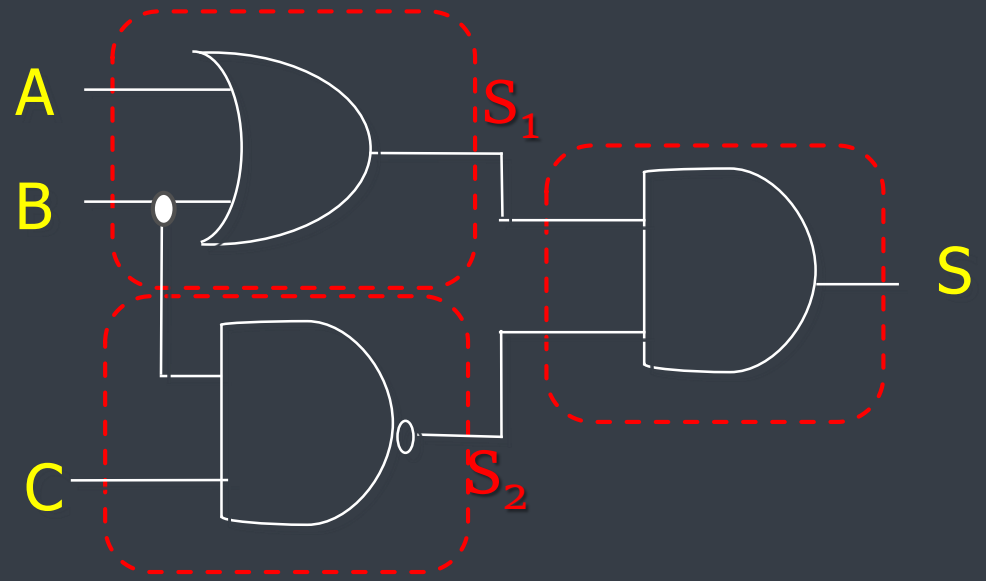
Departamento de
Engenharia Elétrica e
de Computação

