

Faculdade Senac Porto Alegre  
 Curso Superior de Tecnologia em Redes de Computadores  
 Curso Superior de Tecnologia em Análise e Desenvolvimento de Sistemas  
 Disciplina: Organização de Computadores

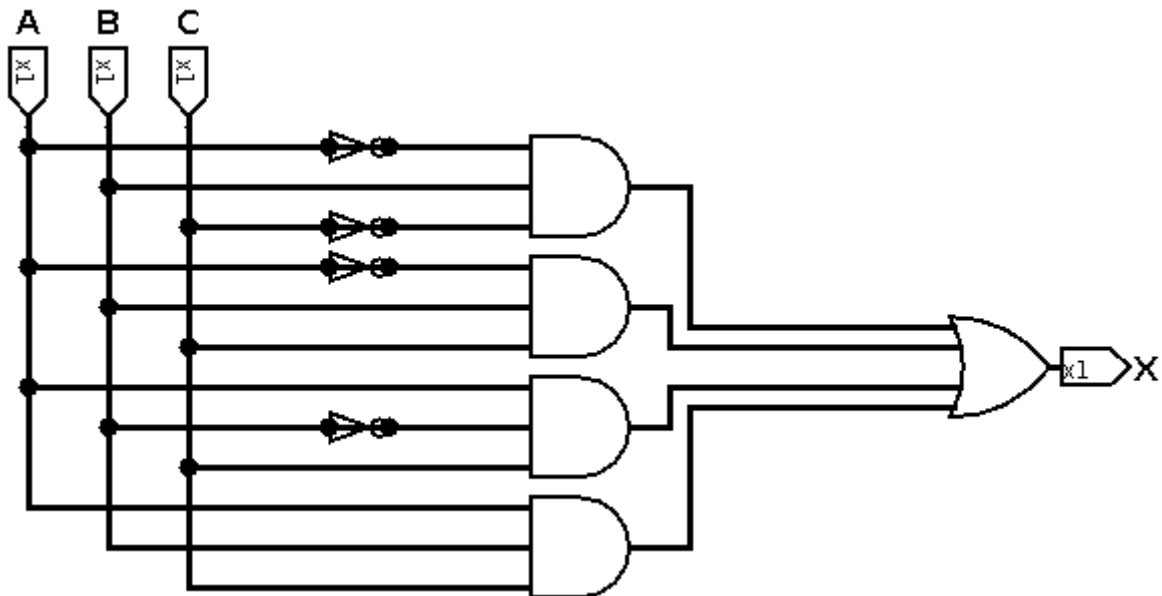
**Atividade - Simplificação de expressões lógicas e circuitos com Mapas de Karnaugh**

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0) De acordo com a expressão:

$$X = \bar{A}.B.\bar{C} + \bar{A}.B.C + A.\bar{B}.C + A.B.C \quad (1)$$

a. Mostre o diagrama lógico (circuito) correspondente:



b. Simplifique a expressão utilizando as propriedades da Álgebra Booleana ou Mapas de Karnaugh.

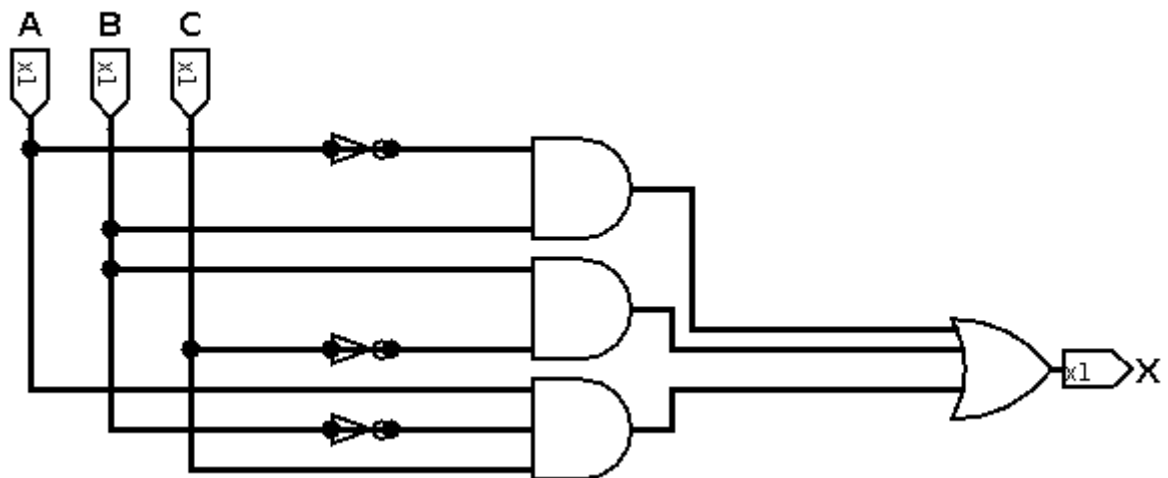
$$X = \bar{A}.B.\bar{C} + \bar{A}.B.C + A.\bar{B}.C + A.B.C \quad (2)$$

