Circuitos Combinacionais

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Arquitetura de Computadores

AULA PASSADA: EXPRESSÕES E FUNÇÕES LÓGICAS

Tabela verdade da conjunção (e)

X	Y	$X \cdot Y$
0	0	**0**
0	1	**0**
1	0	**0**
1	1	**1**

Tabela verdade da disjunção (ou)

X	Y	$X + Y$
0	0	0
0	1	**1**
1	0	**1**
1	1	**1**

Tabela verdade da negação (não)

X	$\overline{X}$
0	1
1	0

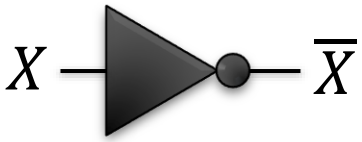
Conjunção (e): resultado verdadeiro apenas se X e Y forem verdadeiros.

Disjunção (ou): resultado verdadeiro apenas se Y ou Y forem verdadeiros.

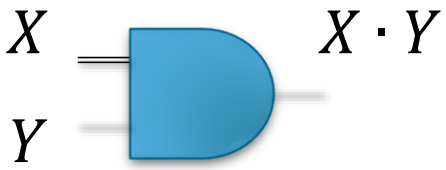
Negação (não): resultado só será verdadeiro se X não for verdadeiro.

PORTAS LÓGICAS

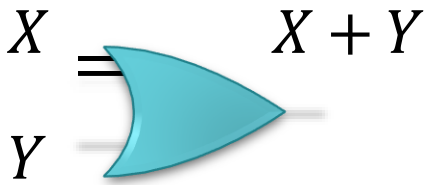
Trata-se de circuitos que efetuam operações básicas da álgebra booleana



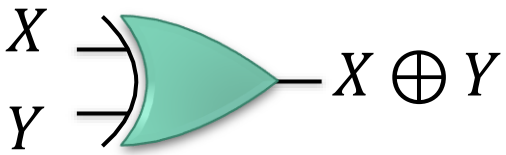
Porta **not**



Porta **and**



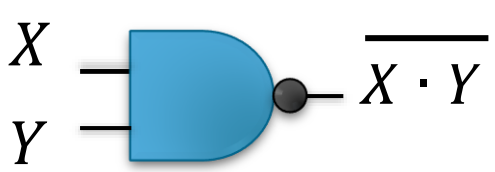
Porta **or**



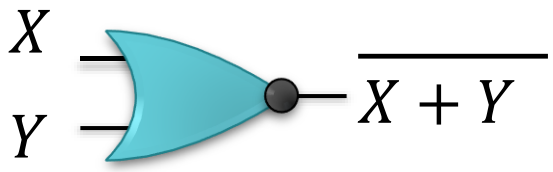
Porta **xor**

PORTAS LÓGICAS COM SAÍDAS INVERTIDAS

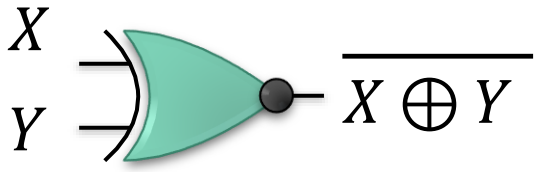
Também existem as seguintes portas com saída invertida (negada)



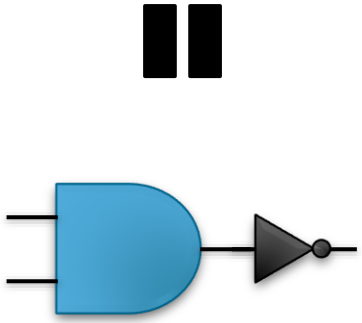
Porta **nand**

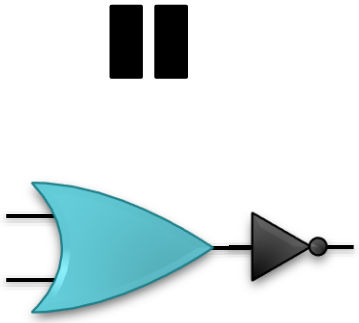


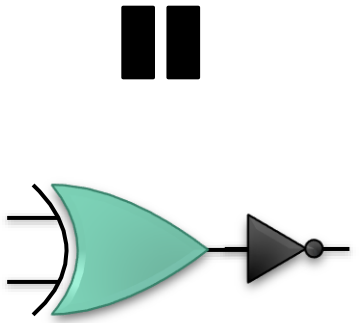
Porta **nor**



Porta **xnor**



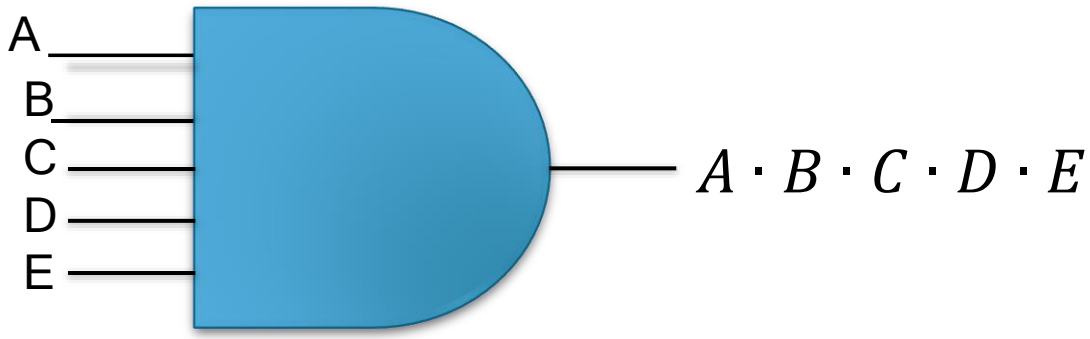




OBSERVAÇÕES SOBRE PORTAS LÓGICAS

Quaisquer portas lógicas podem ser construídas usando-se apenas as portas básicas $\boldsymbol{not}$, $\boldsymbol{and}$ com duas entradas e $\boldsymbol{or}$ com duas entradas.

