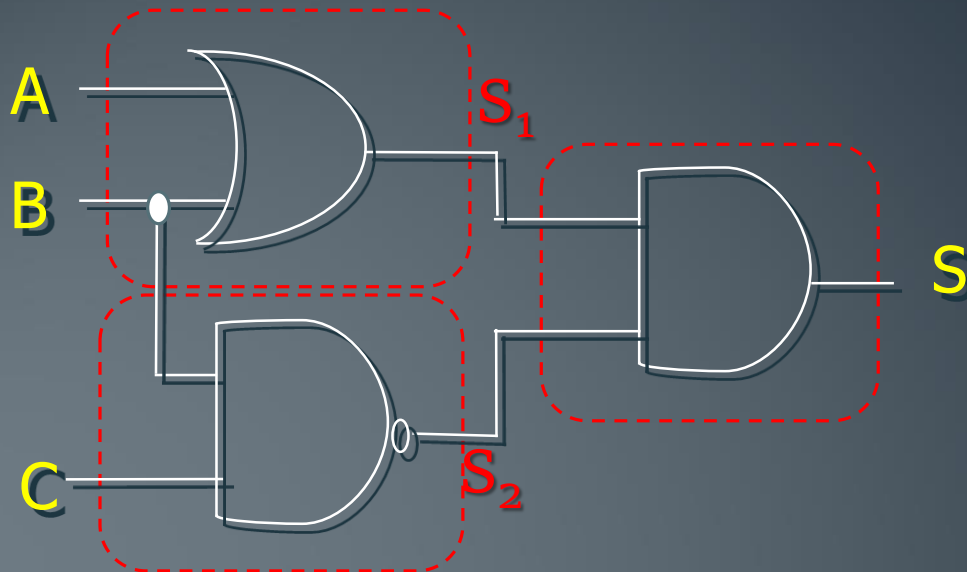


SEL 454

Introdução aos Sistemas Digitais

FUNÇÕES LÓGICAS

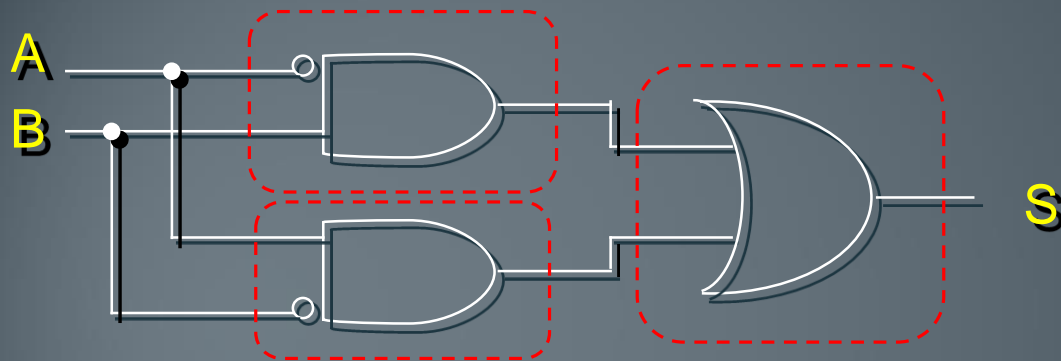
Prof. Homero Schiabel



$$S_1 = A + B$$

$$S_2 = \overline{B C}$$

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



$$S = \bar{A}B + A\bar{B}$$

$$1.0 + 0.1$$

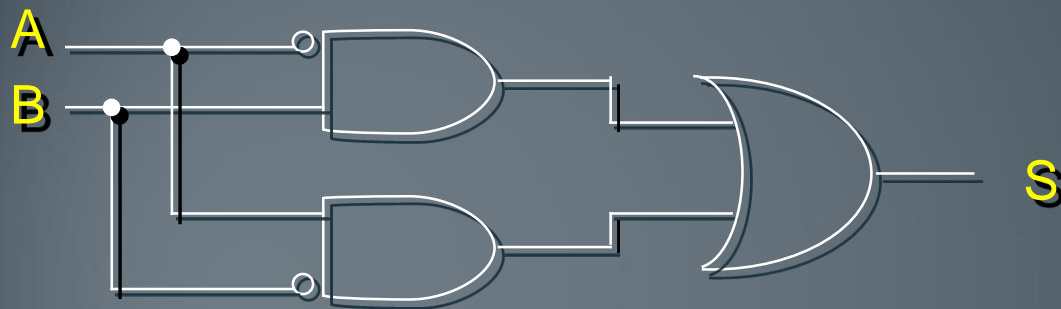
$$0 \quad 0$$

$$S = \bar{A}B + A\bar{B}$$



TABELA DA VERDADE

A	B	S
0	0	0
0	1	1
1	0	1
1	1	0



$$S = \bar{A}B + A\bar{B}$$

$$1.1 + 0.0$$