	A	B	C	X
0	0	0	0	0
1	0	0	1	0
2	0	1	0	1
3	0	1	1	1
4	1	0	0	0
5	1	0	1	1
6	1	1	0	0
7	1	1	1	1

A\BC	00	01	11	10
0			1	1
1		1		1

$$X = \bar{A}.B + B.\bar{C} + A.\bar{B}.C \quad (3)$$

c. Mostre o diagrama lógico da expressão mínima.



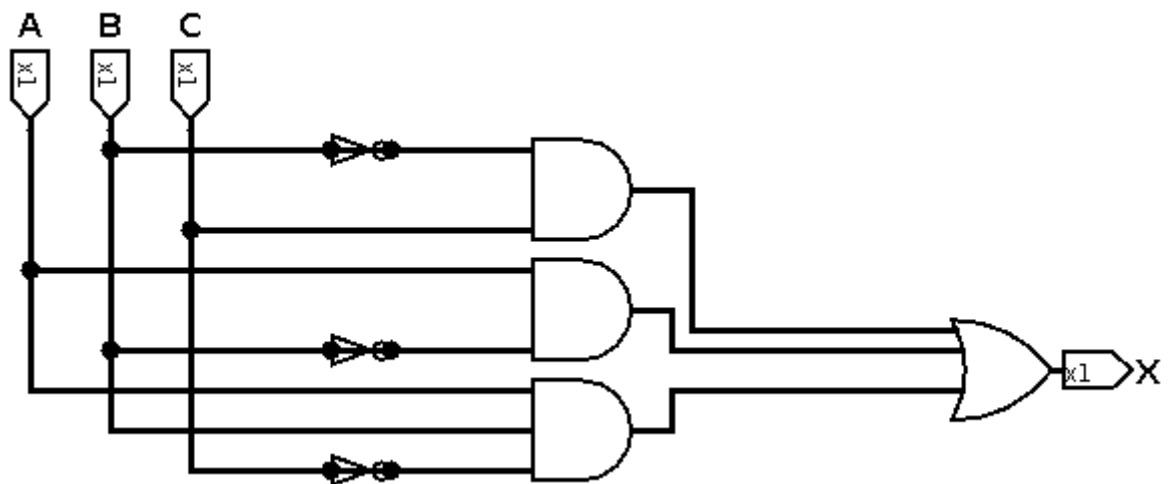
1) Projetar um circuito combinacional com portas lógicas E, OU e NOT, utilizando o menor número de portas possíveis, para a seguinte expressão:

$$S = \bar{X}.\bar{Y}.Z + X.Y.Z + X.\bar{Y}.\bar{Z} + X.\bar{Y}.Z \quad (4)$$

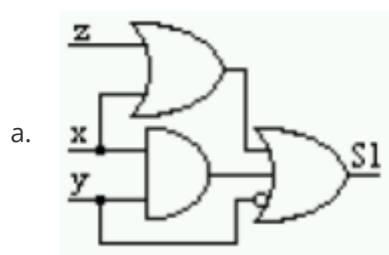
	X	Y	Z	S
0	0	0	0	0
1	0	0	1	1
2	0	1	0	0
3	0	1	1	0
4	1	0	0	1
5	1	0	1	1
6	1	1	0	0
7	1	1	1	1

A\BC	00	01	11	10
0		1		
1	1	1		1

$$S = \bar{B}.C + A.\bar{B} + A.B.\bar{C} \quad (5)$$



2) Simplifique os circuitos abaixo:

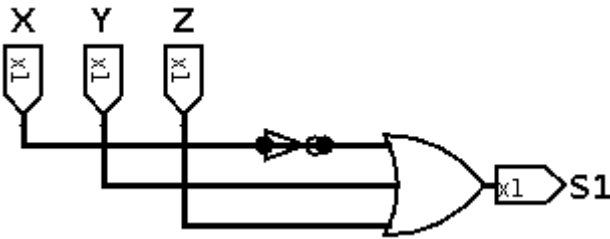


$$S1 = (X + Z) + (X.Y) + \bar{Y} \quad (6)$$

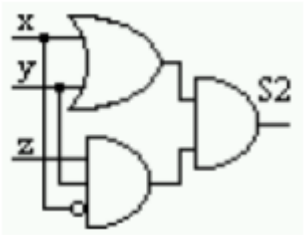
	X	Y	Z	$(X + Z)$	$(X.Y)$	$\bar{Y}$	$S1 = (X + Z) + (X.Y) + \bar{Y}$
0	0	0	0	0	0	1	1
1	0	0	1	1	0	1	1
2	0	1	0	0	0	0	0
3	0	1	1	1	0	0	1
4	1	0	0	1	0	1	1
5	1	0	1	1	0	1	1
6	1	1	0	1	1	0	1
7	1	1	1	1	1	0	1

X\YZ	00	01	11	10
0			0	
1				

$S1 = \bar{X} + Y + Z$ 
(7)



b.

