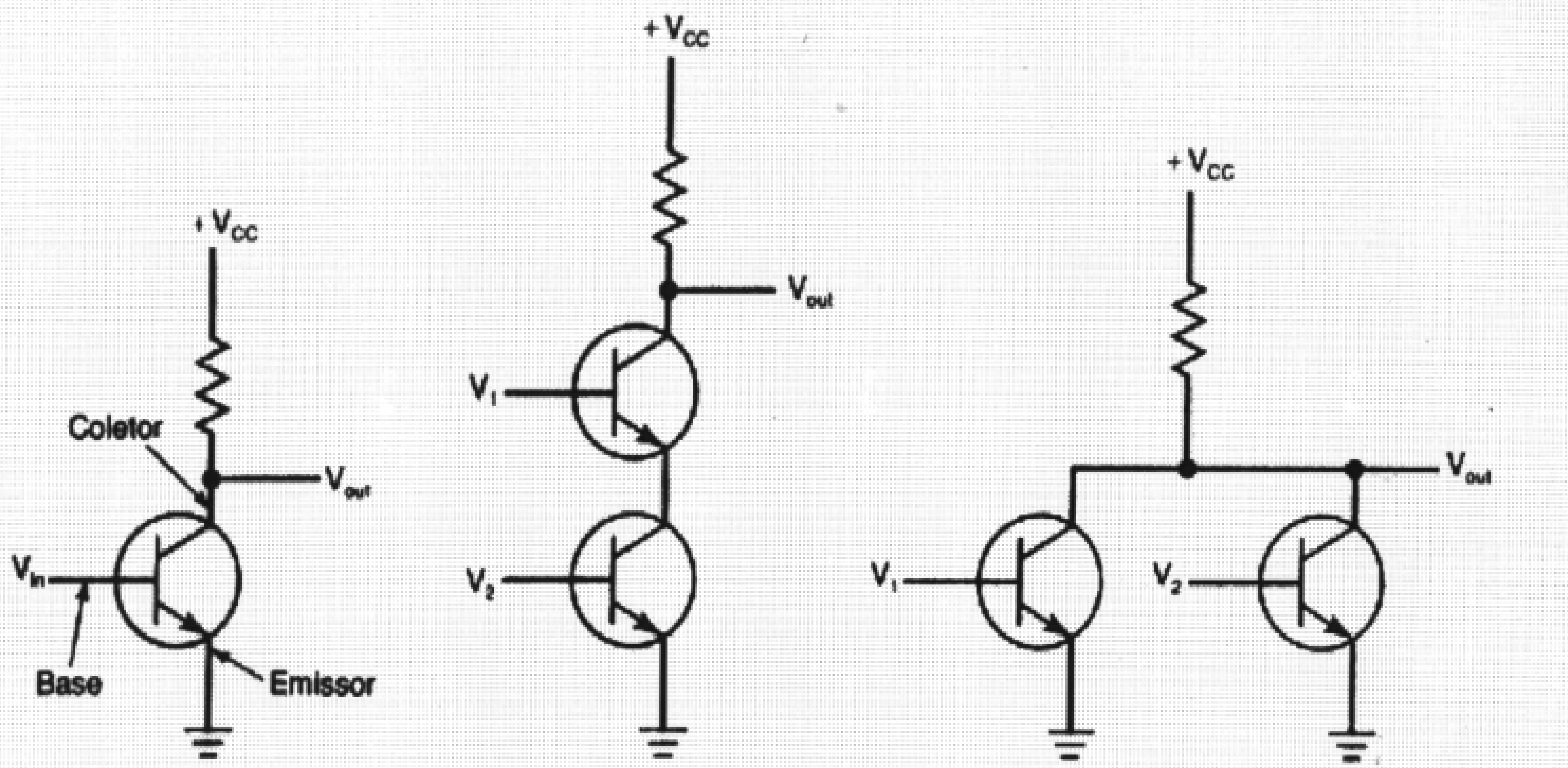
Simplificação de Portas lógicas usando Transistores como chaves



