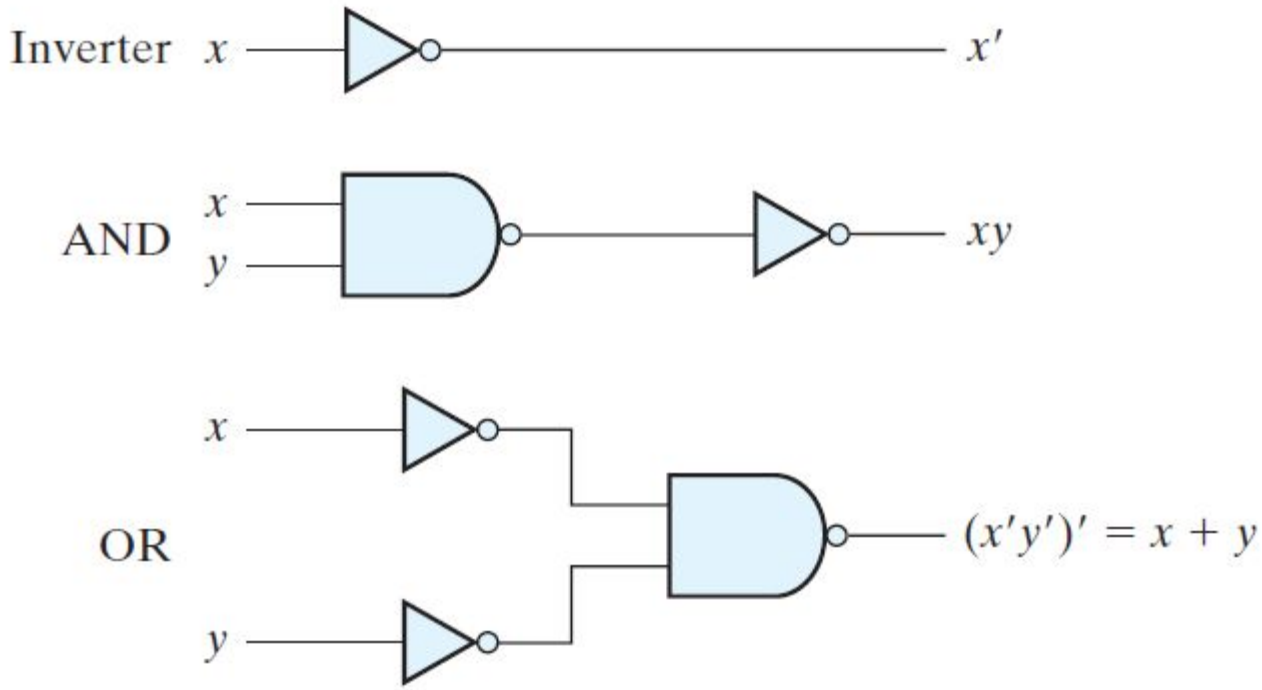
IMPLEMENTACIÓN NAND-NOR

Técnicas Digitales I

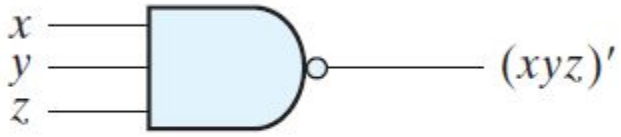
Luis Eduardo Toledo

UTN

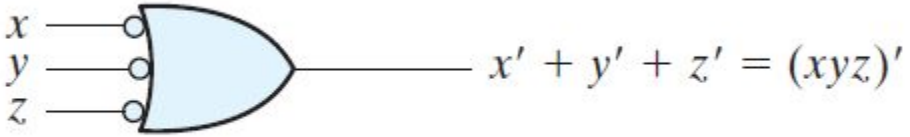
OPERACIONES LÓGICAS CON COMPUERTAS
NAND



DOS SÍMBOLOS LÓGICOS PARA LA COMPUERTA NAND

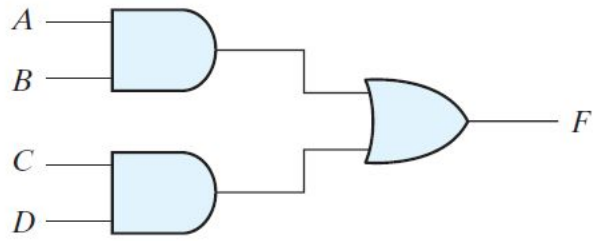


(a) AND-invert

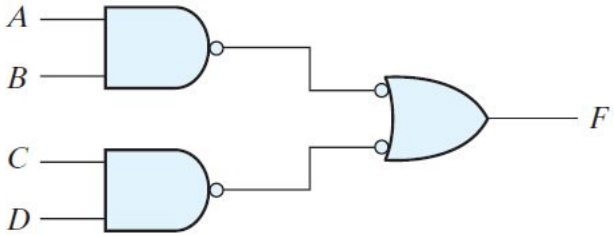