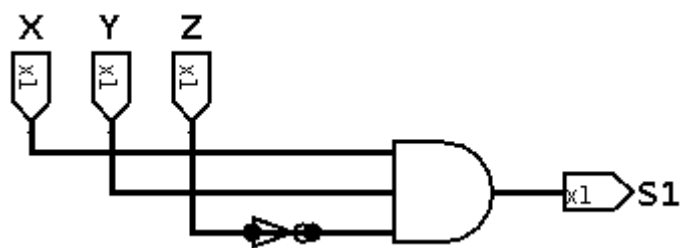


$S2 = (X + Y).(X.Y.\bar{Z})$ 
(8)

	X	Y	Z	$(X + Y)$	$\bar{Z}$	$(X.Y.\bar{Z})$	$S2 = (X + Y).(X.Y.\bar{Z})$
0	0	0	0	0	1	0	0
1	0	0	1	0	0	0	0
2	0	1	0	1	1	0	0
3	0	1	1	1	0	0	0
4	1	0	0	1	1	0	0
5	1	0	1	1	0	0	0
6	1	1	0	1	1	1	1
7	1	1	1	1	0	0	0

X\YZ	00	01	11	10
0				
1				1

$$S2 = X.Y.\bar{Z} \quad (9)$$



3) Dada a Tabela Verdade abaixo:

	X	Y	Z	F1	F2
0	0	0	0	0	0
1	0	0	1	1	0
2	0	1	0	1	0
3	0	1	1	0	1
4	1	0	0	1	0
5	1	0	1	0	1
6	1	1	0	0	1
7	1	1	1	1	1

a) Expresse F1 e F2 como soma de produtos, o mais simples possível.

X\YZ	0 0	0 1	1 1	1 0
0		1		1
1	1			1

$$F1 = (X \cdot \bar{Z}) + (Y \cdot \bar{Z}) + (\bar{X} \cdot \bar{Y} \cdot Z) \quad (10)$$

X\YZ	0 0	0 1	1 1	1 0
0			1	
1		1	1	1

$$F2 = (X \cdot Z) + (X \cdot Y) + (Y \cdot Z) \quad (11)$$

b) Expresse F1 e F2 como produto de somas, o mais simples possível.

X\YZ	0 0	0 1	1 1	1 0
0	0		0	
1		0	0	

$$F1 = (\bar{X} + \bar{Y} + \bar{Z}) \cdot (X + \bar{Z}) \cdot (X + Z) \quad (12)$$

X\YZ	0 0	0 1	1 1	1 0
0	0	0		0
1	0			

$$F2 = (\bar{Y} + \bar{Z}) \cdot (\bar{X} + \bar{Y}) \cdot (\bar{X} + \bar{Z}) \quad (13)$$

4) Escreva a expressão mínima correspondente às funções lógicas abaixo, utilizando mapas de Karnaugh e desenhe os circuitos correspondentes.

a)

$$F(A, B, C, D) = \sum m(0, 3, 4, 6, 8, 12) \quad (14)$$

	A	B	C	D	F
0	0	0	0	0	1
1	0	0	0	1	0
2	0	0	1	0	0
3	0	0	1	1	1
4	0	1	0	0	1
5	0	1	0	1	0
6	0	1	1	0	1
7	0	1	1	1	0
8	1	0	0	0	1
9	1	0	0	1	0
10	1	0	1	0	0
11	1	0	1	1	0
12	1	1	0	0	1
13	1	1	0	1	0
14	1	1	1	0	0
15	1	1	1	1	0

AB\CD	00	01	11	10
00	1		1	
01	1			1
11	1			
10	1			

$$F = (\bar{C} \cdot \bar{D}) + (\bar{A} \cdot \bar{B} \cdot C \cdot D) + (\bar{A} \cdot B \cdot C \cdot \bar{D}) \quad (15)$$

b)

$$F(A, B, C) = \prod M(1, 2, 5, 7) \quad (16)$$

	<b>A</b>	<b>B</b>	<b>C</b>	<b>F</b>
<b>0</b>	0	0	0	1
<b>1</b>	0	0	1	0
<b>2</b>	0	1	0	0
<b>3</b>	0	1	1	1
<b>4</b>	1	0	0	1
<b>5</b>	1	0	1	0
<b>6</b>	1	1	0	1
<b>7</b>	1	1	1	0

