab'	1	0	1
ab	1	1	0

CSOP exp for f ?

$$\sum m(f=1)$$

$$f = \bar{a}b + a\bar{b}$$

min terms	a	b	f
$a'b'$	0	0	0
$a'b$	0	1	1
ab'	1	0	1
ab	1	1	0

CSOP exp for f ?

$\sum m(f=1)$

$f = \bar{a}b + a\bar{b}$ — Same

$f = 0 \cdot \bar{a}\bar{b} + 1 \cdot \bar{a}b + 1 \cdot a\bar{b}$

$+ 0 \cdot ab$

min term	a	b	f
$a'b'$	0	0	1
$a'b$	0	1	1
ab'	1	0	1
ab	1	1	0

CSOP of f:

$f = \sum m(f=1)$

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

$f = 1\cdot\bar{a}\bar{b} + 1\cdot\bar{a}b + 1\cdot a\bar{b} + 0\cdot ab$

$ab \rightarrow 0$

Same

a	b	f
0	0	0
0	1	0
1	0	1 ✓
1	1	0

$f = a\bar{b}$ ✓

$f = 0 \cdot \bar{a}\bar{b} + 0 \cdot \bar{a}b + 1 \cdot a\bar{b}$

$0 \quad 0 \quad 0$

$+ 0 \cdot ab$

0

$= a\bar{b}$ ✓

Note:

a	b	f
0	0	x
0	1	y
1	0	z
1	1	w

$$f = x\bar{a}\bar{b} + y\bar{a}b + z a\bar{b} + w ab$$

Note:

a	b	f
0	0	x
0	1	y
1	0	z
1	1	w

$$f = x\bar{a}\bar{b} + y\bar{a}b + z a\bar{b} + w ab$$

Verify!

$$\begin{cases} a=0=b\ ;\ f=x \\ a=0,\ b=1\ ;\ f=y \\ a=1,\ b=1\ ;\ f=w \end{cases}$$ Verification

a	b	f
0	0	0
0	1	1
1	0	c
1	1	$\bar{c}$

Compact Truth Table

$f = 0 \cdot \bar{a}\bar{b} + 1 \cdot \bar{a}b +$ (0) $c\,a\bar{b} + \bar{c}\,ab$