(b) Invert-OR

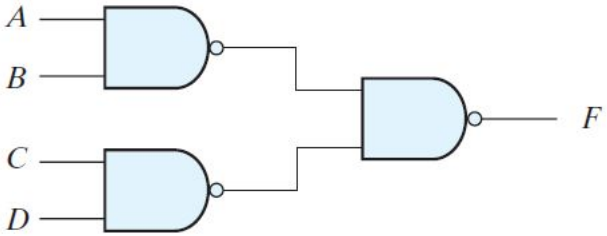
TRES FORMAS PARA IMPLEMENTAR LA FUNCIÓN F= A.B+C.D



(a)



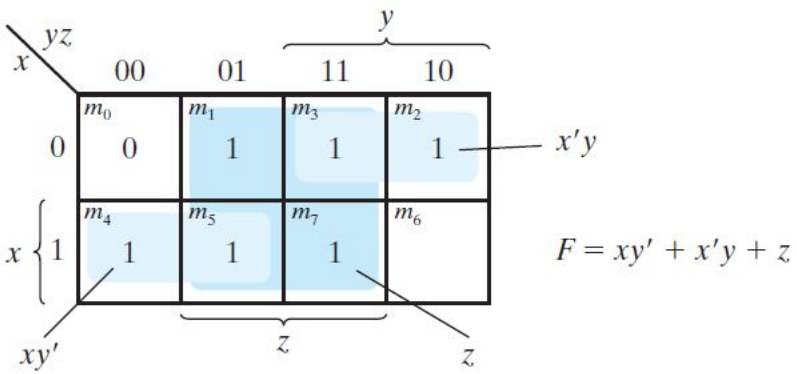
(b)



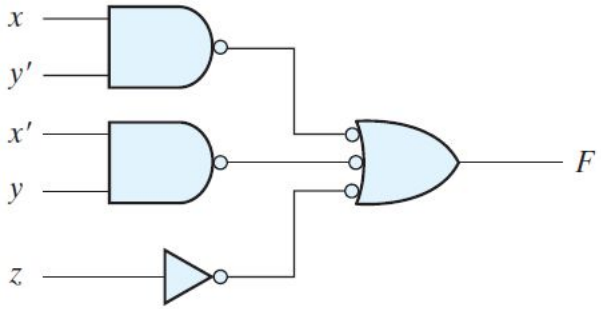
(c)

EJEMPLO DE IMPLEMENTACIÓN DE UNA FUNCIÓN USANDO NAND

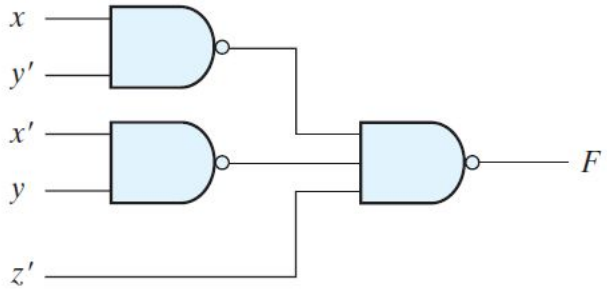
$$F(x, y, z) = (1, 2, 3, 4, 5, 7)$$



(a)



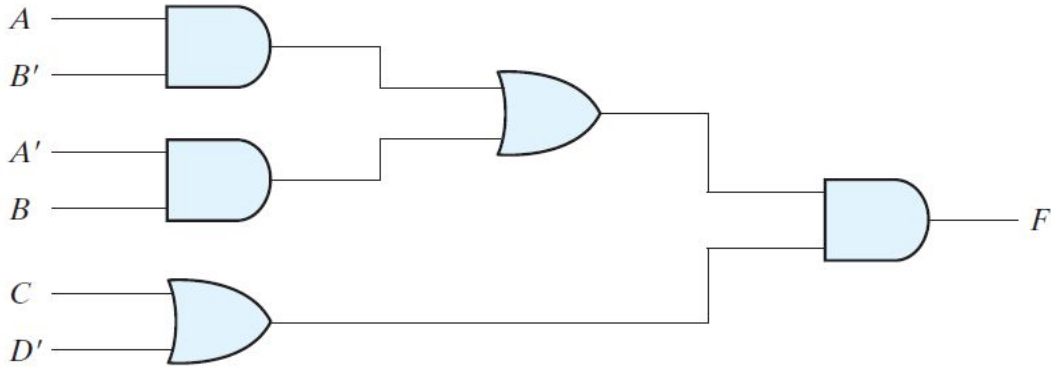
(b)