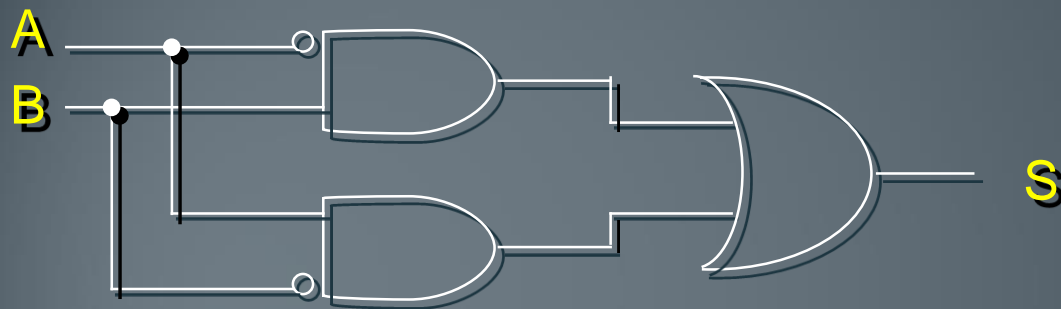
$$1 \quad 0$$

$$S = \bar{A}B + A\bar{B}$$



TABELA DA VERDADE

A	B	S
0	0	0
0	1	1



$$S = \bar{A}B + A\bar{B}$$

$$0.0 + 1.1$$

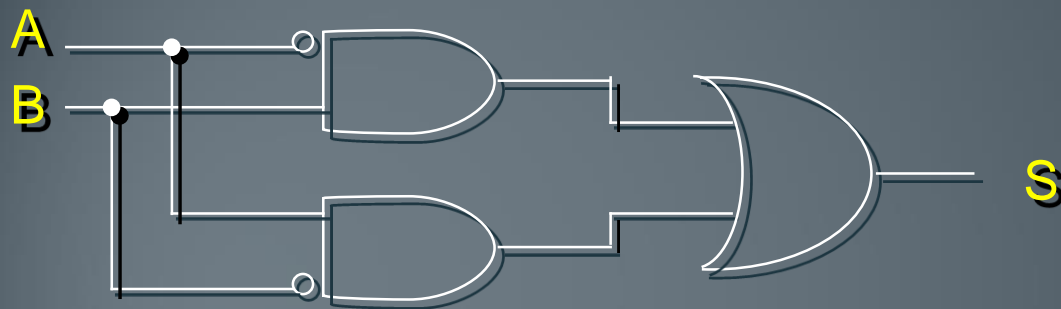
$$0 \quad 1$$

$$S = \bar{A}B + A\bar{B}$$



TABELA DA VERDADE

A	B	S
0	0	0
0	1	1
1	0	1



$$S = \bar{A}B + A\bar{B}$$

$$0.1 + 1.0$$

$$0 \quad 0$$

$$S = \bar{A}B + A\bar{B}$$

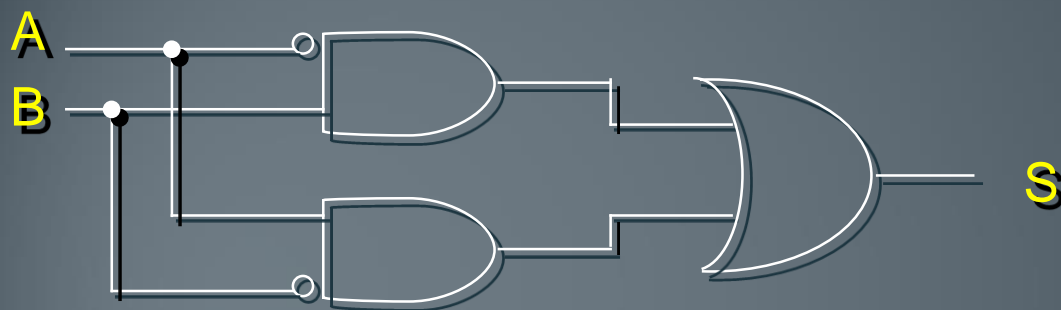


TABELA DA VERDADE

A	B	S
0	0	0
0	1	1
1	0	1
1	1	0

FUNÇÃO OU-EXCLUSIVO ("X-OR")