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

$f(a, b, c)$

Truth value of f Depends on a, b, c

$a = 1, \; b = 0$ $\quad f = ?$

$f = c$

Truth value

0, 1

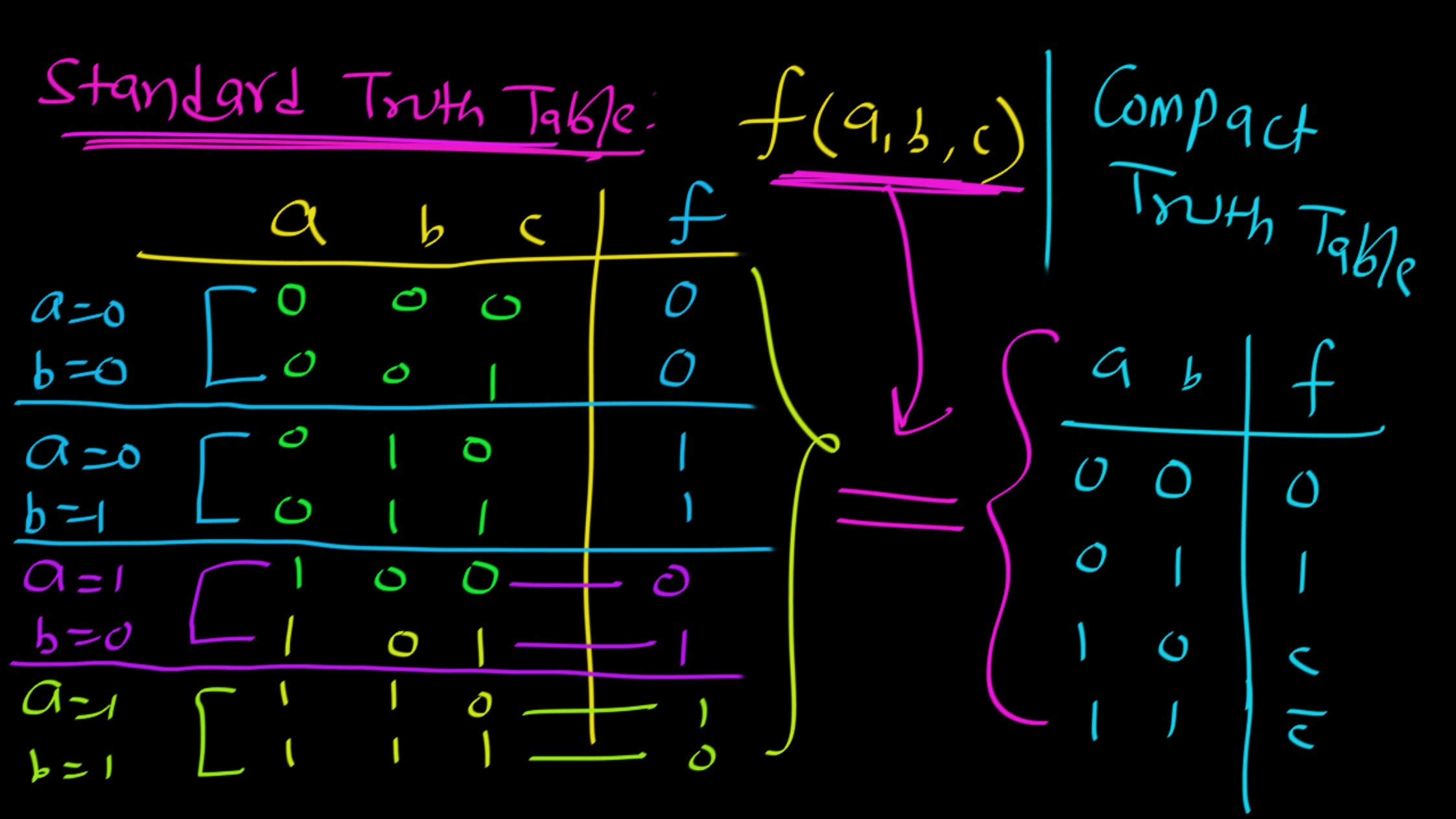
is this Truth value of f?

No

Truth value of f

Depends on c also.

$f(a, b, c)$


Standard Truth Table:
f(a, b, c)
Compact Truth Table
a b c | f
a=0 b=0: 0 0 0 | 0; 0 0 1 | 0
a=0 b=1: 0 1 0 | 1; 0 1 1 | 1
a=1 b=0: 1 0 0 | 0; 1 0 1 | 1
a=1 b=1: 1 1 0 | 1; 1 1 1 | 0
a b | f
0 0 | 0
0 1 | 1
1 0 | c
1 1 | c̄

Note: we are only interested in the function,

many Represent-ations

- K-map - - -
- Standard Truth Table - -
- Compact " " - -
- CSOP , mSOP - - -
- CPOS , mPOS - - -

a	b	f
0	0	0
0	1	c
1	0	d
1	1	$\bar{c}$

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

$$f(a,b,c,d)$$

Standard TT:

16 Rows

a	b	c	d	f
0	0	1	0	0
0	0	1	1	0
1	1	0	1	1
1	0	1	1	1
0	1	0	0	0

Standard Truth Table: $f(a, b, c)$

a	b	c	f
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

Q: find Compact Truth Table!

Standard Truth Table: $f(a, b, c)$

a	b	c	f
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

a	b	f
0	0	
0	1	
1	0	
1	1	

?!