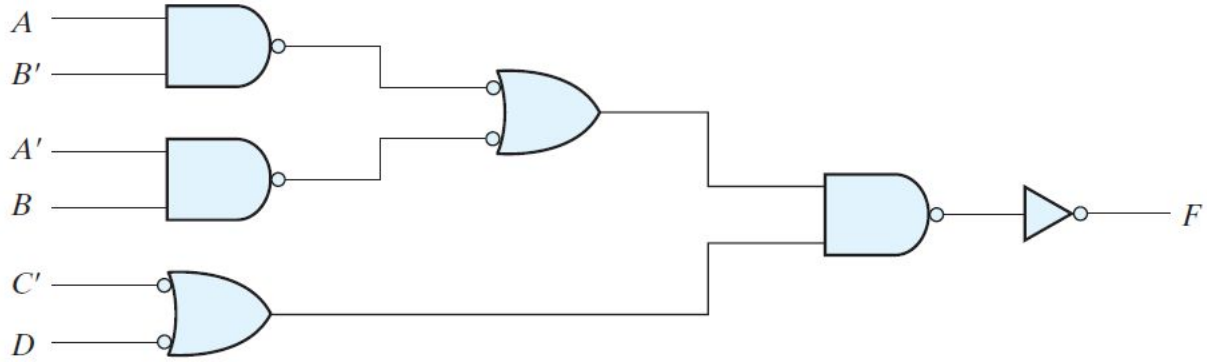
(c)

