



# LÓGICA MATEMÁTICA

**MSc. Fernanda Dias**

Decimal	Binário	Octal	Hexadecimal
0	0000	0	0
1	0001	1	1
2	0010	2	2
3	0011	3	3
4	0100	4	4
5	0101	5	5
6	0110	6	6
7	0111	7	7
8	1000	10	8
9	1001	11	9
10	1010	12	A
11	1011	13	B
12	1100	14	C
13	1101	15	D
14	1110	16	E
15	1111	17	F

# SOMA

$$\begin{array}{r} 0^1 1^1 1 1 0 0 \\ + 0 1 1 0 1 0 \\ \hline 1 1 0 1 1 0 \end{array}$$

1 e vai 1

# SUBTRAÇÃO

$$\begin{array}{r} 111^100 \\ - 01010 \\ \hline 10010 \end{array}$$

1 e vai 1

emprestado

# NOTA DE AULA

Resolva as seguintes operações

a)  $0001 + 0101 =$

b)  $1100 + 1001 =$

c)  $1001 - 0101 =$

d)  $1011 - 10 =$

# MULTIPLICAÇÃO

$$\begin{array}{r} 101 \\ \times 110 \\ \hline 000 \end{array}$$

$$\begin{array}{r} 101 \\ + 101 \\ \hline 11110 \end{array}$$

$$\begin{array}{cccccc} 4 & & 3 & & 2 & & 1 & & 0 \\ 1 \times 2^4 + 1 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 0 \times 2^0 \\ 16 + 8 + 4 + 2 + 0 = 30 \end{array}$$

$$5 \times 6 = 30$$

# DIVISÃO

$$\begin{array}{r} 10101 \overline{) 111} \\ - 111 \phantom{00} \\ \hline 00111 \\ - 111 \\ \hline 000 \end{array}$$

$$21 / 7 = 3$$

# DIVISÃO

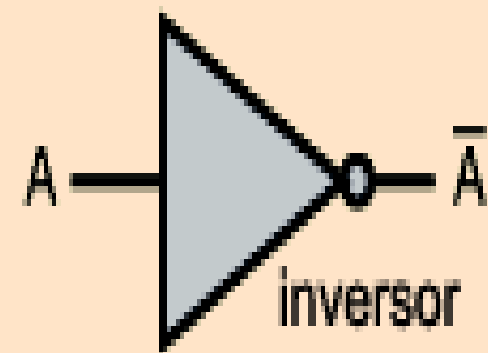
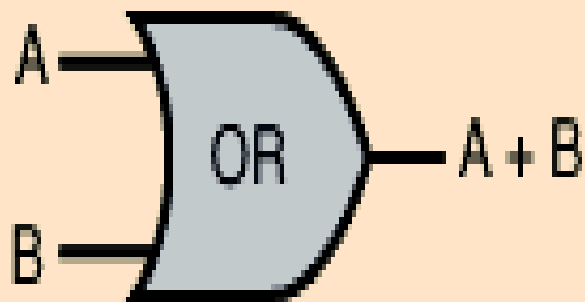
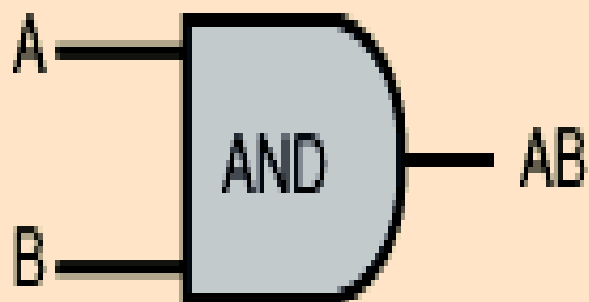
$$\begin{array}{r} \overset{1}{1} \overset{1}{0} \overset{1}{1} 0' 1 \mid 111 \\ - \underset{\overset{1}{1} \overset{0}{0}}{111} \phantom{11} \\ \hline 00111 \\ - \phantom{00}111 \\ \hline 000 \end{array}$$

$$21 / 7 = 3$$



# **PORTAS E CIRCUITOS LÓGICOS**

# OPERADORES FUNDAMENTAIS



# AND (E) Falso

Operação entre duas ou mais variáveis somente apresenta resultado 1 se todas as variáveis estiverem no estado lógico 1.

Símbolo Lógico

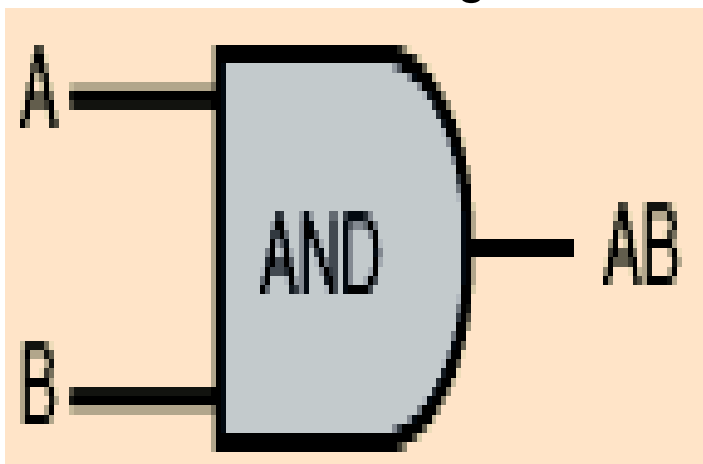


Tabela Verdade

A	B	Saída
0	0	0
0	1	0
1	0	0
1	1	1

# OR (OU) Verdadeiro

Operação lógica OR entre duas ou mais variáveis apresenta resultado 1 se pelo menos uma das variáveis estiver no estado lógico 1.

