CS & IT ENGINEERING

Digital Logic
Minimization
Lecture No. 2

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01 QUESTION PRACTICE

04 DUAL & SELF DUAL

05 DISCUSSION

✯ Distribution Theorem

$$A + BC = (A+B)(A+C)$$

$$A + BCD = (A+B)(A+C)(A+D)$$

✯ Concensus Theorem

$$AB + \bar{A}C + BC = AB + \bar{A}C$$

$$\bar{x}\bar{y} + \bar{x}\bar{z} + \bar{y}z = \bar{x}\bar{z} + \bar{y}z$$

✯ Transpose Theorem

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

Ex $(A+B)(\bar{A}+\bar{B}) = A\bar{B} + \bar{A}B = A \oplus B$

Ex. $(\bar{A}+B)(A+\bar{B}) = \bar{A}\bar{B} + AB = A \odot B$

De-Morgan's Law

$$\overline{ABC} = \bar{A} + \bar{B} + \bar{C}$$

$$\overline{A + B + C} = \bar{A} \cdot \bar{B} \cdot \bar{C}$$

Q.1

Find the minimum number of the NAND gate required to implement the Boolean function given below:

$f(A, B, C) = A + ABC + AB\bar{C}$

$= A[1 + BC + B\bar{C}]$

$= A$

= NAND

Q.2

Minimize the expression:

$f(A, B) = A + A\bar{B}$

$= A(1 + \bar{B})$

$= A$

$A \cdot 0$

Q.3

Minimize the expression.

$f(A, B) = \overline{A}\,\overline{B} + \overline{A}B + AB$

$= \bar{A}[\bar{B} + B] + AB$

$= \bar{A} + AB$

$= (\bar{A} + A)(\bar{A} + B)$

$= \bar{A} + B$

Ans

Q.4

Minimize the expression.

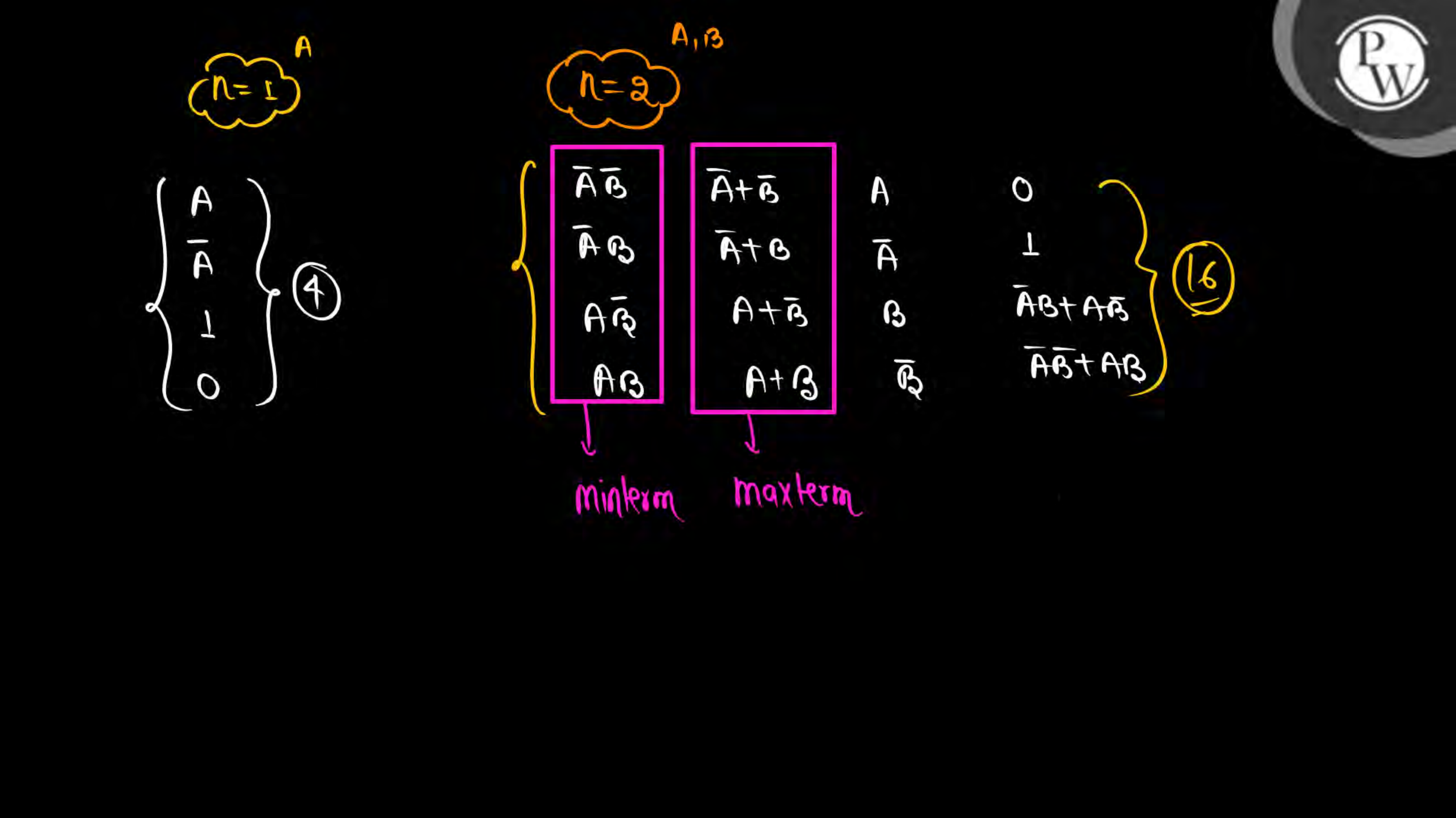
$f(A, B) = \overline{A}\,\overline{B} + \overline{A}B + A\overline{B} + AB$