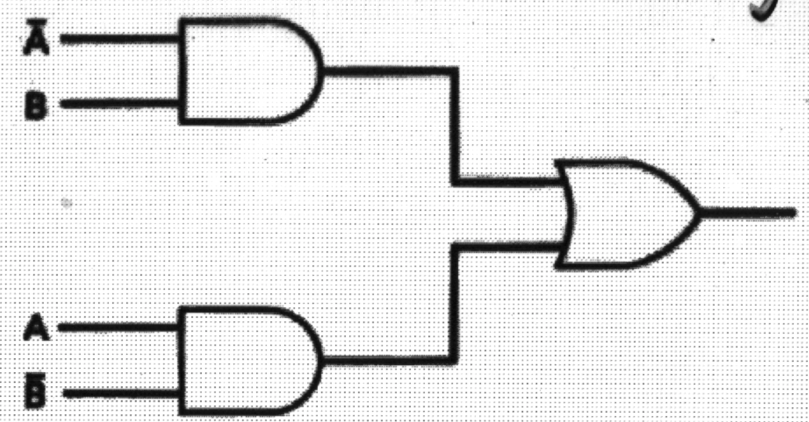
(a) (b) (c)

Inversor NAND NOR

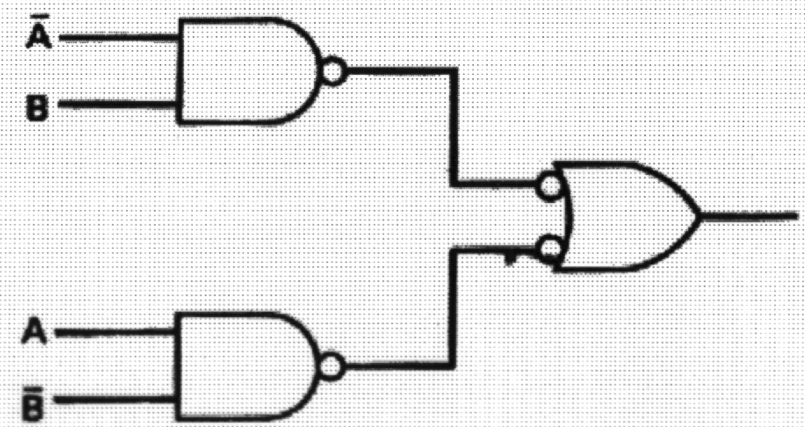
Implementação da função XOR usando portas lógicas

A	B	X0R
0	0	0
0	1	1
1	0	1
1	1	0

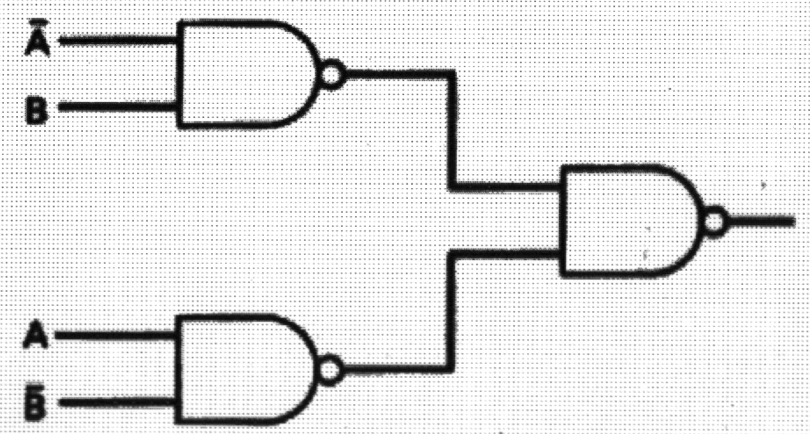
(a)



(b)



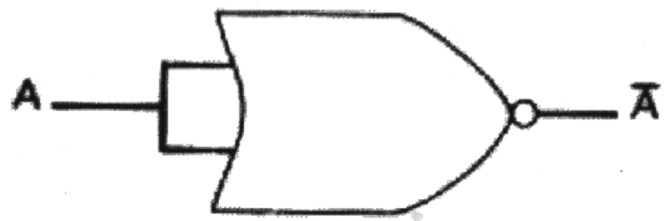
(c)