<b>A\BC</b>	<b>00</b>	<b>01</b>	<b>11</b>	<b>10</b>
<b>0</b>		0		
<b>1</b>	0	0	0	

$$F = (A + \bar{B}).(A + C).(\bar{B}.C) \tag{17}$$

c)

$$F(A,B,C,D) = \sum m(1,3,7,11,15) \tag{18}$$



	A	B	C	D	F
0	0	0	0	0	0
1	0	0	0	1	1
2	0	0	1	0	0
3	0	0	1	1	1
4	0	1	0	0	0
5	0	1	0	1	0
6	0	1	1	0	0
7	0	1	1	1	1
8	1	0	0	0	0
9	1	0	0	1	0
10	1	0	1	0	0
11	1	0	1	1	1
12	1	1	0	0	0
13	1	1	0	1	0
14	1	1	1	0	0
15	1	1	1	1	1

AB\CD	00	01	11	10
00		1	1	
01				
11			1	
10			1	

$$F = (\bar{A} \cdot \bar{B} \cdot D) + (A \cdot C \cdot D) \quad (19)$$

D)

$$F(A, B, C, D) = \sum m(0, 2, 5) \quad (20)$$

	A	B	C	D	F
0	0	0	0	0	1
1	0	0	0	1	0
2	0	0	1	0	1
3	0	0	1	1	0
4	0	1	0	0	0
5	0	1	0	1	1
6	0	1	1	0	0
7	0	1	1	1	0
8	1	0	0	0	0
9	1	0	0	1	0
10	1	0	1	0	0
11	1	0	1	1	0
12	1	1	0	0	0
13	1	1	0	1	0
14	1	1	1	0	0
15	1	1	1	1	0

AB\CD	00	01	11	10
00	1			1
01		1		
11				
10				

$$F = (\bar{A} \cdot \bar{B} \cdot \bar{D}) + (\bar{A} \cdot B \cdot \bar{C} \cdot D) \tag{21}$$

E)

$$F(A,B,C) = \prod m(3,4) \tag{22}$$

	<b>A</b>	<b>B</b>	<b>C</b>	<b>F</b>
<b>0</b>	0	0	0	1
<b>1</b>	0	0	1	1
<b>2</b>	0	1	0	1
<b>3</b>	0	1	1	0
<b>4</b>	1	0	0	0
<b>5</b>	1	0	1	1
<b>6</b>	1	1	0	1
<b>7</b>	1	1	1	1

<b>A\BC</b>	<b>00</b>	<b>01</b>	<b>11</b>	<b>10</b>
<b>0</b>			0	
<b>1</b>	0			

$$F = (A + \bar{B} + \bar{C})(\bar{A} + B + C) \quad (23)$$

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5) Determine a Expressão simplificada para S1, S2, S3, S4 da seguinte tabela:

	A	B	C	D	S1	S2	S3	S4
0	0	0	0	0	1	1	1	0
1	0	0	0	1	1	0	1	1
2	0	0	1	0	1	1	1	0
3	0	0	1	1	0	0	0	0
4	0	1	0	0	1	1	0	0
5	0	1	0	1	1	1	1	1
6	0	1	1	0	1	1	0	1
7	0	1	1	1	1	1	1	1
8	1	0	0	0	1	1	0	0
9	1	0	0	1	1	0	1	0
10	1	0	1	0	1	1	0	0
11	1	0	1	1	0	0	0	1
12	1	1	0	0	1	0	1	1
13	1	1	0	1	1	1	1	1
14	1	1	1	0	1	0	1	0
15	1	1	1	1	1	0	0	1

AB\CD	00	01	11	10
00			0	
01				
11				
10			0	

$$S1 = (\bar{B} + C + D) \quad (24)$$

AB\CD	00	01	11	10
00		0	0	
01				
11	0		0	0
10		0	0	

$$S2 = (\bar{A} + \bar{B} + D). (A + \bar{B} + D). (A + B + C). (A + B + \bar{D}) \quad (25)$$

AB\CD	00	01	11	10
00	1	1		1
01		1	1	
11	1	1		1
10		1		

$$S3 = (\bar{C}.D) + (\bar{A}.\bar{B}.\bar{C}) + (A.B.\bar{C}) + (\bar{A}.B.D) + (\bar{A}.\bar{B}.C.\bar{D}) + (A.B.C.\bar{D}) \quad (26)$$

AB\CD	00	01	11	10
00		1		
01		1	1	1
11	1	1	1	
10			1	

$$S4 = (\bar{A}.\bar{C}.D) + (A.B.\bar{C}) + (\bar{A}.B.C) + (A.C.D) \quad (28)$$