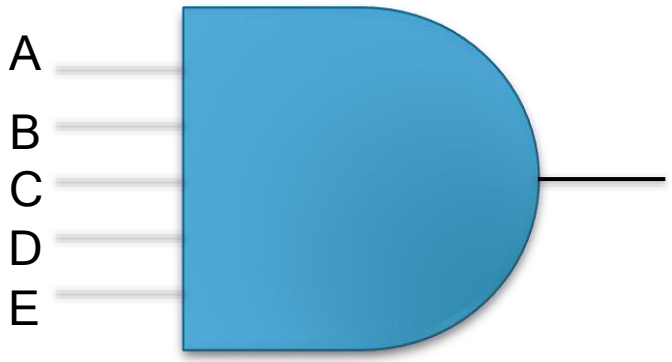
Ex: and com 5 entradas

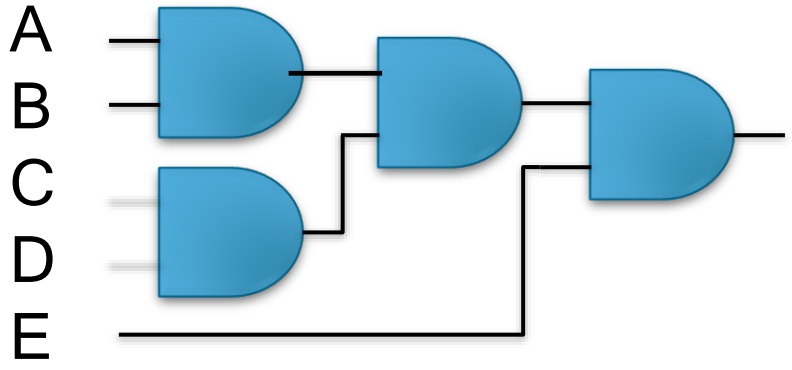


OBSERVAÇÕES SOBRE PORTAS LÓGICAS

Quaisquer portas lógicas podem ser construídas usando-se apenas as portas básicas $\boldsymbol{not}$, $\boldsymbol{and}$ com duas entradas e $\boldsymbol{or}$ com duas entradas.

Ex: and com 5 entradas



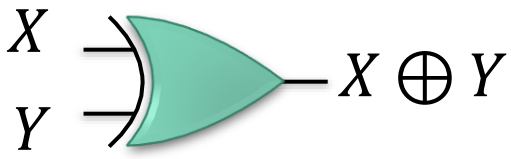


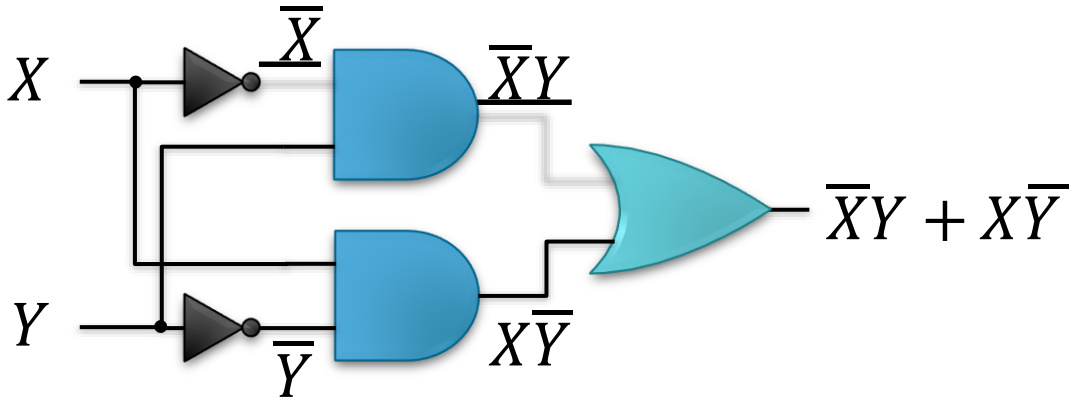
A	B	C	D	E	A.B.C.D.E
0	0	0	0	0	0
0	0	0	0	1	0
0	0	0	1	0	0
0	0	0	1	1	0
0	0	1	0	0	0
0	0	1	0	1	0
0	0	1	1	0	0
0	0	1	1	1	0
0	1	0	0	0	0
0	1	0	0	1	0
0	1	0	1	0	0
0	1	0	1	1	0
0	1	1	0	0	0
0	1	1	0	1	0
0	1	1	1	0	0
0	1	1	1	1	0
1	0	0	0	0	0
1	0	0	0	1	0
1	0	0	1	0	0
1	0	0	1	1	0
1	0	1	0	0	0
1	0	1	0	1	0
1	0	1	1	0	0
1	0	1	1	1	0
1	1	0	0	0	0
1	1	0	0	1	0
1	1	0	1	0	0
1	1	0	1	1	0
1	1	1	0	0	0
1	1	1	0	1	0
1	1	1	1	0	0
1	**1**	**1**	**1**	**1**	**1**

OBSERVAÇÕES SOBRE PORTAS LÓGICAS

Quaisquer portas lógicas podem ser construídas usando-se apenas as portas básicas $\boldsymbol{not}$, $\boldsymbol{and}$ com duas entradas e $\boldsymbol{or}$ com duas entradas.