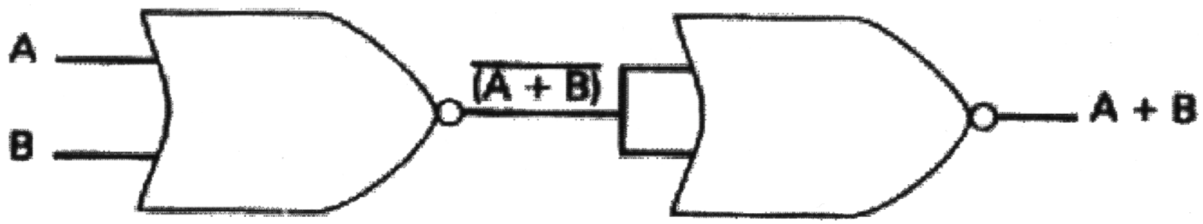
(d)

USANDO APENAS PORTAS NOR para obter função equivalente:

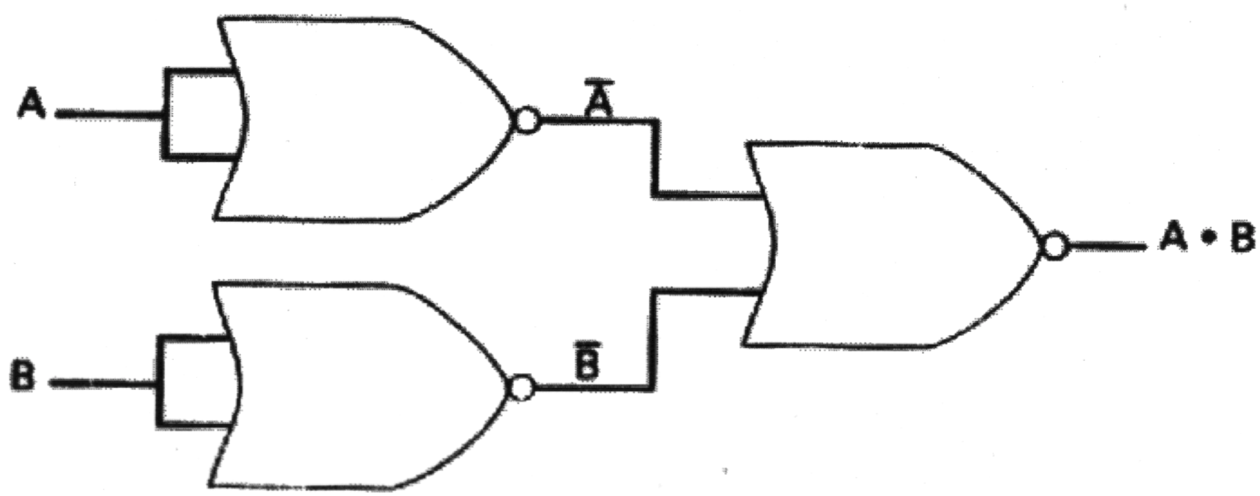
- INVERSOR



- OR

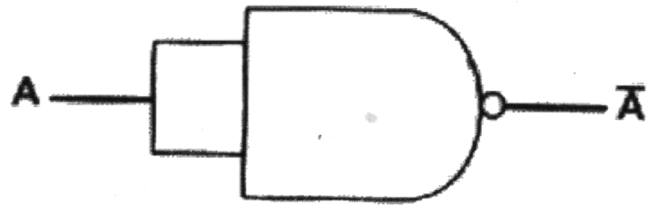


- AND

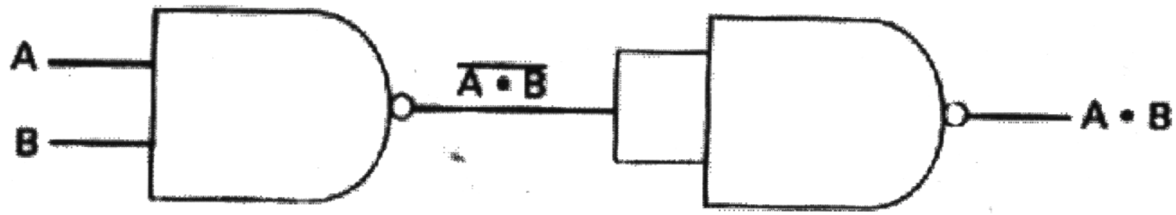


USANDO APENAS PORTAS NAND para obter função equivalente

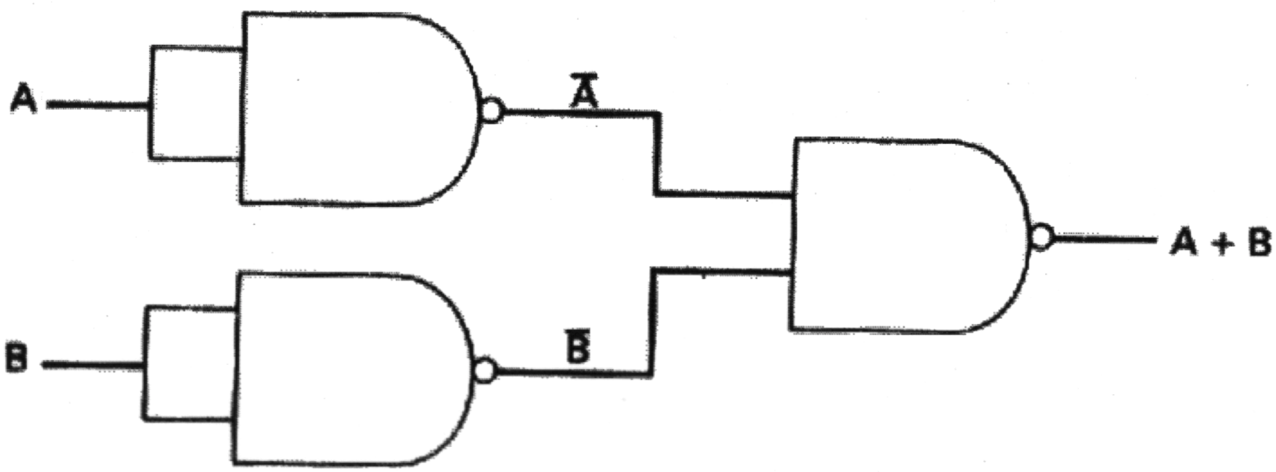
- Inversor

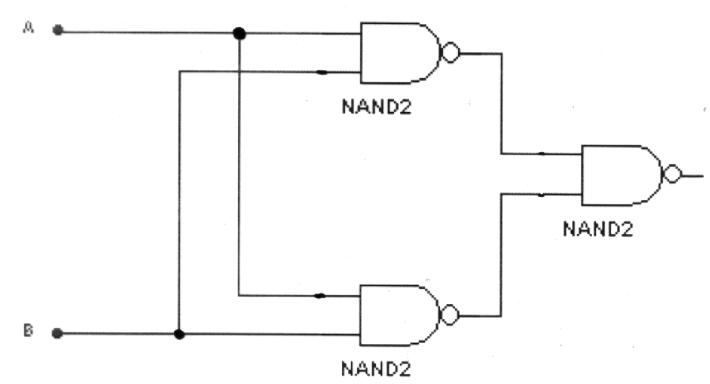