Símbolo Lógico

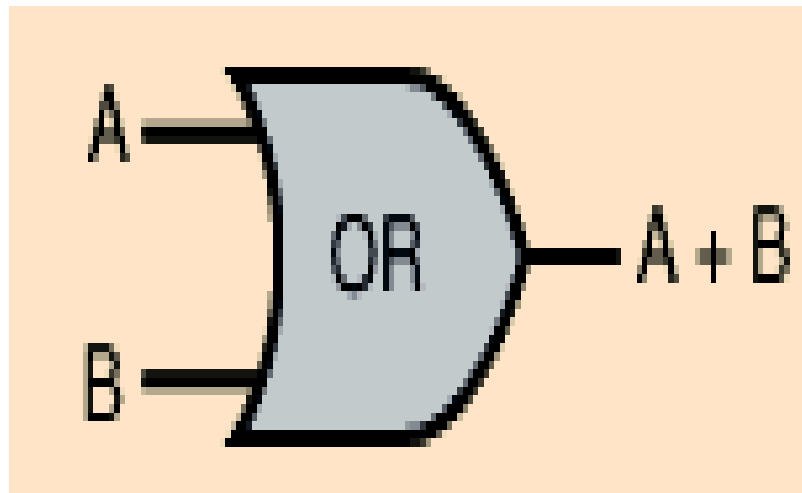
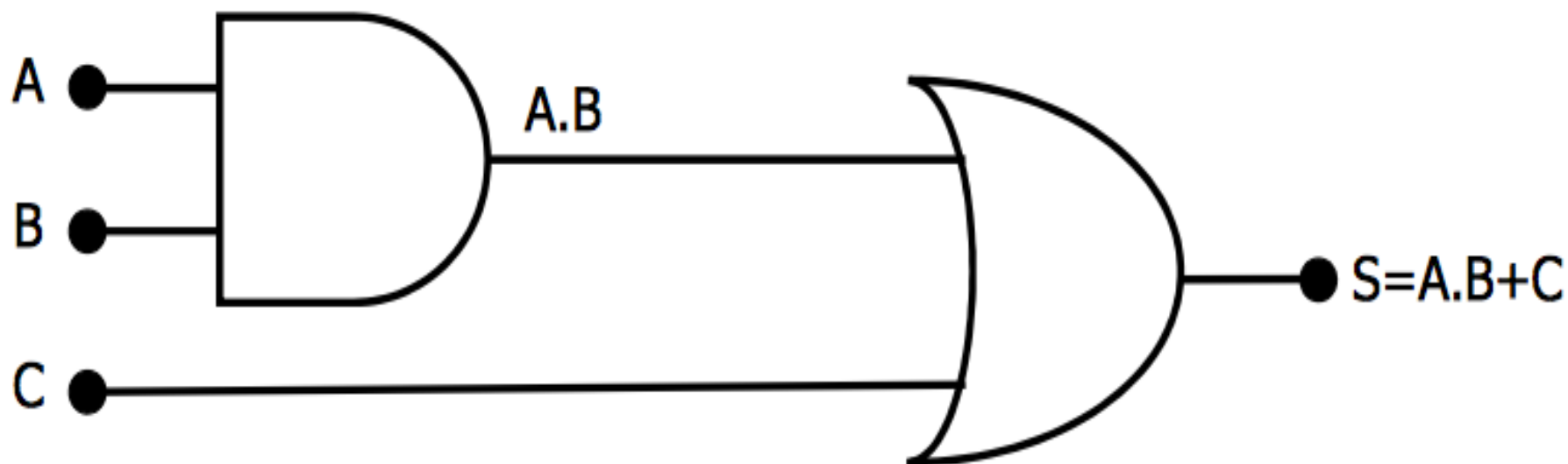


