Universidade Federal da Fronteira Sul
Curso de Ciência da Computação
Disciplina: Circuitos Digitais
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Respostas da Lista de Exercícios 2

1) Simplifique as expressões utilizando a álgebra de Boole:

a)

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

$$= B\overline{B} + BC + \overline{B}\overline{C} + C\overline{C} + \overline{\overline{A}}\,\overline{B}\,\overline{\overline{C}}$$

$$= 0 + BC + \overline{B}\overline{C} + 0 + A\overline{B}C \quad \rightarrow \downarrow$$

$$= C(B + A\overline{B}) + \overline{B}\overline{C} \qquad \overline{B}(\overline{C} + AC) + BC$$

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

$$= AC + BC + \overline{B}\overline{C} \qquad A\overline{B} + \overline{B}\overline{C} + BC$$

b)

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

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

$$= 0 + BC + \overline{B}C + 0 + \overline{A}B\overline{C}$$

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

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

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

c)

$$P = (A + (\overline{B.C})).(\overline{D + B.E})$$

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

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

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

$$= A\overline{B}\overline{D} + A\overline{D}\overline{E} + \overline{B}\overline{B}\overline{D} + \overline{B}\overline{D}\overline{E} + \overline{B}\overline{C}D + \overline{C}\overline{D}\overline{E}$$

$$= A\overline{B}\overline{D} + A\overline{D}\overline{E} + \overline{B}\overline{D} + \overline{B}\overline{D}\overline{E} + \overline{B}\overline{C}D + \overline{C}\overline{D}\overline{E}$$

$$= \overline{B}\overline{D}(A + 1 + \overline{E} + \overline{C}) + A\overline{D}\overline{E} + \overline{C}\overline{D}\overline{E}$$

$$= \overline{B}\overline{D} + A\overline{D}\overline{E} + \overline{C}\overline{D}\overline{E}$$

d)

$$\begin{aligned}
Q &= \left(\overline{\overline{A.C} + B + D}\right) + \left(C.\left(\overline{A.C.D}\right)\right) \\
&= \overline{\overline{AC}}\,\overline{B}\,\overline{D} + (C(\overline{A} + \overline{C} + \overline{D})) \\
&= A\overline{B}C\overline{D} + C\overline{A} + C\overline{C} + C\overline{D} \\
&= C\overline{D}(A\overline{B} + 1) + \overline{A}C \\
&= C\overline{D} + \overline{A}C
\end{aligned}$$

e)

$$\begin{aligned}
R &= A.B.C + A.\overline{C} + A.\overline{B} \\
&= A.(B.C + .\overline{C}) + A.\overline{B} \\
&= A.(B. + .\overline{C}) + A.\overline{B} \\
&= A.B + A.\overline{C} + A.\overline{B} \\
&= A.(B + \overline{B} + .\overline{C}) \\
&= A
\end{aligned}$$

f)

$$\begin{aligned}
M &= \overline{B}.\overline{D} + \overline{A} + A.\overline{B}.\overline{C}.D + A.\overline{B}.C.D + \overline{A}.\overline{C} \\
&== \overline{A}(1 + \overline{C}) + \overline{B}.\overline{D} + + A.\overline{B}.\overline{C}.D + A.\overline{B}.C.D \\
&= \overline{A} + \overline{B}.\overline{D} + A\overline{B}D(\overline{C} + C) \\
&= \overline{A} + A\overline{B}D + \overline{B}.\overline{D} \\
&= \overline{A} + \overline{B}D + \overline{B}.\overline{D} \\
&= \overline{A} + \overline{B}(D + .\overline{D}) \\
&= \overline{A} + \overline{B}
\end{aligned}$$

g)

$$\begin{aligned}
N &= (\overline{A + B}) + (\overline{A.\overline{C}}) + \overline{B} \\
&= \overline{A}\,\overline{B} + \overline{A} + \overline{\overline{C}} + \overline{B} \\
&= \overline{A}(\overline{B} + 1) + C + \overline{B} \\
&= \overline{A} + C + \overline{B}
\end{aligned}$$