$= \bar{A}[\bar{B}+B] + A[\bar{B}+B]$

$= \bar{A} + A$

$= 1$

Ans


A
n = 1
A, B
n = 2
A
Ā
1
0
4
ĀB̄
ĀB
AB̄
AB
Ā + B̄
Ā + B
A + B̄
A + B
A
Ā
B
B̄
0
1
ĀB + AB̄
ĀB̄ + AB
16
minterm
maxterm

2^{2^n} distinct expression can be formed

$2^n \rightarrow$ minterm

$2^n \rightarrow$ maxterm

Q.5

Minimize the expression.

$f(A, B) = \overline{A}B + A\overline{B}$ $= A \oplus B$

↳ Already minimized

$f(A, B) = \overline{A}\,\overline{B} + AB$

↳ Already minimized

Q. $f(A,B,C) = \bar{A}\bar{B}C + \bar{A}B\bar{C} + A\bar{B}\bar{C} + ABC$

(001) (010) (100) (111)

$= \Sigma m(1,2,4,7)$

$= A \oplus B \oplus C$

↳ Already minimized

$$f(A,B,C) = \bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C + \bar{A}B\bar{C} + \bar{A}BC + A\bar{B}\bar{C} + A\bar{B}C + AB\bar{C} + ABC$$

$$= 1$$

Q.6

Minimize the expression.

$f(A, B) = AB + \overline{A}C + BC$

$= AB + \overline{A}C$

$f(A, B) = AB + \overline{A}C + BC$

→ Function written in wrong format

$$f(B,A) = \overset{1}{\bar{A}B} + \overset{2}{A\bar{B}} + \overset{3}{AB} = \Sigma m(1,2,3) \times$$

$$= \overset{1}{B\bar{A}} + \overset{2}{\bar{B}A} + \overset{3}{BA} = \Sigma m(1,2,3) \checkmark$$

$$= 2 \quad 1 \quad 3$$

Q.7

Minimize the expression.

$f(A, B, C) = \overline{A}\,\overline{B} + \overline{A}C + \overline{B}\,\overline{C}$

$= \overline{A}C + \overline{B}C$

Ans

Redundant term = $\overline{A}\,\overline{B}$

Q.8

Minimize the expression.

$f(A, B, C) = (\overline{A + B})(A + C)(\overline{\overline{B} + C})$

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

Ans

Q.9

Write the function for truth table and minimize it.