$$S = \bar{A}B + A\bar{B}$$



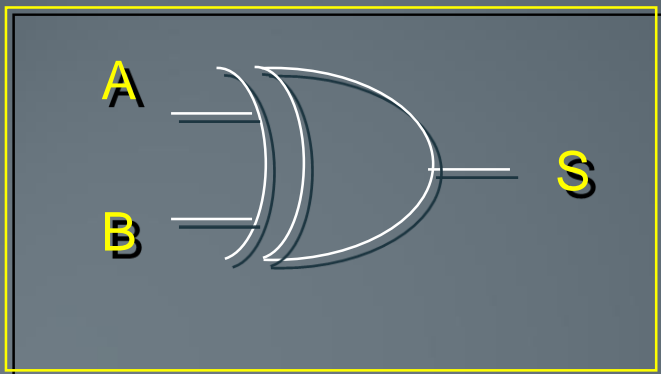
S = 1 quando $A \neq B \rightarrow S = 1$ apenas quando A **OU** B = 1

TABELA DA VERDADE

A	B	S
0	0	0
0	1	1
1	0	1
1	1	0

$$S = A \oplus B$$

FUNÇÃO OU-EXCLUSIVO (“X-OR”)



$$S = \bar{A}B + A\bar{B}$$

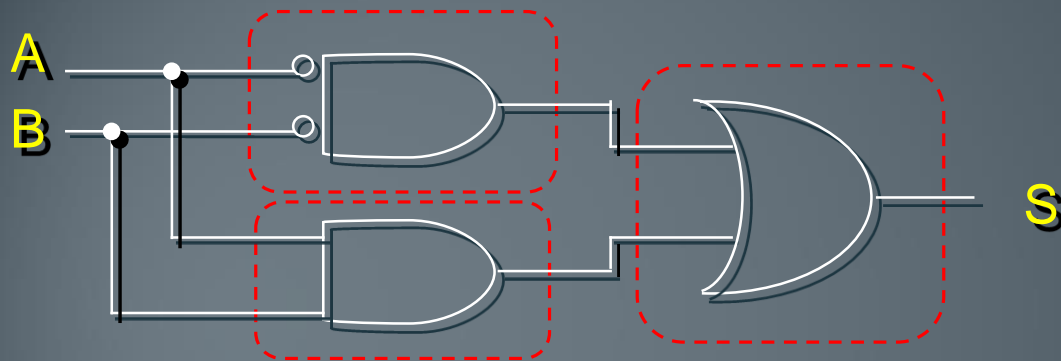


TABELA DA VERDADE

A	B	S
0	0	0
0	1	1
1	0	1
1	1	0

$S = 1$ quando $A \neq B \rightarrow S = 1$ apenas quando A **OU** B = 1

$$S = A \oplus B$$



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

$$1.1 + 0.0$$

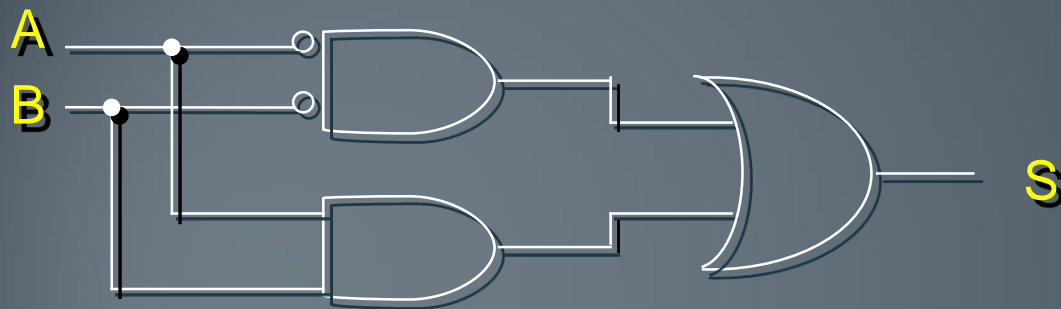
$$1 \quad 0$$

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



TABELA DA VERDADE

A	B	S
0	0	1