Ex: xor com 2 entradas





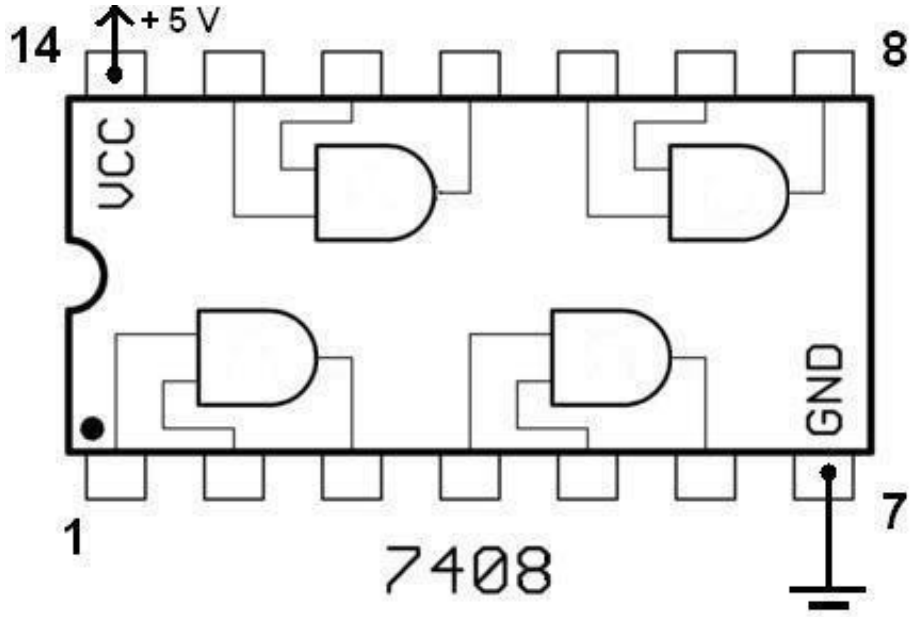
$$\overline{X}.Y + X.\overline{Y}$$

X	Y	$\overline{X}$	$\overline{Y}$	$\overline{X}.Y$	$X.\overline{Y}$	$\overline{X}Y + X\overline{Y}$
0	0	1	1	0	0	0
0	1	1	0	**1**	0	**1**
1	0	0	1	0	**1**	**1**
1	1	0	0	0	0	0

OBSERVAÇÕES SOBRE PORTAS LÓGICAS

Geralmente, usamos portas lógicas encontradas em circuitos integrados.

Por exemplo, 7408 (4 portas and com 2 entradas)



OBSERVAÇÕES SOBRE PORTAS LÓGICAS

Geralmente, usamos portas lógicas encontradas em circuitos integrados.

Encontram-se circuitos integrados para:

inversor (7404 / CD4049)
and (7408 / CD4081)
or (7432 / CD4071)
xor (7486)
nand (7400 / CD4012) nor (7402 / CD4001)
xnor (CD4077)

74xx – tradicionalmente de tecnologia TTL (74LSxx)
+ Robustez

CD40xx – tecnologia CMOS
+ Integração
- Consumo

Circuitos com portas lógicas com até 8 entradas também estão disponíveis

Exemplo 1 S = (A.B) . (B+C)

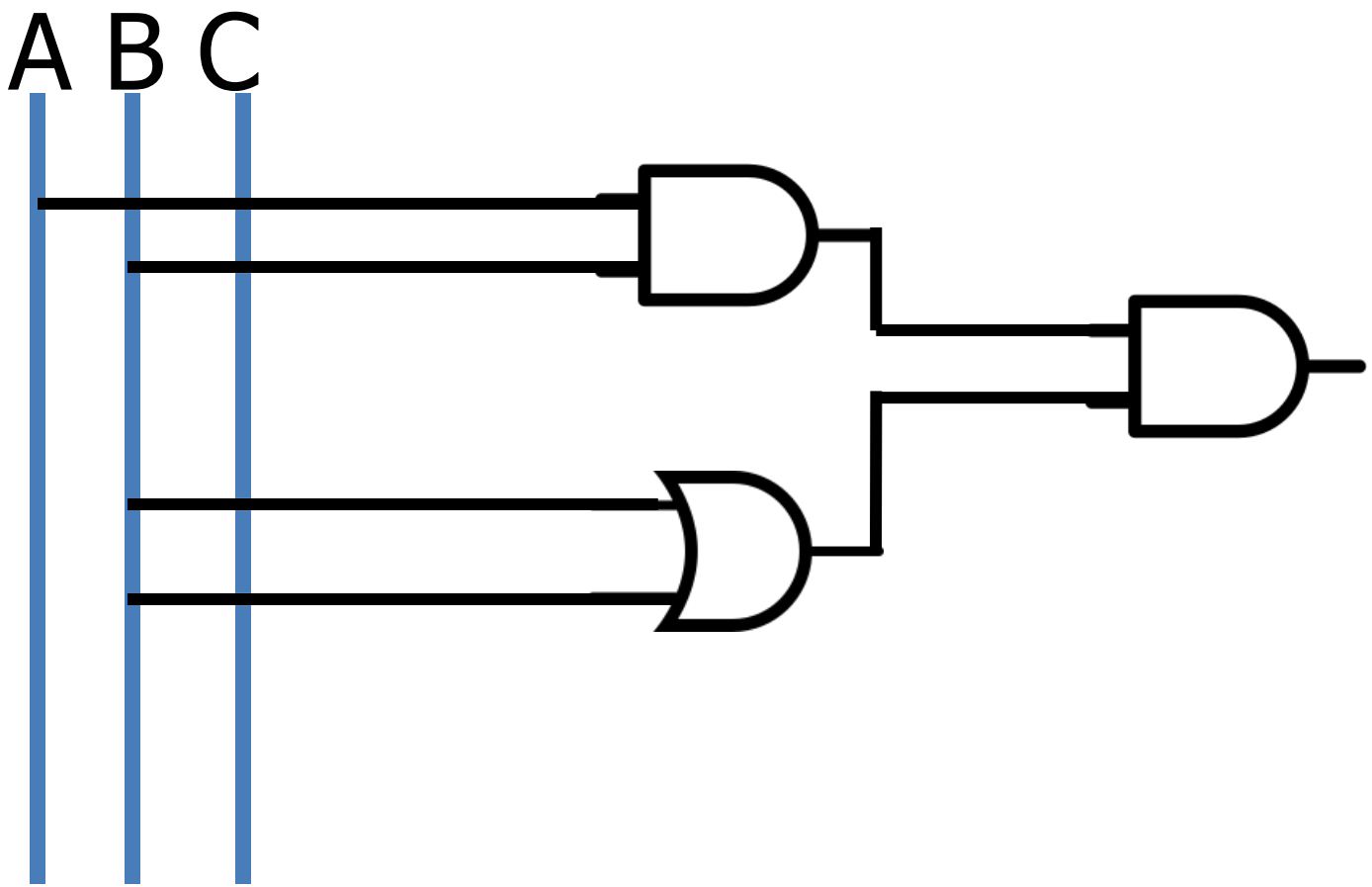


Tabela Verdade S = (A.B) . (B+C)