Tabela Verdade

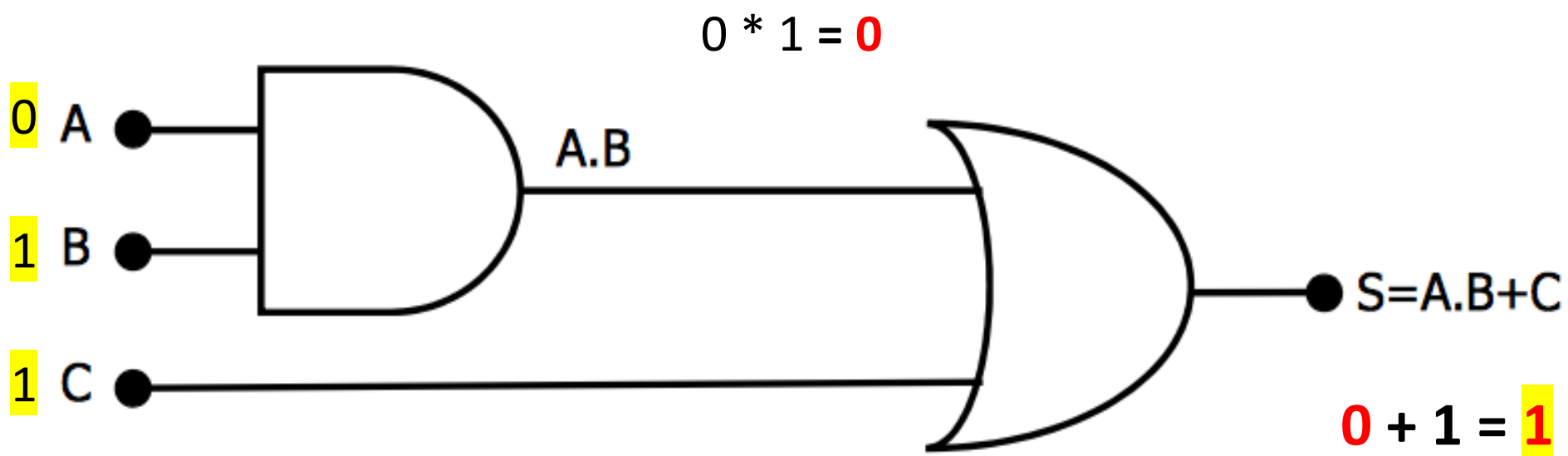
A	B	Saída
0	0	0
0	1	1
1	0	1
1	1	1

# EXEMPLO

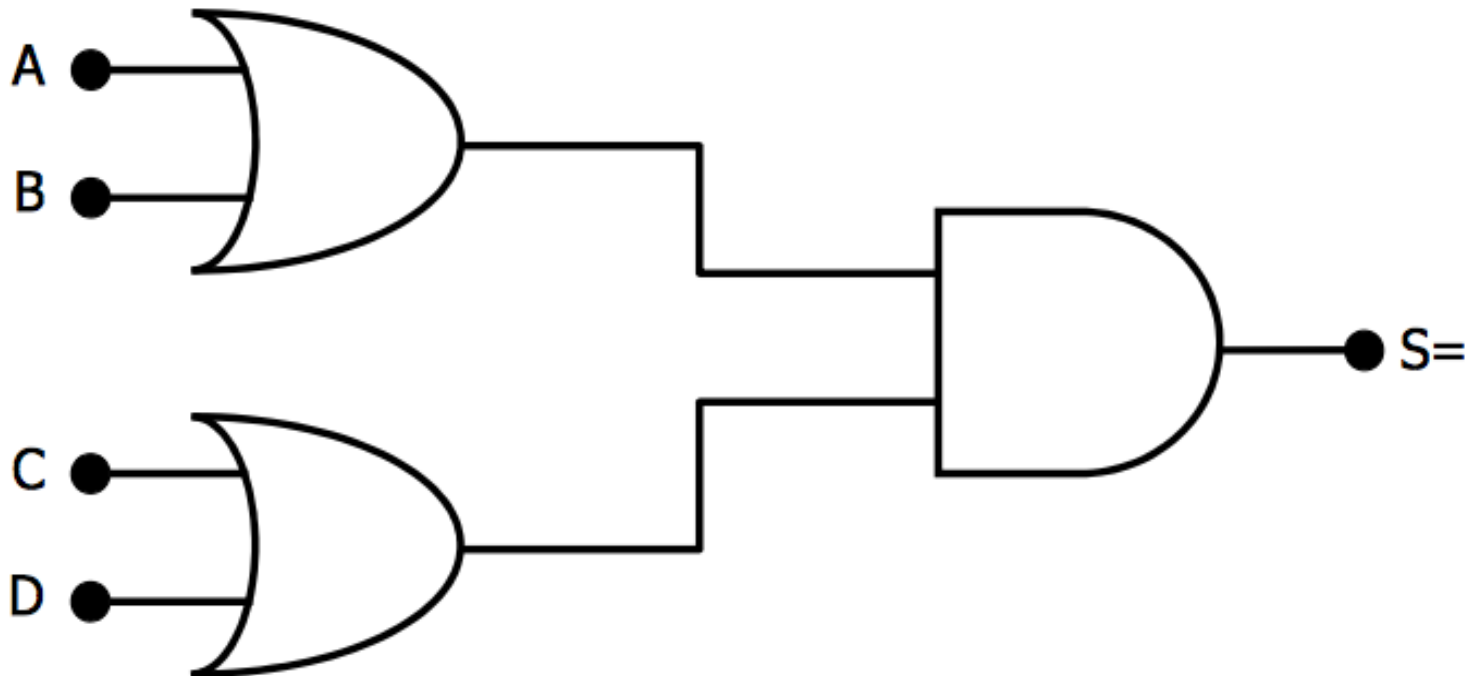


$$A=0 \quad B=1 \quad C=1$$

# EXEMPLO

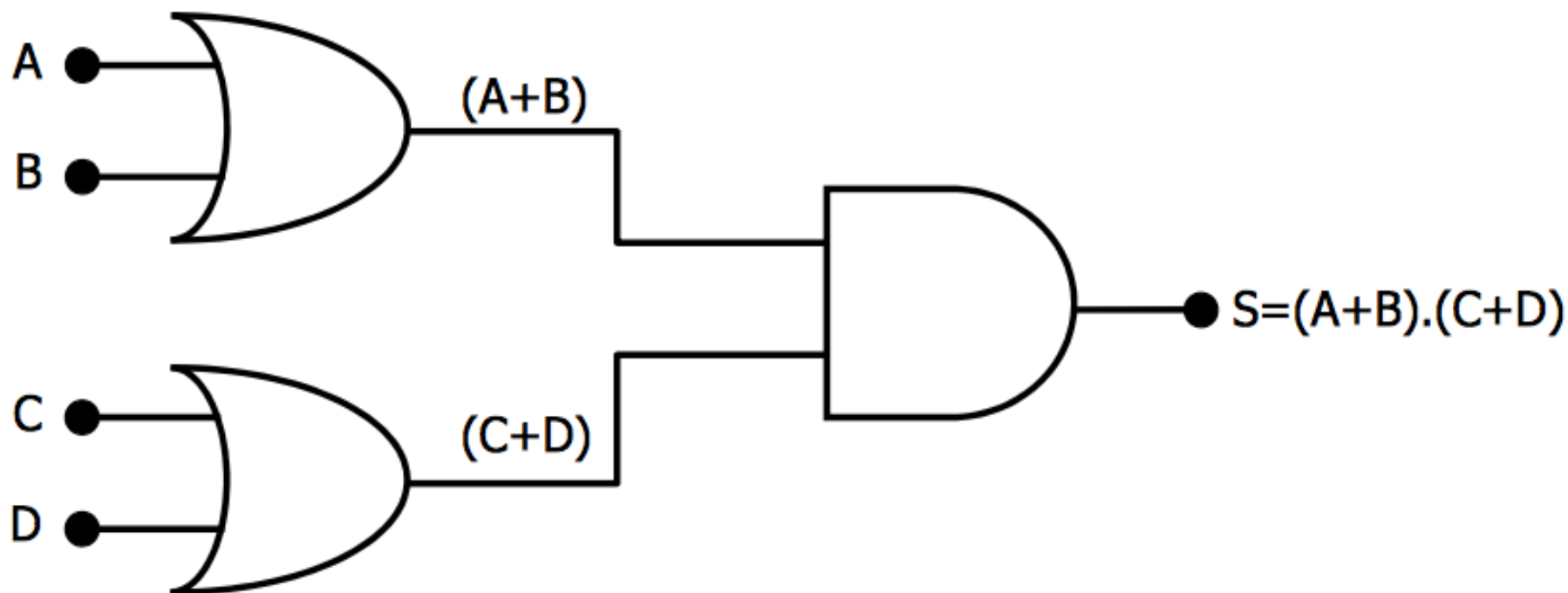


# Agora é com vocês!



A = 0   B = 1   C = 1   D = 1

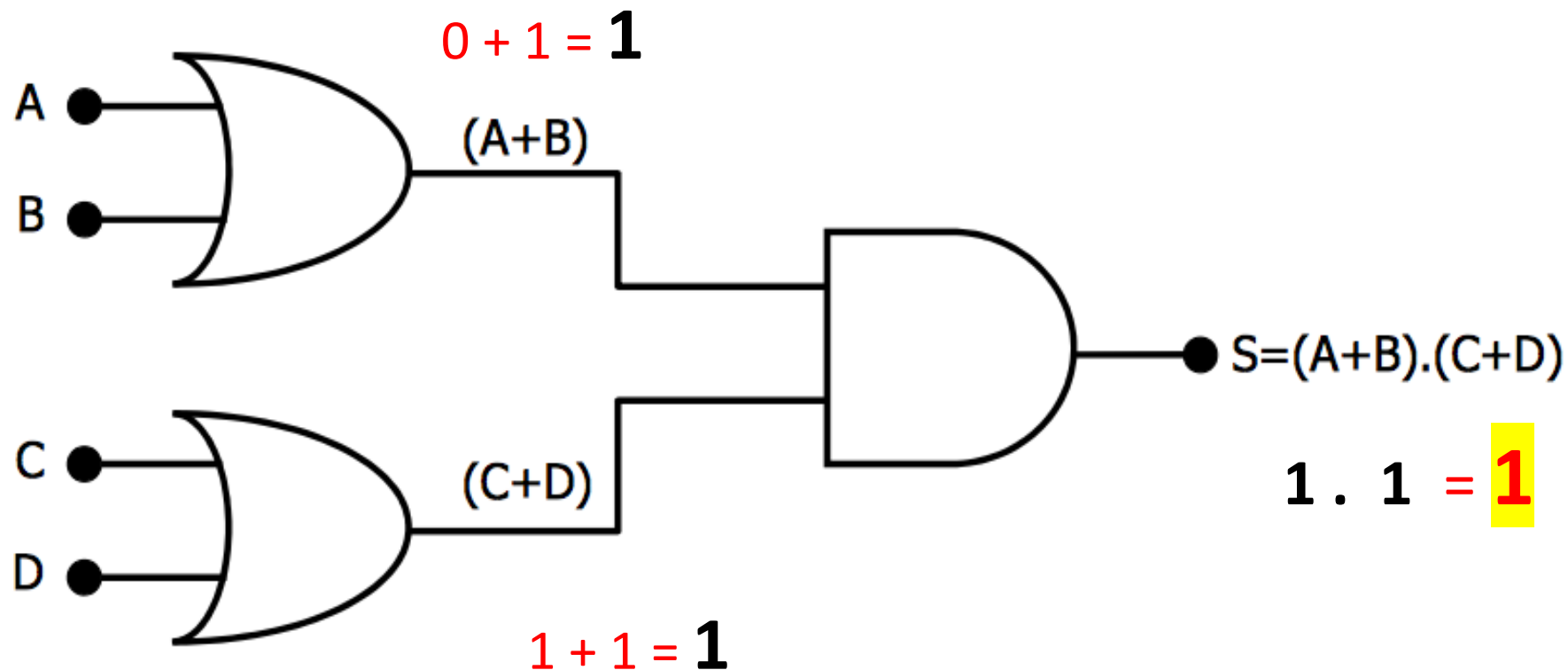
# Agora é com vocês!