Standard Truth Table: $f(a, b, c)$

	a	b	c	f
a=0, b=0	0	0	0	1
	0	0	1	0
a=0, b=1	0	1	0	1
	0	1	1	1
a=1, b=0	1	0	0	1
	1	0	1	0
a=1, b=1	1	1	0	1
	1	1	1	0

a	b	f
0	0	$\bar{c}$
0	1	1
1	0	c
1	1	$\bar{c}$

Standard Truth Table: $f(a, b, c)$

	a	b	c	f
a=0, b=0	0	0	0	1
	0	0	1	0
a=0, b=1	0	1	0	1
	0	1	1	1
a=1, b=0	1	0	0	1
	1	0	1	0
a=1, b=1	1	1	0	1
	1	1	1	0

a	b	f
0	0	$\bar{c}$
0	1	b → 1 ✓
		b → Unnecessary
1	0	$\bar{c}$
1	1	$\bar{c}$

Standard Truth Table: $f(a, b, c)$

a	b	c	f
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

b	c	f
0	0	?
0	1	
1	0	
1	1	

Standard Truth Table: $f(a, b, c)$

a	b	c	f
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

b	c	f
0	0	1
0	1	0
1	0	1
1	1	$\bar{a}$

Standard Truth Table: $f(a, b, c)$

a	b	c	f
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

a	c	f
0	0	?
0	1	
1	0	
1	1	

Standard Truth Table: $f(a, b, c)$

a	b	c	f
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

a	c	f
0	0	1
0	1	b
1	0	1
1	1	0

STT

CTT

$f = ?$

$f = ?$

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

$f = \bar{a}\bar{c} + \bar{a}bc + a\bar{c}$

Simplify this → $\bar{c} + \bar{a}b$

II simplify

Standard Truth Table: $f(a, b, c)$

a	b	c	f
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

a	f
0	?
1	

Standard Truth Table: $f(a, b, c)$

a	b	c	f
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

a	f
0	$b + \bar{c}$
1	$\bar{c}$

Standard Truth Table: $f(a, b, c)$

a	b	c	f
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

b	f
0	
1	?

Standard Truth Table: $f(a, b, c)$

a	b	c	f
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

$b = 0$

$b = 1$

b	f
0	$\overline{c}$
1	$\overline{ac}$

Standard Truth Table: $f(a, b, c)$

a	b	c	f
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

c	f
0	
1	?

Standard Truth Table: $f(a, b, c)$

a	b	c	f
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

c	f
0	1
1	$\bar{a}b$

a	b	f
0	0	1
0	1	0
1	0	1
1	1	1

$$f_{(a,b,c)} = \Sigma(0, 2, 6, 7)$$

a	b	f
0	0	$\bar{c}$
0	1	$\bar{c}$
1	0	0
1	1	1

$$f_{(a,b,c)} = \Sigma(0,2,6,7)$$

$$= \bar{a}\bar{b}\bar{c} + \bar{a}b\bar{c} + (+0 \cdot a\bar{b}) + ab\bar{c} + abc$$

$$ab(c+\bar{c}) = ab \cdot 1$$

a	b	f
0	0	$\bar{c}$
0	1	
1	0	
1	1	

$f_{(a,b,c)} = \Sigma(0, 2, 6, 7)$

$= \bar{a}\bar{b}\bar{c} + \bar{a}b\bar{c} + ab\bar{c} + abc$

when $a=1, b=1$

$f = 1$

when $a=1, b=0 \Rightarrow f = 0$

when $a=0, b=0 \Rightarrow f = \bar{c}$

a	b	f
0	0	
0	1	
1	0	
1	1	

1

$f(a,b,c,d) = \Sigma(2, 5, 6, 7, 10, 11, 15)$

a	b	f
0	0	$c\bar{d}$
0	1	$c+d$
1	0	c
1	1	cd

$$f(a,b,c,d) = \Sigma(2, 5, 6, 7, 10, 11, 15)$$

$$= \bar{a}\bar{b}cd + \bar{a}b\bar{c}d + \bar{a}bcd + a\bar{b}cd + abcd + a\bar{b}c\bar{d}$$