A	B	C	A.B	B+C	(A.B). (B+C)
0	0	0	0	0	0
0	0	1	0	1	0
0	1	0	0	1	0
0	1	1	0	1	0
1	0	0	0	0	0
1	0	1	0	1	0
1	1	0	1	1	1
1	1	1	**1**	**1**	1

Exemplo 2 $S = (A.B.C) + [\overline{(\overline{C+D})+\overline{A}}]$

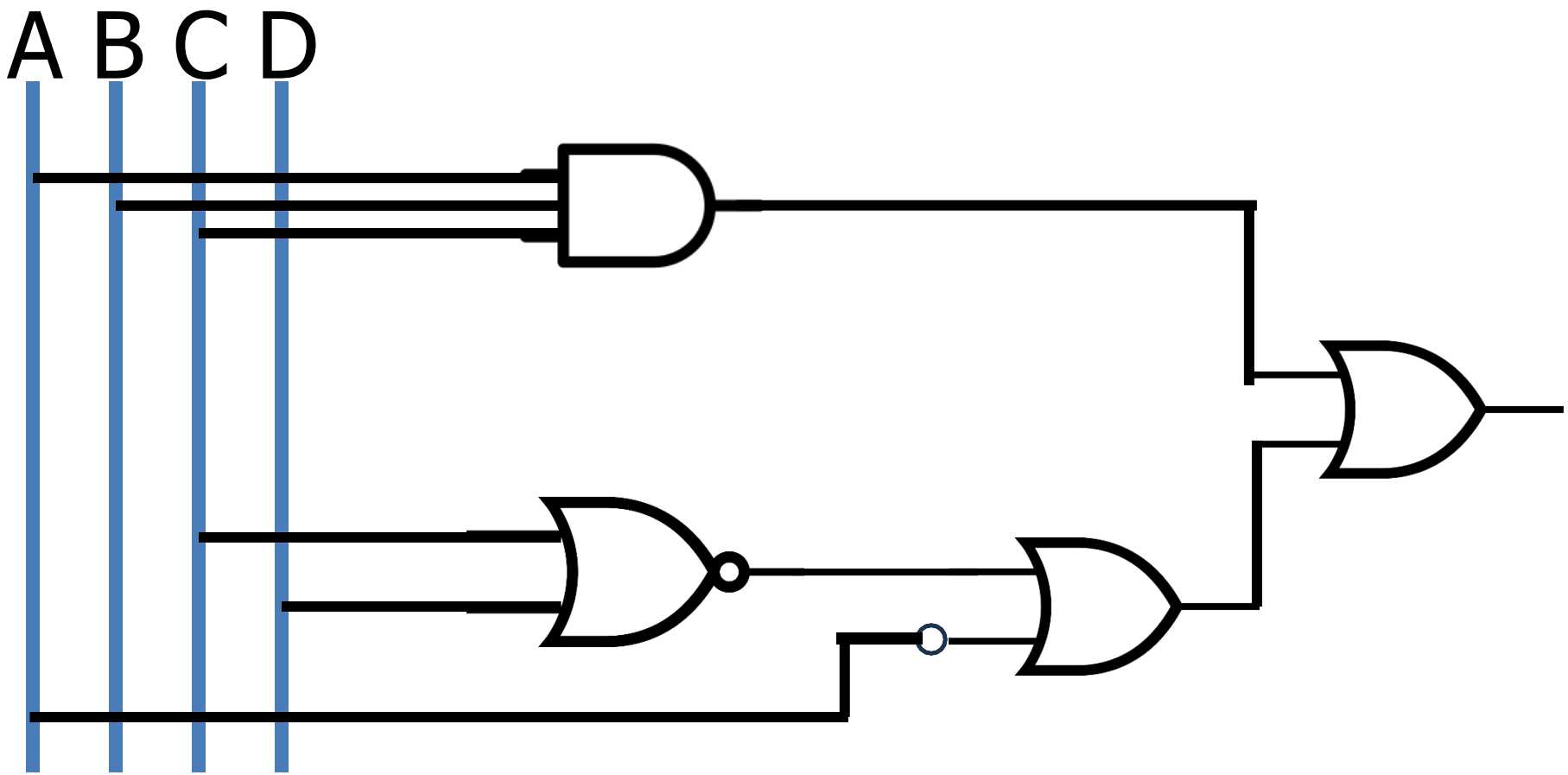


Tabela Verdade $S = (A.B.C) + [(\overline{C+D})+\overline{A}]$

A	B	C	D	A.B.C	C+D	$\overline{C+D}$	$\overline{A}$	(C + D) + A)	S
0	0	0	0	0	0	1	1	1	**1**
0	0	0	1	0	1	0	1	1	**1**
0	0	1	0	0	1	0	1	1	**1**
0	0	1	1	0	1	0	1	1	**1**
0	1	0	0	0	0	1	1	1	**1**
0	1	0	1	0	1	0	1	1	**1**
0	1	1	0	0	1	0	1	1	**1**
0	1	1	1	0	1	0	1	1	**1**
1	0	0	0	0	0	1	0	1	**1**
1	0	0	1	0	1	0	0	0	**0**
1	0	1	0	0	1	0	0	0	**0**
1	0	1	1	0	1	0	0	0	**0**
1	1	0	0	0	0	1	0	1	**1**
1	1	0	1	0	1	0	0	0	**0**
1	1	1	0	1	1	0	0	0	**1**
1	1	1	1	1	1	0	0	0	**1**