A	B	Y(O/p)
0	0	1
0	1	0
1	0	1
1	1	1

INPUT

OUTPUT

SOP form

$Y = \bar{A}\bar{B}\cdot 1 + \bar{A}B\cdot 0 + A\bar{B}\cdot 1 + AB\cdot 1$

$Y = \bar{A}\bar{B} + A\bar{B} + AB$

$Y = \bar{A}\bar{B} + A[\bar{B}+B]$

$Y = A + \bar{A}\bar{B} = (A+\bar{A})(A+\bar{B})$

$\boxed{Y = A+\bar{B}}$ Ans

POS $Y = (A+B+1)\cdot(A+\bar{B}+0)\cdot(\bar{A}+B+1)\cdot(\bar{A}+\bar{B}+1)$

$= 1\cdot(A+\bar{B})\cdot 1\cdot 1$

$= A+\bar{B}$ Ans

Q.10

SOP :: $Y = \bar{A}\bar{B}C + \bar{A}B\bar{C} + A\bar{B} + AB$

$Y(A, B, C)$

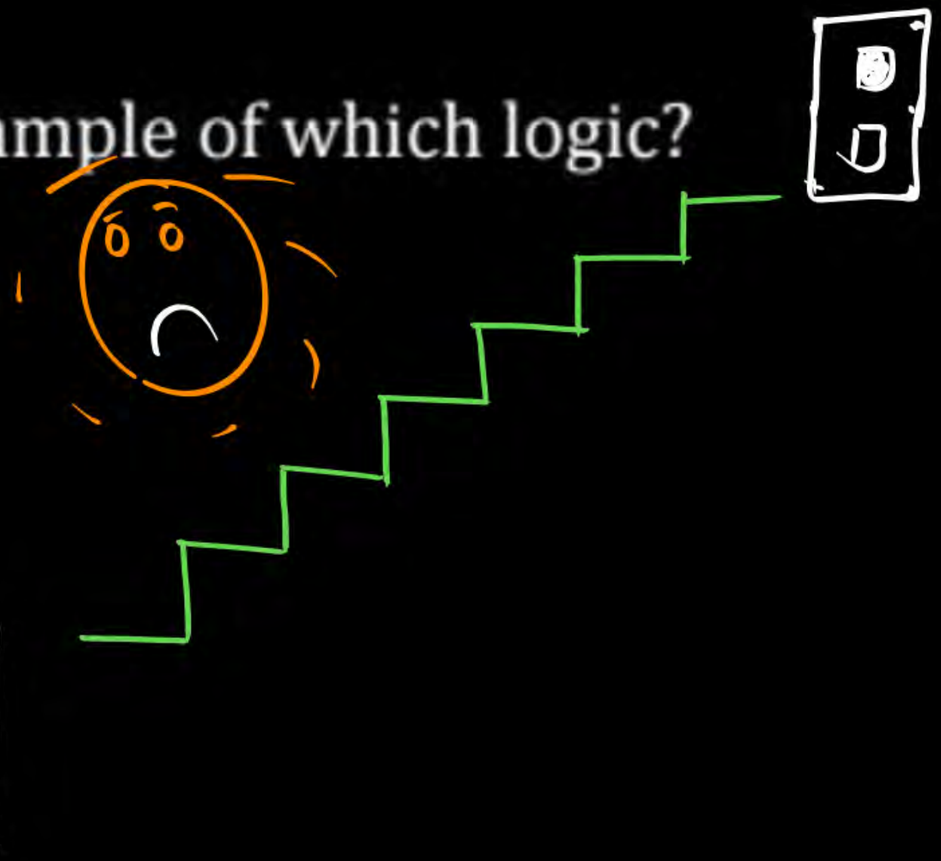
Write the function for truth table and minimize it.

A	B	Y(O/p)
0	0	C
0	1	$\overline{C}$
1	0	1
1	1	1

Q.11

MCQ

Two way switch is a example of which logic?