When $a=1, b=0$

$\Rightarrow f = c\bar{d} + cd = c$

When $a=0, b=1$

$\Downarrow$

$\bar{c}d + c\bar{d} + cd$

$= c + d$

When $a=0, b=0 \Rightarrow f = c\bar{d}$

" $a=1, b=1 \Rightarrow f = cd$

$f(a,b,c,d) = \Sigma(2, 5, 6, 7, 10, 11, 15)$

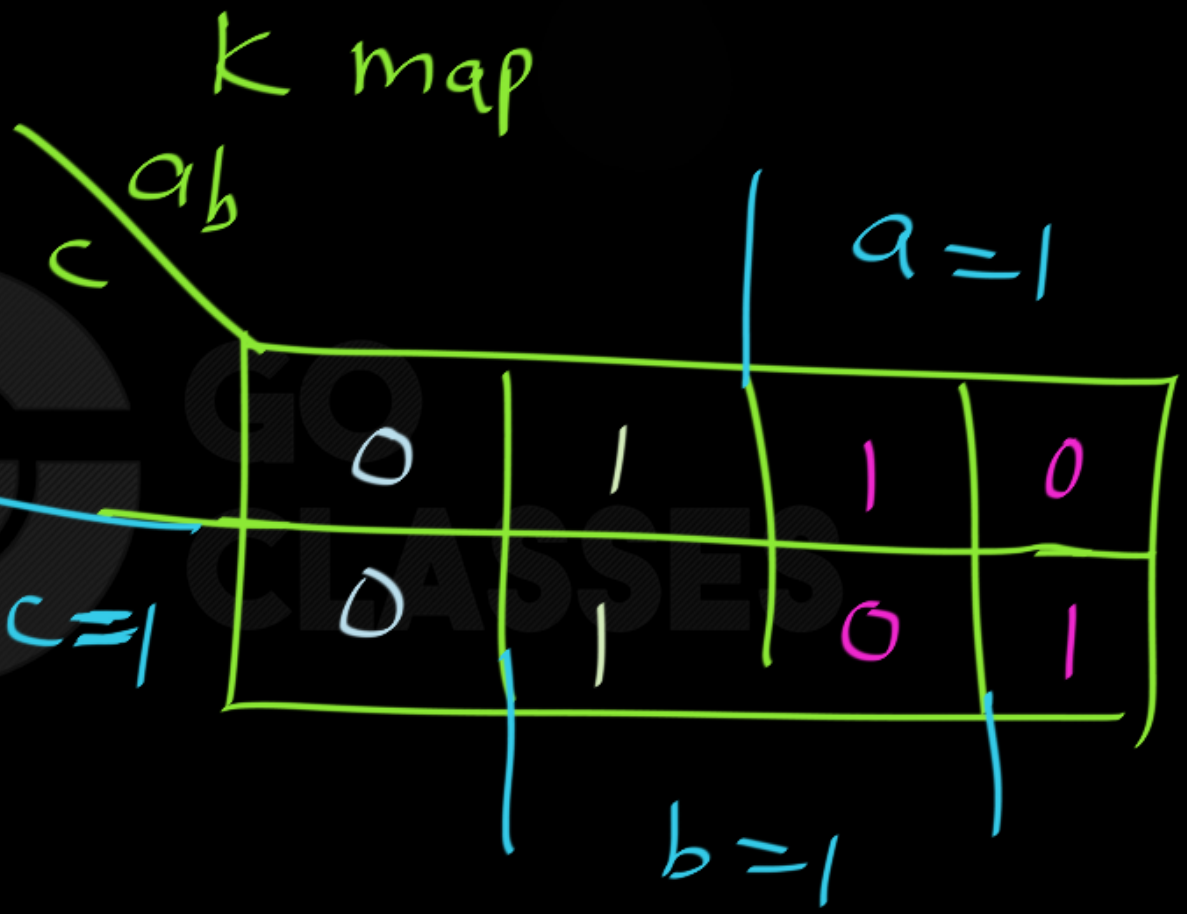
$= \bar{a}\bar{b}c\bar{d} + \bar{a}b\bar{c}d + \bar{a}bcd + a\bar{b}cd + abcd + a\bar{b}c\bar{d}$