OTRO EJEMPLO DE IMPLEMENTACIÓN DE UNA FUNCIÓN USANDO NAND

$$F = (AB' + A'B)(C + D')$$

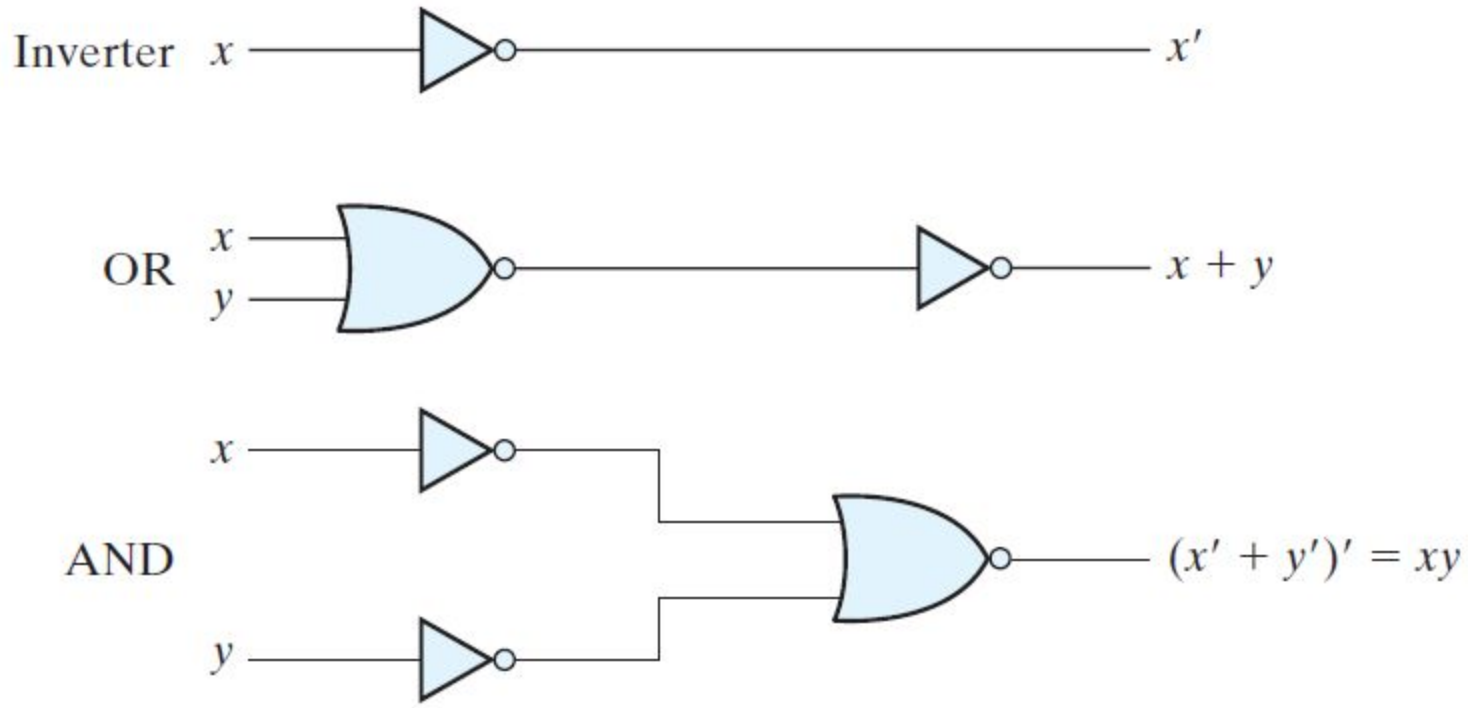


(a) AND–OR gates

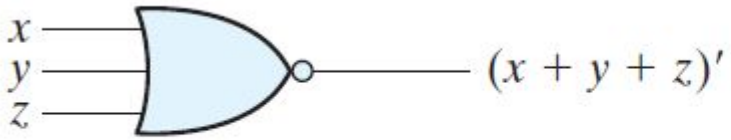


(b) NAND gates

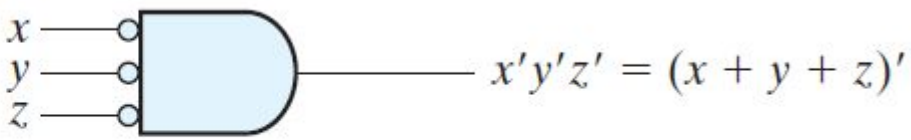
OPERACIONES LÓGICAS CON COMPUERTAS
NOR



DOS SÍMBOLOS GRÁFICOS PARA REPRESENTAR LA COMPUERTA NOR



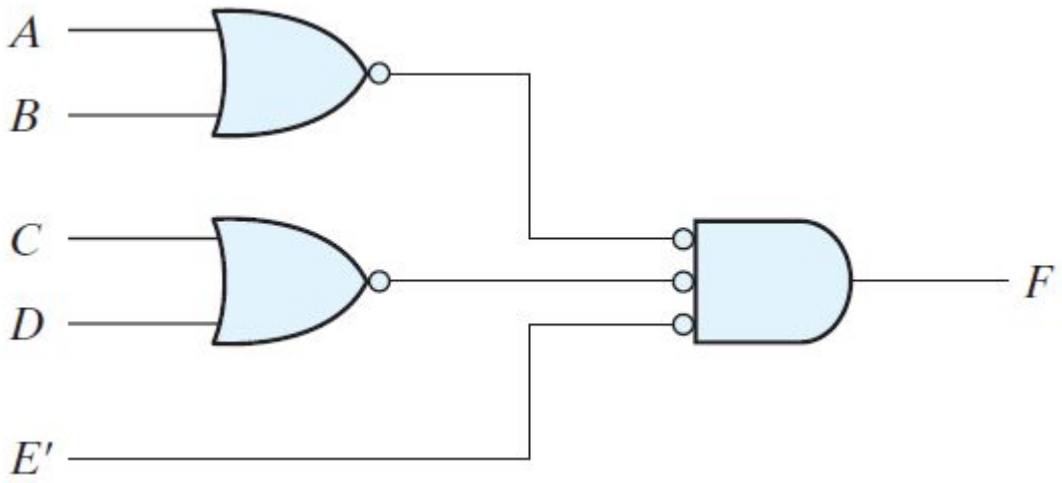
(a) OR-invert



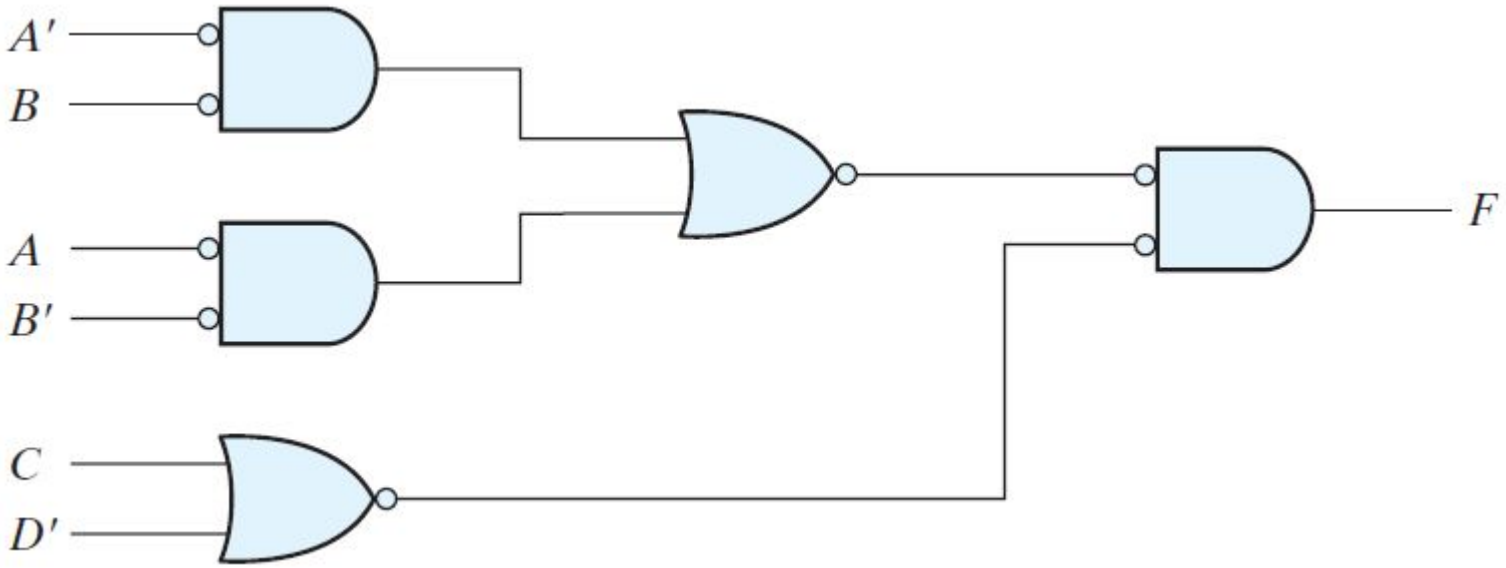
(b) Invert-AND

EJEMPLOS DE IMPLEMENTACIÓN DE FUNCIONES USANDO COMPUERTAS NOR

$F = (A + B)(C + D)E$



$F = (AB' + A'B)(C + D')$



FUNCIÓN XOR

x	y	f
0	0	0
0	1	1
1	0	1
1	1	0

$$x \oplus y = xy' + x'y$$

La OR exclusiva es igual a 1 si únicamente *x* es igual a 1 o si únicamente *y* es igual a 1 (es decir, *x* e *y* difieren en su valor).

La NOR exclusiva, también conocida como *equivalencia*, realiza la siguiente operación Booleana:

x	y	f
0	0	1
0	1	0
1	0	0
1	1	1

$$(x \oplus y)' = xy + x'y'$$

La NOR exclusiva es igual a 1 si tanto *x* como *y* son iguales a 1 o si ambas son iguales a 0.

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FUNCIÓN XOR

Las siguientes identidades se aplican a la operación OR exclusiva:

$$x \oplus 0 = x$$

$$x \oplus 1 = x'$$

$$x \oplus x = 0$$

$$x \oplus x' = 1$$

$$x \oplus y' = x' \oplus y = (x \oplus y)'$$

x	y	f
0	0	0
0	1	1
1	0	1
1	1	0

La OR exclusiva es conmutativa y asociativa.