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

$$1.0 + 0.1$$

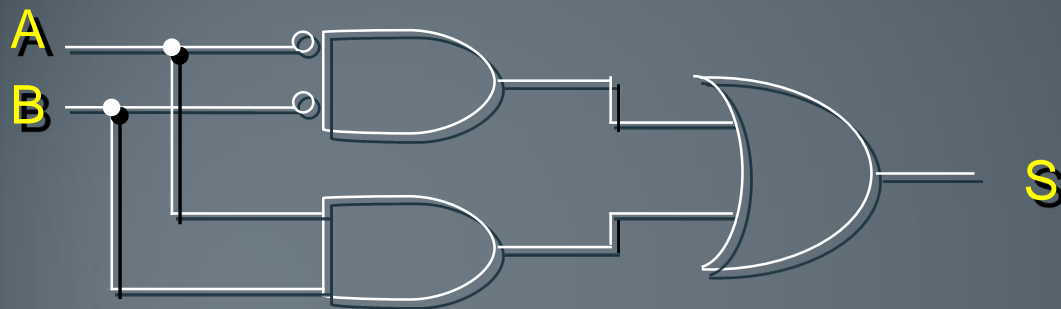
$$0 \quad 0$$

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



TABELA DA VERDADE

A	B	S
0	0	1
0	1	0



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

$$0.1 + 1.0$$

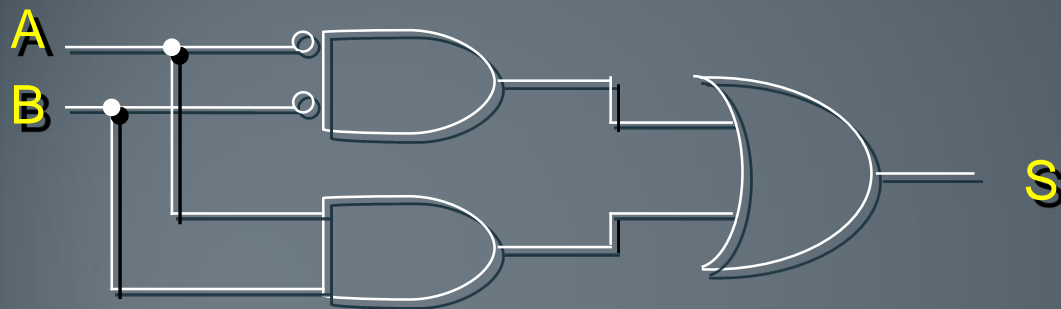
$$0 \quad 0$$

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



TABELA DA VERDADE

A	B	S
0	0	1
0	1	0
1	0	0



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

$$0.0 + 1.1$$

$$0 \quad 1$$

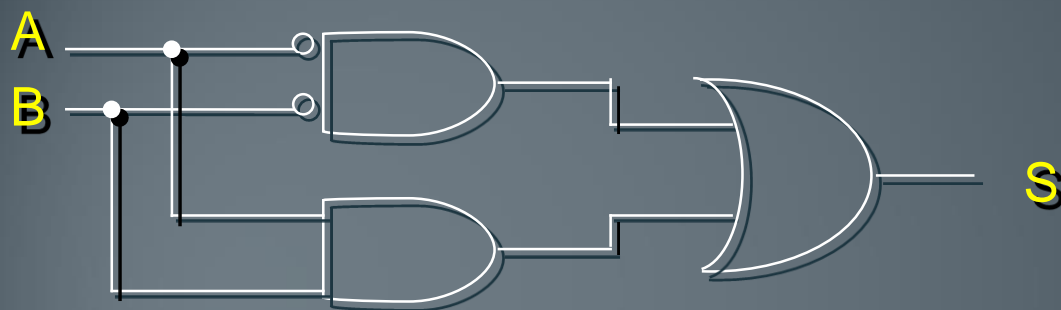
$$S = \bar{A}\bar{B} + AB$$



TABELA DA VERDADE

A	B	S
0	0	1
0	1	0
1	0	0
1	1	1

FUNÇÃO COINCIDÊNCIA (“X-NOR”)