Atividades

Realize as seguintes expressões logicas seguido de sua tabela verdade

a) S = (A+B+C) . A+D

Atividade 1 S= (A+B+C) . A+D

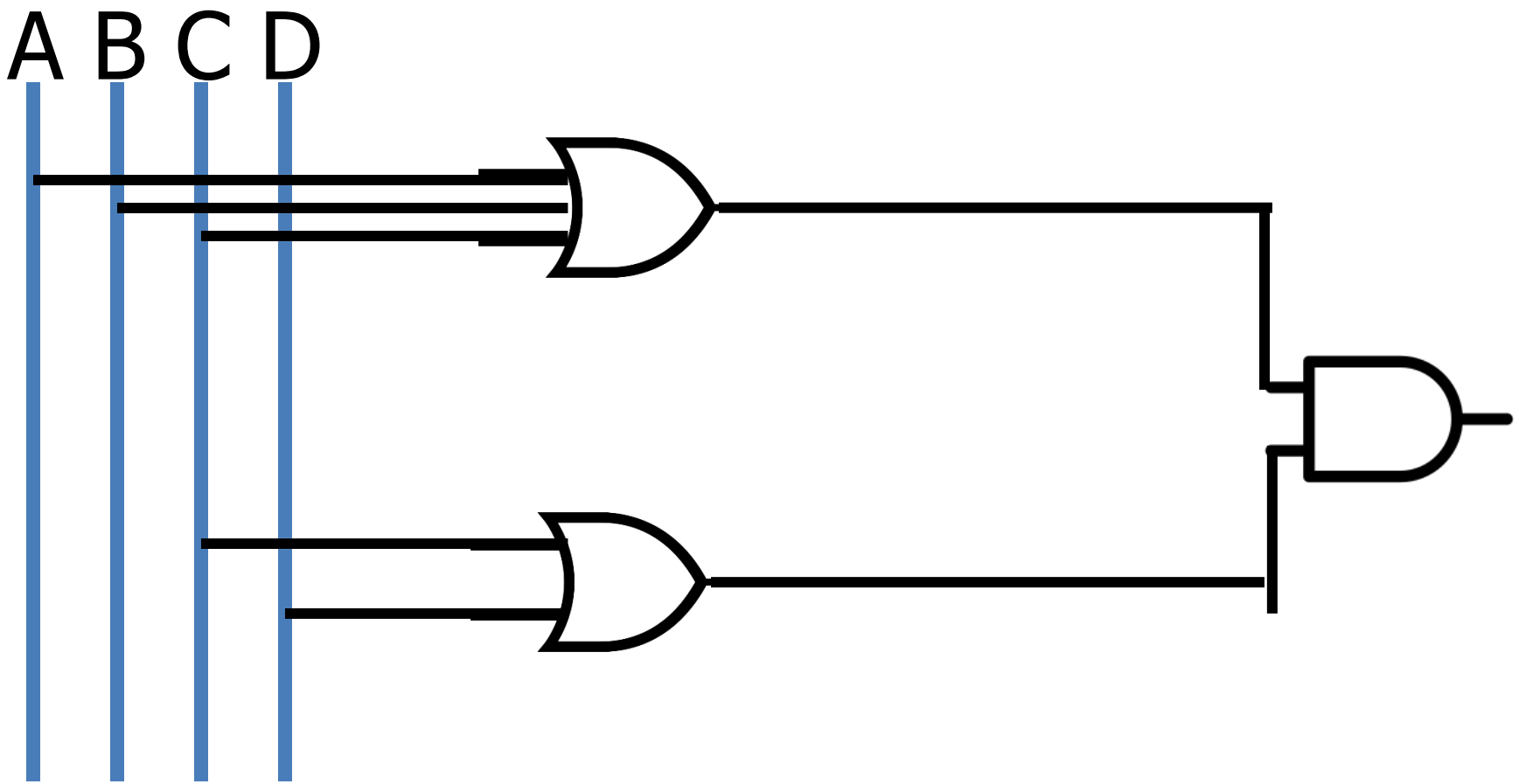


Tabela Verdade S = (A+B+C) . A+D

A	B	C	D	A+B+C	A+D	S
0	0	0	0	**0**	**0**	**0**
0	0	0	1	**0**	**1**	**0**
0	0	1	0	**1**	**0**	**0**
0	0	1	1	**1**	**1**	**1**
0	1	0	0	**1**	**0**	**0**
0	1	0	1	**1**	**1**	**1**
0	1	1	0	**1**	**0**	**0**
0	1	1	1	**1**	**1**	**1**
1	0	0	0	**1**	**1**	**1**
1	0	0	1	**1**	**1**	**1**
1	0	1	0	**1**	**1**	**1**
1	0	1	1	**1**	**1**	**1**
1	1	0	0	**1**	**1**	**1**
1	1	0	1	**1**	**1**	**1**
1	1	1	0	**1**	**1**	**1**
1	1	1	1	**1**	**1**	**1**

Atividade 2

Realize as seguintes expressões logicas seguido de sua tabela verdade

a) S= (A+B+C) . (A.D) . (C.B)