$$A \oplus B = B \oplus A$$

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

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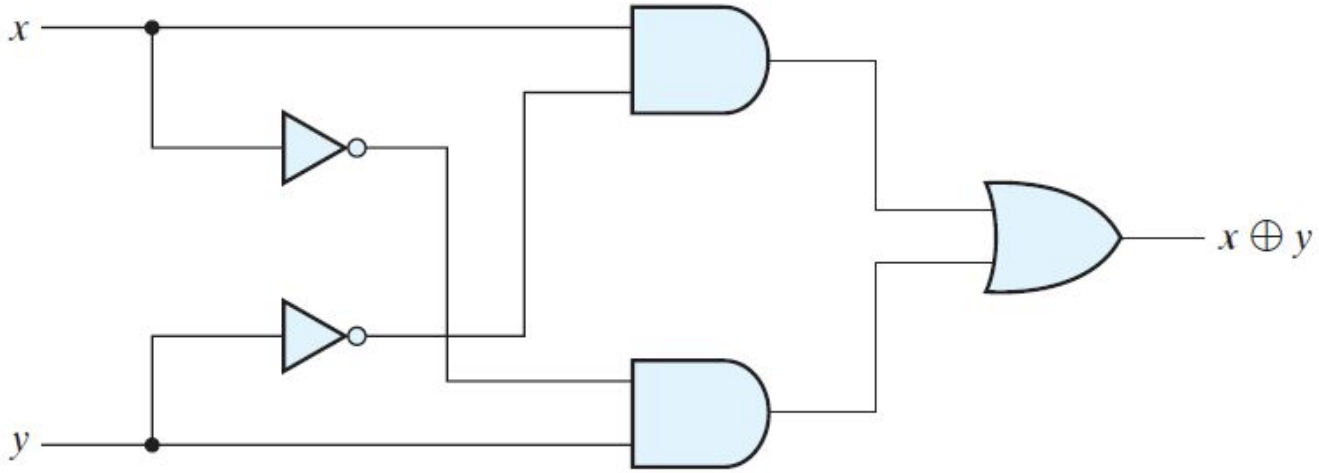
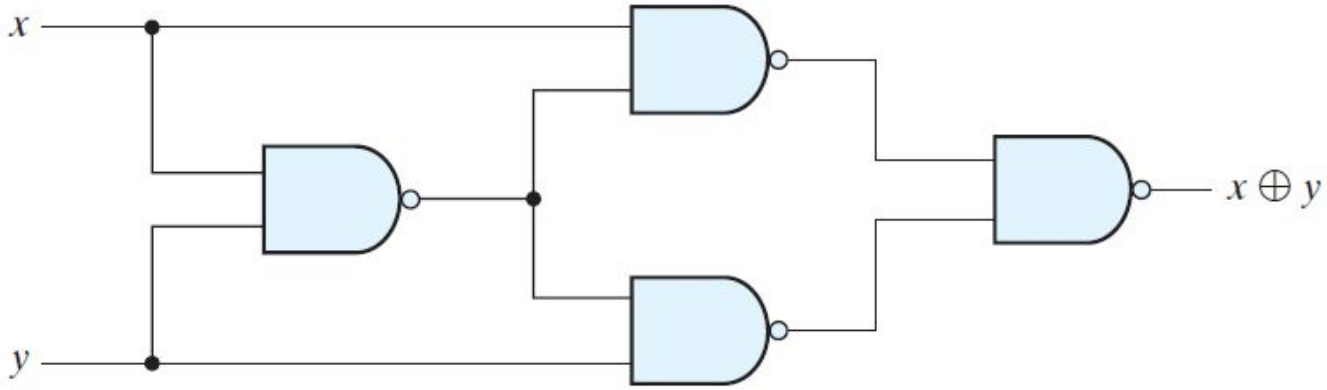
IMPLEMENTACIÓN DE LA FUNCIÓN XOR



(a) Exclusive-OR with AND–OR–NOT gates



(b) Exclusive-OR with NAND gates

FUNCIÓN IMPAR

La operación OR exclusiva con tres o mas variables puede convertirse en un función Booleana común reemplazando el símbolo $\oplus$ con su equivalente expresión Booleana.

$$\begin{aligned} A \oplus B \oplus C &= (AB' + A'B)C' + (AB + A'B')C \\ &= AB'C' + A'BC' + ABC + A'B'C \\ &= \Sigma(1, 2, 4, 7) \end{aligned}$$

En el caso de tres o mas variables el requerimiento es que un número impar de variables sea igual a 1.

En general, una OR exclusiva de n variables es una función impar definida como la suma lógica de los $2^n/2$ minitérminos cuyo valor numérico binario tenga un número impar de 1s.