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



# Agora é com vocês!



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

# NOT

Negando o valor

Símbolo Lógico

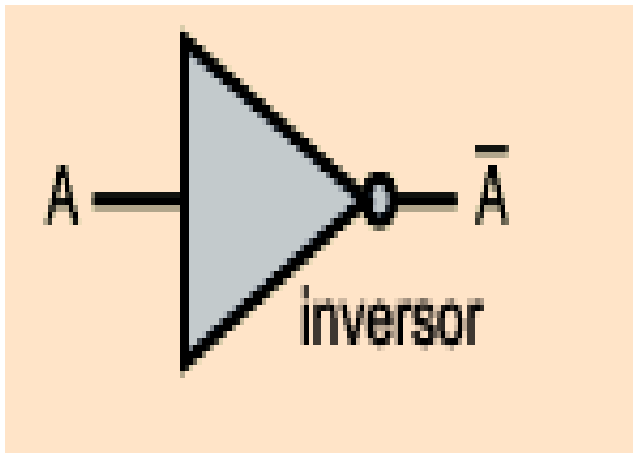
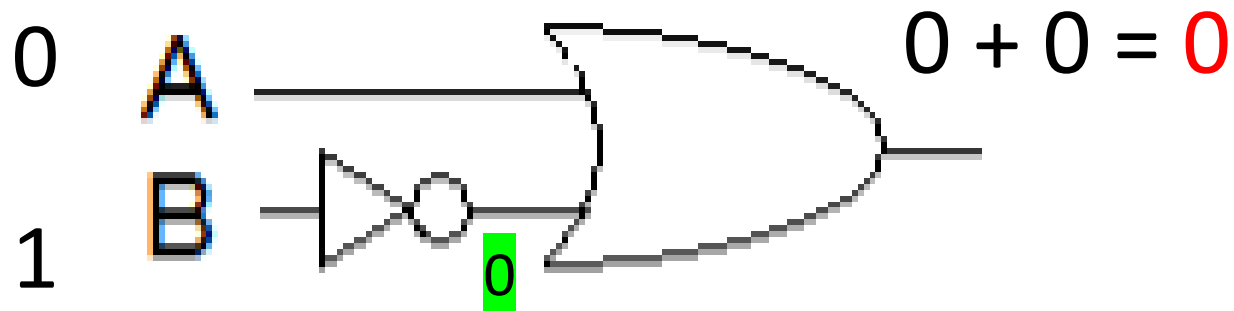


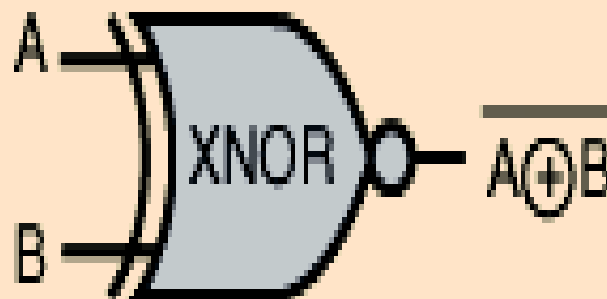
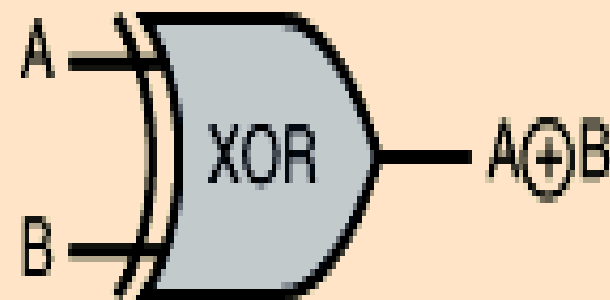
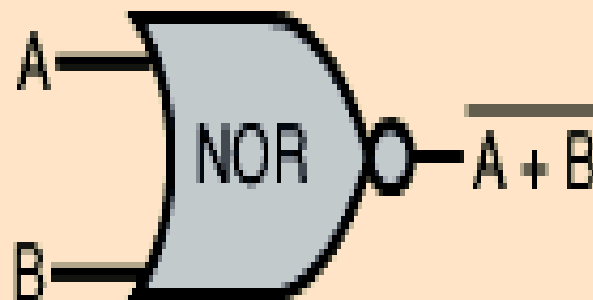
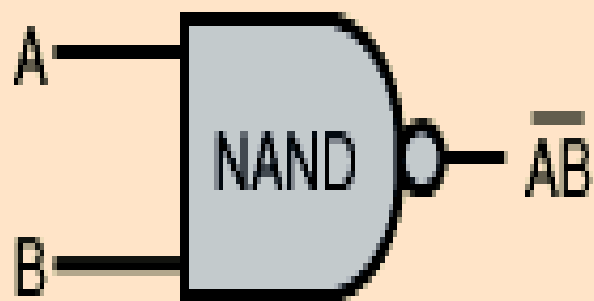
Tabela Verdade

Entrada	Saída
0	1
1	0

# EXEMPLO

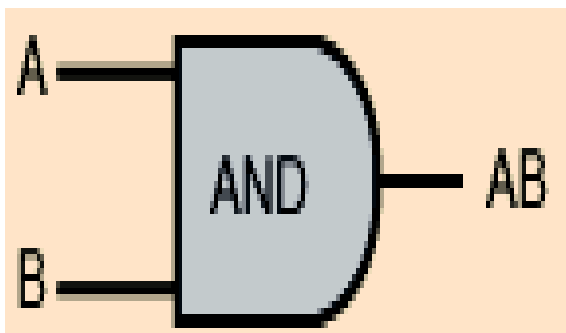


# OPERADORES SECUNDÁRIOS



# NAND

Negação do AND - falso



A	B	Saída
0	0	0
0	1	0
1	0	0
1	1	1

Símbolo Lógico

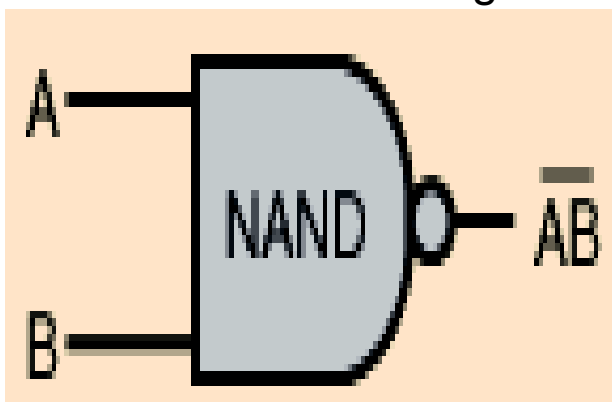
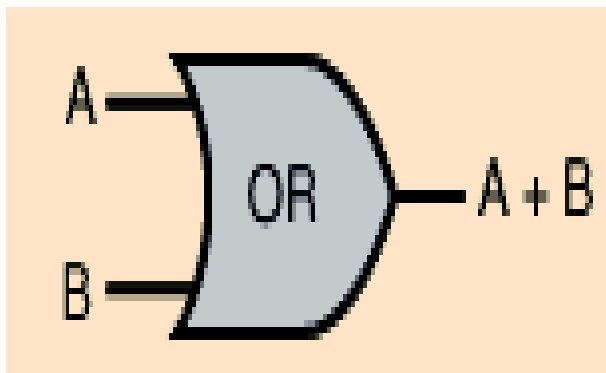