SEL 414 - Sistemas Digitais

FUNÇÕES LÓGICAS

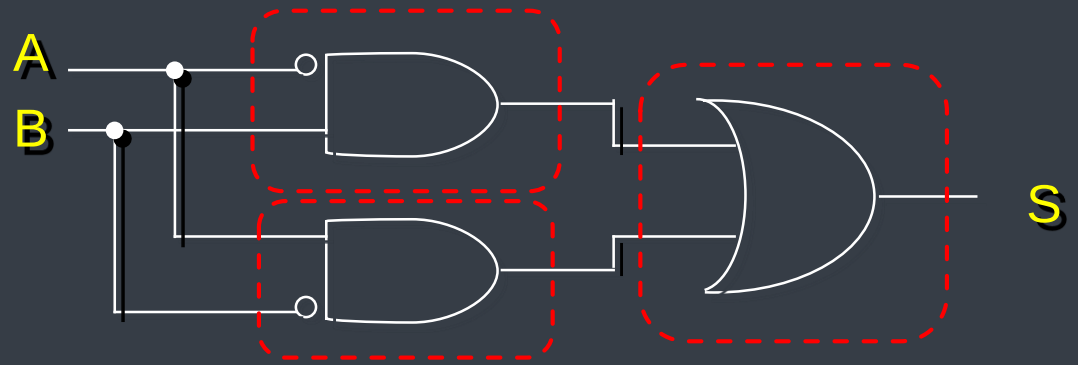
Prof. Homero Schiabel



$$S_1 = A + B$$

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

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



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

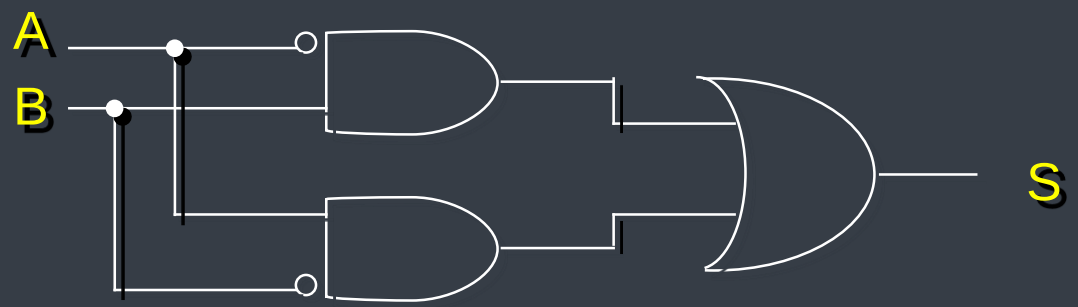
1.0 + 0.1

0 0

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

TABELA DA VERDADE

A	B	S
0	0	0



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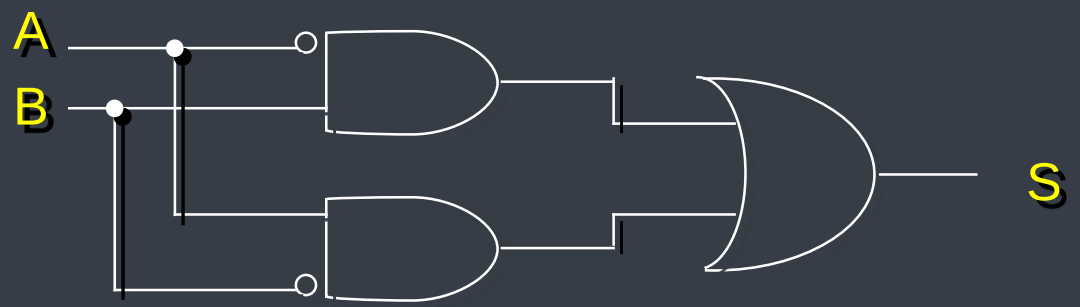
$$1.1 + 0.0$$

$$1 \qquad 0$$

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

TABELA DA VERDADE

A	B	S
0	0	0
0	1	1



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

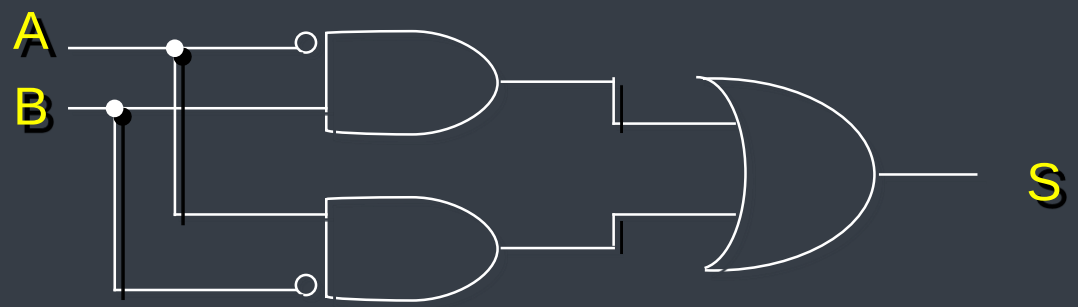

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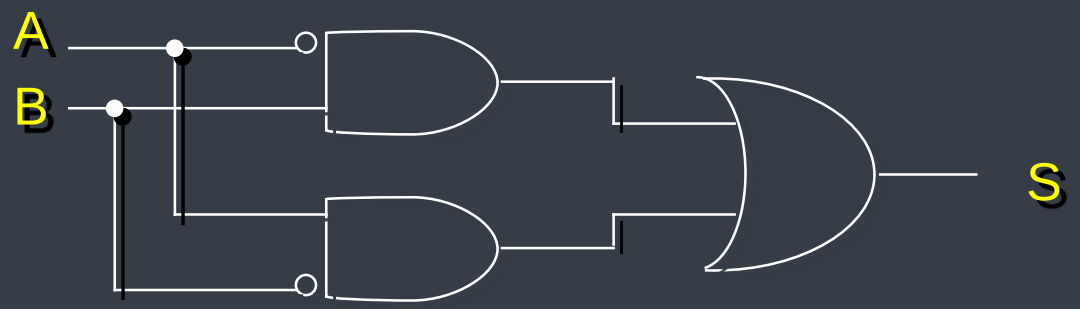
TABELA DA VERDADE

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

FUNÇÃO OU-EXCLUSIVO ("X-OR")

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



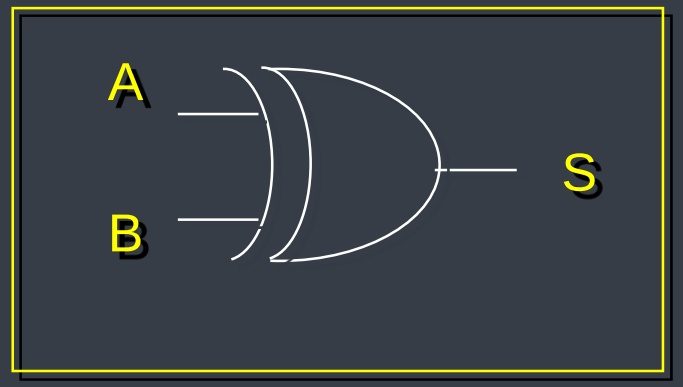
S = 1 quando A ≠ B ➔ S = 1 apenas quando A OU B = 1