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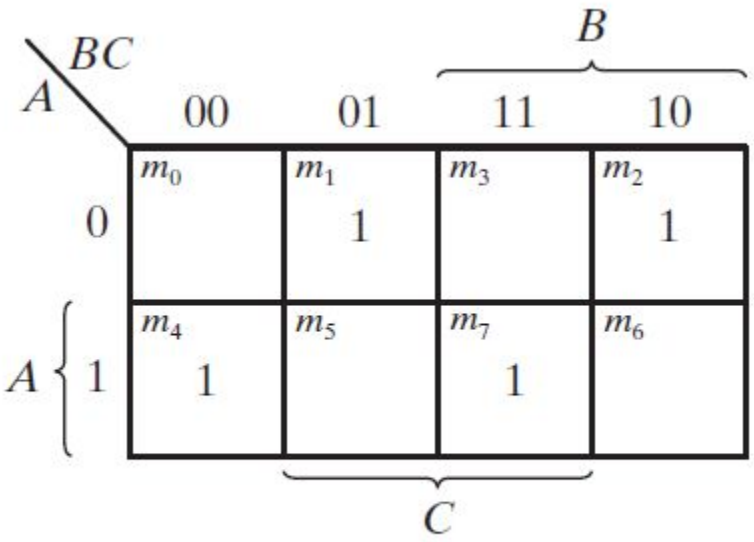
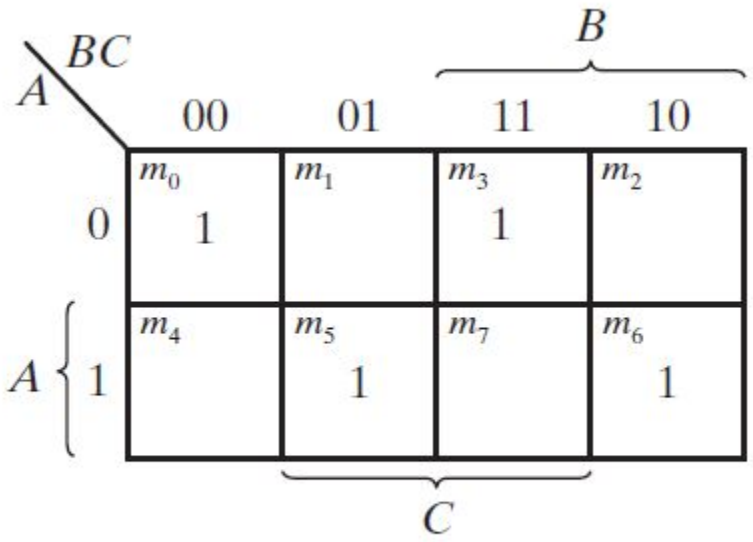
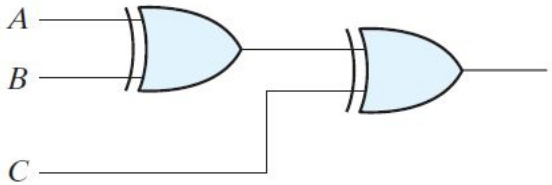
LA FUNCIÓN XOR Y EL MAPA DE KARNAUGH



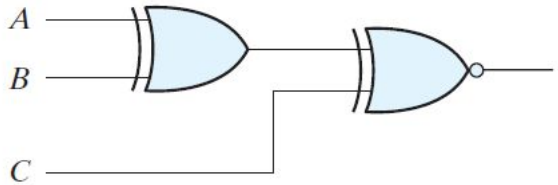
(a) Odd function $F = A \oplus B \oplus C$



