MATEMÁTICAS PARA LA COMPUTACIÓN
CAPÍTULO 5. ÁLGEBRA BOOLEANA

RESPUESTA Y DESARROLLO DE EJERCICIOS

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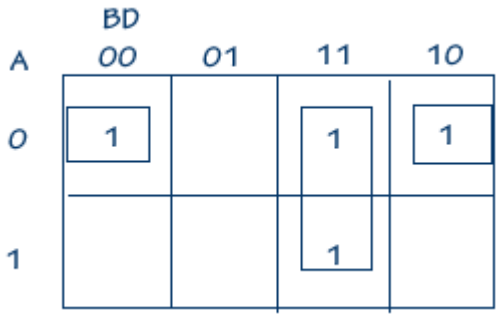
5.1.-

a) F = A'B'C' + A'B'CD + A'BC + A'BC'D + ABC' + ABC +AB'D + AB'C'D'

A	B	C	D	A'	B'	C'	D'	A'B'C'	A'B'CD	A'BC	A'BC'D	ABC'	ABC	AB'D	AB'C'D'	F
0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	1
0	0	0	1	1	1	1	0	1	0	0	0	0	0	0	0	1
0	0	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0
0	0	1	1	1	1	0	0	0	1	0	0	0	0	0	0	1
0	1	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0
0	1	0	1	1	0	1	0	0	0	0	1	0	0	0	0	1
0	1	1	0	1	0	0	1	0	0	1	0	0	0	0	0	1
0	1	1	1	1	0	0	0	0	0	1	0	0	0	0	0	1
1	0	0	0	0	1	1	1	0	0	0	0	0	0	0	1	1
1	0	0	1	0	1	1	0	0	0	0	0	0	0	1	0	1
1	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0
1	0	1	1	0	1	0	0	0	0	0	0	0	0	1	0	1
1	1	0	0	0	0	1	1	0	0	0	0	1	0	0	0	1
1	1	0	1	0	0	1	0	0	0	0	0	1	0	0	0	1
1	1	1	0	0	0	0	1	0	0	0	0	0	1	0	0	1
1	1	1	1	0	0	0	0	0	0	0	0	0	1	0	0	1

5.3.-

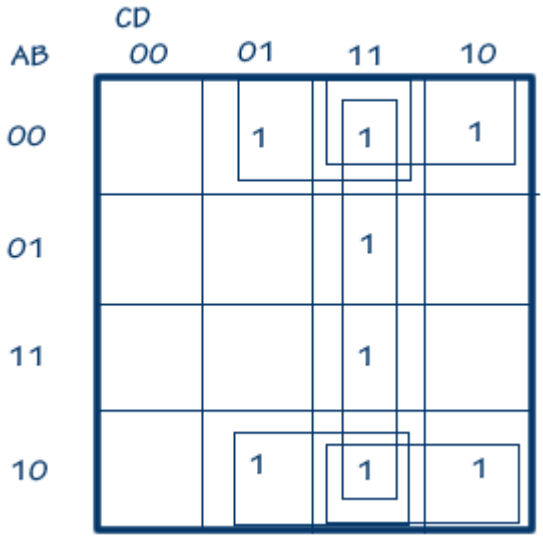
a) F = A'B'D' + A'BD' + A'BD + ABD
F = A'D'(B' + B) + BD(A' + A)
F = A'D' + BD



F = A'D' + BD

b) F = A'CD + ACD + A'B'D + A'B'C + AB'D + AB'CD'

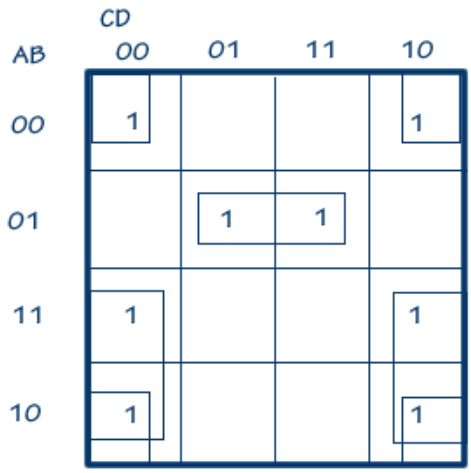
F = CD(A' +A) + B'D(A' + A) + BC'(A' + AD')
F = CD + B'D + A'B'C + B'CD'
F = C(D + D'B') + B'D + A'B'C
F = CD + B'C + B'D + A'B'C
F = B'C(1 + A') + CD + B'D
F = B'C +CD +B'D



F = B'C + CD + B'D

c) F = A'B'C'D' + A'B'CD' +A'BC'D + A'BCD + ABC'D' + ABCD' + AB'C'D' +AB'CD'.