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
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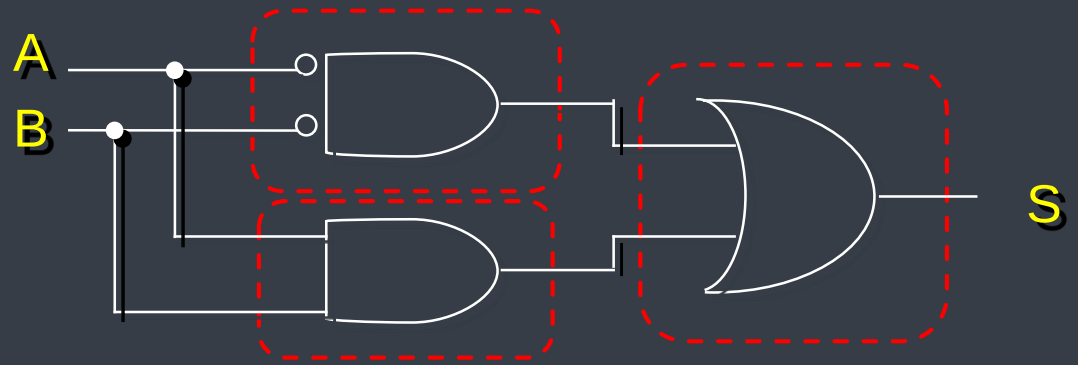