(b) Even function $F = (A \oplus B \oplus C)'$

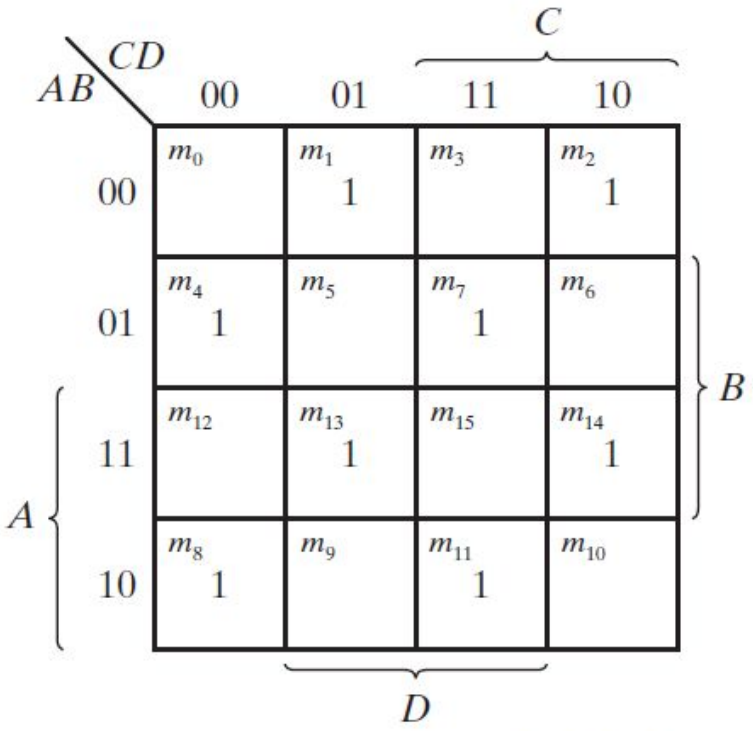


(a) 3-input odd function

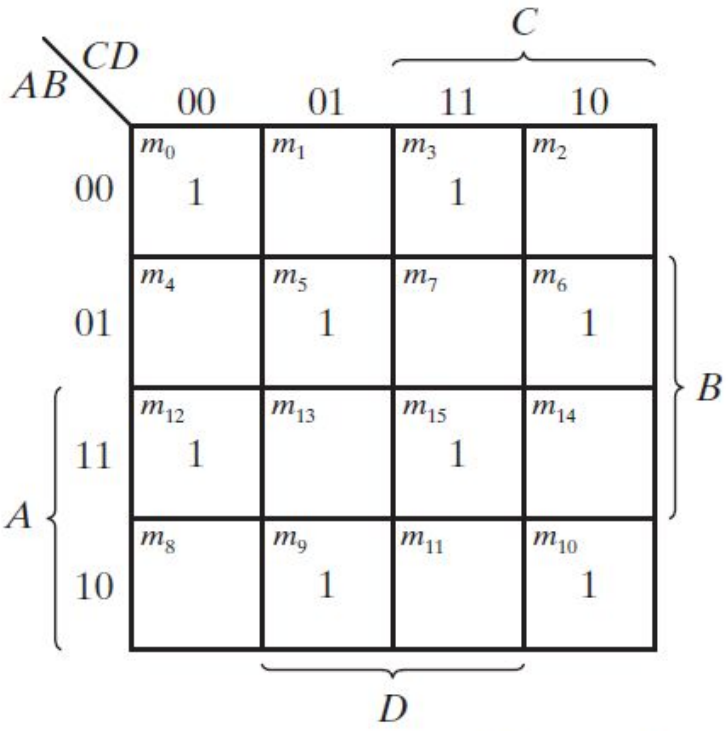


(b) 3-input even function

LA FUNCIÓN XOR Y EL MAPA DE KARNAUGH



(a) Odd function $F = A \oplus B \oplus C \oplus D$

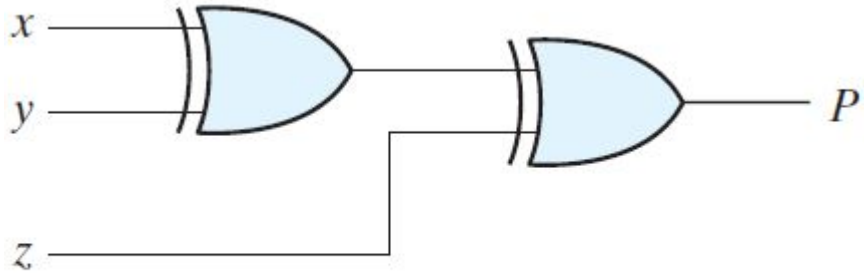


(b) Even function $F = (A \oplus B \oplus C \oplus D)'$

GENERACIÓN Y COMPROBACIÓN DE PARIDAD

Even-Parity-Generator Truth Table

Three-Bit Message			Parity Bit
x	***y***	***z***	***P***
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1

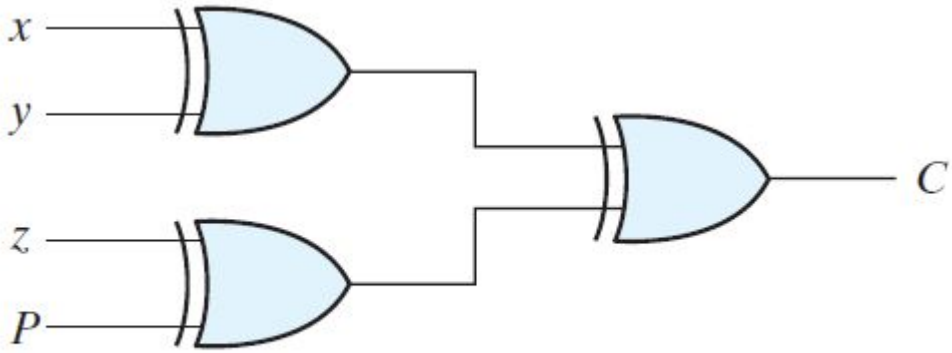


(a) 3-bit even parity generator

GENERACIÓN Y COMPROBACIÓN DE PARIDAD

Even-Parity-Checker Truth Table

Four Bits Received				Parity Error Check
x	*y*	*z*	*P*	*C*
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	0
0	1	0	0	1
0	1	0	1	0
0	1	1	0	0
0	1	1	1	1
1	0	0	0	1
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0



(b) 4-bit even parity checker