F = A'B'D'(C' + C) + A'BD(C' + C) + ABD'(C' +C) + AB'D'(C' + C)
F = A'B'D' + A'BD + ABD' + AB'D'
F = B'D'(A' + A) + A'BD + ABD'
F = B'D' + A'BD + ABD'
F = D'(B' + BA) + A'BD
F = B'D' + AD' + A'BD



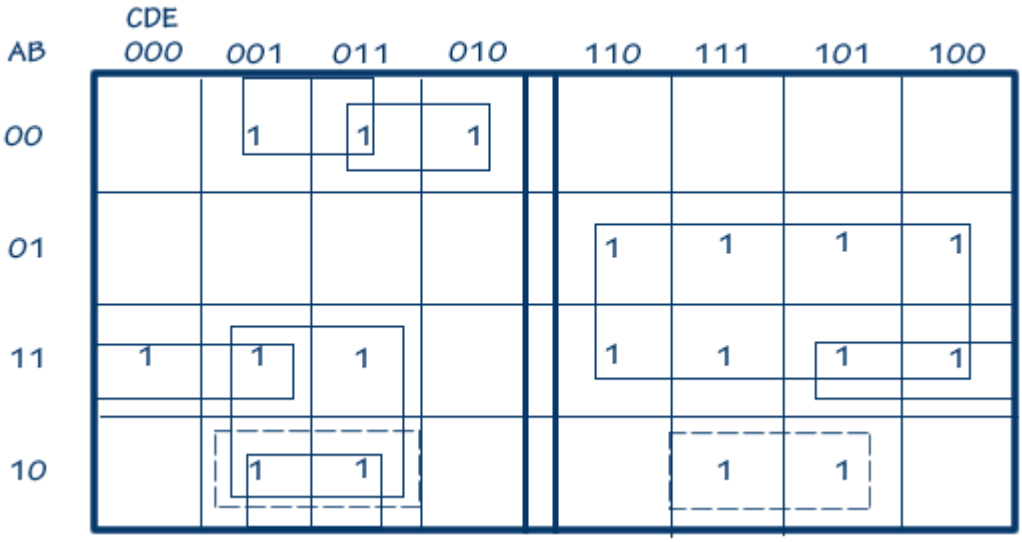
F = B'D' + AD' + A'BD

d)

F= ABC'D'E + ABC'DE + AB'C'D'E + AB'C'DE + AB'CDE + AB'CD'E

F= A'B'C'E(D' + D) + AB'C'E(D' + D) + BC(A' + A) + ABC'D'(E'+E) + AB'CE(D + D') + A'B'C'DE' + ABC'DE

F = A'B'C'E + AB'C'E + BC + ABC'D' + AB'CE + A'B'C'DE' + BC'DE
F = B'C'E(A' + A) + B(C + C'AD') + AB'CE + A'B'C'DE' + ABC'DE
F = B'C'(E + E'A'D) + AB(D' + DC'E) + BC + AB'CE
F = B'C'E + A'B'C'D + ABD' + ABC'E + BC + AB'CE
F = B'E(C' + CA) + A'B'C'D + ABD' + ABC'E + BC
F = B'C'E + AB'E + A'B'C'D + ABD' + ABC'E + BC
F = C'E(B' + BA) + AB'E + A'B'C'D + ABD' + BC
F = B'C'E + AC'E + AB'E + A'B'C'D + ABD' + BC



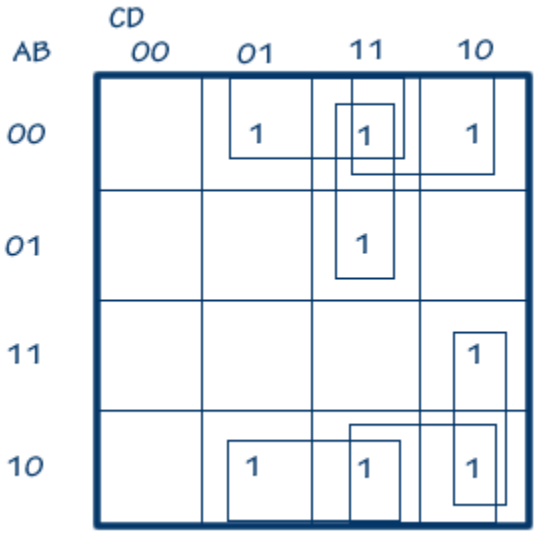
e)