$$S = \bar{A}\bar{B} + AB$$

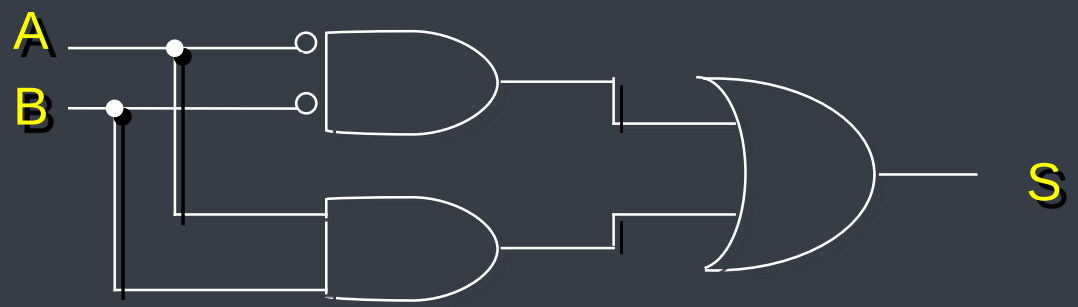
$$1.1 + 0.0$$

$$1 \qquad 0$$

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

TABELA DA VERDADE

A	B	S
0	0	1



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

TABELA DA VERDADE

A	B	S
0	0	1
0	1	0

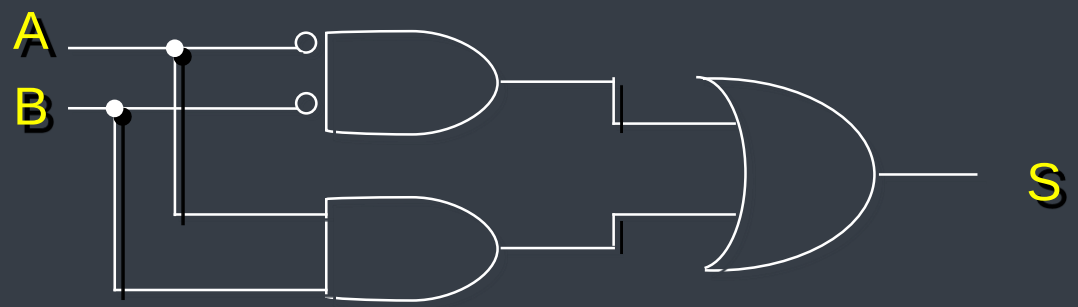

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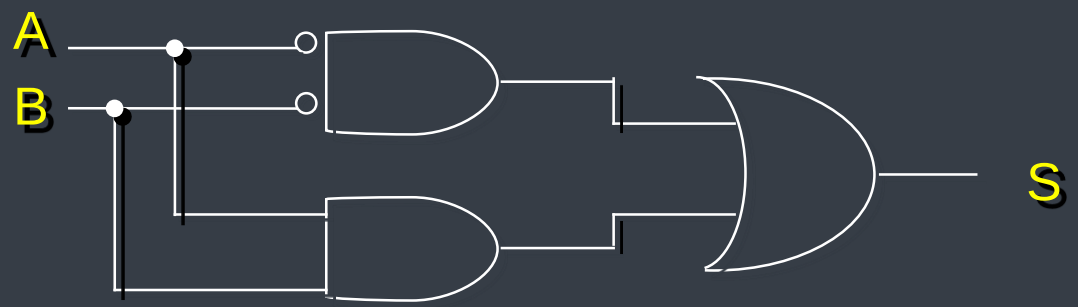
TABELA DA VERDADE

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



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

0.0 + 1.1

0 1

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TABELA DA VERDADE

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

FUNÇÃO COINCIDÊNCIA ("X-NOR")

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

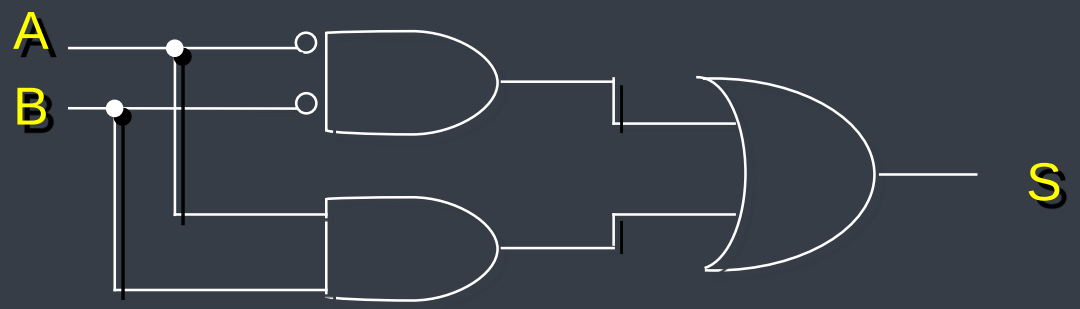


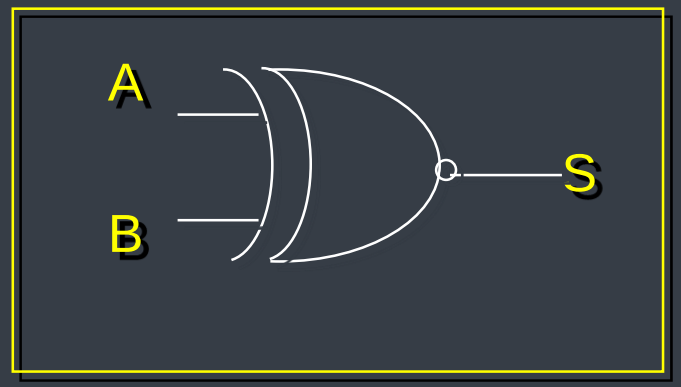
TABELA DA VERDADE

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

S = 1 somente quando A = B

$$S = A \odot B \quad \Rightarrow \quad S = \overline{A \oplus B}$$

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

$$S = A \odot B \quad \Rightarrow \quad S = \overline{A \oplus B}$$

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

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

Departamento de
Engenharia Elétrica e
de Computação

EESC • USP

SEL 414 - Sistemas Digitais

SISTEMAS COMBINATÓRIOS

Prof. Homero Schiabel

1. MONTAGEM

I. Sistema (expressão) ➡ 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

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

1. MONTAGEM

II. Tabela ➡ Expressão e Sistema

ABC	S
0 0 0	0
0 0 1	0
0 1 0	1
0 1 1	0
1 0 0	1
1 0 1	1
1 1 0	1
1 1 1	0

S = 1 para

- A = 0 B = 1 C = 0
- A = 1 B = 0 C = 0
- A = 1 B = 0 C = 1
- A = 1 B = 1 C = 0

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

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

2. ÁLGEBRA DE BOOLE

2.1. POSTULADOS

(a) Complemento

$\bar{A}$ = complemento de A

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

- $A + B = B + A$
- $A \cdot B = B \cdot A$

(b) Associativa ⇨

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

(c) Distributiva ⇨

$A \cdot (B+C) = AB + AC$

2. ÁLGEBRA DE BOOLE

2.3. TEOREMAS DE De Morgan

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

A	B	$\overline{AB}$	$\overline{A}+\overline{B}$
0	0	1	1
0	1	1	1
1	0	1	1
1	1	0	0

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

A	B	$\overline{A+B}$	$\overline{A}\,\overline{B}$
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) $A + A\,B = A$ → **Lei da Absorção**