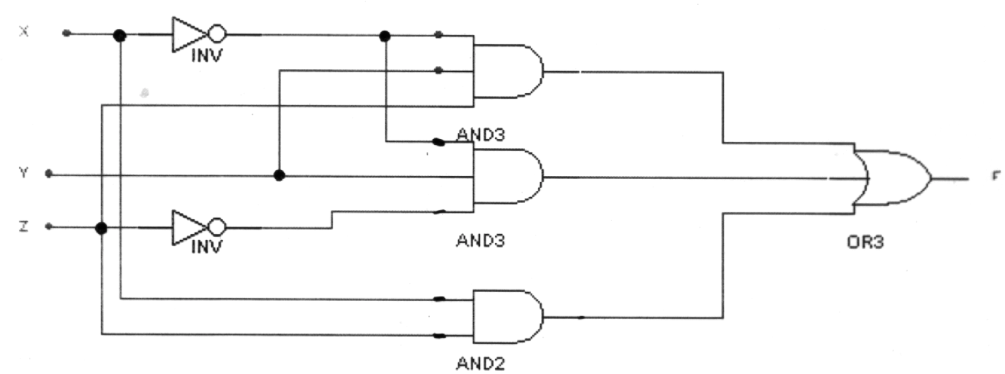
- AND

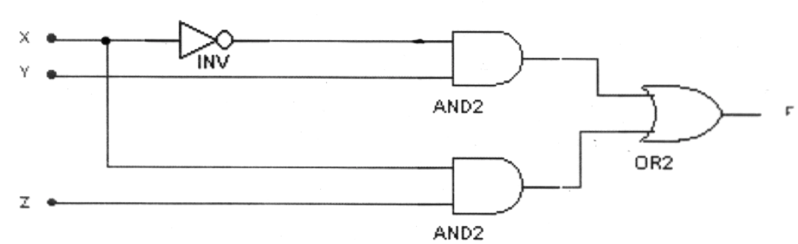


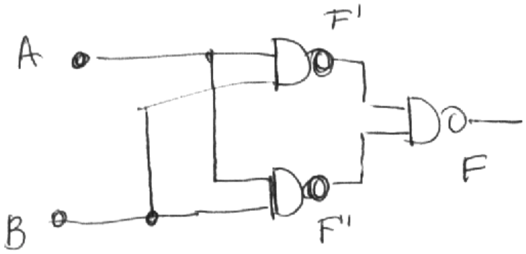
- OR




A
B
NAND2
NAND2
NAND2


X
Y
Z
INV
INV
AND3
AND3
AND2
OR3
F


X
Y
Z
INV
AND2
AND2
OR2
F



$$F = \overline{F' \cdot F''}$$ (NAND)

$$F' = \overline{A \cdot B}$$

$$F'' = \overline{A \cdot B}$$

$$F = \overline{(\overline{A \cdot B}) \cdot (\overline{A \cdot B})}$$ Idempotência