F = ((A + B)' + C' + D') ((AC)' + (A + (BC)')' + D)
F = (A'B' + C' + D') (A' + C' + (A + B' + C')' + D)
F = (A'B' + C' + D') (A' + C' + A'BC + D)
F = (A'B' + C' + D') (A'(1 + BC) + C' + D)
F = (A'B' + C' + D') (A' + C' + D)
F = A'A'B' + A'B'C' + A'B'D + A'C' + C'C' + C'D + A'D' + C'D' + D'D
F = A'B' + A'B'C' + A'B'D + A'C' + C' + C'D + A'D' + C'D'
F = A'B'(1 + C' + D) + C'(A' + 1 + D + D') + A'D'
F = A'B' + C' + A'D'

f)

F = A'B'C'D + A'B'CD + A'B'CD' + A'BCD + ABCD' + AB'C'D + AB'CD + AB'CD'

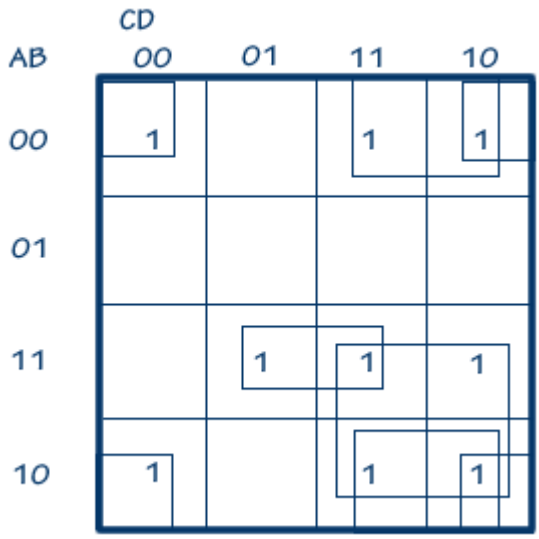
F = A'B'D(C' + C) + AB'C(D + D') + A'B'CD' + A'BCD + ABCD' + AB'C'D
F = A'B'D + AB'C + A'B'CD' + A'BCD + ABCD' + AB'C'D
F = A'B'(D + D'C) + AB'(C + C'D) + A'BCD + ABCD'
F = A'B'D + A'B'C + AB'C + AB'D + A'BCD + ABCD'
F = B'C(A' + A) + B'D(A' + A) + A'BCD + ABCD'
F = B'C + B'D + A'BCD + ABCD'
F = C(B' + BA'D) + B'D + ABCD'
F = B'C + A'CD + B'D + ABCD'
F = C(B' + BAD') + A'CD + B'D
F = B'C + ACD' + A'CD + B'D



F = B'C + ACD' + A'CD + B'D

g)