Atividade 2

$S = (A+B+C) \cdot (A.D) \cdot (C.B)$

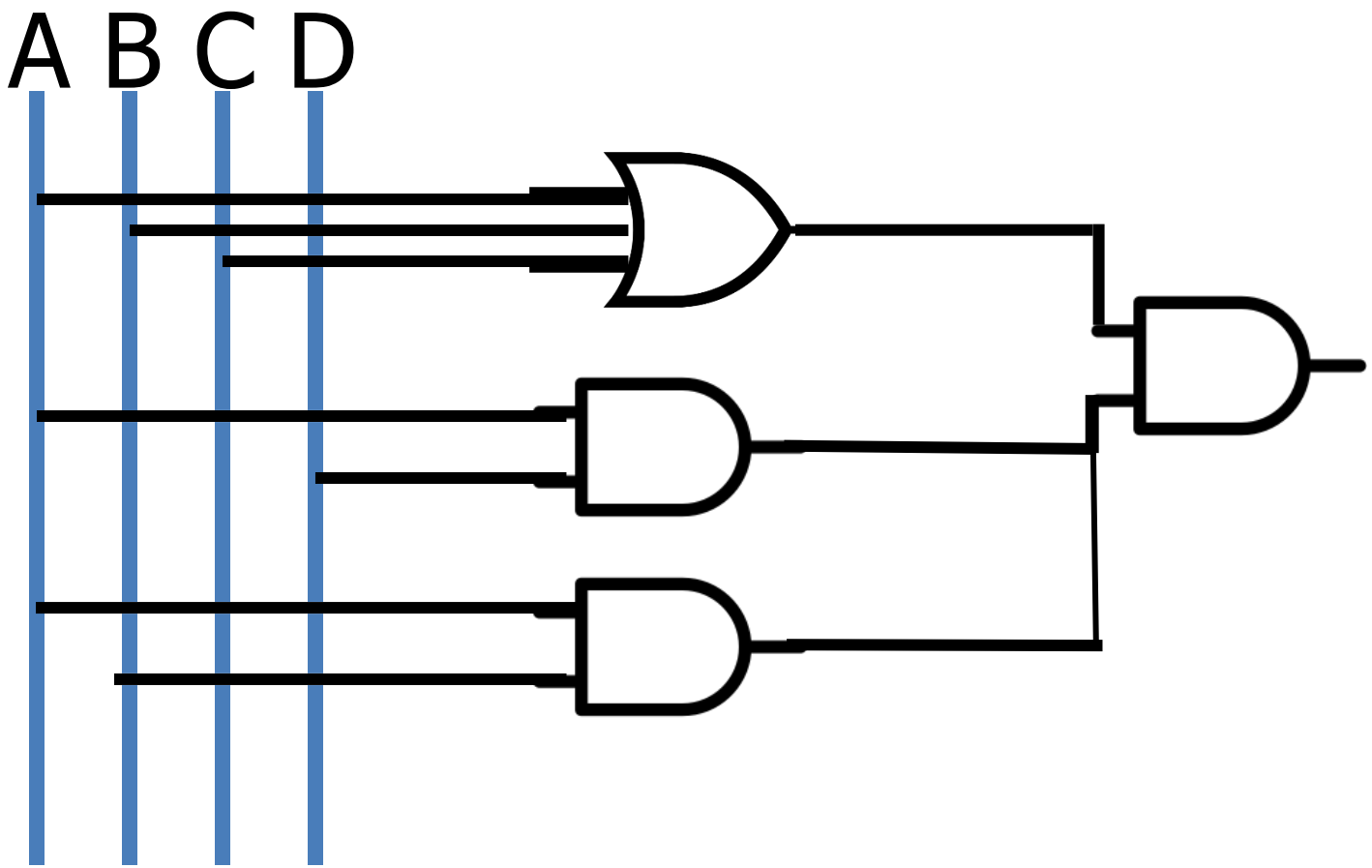


Tabela Verdade S = S= (A+B+C) . (A.D) . (C.B)

A	B	C	D	A+B+C	A.D		B.C	S
0	0	0	0	0	0		0	0
0	0	0	1	0	0		0	0
0	0	1	0	1	0		0	0
0	0	1	1	1	0		0	0
0	1	0	0	1	0		0	0
0	1	0	1	1	0		0	0
0	1	1	0	1	0		1	0
0	1	1	1	1	0		1	0
1	0	0	0	1	0		0	0
1	0	0	1	1	1		0	0
1	0	1	0	1	0		0	0
1	0	1	1	1	1		0	0
1	1	0	0	1	0		0	0
1	1	0	1	1	1		0	0
1	1	1	0	1	0		1	0
1	1	1	1	1	1		1	1