Tabela Verdade

A	B	Saída
0	0	1
0	1	1
1	0	1
1	1	0

# NOR

Negação do OR – verdade1ro



A	B	Saída
0	0	0
0	1	1
1	0	1
1	1	1

Símbolo Lógico

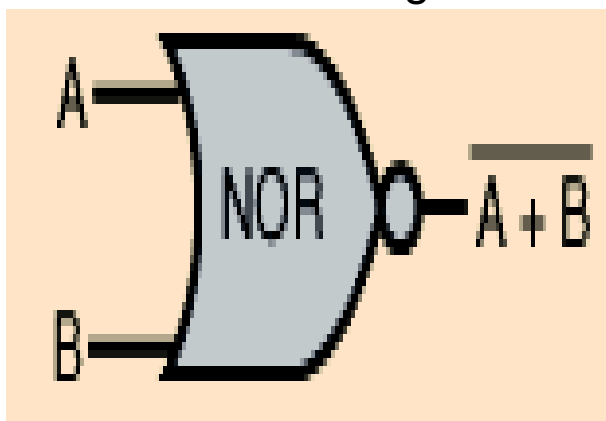
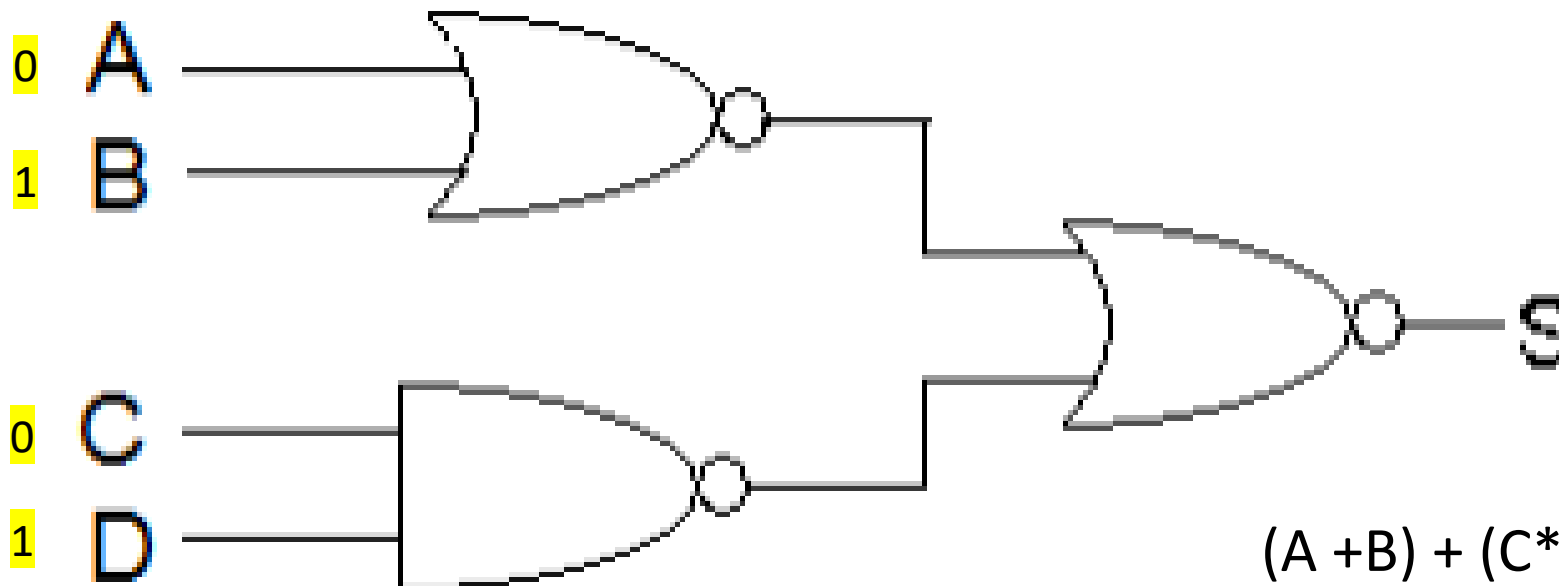


Tabela Verdade

A	B	Saída
0	0	1
0	1	0
1	0	0
1	1	0

# EXEMPLO

$$\overline{A + B} \quad 0 + 1 = 1 \quad \text{negando } 0$$



$$(A + B) + (C \cdot D) = 0 + 1 = 1 \quad \text{negando } 0$$

$$\overline{C \cdot D} \quad 0 \cdot 1 = 0 \quad \text{negando } 1$$

# XOR

Operação entre duas variáveis A e B apresenta resultado 1 se apenas uma das duas variáveis estiver no estado lógico 1

Iguais =0 Diferentes 1

Símbolo Lógico

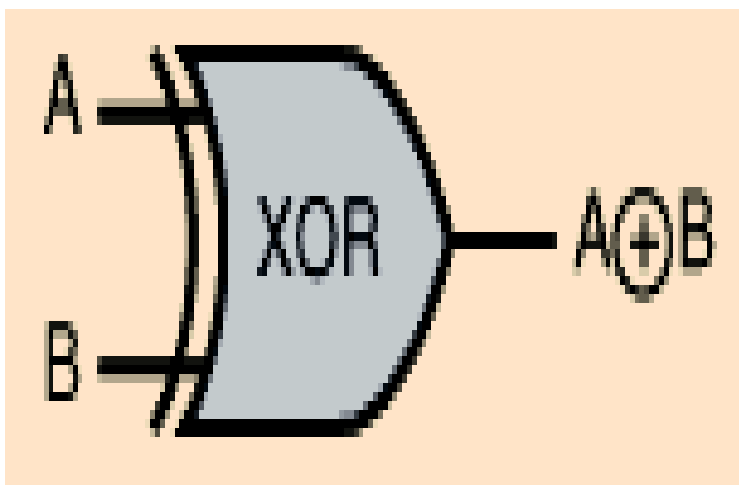


Tabela Verdade

A	B	Saída
0	0	0
0	1	1
1	0	1
1	1	0



# XNOR

XNOR entre duas variáveis A e B apresenta resultado 1 se e somente se as duas variáveis estiverem no mesmo estado lógico.