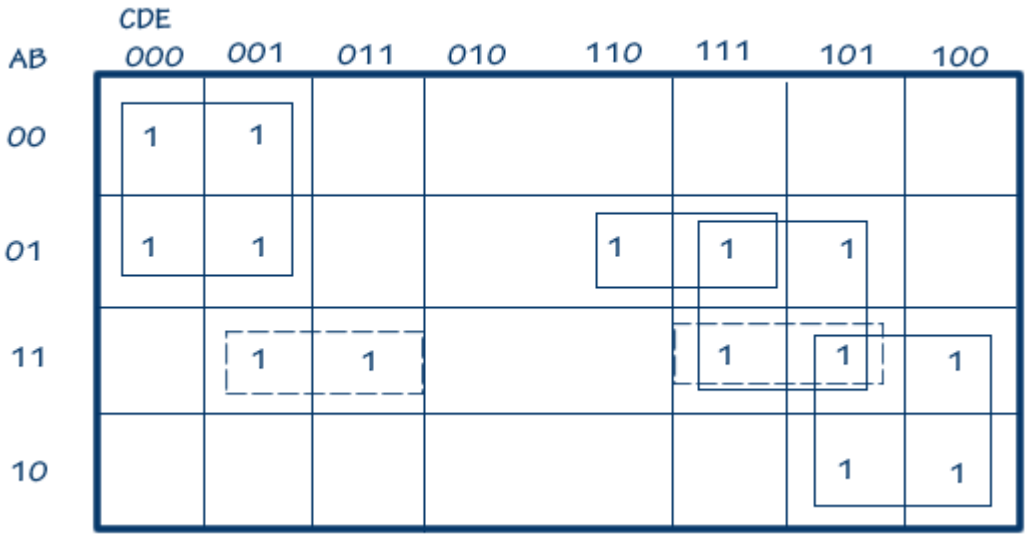
F = A'B'C'D' + A'B'CD + A'B'CD' + ABC'D + ABCD +
ABCD' + AB'C'D' + AB'CD + AB'CD'
F = A'B'C(D + D') + ABD(C' + C) + AB'C(D + D') + B'C'D'(A' + A)
+ ABCD'
F = A'B'C + ABD + AB'C + B'C'D'(A' + A) + ABCD'
F = B'C(A' + A) + AB(D + D'C) + B'C'D'
F = B'C + ABD + ABC + B'C'D'
F = B'(C + C'D') + ABD + ABC
F = B'C + B'D' ABD + ABC
F = C(B' + BA) + B'D' + ABD
F = B'C + AC + B'D' + ABD



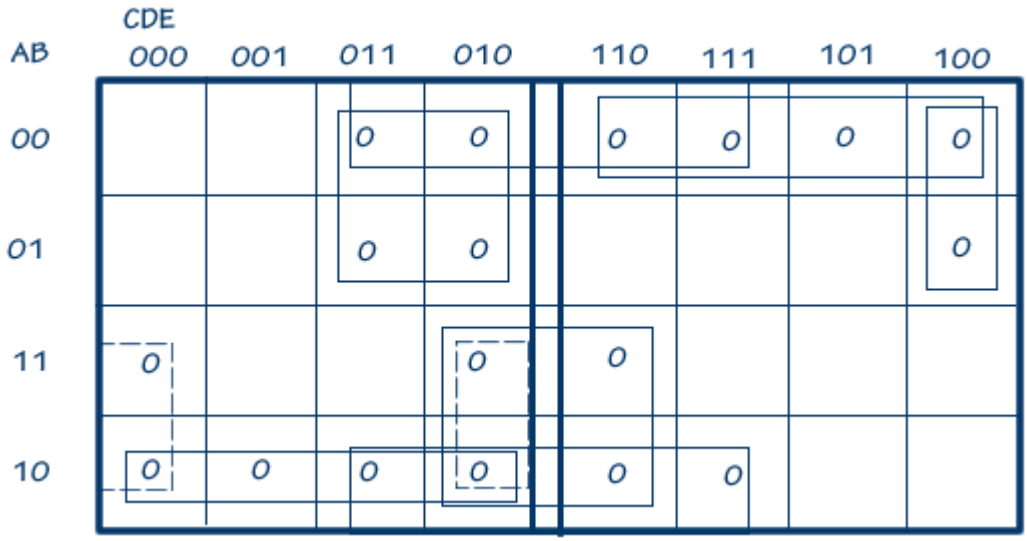
F = B'C + AC + B'D' + ABD

5.5.-

a)