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

1

2. ÁLGEBRA DE BOOLE

2.4. OUTRAS IDENTIDADES

(a) $A + A\,B = A$ → **Lei da Absorção**

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

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

2. ÁLGEBRA DE BOOLE

2.4. OUTRAS IDENTIDADES

(a) $A + A\,B = A$ → Lei da Absorção

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

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

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

A

1

3. SIMPLIFICAÇÃO DE EXPRESSÕES

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

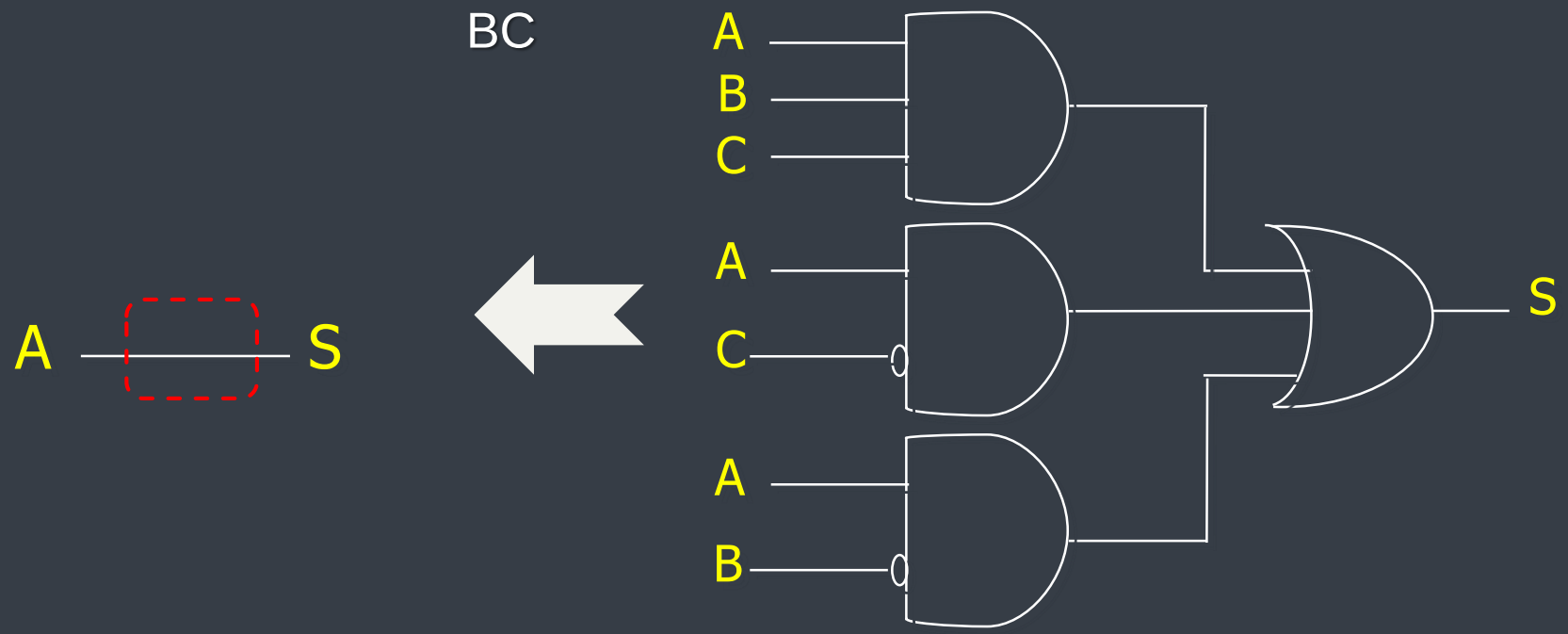
3.2. $S = AB + AB\overline{C}D + ABC\overline{D}$