$$F = \overline{\overline{(A \cdot B)}}$$ ↓ dupla negação (involução)

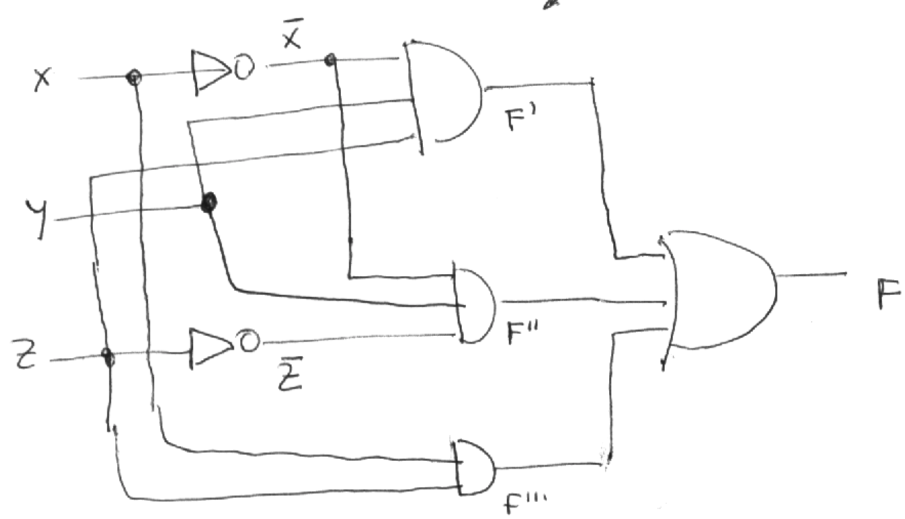
$$F = A \cdot B$$

USANDO TABELA VERDADE

A	B	F'	F''	F
0	0	1	1	0
0	1	1	1	0
1	0	1	1	0
1	1	0	0	1

tabela verdade da função AND!

AND de 3 entradas



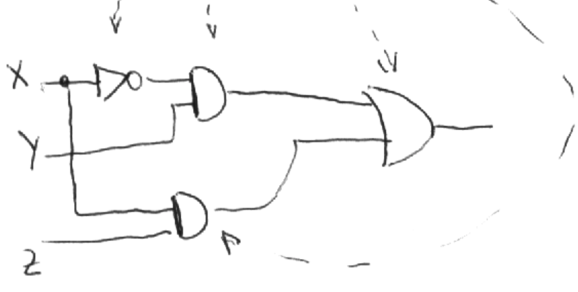
$$\left\{\begin{array}{l} F = F' + F'' + F''' \\ F' = \bar{X} \cdot Y \cdot Z \\ F'' = \bar{X} \cdot Y \cdot \bar{Z} \\ F''' = X \cdot Z \end{array}\right.$$