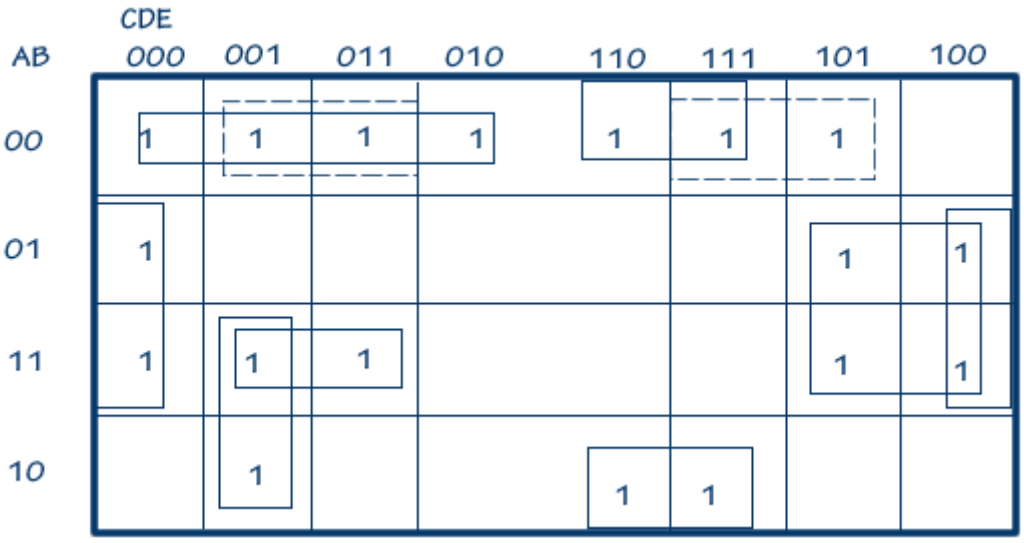


F = A'C'D' + BCE + ACD' + ABE + A'BCD

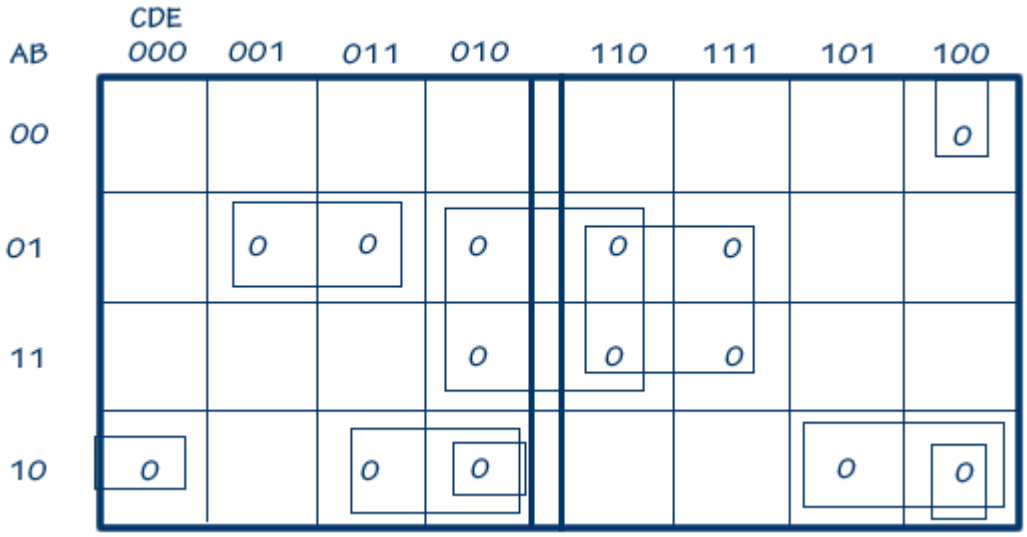


F = (A'+C+E)(A'+B+C)(A'+D'+E)(B+D')(A+C+D')(A+B+C')(A+C'+D+E)

b)