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



TABELA DA VERDADE

A	B	S
0	0	1
0	1	0
1	0	0
1	1	1

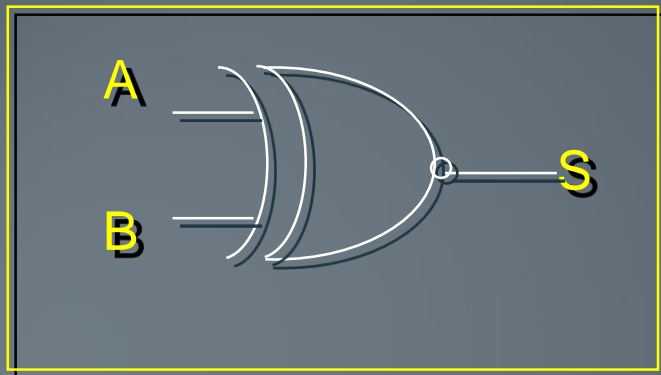
S = 1 somente quando A = B

$$S = A \odot B$$



$$S = \overline{A \oplus B}$$

FUNÇÃO COINCIDÊNCIA (“X-NOR”)



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



TABELA DA VERDADE

A	B	S
0	0	1
0	1	0
1	0	0
1	1	1

S = 1 somente quando A = B

$$S = A \odot B$$



$$S = \overline{A \oplus B}$$

$$\overline{A \oplus B} = A \odot B$$

A	B	$A \oplus B$	$A \odot B$
0	0	0	1
0	1	1	0
1	0	1	0
1	1	0	1

SEL 405

Introdução aos Sistemas Digitais

SISTEMAS COMBINATÓRIOS

Prof. Homero Schiabel

1. MONTAGEM

I. Sistema (expressão) \Rightarrow Tabela da Verdade

ABC	S_1	S_2	S
0 0 0	0	1	0
0 0 1	0	1	0
0 1 0	1	1	1
0 1 1	1	0	0
1 0 0	1	1	1
1 0 1	1	1	1
1 1 0	1	1	1
1 1 1	1	0	0

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

1. MONTAGEM

II. Tabela \Rightarrow Expressão e Sistema

ABC	S
000	0
001	0
010	1
011	0
100	1
101	1
110	1
111	0

$S = 1$ para

- $A = 0 \quad B = 1 \quad C = 0$
- $A = 1 \quad B = 0 \quad C = 0$
- $A = 1 \quad B = 0 \quad C = 1$
- $A = 1 \quad B = 1 \quad C = 0$