A AND

B OR

C X-OR

D NAND

Q.12

If we have '4' variable, then total different expression will be?

$$2^{2^n} = 2^{2^4} = 2^{16} = 2^6 \cdot 2^{10} = 64 \times 1024$$

$$= 64K$$

$2^{10} = K$

$2^{20} = M$

$2^{30} = G$

$2^{40} = T$

Q.13

$A + BC + \bar{A}C$ is equal to

(a) $(A + B)$ ✗

(b) $(A + B)(B + C)$ ✗

(c) $(A + B)(\bar{A} + C) = AC + \bar{A}B$

(d) $C(\bar{A} + B)$

$\bar{A}C + BC$

$A + BC + \bar{A}C$

$(A + \bar{A})(A + C) + BC$

$A + C + BC$

$A + C[1 + B]$

$A + C$ PKP

C

$$f = AB + \bar{A}\bar{B} + ABC + \bar{A}\bar{B}\bar{C}$$

$$= AB[1+C] + \bar{A}\bar{B}[1+\bar{C}]$$

$$= AB + \bar{A}\bar{B}$$ Ans

(A) $A+B$

~~(B)~~ $AB + \bar{A}\bar{B} + \bar{A}\bar{B}\bar{C}$

(C) $A+C$

(D) $A+B+C$

$A + B.C + \bar{A}C$

$A + (B + \bar{A})C$

Q.14

$\bar{A}B + AC + \bar{B}C$ is equivalent to

(a) $\bar{A}B + AC$

(b) $\bar{A}B + C$

(c) $AC + \bar{B}C$

(d) $\bar{A}B + \bar{B}C$

Q.16

$\overline{(\bar{A}+\bar{B})(\bar{B}+\bar{C})}$ is equal to

(a) $\bar{B}(A+C)$

(b) $A\,(B+C)$

(c) $B(A+C)$

(d) $C(A+B)$

Q.17

$\bar{A}\bar{B} + AC + \bar{B}C$ is equivalent to

(a) $(A + \bar{B}) \cdot (\bar{A}\bar{B} + C)$

(b) $\bar{A}\bar{B} + AC$

(c) $AC + \bar{B}C$

(d) $\bar{A}\bar{B} + \bar{B}C$

Q.18

$(A + B)(A + C)(A + \bar{C})$ is equivalent to

(a) $A + BC$

(b) $A + B\bar{C}$

(c) 0

(d) A

Q.19

A logical function is given as:

$f(\mathrm{A}, \mathrm{B}, \mathrm{C}) = B\bar{C}\left[A + B\bar{C}D + \bar{B}CD + \bar{A}B\bar{C} + \bar{A}\bar{B}\bar{C}\right]$

is equivalent to

(a) $\mathrm{A}\bar{\mathrm{B}}\mathrm{CD}$

(b) $\mathrm{B}\bar{\mathrm{C}}$

(c) $\mathrm{A}\bar{\mathrm{B}} + \mathrm{B}\bar{\mathrm{C}} + \mathrm{CD}$

(d) $\mathrm{AB}\bar{\mathrm{C}}\mathrm{D}$

Q.20

A logical function

$f(A, B, C) = (A + B)(\overline{B} + C)(A + C)$, then will be equal to

(a) $AB + \overline{B}C$

(b) $\overline{A}\overline{B} + B\overline{C}$

(c) $\overline{A}\overline{B} + \overline{A}\overline{C}$

(d) $AB + AC$

Q.21

Which of the following is true?

(a) $\overline{\bar{A}B + A\bar{B}} = (\bar{A} + \bar{B})(A + B)$

(b) $\overline{AB\overline{CD}} = \bar{A} + \bar{B} + \bar{C} + \bar{D}$

(c) $\overline{\overline{A\bar{B}}.C} = (A + \bar{C})(\bar{B} + \bar{C})$

(d) None of these

Q.21

A logical function

$f(A, B, C) = (A + B)(\overline{B} + C)(A + C)$, then will be equal to

(a) $AB + \overline{B}C$

(b) $\overline{A}\overline{B} + B\overline{C}$

(c) $\overline{A}\overline{B} + \overline{A}\overline{C}$

(d) $AB + AC$

Laws of Boolean Algebra

- BOOLEAN ALGEBRA

Thank you

GW

Soldiers !