Atividade 3

Realize as seguintes expressões logicas seguido de sua tabela verdade

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

Exercício 3

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

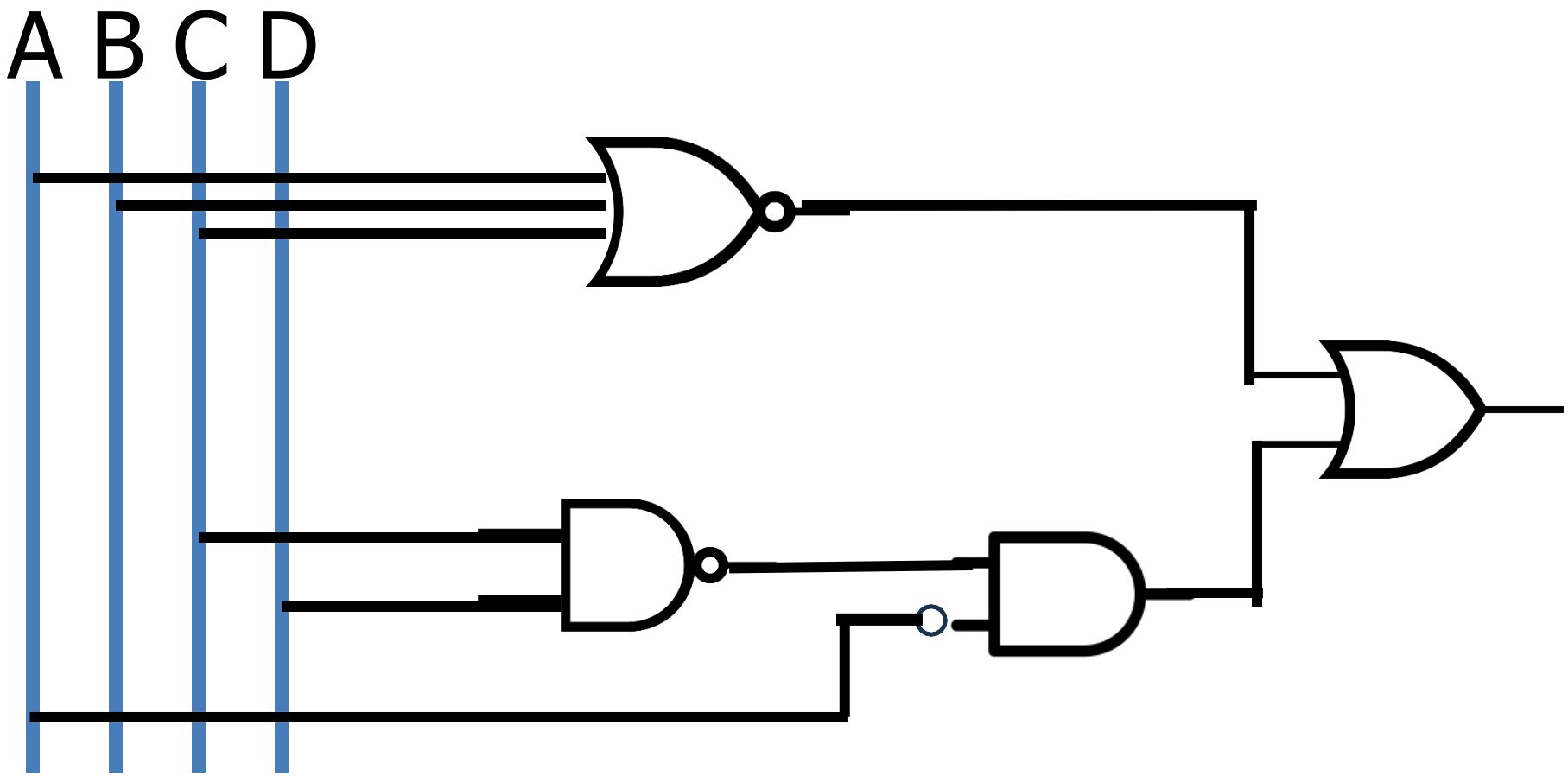


Tabela Verdade $S = (\overline{A+B+C}) + [\overline{(C.D)}.\overline{A}]$

A	B	C	D	A+B+C	$\overline{A+B+C}$	C.D	$\overline{C.D}$	$\overline{A}$	$\overline{(C.D).A}$	S
0	0	0	0	0	1	0	1	1	1	**1**
0	0	0	1	0	1	0	1	1	1	**1**
0	0	1	0	1	0	0	1	1	1	**1**
0	0	1	1	1	0	1	0	1	0	**0**
0	1	0	0	1	0	0	1	1	1	**1**
0	1	0	1	1	0	0	1	1	1	**1**
0	1	1	0	1	0	0	1	1	1	**1**
0	1	1	1	1	0	1	0	1	0	**0**
1	0	0	0	1	0	0	1	0	0	**0**
1	0	0	1	1	0	0	1	0	0	**0**
1	0	1	0	1	0	0	1	0	0	**0**
1	0	1	1	1	0	1	0	0	0	**0**
1	1	0	0	1	0	0	1	0	0	**0**
1	1	0	1	1	0	0	1	0	0	**0**
1	1	1	0	1	0	0	1	0	0	**0**
1	1	1	1	1	0	1	0	0	0	**0**