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

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

2. ÁLGEBRA DE BOOLE

2.1. POSTULADOS

(a) Complemento

\bar{A} = complemento de A

- $A = 0 \Rightarrow \bar{A} = 1$
- $A = 1 \Rightarrow \bar{A} = 0$

2. ÁLGEBRA DE BOOLE

2.1. POSTULADOS

(b) Adição

$$0 + 0 = 0$$

$$0 + 1 = 1$$

$$1 + 0 = 1$$

$$1 + 1 = 1$$



$$A + 0 = A$$

$$A + 1 = 1$$



$$A + A = A$$

$$A + \bar{A} = 1$$

2. ÁLGEBRA DE BOOLE

2.1. POSTULADOS

(c) Multiplicação

$$0 \cdot 0 = 0$$

$$0 \cdot 1 = 0$$

$$1 \cdot 0 = 0$$

$$1 \cdot 1 = 1$$



$$A \cdot 0 = 0$$

$$A \cdot 1 = A$$



$$A \cdot A = A$$

$$A \cdot \bar{A} = 0$$

2. ÁLGEBRA DE BOOLE

2.2. PROPRIEDADES

(a) Comutativa



- $A + B = B + A$
- $A . B = B . A$

(b) Associativa



- $A + (B+C) = (A+B) + C$
 $= A + B + C$
- $A.(BC) = (AB).C = ABC$

(c) Distributiva



$$A . (B+C) = AB + AC$$

2. ÁLGEBRA DE BOOLE

2.3. TEOREMAS DE De Morgan

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



A	B	$\overline{A \cdot B}$	$\bar{A} + \bar{B}$
0	0	1	1
0	1	1	1
1	0	1	1
1	1	0	0

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



A	B	$\overline{A + B}$	$\bar{A} \cdot \bar{B}$
0	0	1	1
0	1	0	0
1	0	0	0
1	1	0	0

2. ÁLGEBRA DE BOOLE

2.4. OUTRAS IDENTIDADES

(a) $A + AB = A$  **Lei da Absorção**

$$A + AB = A(1 + B) = A \cdot 1 = A$$

1



2. ÁLGEBRA DE BOOLE

2.4. OUTRAS IDENTIDADES

$$(a) \quad A + AB = A \quad \longrightarrow \quad \text{Lei da Absorção}$$

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

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

2. ÁLGEBRA DE BOOLE

2.4. OUTRAS IDENTIDADES

$$(a) \quad A + A B = A \quad \Longrightarrow \quad \text{Lei da Absorção}$$

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

$$(c) \quad (A + B)(A + C) = A + B C$$

$$A.A + A.C + A.B + B.C = A(1 + C + B) + B.C = A + BC$$

2. ÁLGEBRA DE BOOLE

2.4. OUTRAS IDENTIDADES

$$(a) \quad A + A B = A$$

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

$$(c) \quad (A + B) (A + C) = A + B C$$

3. SIMPLIFICAÇÃO DE EXPRESSÕES

$$3.1. S = ABC + A\bar{C} + A\bar{B}$$

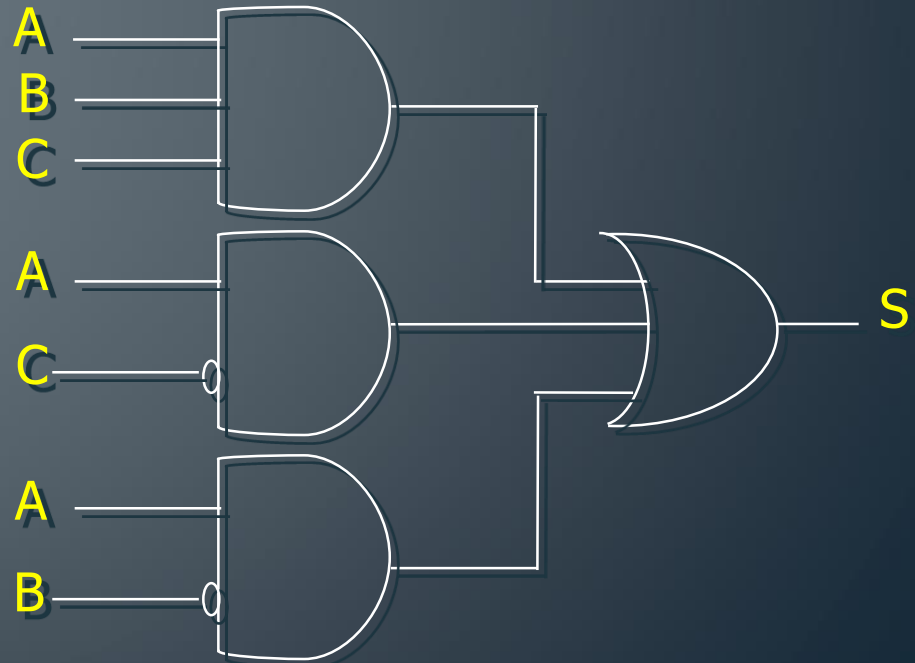
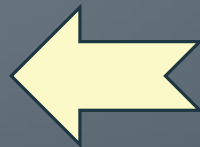
$$3.2. S = AB + AB\bar{C}D + ABC\bar{D}$$