Iguais = 1 Diferentes 0

Símbolo Lógico

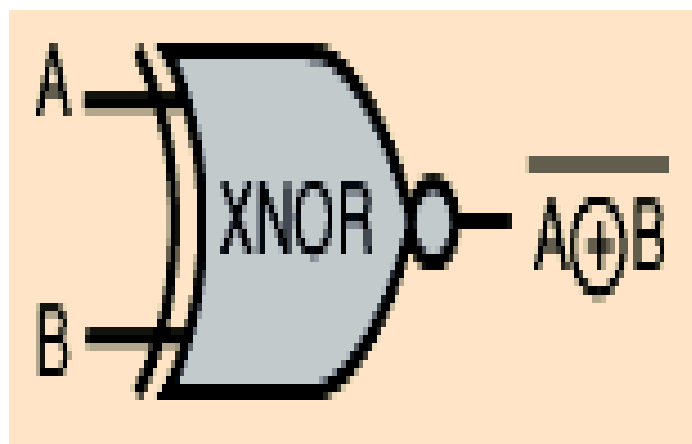


Tabela Verdade

A	B	Saída
0	0	1
0	1	0
1	0	0
1	1	1

# EXEMPLO

$$A \oplus B = 0$$

XNOR Iguais = 1 Diferentes 0

0

A

1

B

0

C

$$(A \oplus B) \oplus (B.C) =$$

$$0 \oplus 0 = 0$$

$$B.C = 1.0 = 0$$

XOR

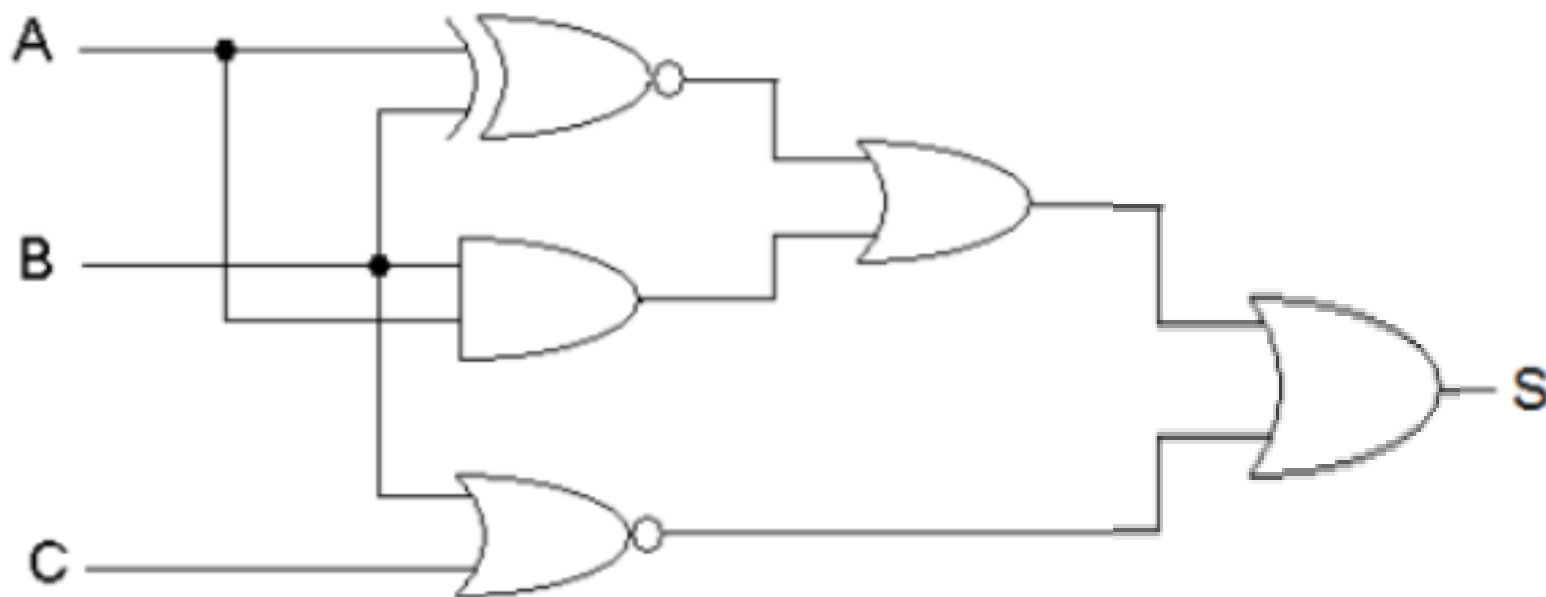
Iguais = 0  
Diferentes 1

# EXPRESÕES LÓGICAS

**Obter o circuito com base na expressão lógica**

$$\overline{[(A \oplus B) + (A.B)]} + \overline{(B + C)}$$

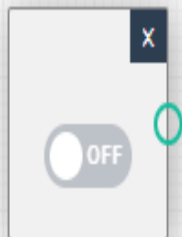
$$\overline{[(A \oplus B) + (A.B)]} + \overline{(B + C)}$$