h)

$$\begin{aligned}
L &= \overline{\overline{\overline{A.B.C.D}}} + \overline{\overline{\overline{A.B.\overline{C}.D}}} \\
&= \overline{\overline{\overline{A.B.C.}}} + \overline{D} + \overline{\overline{\overline{A.B.\overline{C}.}}} + \overline{D} \\
&= \overline{\overline{AB}C} + \overline{D}_\overline{\overline{AB}\,\overline{C}} \\
&= (\overline{A} + \overline{B})C + \overline{D} + (\overline{A} + \overline{B})\overline{C} \\
&= \overline{A}C + \overline{B}C + \overline{D} + \overline{A}\,\overline{C} + \overline{B}\,\overline{C} \\
&= \overline{A}(C + \overline{C}) + \overline{B}(C + \overline{C}) + \overline{D} \\
&= \overline{A} + \overline{B} + \overline{D}
\end{aligned}$$

i)

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

j)

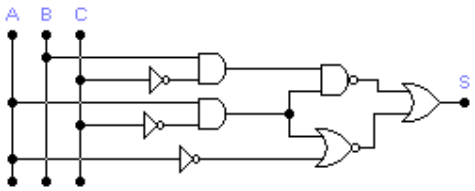
$$K = (\overline{A} + B).(A + B + D).\overline{D}$$
$$= (\overline{A} + B).(A\overline{D} + B\overline{D} + D\overline{D})$$
$$= (\overline{A} + B).(A\overline{D} + B\overline{D} + 0)$$
$$= \overline{A}A\overline{D} + \overline{A}B\overline{D} + AB\overline{D} + BB\overline{D}$$
$$= 0 + \overline{A}B\overline{D} + AB\overline{D} + B\overline{D}$$
$$= B\overline{D}(\overline{A} + A + 1)$$
$$= B\overline{D}$$

k)

$$J = \overline{A}.\overline{B}.C.D + \overline{A}.\overline{B}.C.D + A.\overline{B}.\overline{C}.\overline{D} + A.\overline{B}.C.\overline{D}$$
$$= \overline{A}.\overline{B}.C.D + A.\overline{B}.\overline{D}(C + C.)$$
$$= = \overline{A}.\overline{B}.C.D + A.\overline{B}.\overline{D}$$

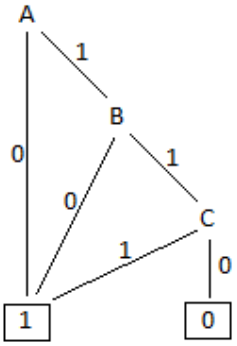
2) Dado os circuitos mostrados abaixo obtenha a expressão, simplifique-as utilizando álgebra de Boole, obtenha a tabela verdade e o BDD da mesma.

a)

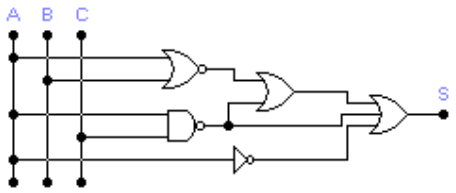


$$S = \overline{B\overline{C}.A\overline{C}} + \overline{A\overline{C} + \overline{A}}$$
$$= \overline{AB\overline{C}} + \overline{\overline{C} + \overline{A}}$$
$$= \overline{A} + \overline{B} + C + AC$$
$$= \overline{A} + \overline{B} + C(1 + A)$$
$$= \overline{A} + \overline{B} + C$$

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



b)



$$S = \overline{A} + \overline{AC} + (\overline{AC} + \overline{A+B})$$
$$= \overline{A} + \overline{AC} + \overline{A+B}$$
$$= \overline{A} + \overline{A} + \overline{C} + \overline{A}\,\overline{B}$$
$$= \overline{A} + \overline{C} + \overline{A}\,\overline{B}$$
$$= \overline{A}(1+B) + \overline{C}$$
$$= \overline{A} + \overline{C}$$

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