$$3.3. S = \overline{[(A + B) C]} + \overline{[D (C + B)]}$$

3. SIMPLIFICAÇÃO DE EXPRESSÕES

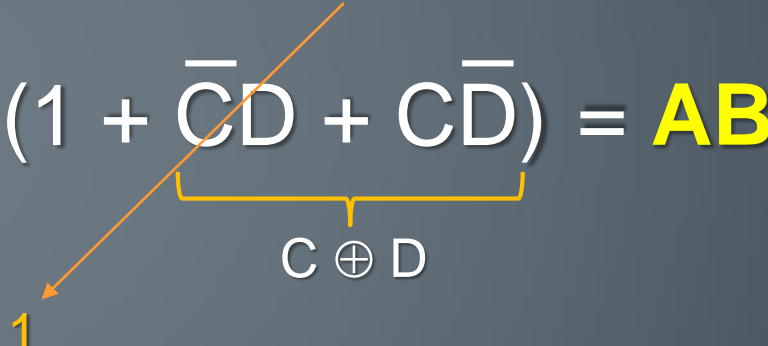
$$3.1. S = ABC + A\bar{C} + A\bar{B}$$

$$S = A (BC + \underbrace{\bar{C} + \bar{B}}_{BC}) = A \cdot 1 = \mathbf{A}$$



3. SIMPLIFICAÇÃO DE EXPRESSÕES

$$3.2. S = AB + AB\bar{C}D + ABC\bar{D}$$

$$S = AB (1 + \underbrace{\bar{C}D + C\bar{D}}_{C \oplus D}) = \mathbf{AB}$$


3. SIMPLIFICAÇÃO DE EXPRESSÕES

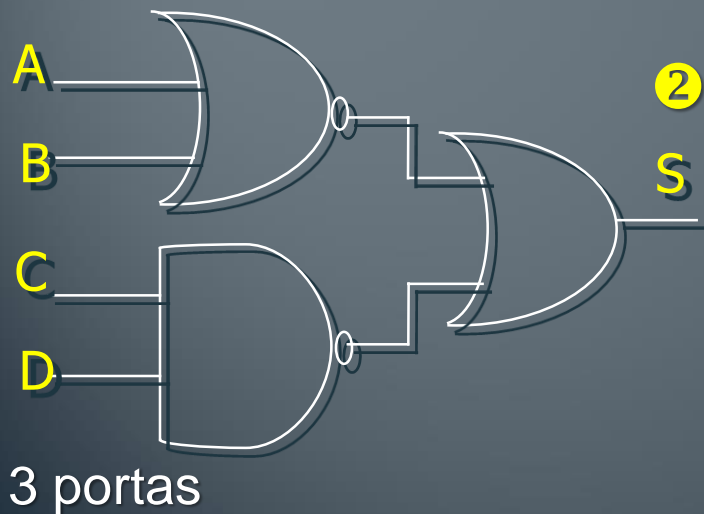
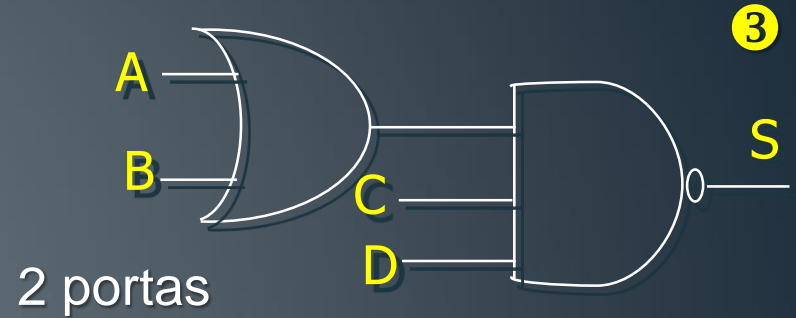
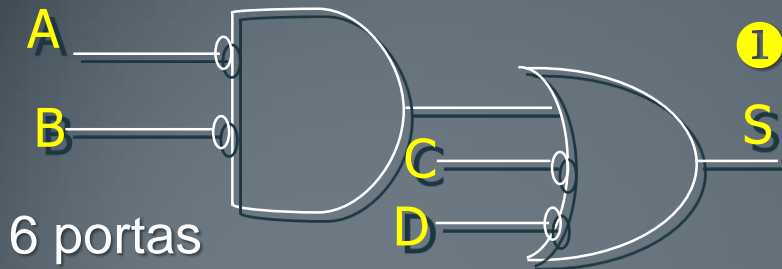
$$3.3. S = \overline{[(A + B) C]} + \overline{[D (C + B)]}$$

$$S = \overline{[(A + B) C]} + \overline{[D (C + B)]} = \underbrace{\overline{(A + B)}} + \overline{C} + \overline{D} + \underbrace{\overline{(C + B)}}$$

$$= \overline{A} \cdot \overline{B} + \underbrace{\overline{C}} + \overline{D} + \underbrace{\overline{C} \cdot \overline{B}} = \overline{A} \overline{B} + \overline{C} + \overline{D} \Rightarrow \textcircled{1}$$

\overline{C}

3. SIMPLIFICAÇÃO DE EXPRESSÕES



$$\overline{\overline{A} \overline{B}} + \overline{\overline{C} \overline{D}} \longrightarrow 1$$

$\underbrace{\overline{\overline{A} \overline{B}}}_{A+B} \quad \underbrace{\overline{\overline{C} \overline{D}}}_{CD}$

$$\overline{A+B} + \overline{CD} \longrightarrow 2$$

$$\overline{(A+B) CD} \longrightarrow 3$$

CIRCUITO INTEGRADO (CI) ou "CHIP"