# NA PRÁTICA

<https://academo.org/demos/logic-gate-simulator/>



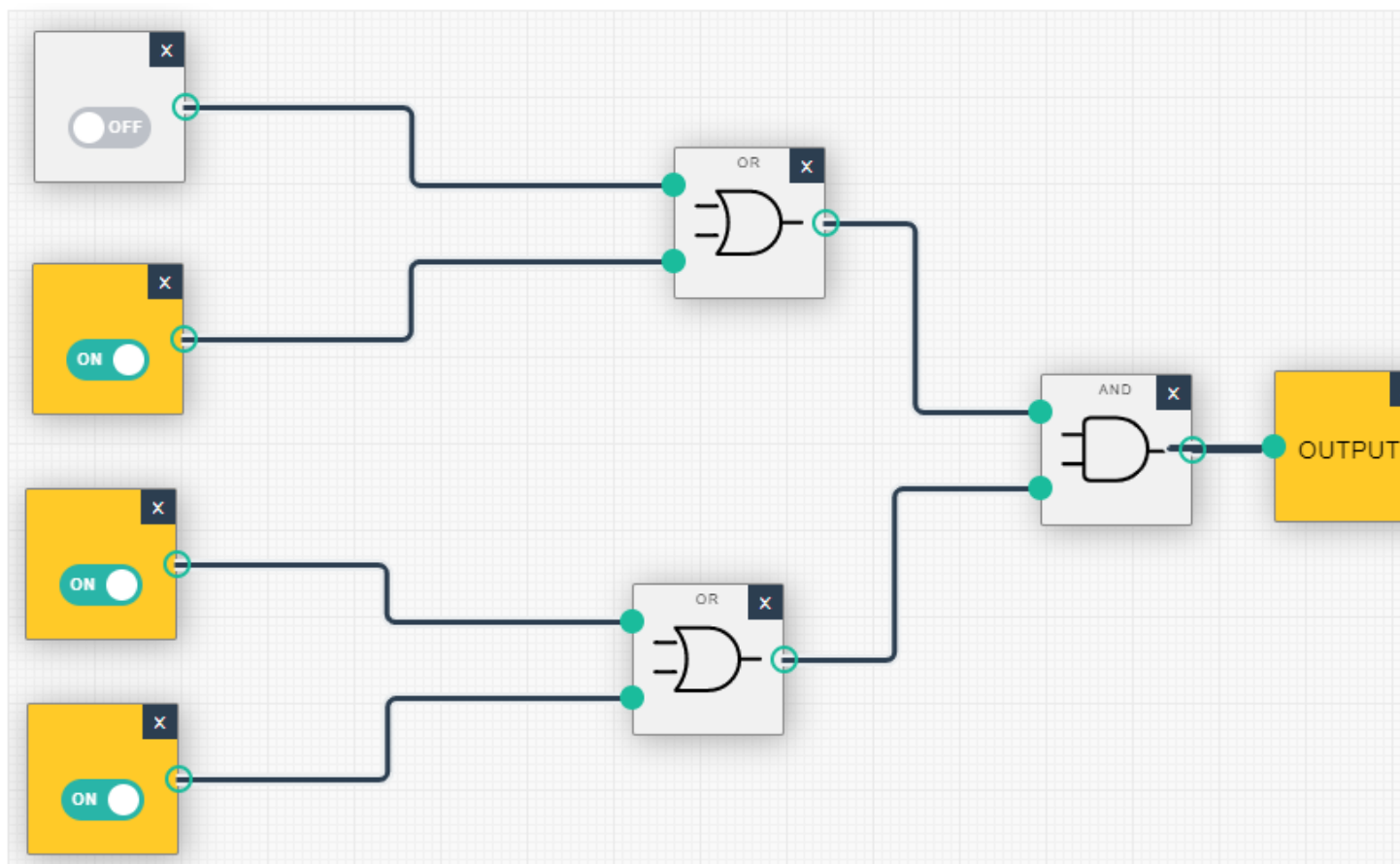


INPUT



Add node

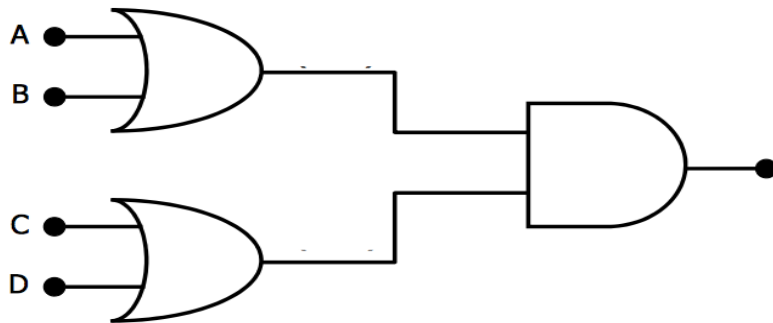
Full screen mode



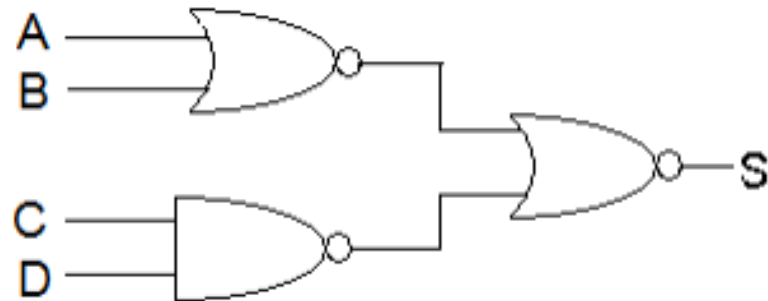


# PRATICANDO

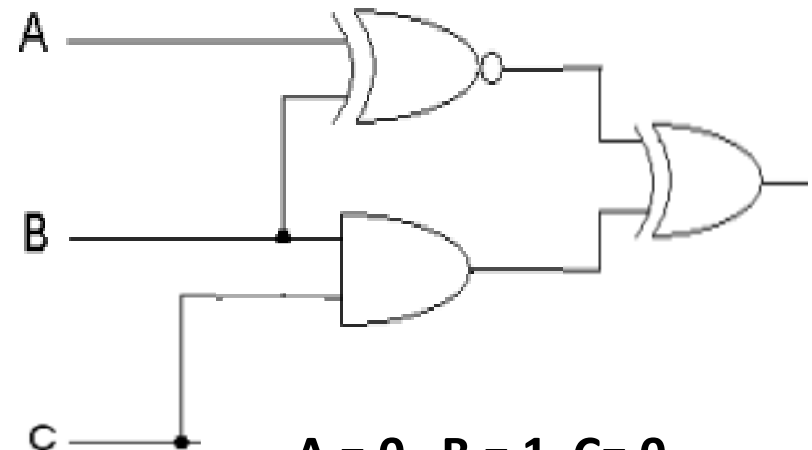
**A = 0 B = 1 C = 1 D = 1**



**A = 0 B = 1**



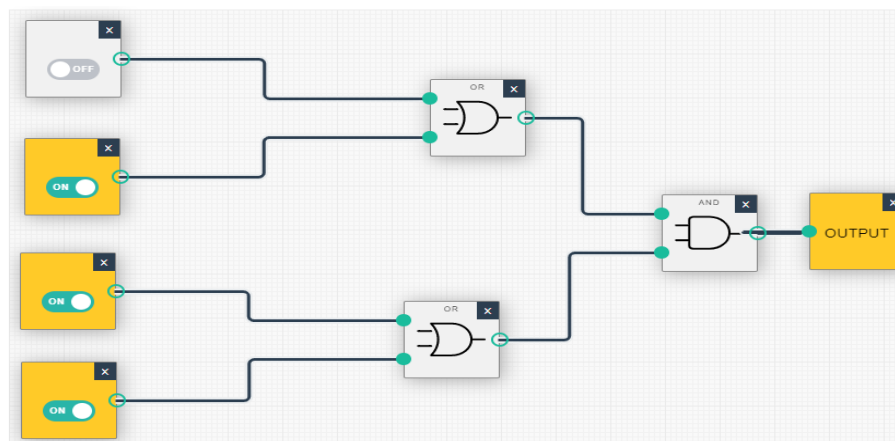
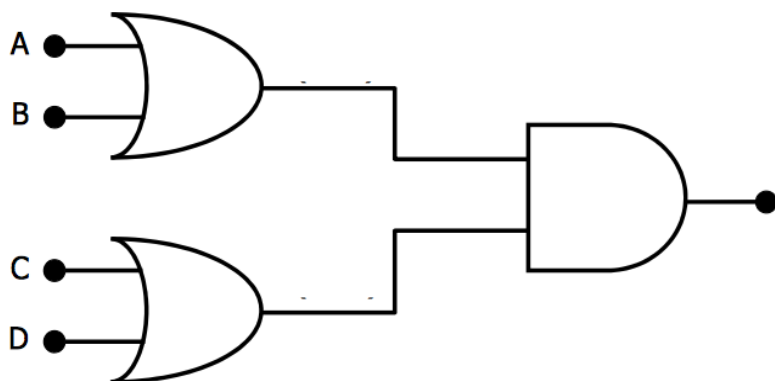
**A = 0 B = 1 C = 0 D = 1**



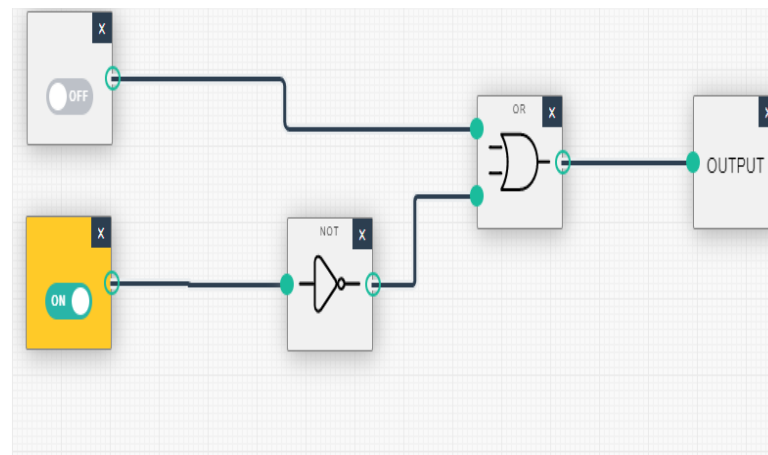
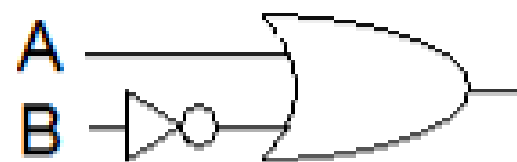
**A = 0 B = 1 C = 0**