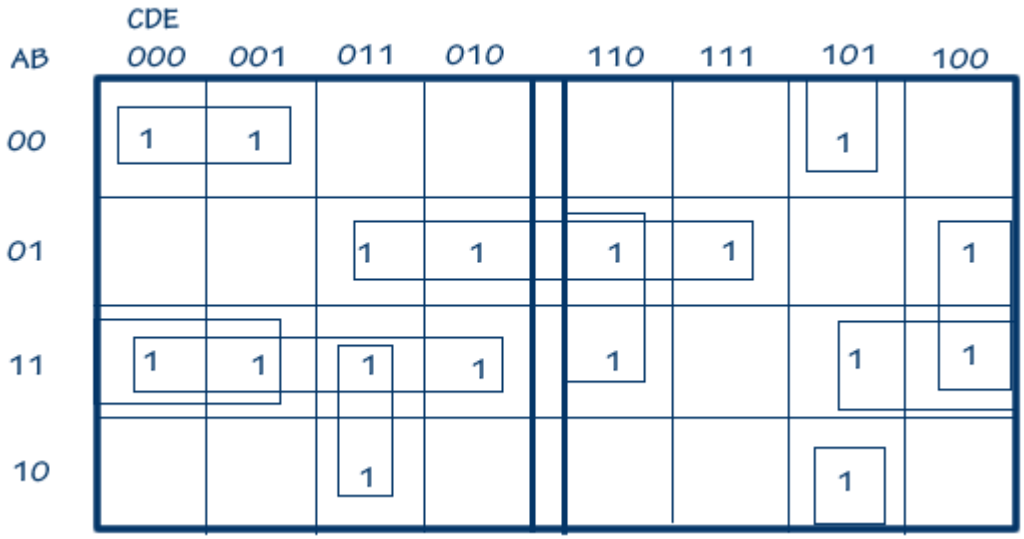


F = A'B'C' + BD'E' + B'CD + BCD' + A'B'E + ABC'E + AC'D'E

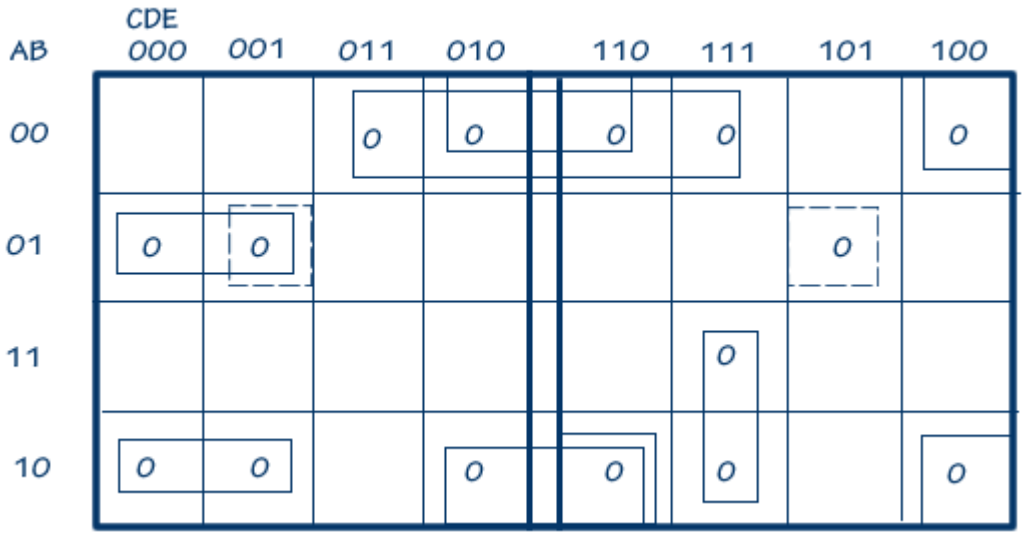


F = (A+B'+C+E')(B'+D'+E)(B'+C'+D')(A'+B+C+E)(A'+B+C'+D)
(A'+B+C+D')(B+C'+D+E)

c)

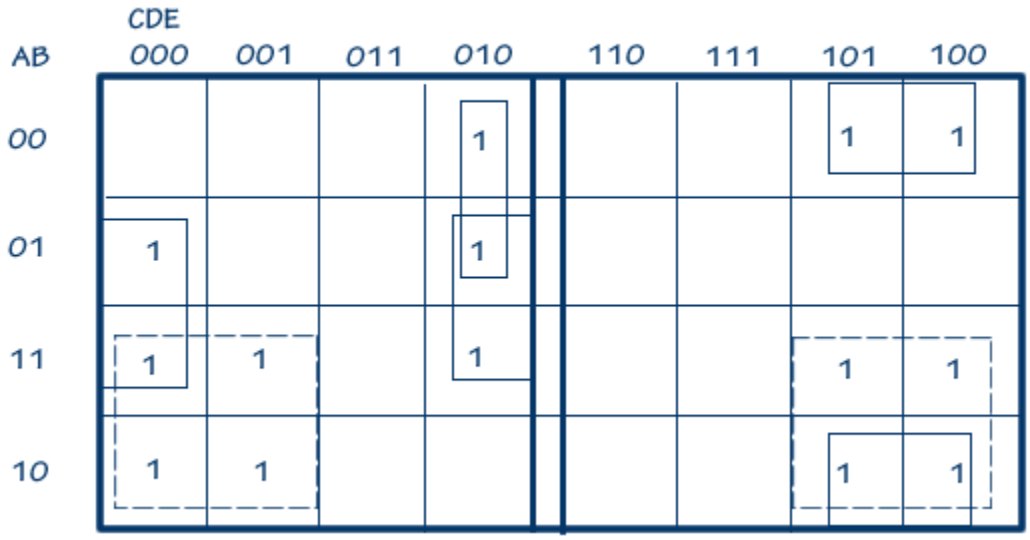


F = ABC'+A'BD+BCE'+B'CD'E+A'B'C'D'+AC'DE+ABD'