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

3. SIMPLIFICAÇÃO DE EXPRESSÕES

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

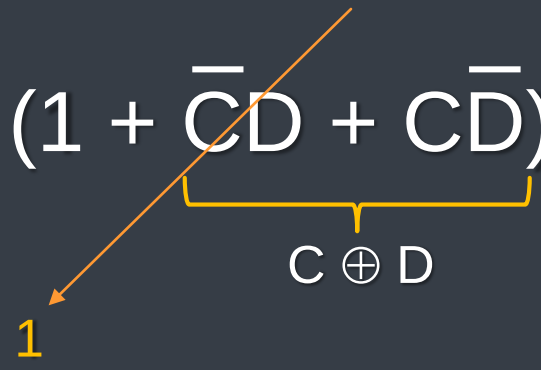
$$S = A\,(BC + \overline{C} + \overline{B}) = A \cdot 1 = \mathbf{A}$$



3. SIMPLIFICAÇÃO DE EXPRESSÕES

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

$$S = AB\,(1 + \bar{C}D + C\bar{D}) = \mathbf{AB}$$



3. SIMPLIFICAÇÃO DE EXPRESSÕES

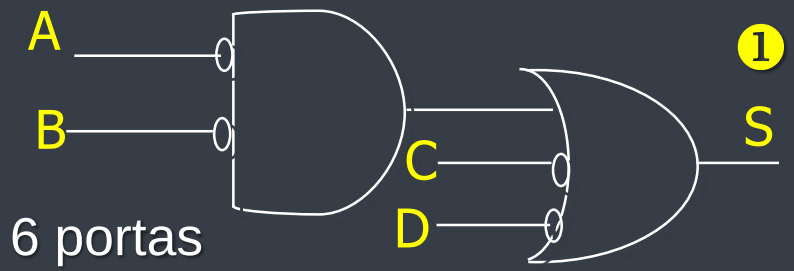
3.3. $S = \overline{[(A + B)\, C]} + \overline{[D\, (C + B)]}$

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

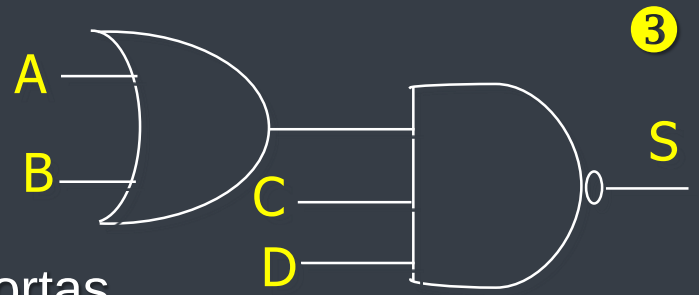
$$= \overline{A} \cdot \overline{B} + \overline{C} + \overline{D} + \overline{C} \cdot \overline{B} = \overline{A}\ \overline{B} + \overline{C} + \overline{D} \Rightarrow ❶$$

$$\overline{C}$$

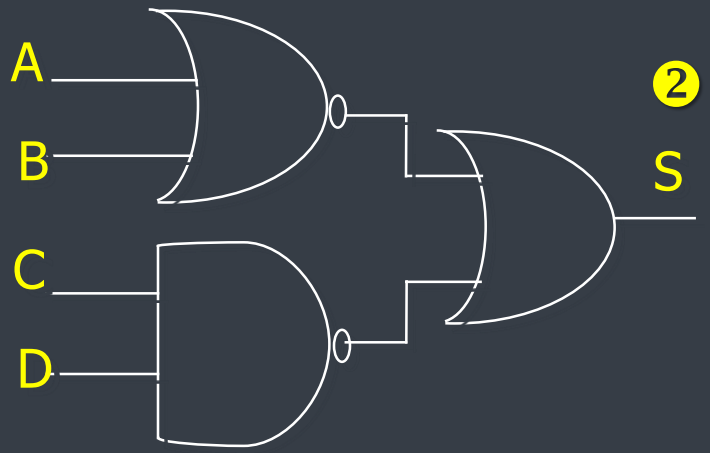
3. SIMPLIFICAÇÃO DE EXPRESSÕES



6 portas



2 portas



3 portas

$$\overline{A}\,\overline{B} + \overline{C} + \overline{D} \Rightarrow ❶$$

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

$$\overline{\overline{A+B} + \overline{CD}} \Rightarrow ❷$$

$$\overline{(A+B)\,CD} \Rightarrow ❸$$

CIRCUITO INTEGRADO (CI) ou "CHIP"