a	b	f
0	0	0
0	1	1
1	0	c
1	1	c

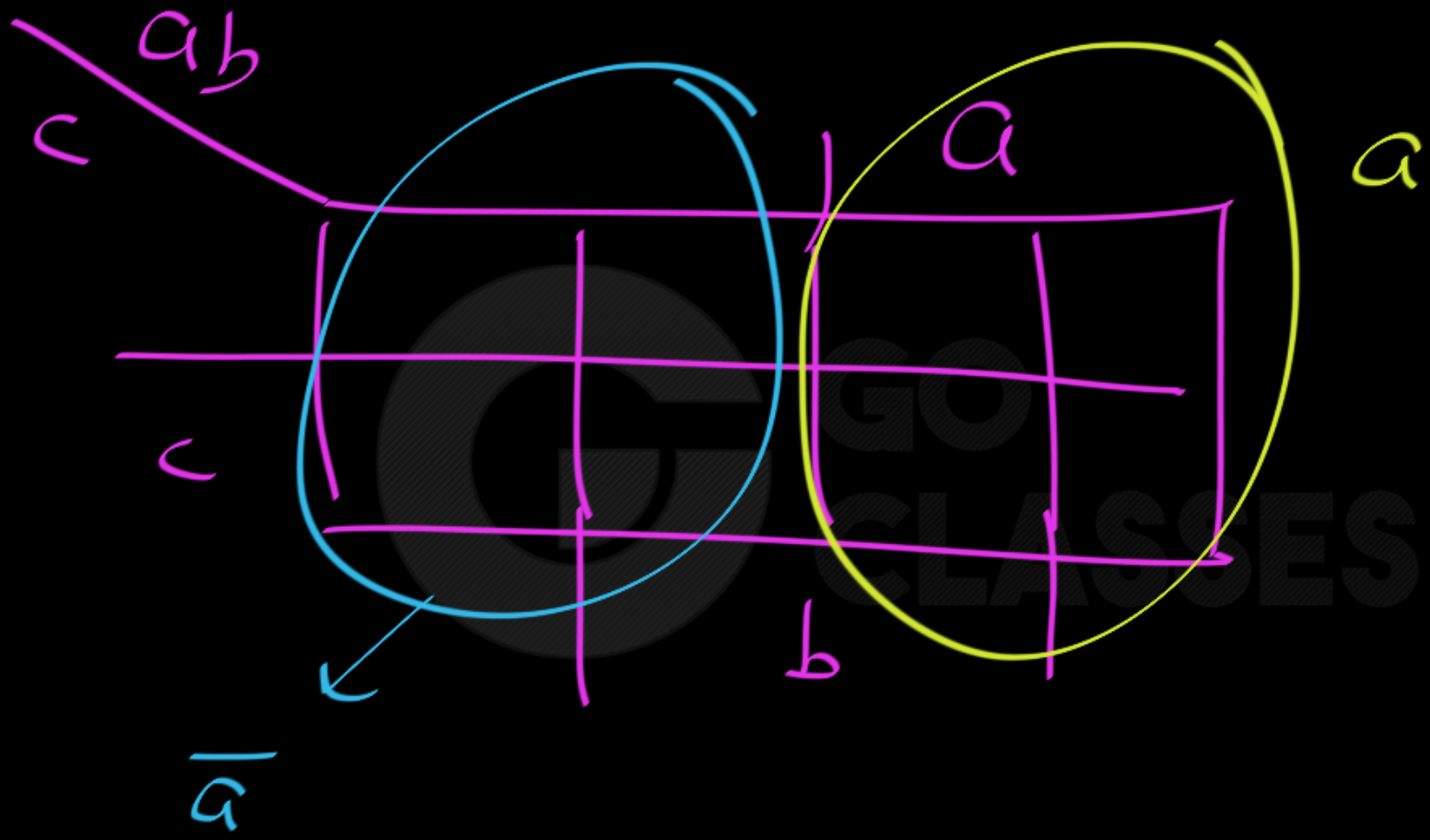
k map ?