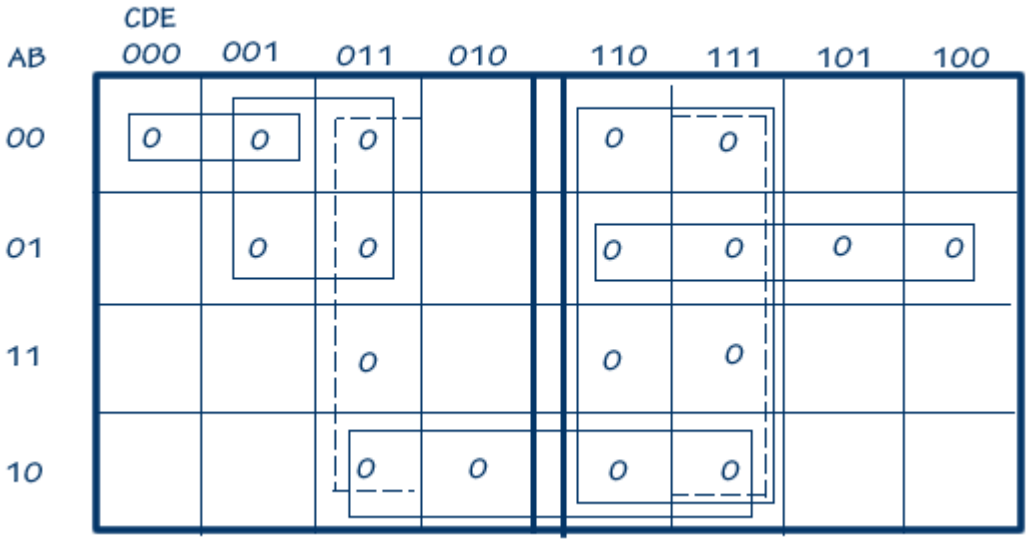


F = ABC'+A'BD+BCE'+B'CD'E+A'B'C'D'+AC'DE+ABD'

d)