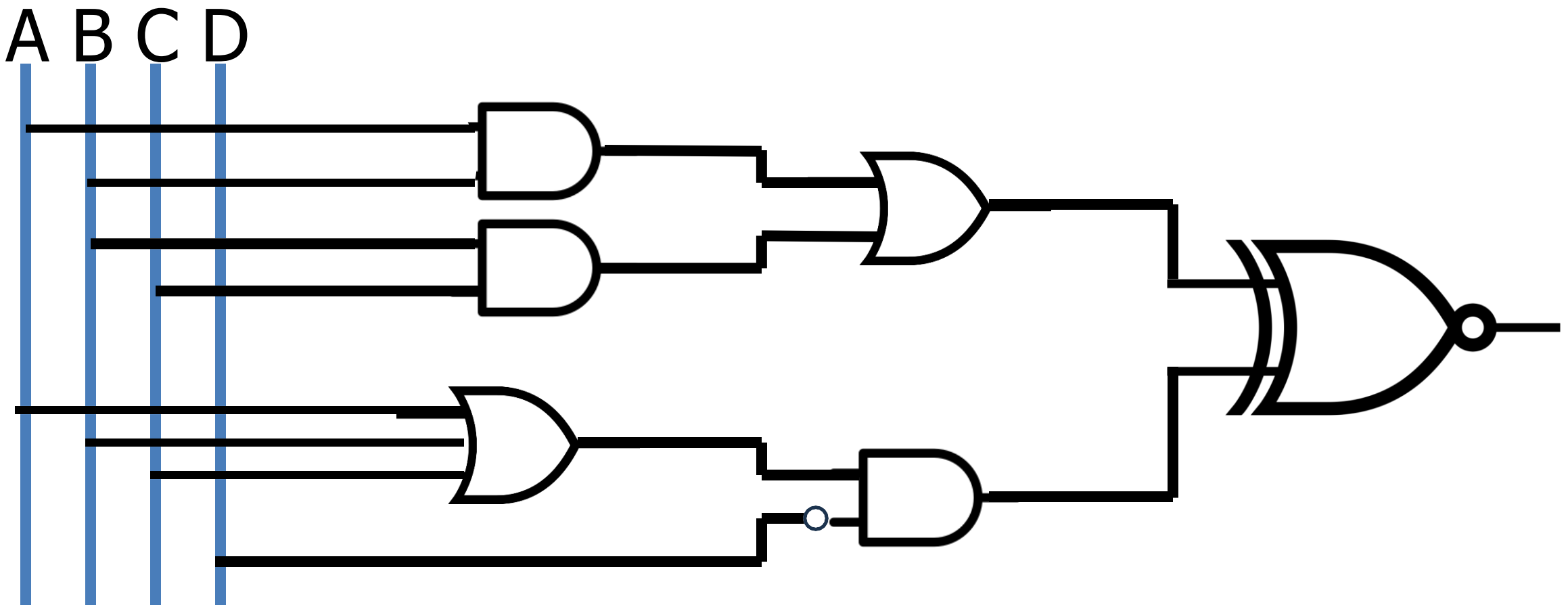
Atividade 4

Realize as seguintes expressões logicas seguido de sua tabela verdade

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

Exercício 4

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



TABELA

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

A	B	C	D	A.B	B.C	(A.B)+(B.C)	(A+B+C)	$\overline{D}$	(A+B+C).D	((A.B) + (B.C)) ⊕ [(A+B+C).D]	S
0	0	0	0	0	0	0	0	1	0	0	**1**
0	0	0	1	0	0	0	0	0	0	0	**1**
0	0	1	0	0	0	0	1	1	1	1	**0**
0	0	1	1	0	0	0	1	0	0	0	**1**
0	1	0	0	0	0	0	1	1	1	1	**0**
0	1	0	1	0	0	0	1	0	0	0	**1**
0	1	1	0	0	1	1	1	1	1	0	**1**
0	1	1	1	0	1	1	1	0	0	1	**0**
1	0	0	0	0	0	0	1	1	1	0	**1**
1	0	0	1	0	0	0	1	0	0	0	**1**
1	0	1	0	0	0	0	1	1	1	1	**0**
1	0	1	1	0	0	0	1	0	0	0	**1**
1	1	0	0	1	0	1	1	1	1	1	**0**
1	1	0	1	1	0	1	1	0	0	1	**0**
1	1	1	0	1	1	1	1	1	1	0	**1**
1	1	1	1	1	1	1	1	0	0	1	**0**

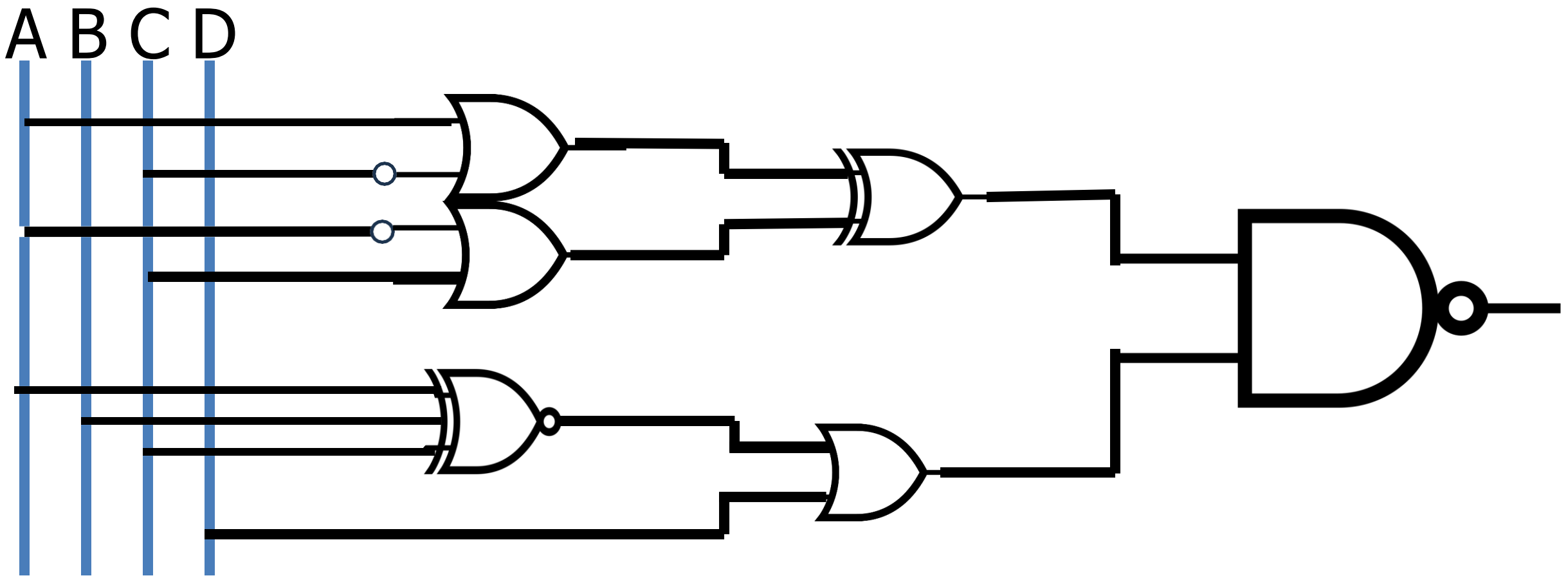
Atividade 5

Realize as seguintes expressões logicas seguido de sua tabela verdade

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

Exercício 4

$$s = \overline{((\overline{A}+C) \oplus (A.\overline{C})) \; . \; [\overline{(A \oplus B \oplus C)}+D]}$$



TABELA

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

A	B	C	D	$\overline{A}$	$\overline{A}+C$	$\overline{C}$	$A+\overline{C}$	$\overline{((A+C) \oplus (A.C))}$	$A \oplus B \oplus C$	$\overline{A \oplus B \oplus C}$	$\overline{[(A \oplus B \oplus C)+D]}$	$\overline{((A+C) \oplus (A.C)) \,.\, [(A \oplus B \oplus C)+D]}$	S
0	0	0	0	1	1	1	1	0	0	1	1	0	1
0	0	0	1	1	1	1	1	1	0	1	1	1	0
0	0	1	0	1	1	0	0	1	1	0	0	0	1
0	0	1	1	1	1	0	0	1	1	0	1	1	0
0	1	0	0	1	1	1	1	0	1	0	0	0	1
0	1	0	1	1	1	1	1	0	1	0	1	0	1
0	1	1	0	1	1	0	0	1	1	0	0	0	1
0	1	1	1	1	1	0	0	1	1	0	1	1	0
1	0	0	0	0	0	1	1	1	1	0	0	0	1
1	0	0	1	0	0	1	1	1	1	0	1	1	0
1	0	1	0	0	1	0	1	0	1	0	0	0	1
1	0	1	1	0	1	0	1	0	1	0	1	0	1
1	1	0	0	0	0	1	1	1	1	0	0	0	1
1	1	0	1	0	0	1	1	1	1	0	1	1	0
1	1	1	0	0	1	0	1	0	0	1	1	0	1
1	1	1	1	0	1	0	1	0	0	1	0	0	1