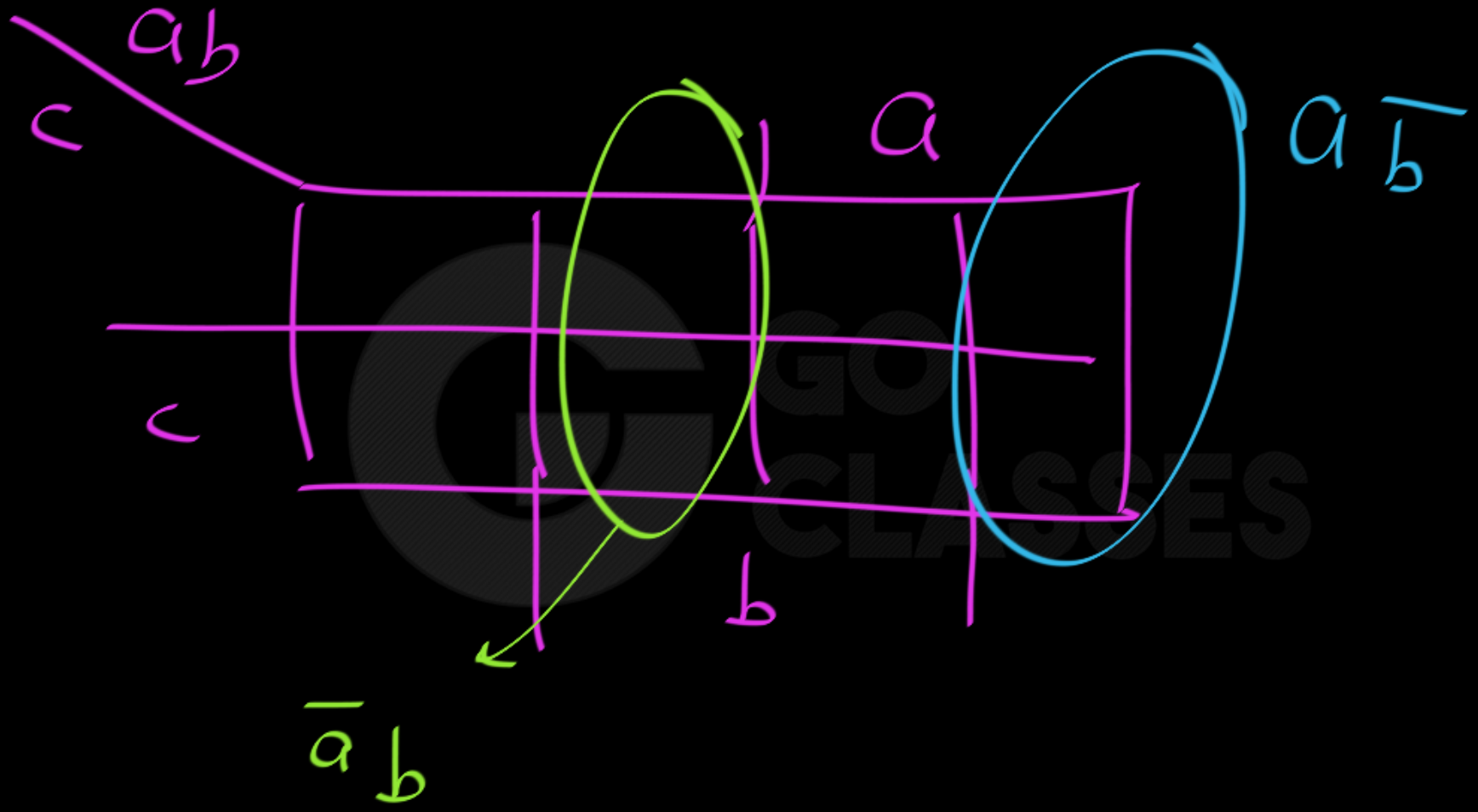
⇒

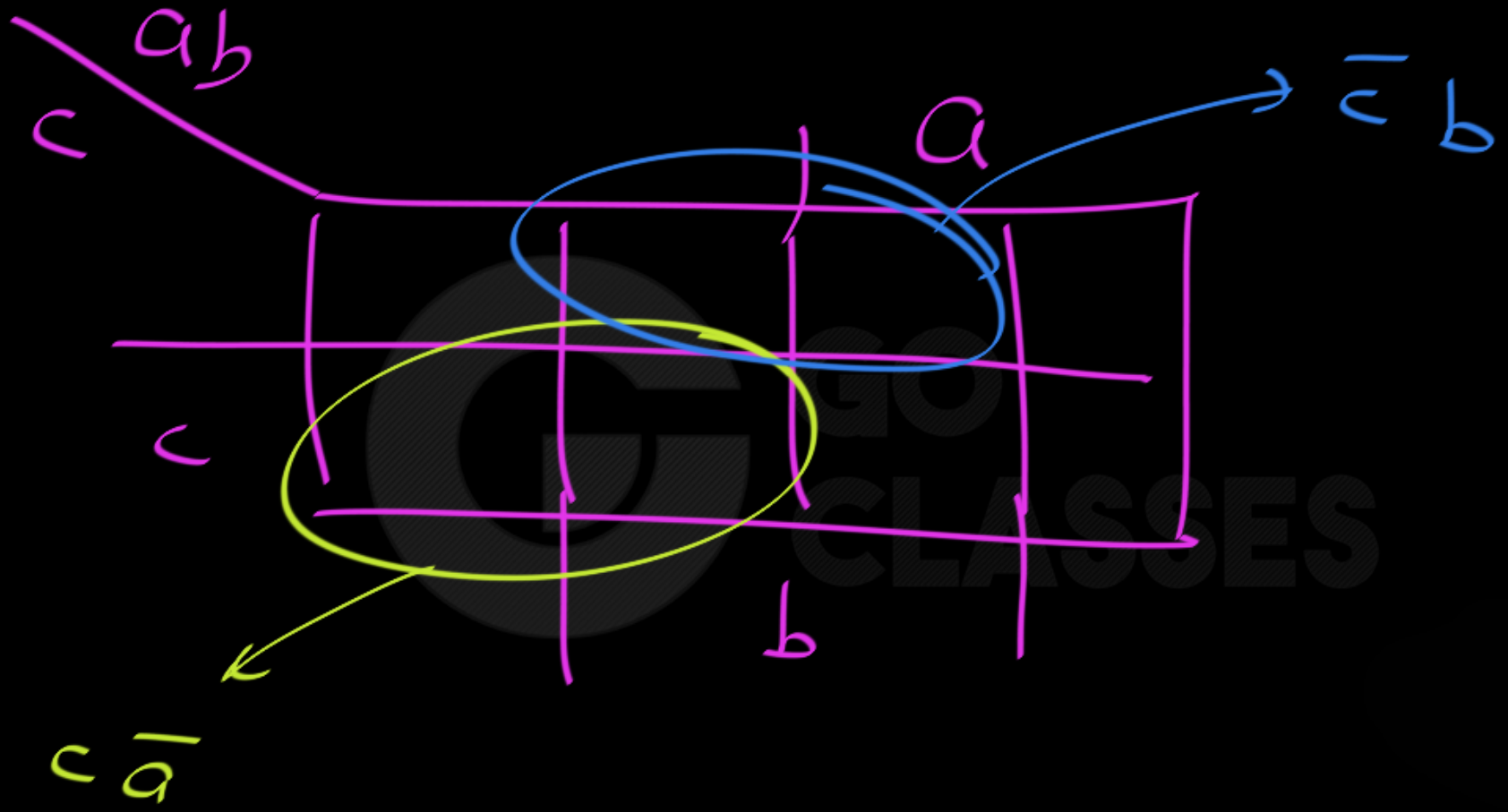
a	b	f
0	0	0
0	1	1
1	0	c
1	1	$\bar{c}$