# RESPOSTAS

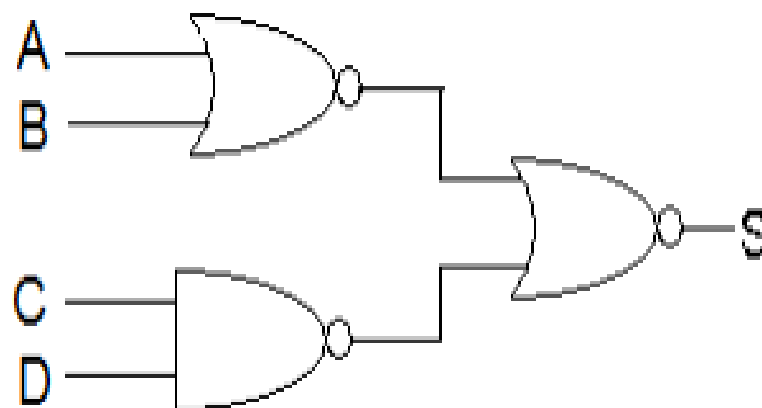
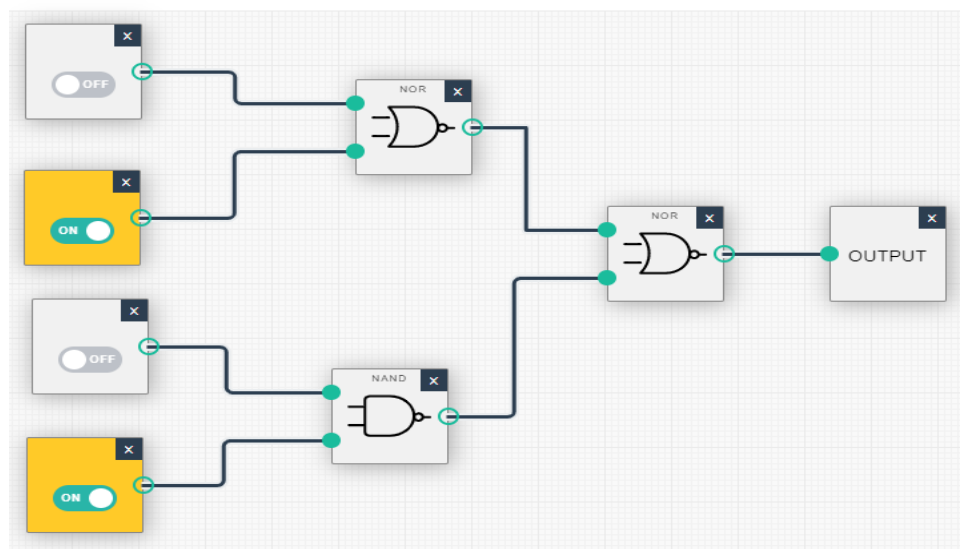
A = 0 B = 1 C = 1 D = 1



A = 0 B = 1

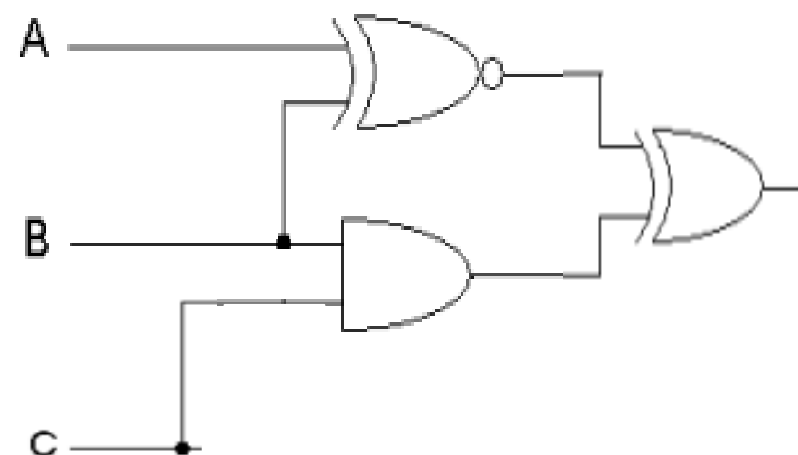
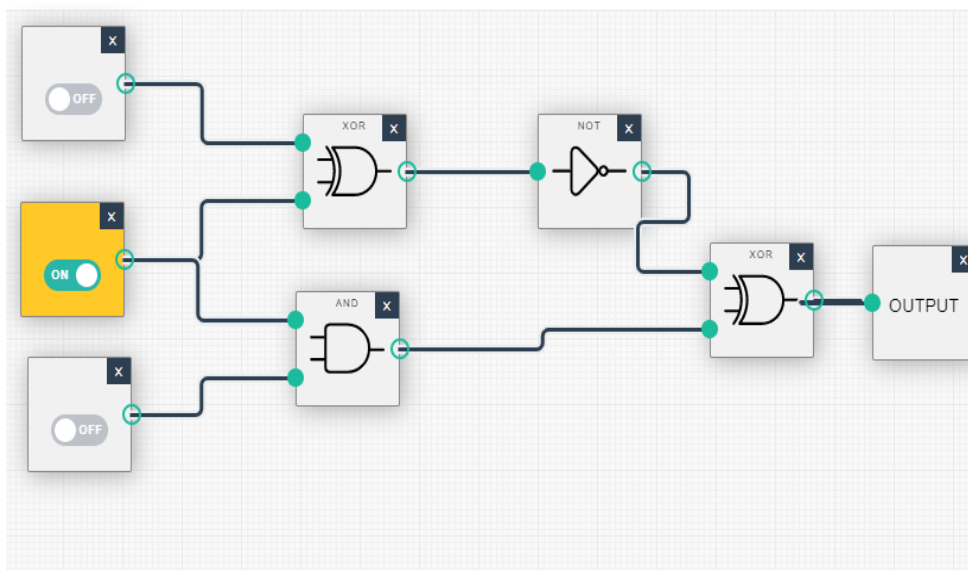


# RESPOSTAS



A = 0   B = 1   C = 0   D = 1

# RESPOSTAS

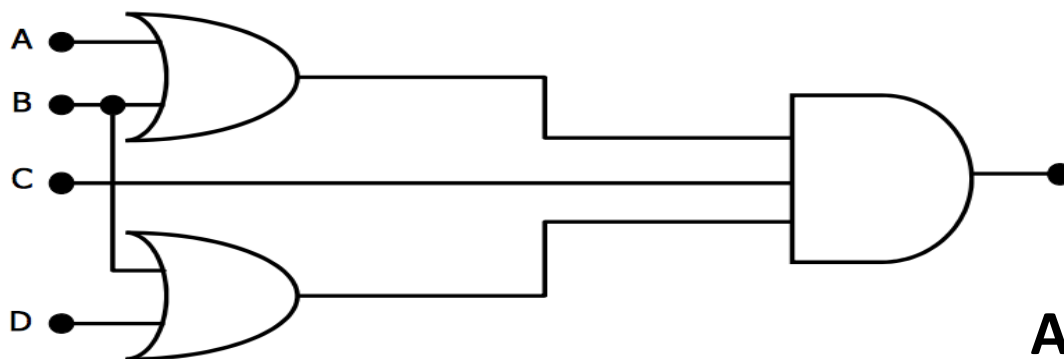


$A = 0 \quad B = 1 \quad C = 0$

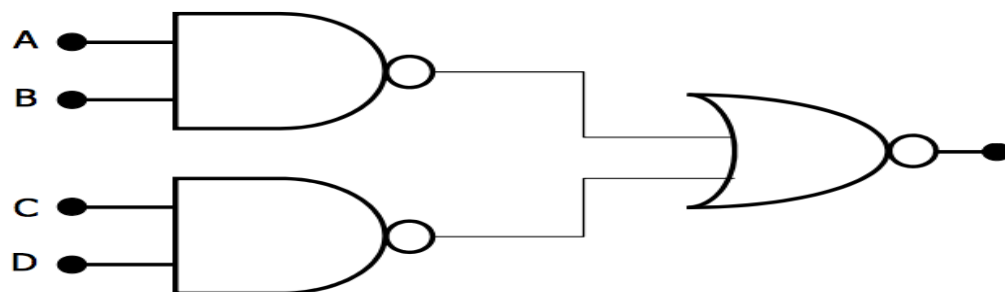
# NOTA DE AULA

# QUESTÃO 1

Obtenha a saída dos seguintes circuitos :



**A= 0   B =1   C=1   D =0**



**A= 0   B =1   C=1   D =0**

## QUESTÃO 2

Obtenha o circuito lógico das seguintes expressões e informe a resposta da saída lógica:

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

$$S = [\overline{(B \cdot C)} + (A \oplus C)]$$