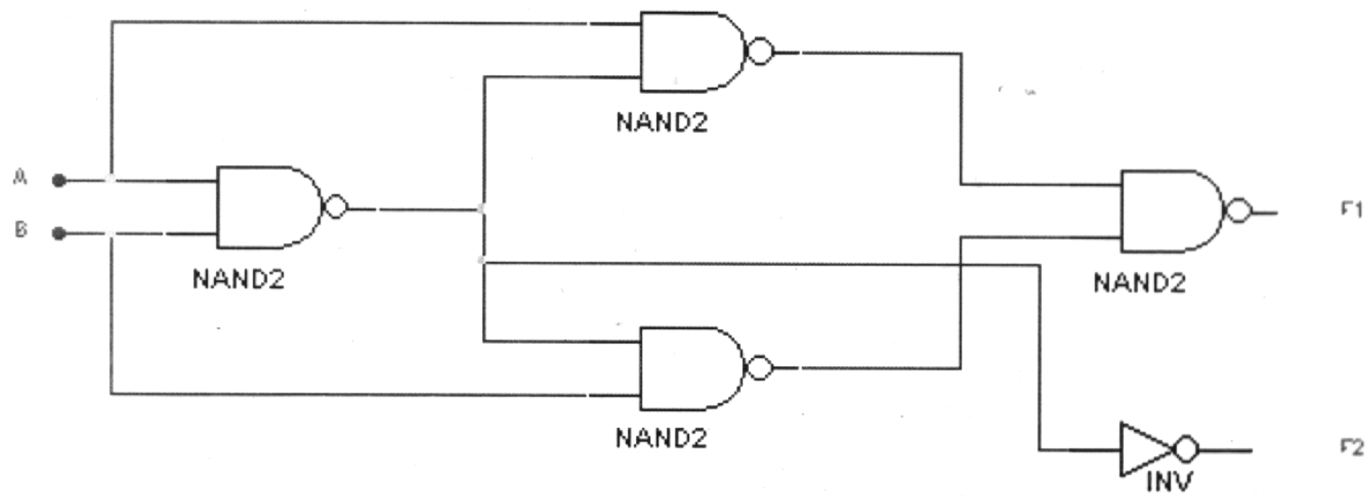
$$F = \bar{X} \cdot Y \cdot Z + \bar{X} \cdot Y \cdot \bar{Z} + X \cdot Z$$