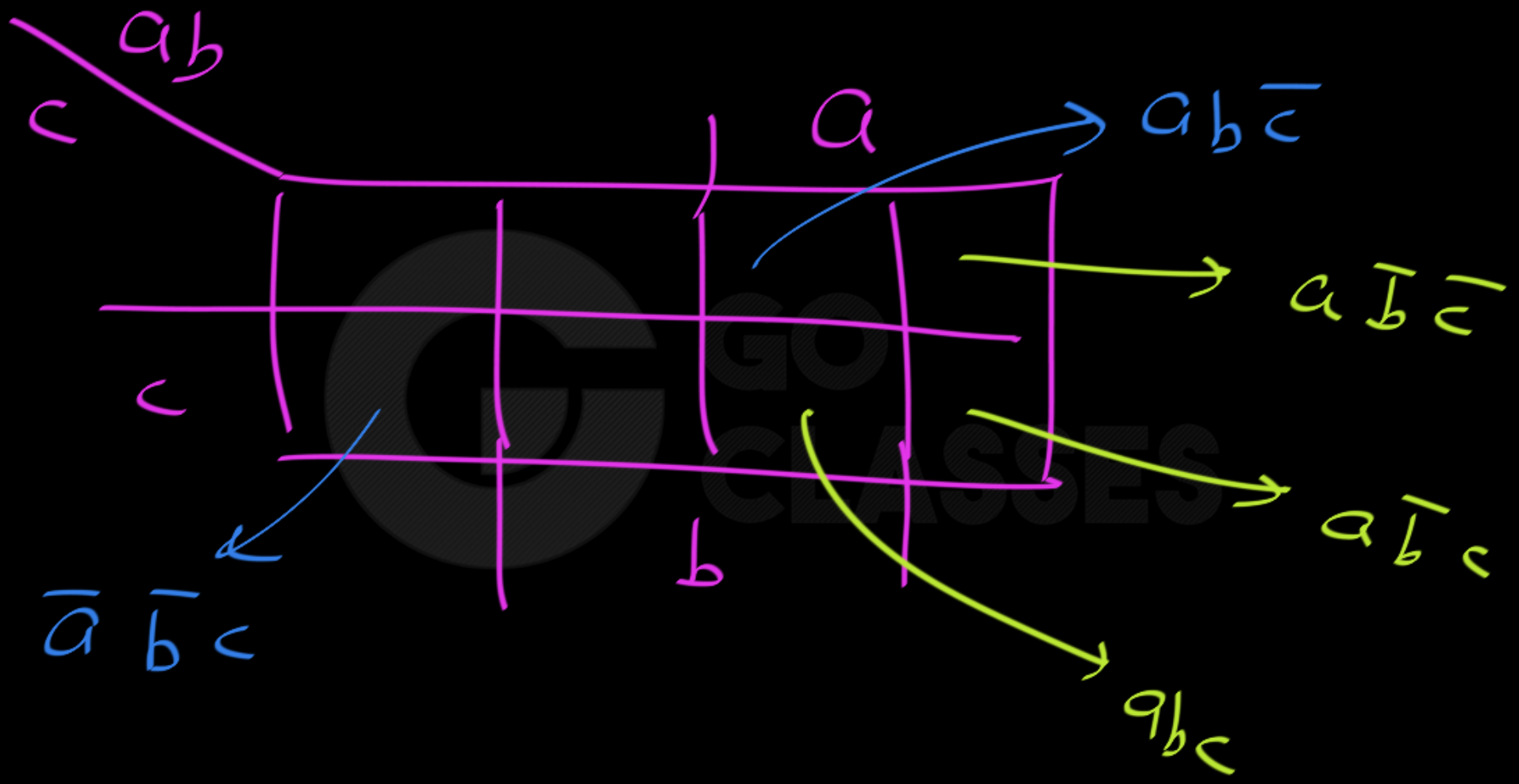


$f(a, b, c)$


ab
c
a
a
c
b
$\bar{a}$


ab
c
a
a b̄
c
b
ā b


ab
c
a
$\bar{c}$ b
c
b
c $\bar{a}$


ab
c
a
abc̄
ab̄c̄
c
ab̄c
b
ā b̄ c
abc

Imp :-

a	f
0	w
1	x

$$f = \bar{a}w + ax$$

a	b	f
0	0	w
0	1	x
1	0	y
1	1	z

$$f = \bar{a}\bar{b}w + \bar{a}bx + a\bar{b}y + abz$$