$$F = \bar{X} \cdot Y (\underbrace{Z + \bar{Z}}) + X \cdot Z$$

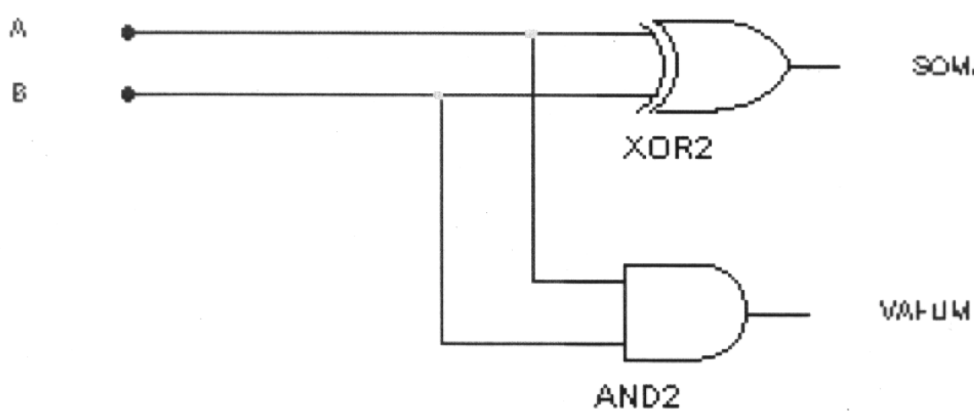
sempre verdadeiro = 1

$$F = \bar{X} \cdot Y + X \cdot Z$$

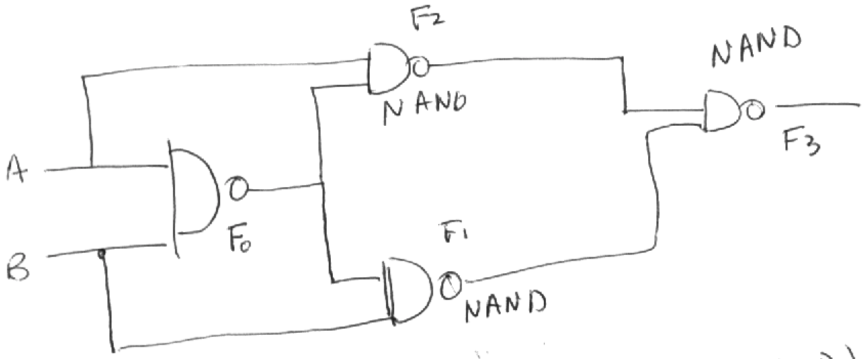




↓ simplificação



MEIO-SOMADOR



$$F_0 = \overline{A \cdot B}$$ (devido ao NAND)

$$F_1 = \overline{B \cdot (\overline{A \cdot B})}$$

$$F_2 = \overline{A \cdot (\overline{A \cdot B})}$$

$$F_3 = \overline{\overline{A \cdot (\overline{A \cdot B})} \cdot \overline{B \cdot (\overline{A \cdot B})}}$$

usando DEMORGAM

$$F_3 = \overline{\overline{A \cdot (\overline{A \cdot B})}} + \overline{\overline{B \cdot (\overline{A \cdot B})}}$$

dupla negação

$$F_3 = A \cdot (\overline{A \cdot B}) + B \cdot (\overline{A \cdot B})$$

DEMORGAM

$$F_3 = A \cdot (\bar{A} + \bar{B}) + B \cdot (\bar{A} + \bar{B})$$

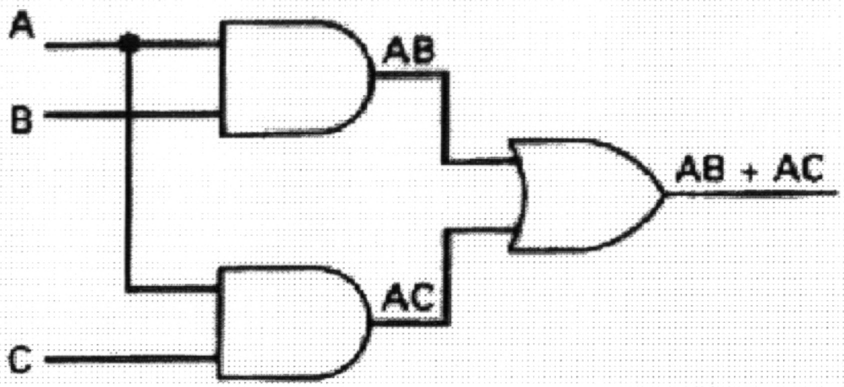
distrib.

$$F_3 = \underbrace{A \cdot \bar{A}}_{\text{é sempre falso} = 0} + A \cdot \bar{B} + B \cdot \bar{A} + \underbrace{B \cdot \bar{B}}_{\text{é sempre falso} = 0}$$

$$F_3 = A \cdot \bar{B} + B \cdot \bar{A}$$ -

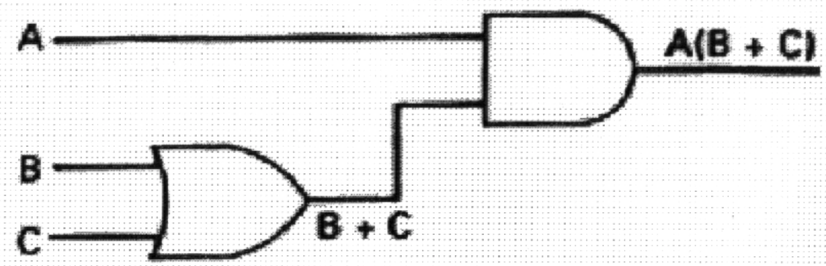
$$F_3 = A \oplus B$$ (XOR)

Análise de circuitos com Tabela verdade



A	B	C	AB	AC	AB + AC
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	1	1
1	1	0	1	0	1
1	1	1	1	1	1

(a)



A	B	C	A	B + C	A(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	1	0	0
1	0	1	1	1	1
1	1	0	1	1	1
1	1	1	1	1	1

(b)