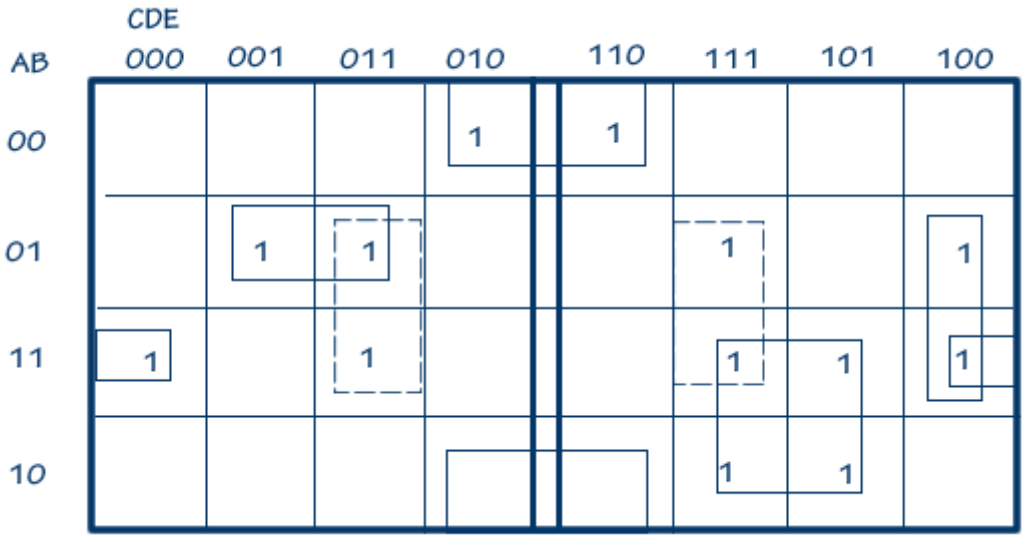


F = AD'+BC'E'+B'CD'+A'C'DE

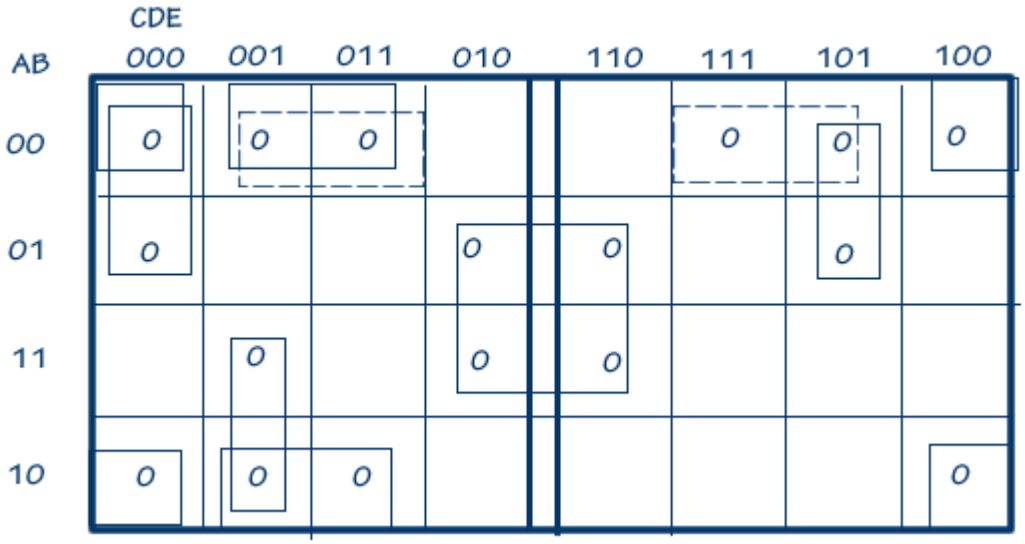


F =(A+B+C+D)(A+C+E')(D'+E')(A'+B+D')(C'+D')(A+B'+C')

e)

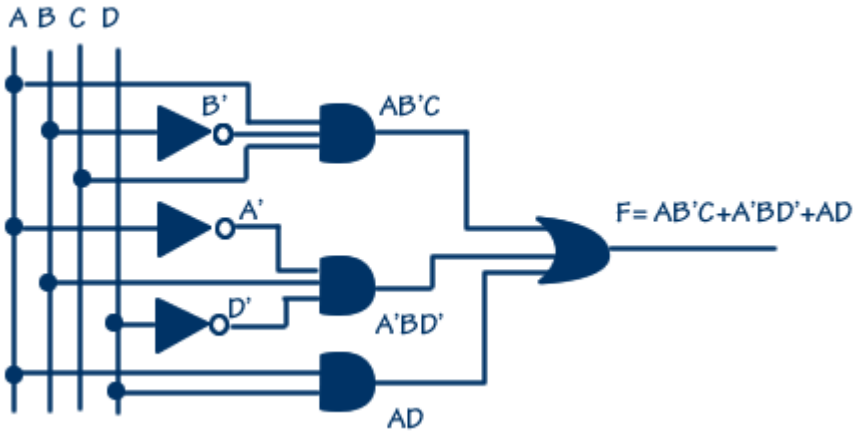


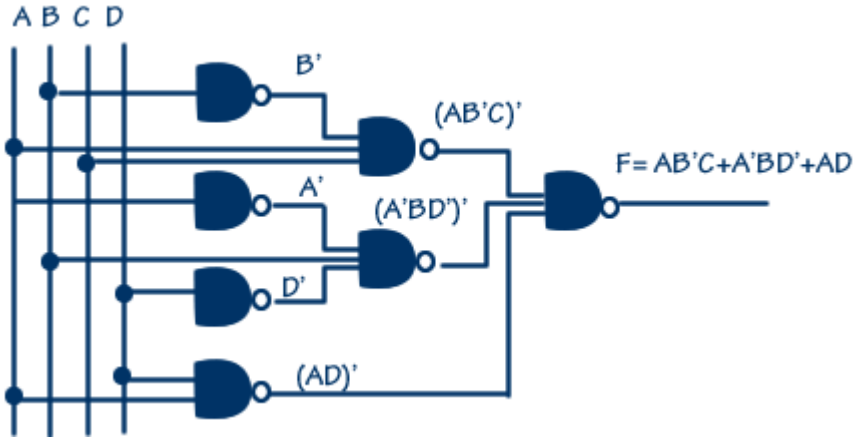
F = ABD'E'+A'BC'E+BDE+B'DE'+ACE+BCD'E'

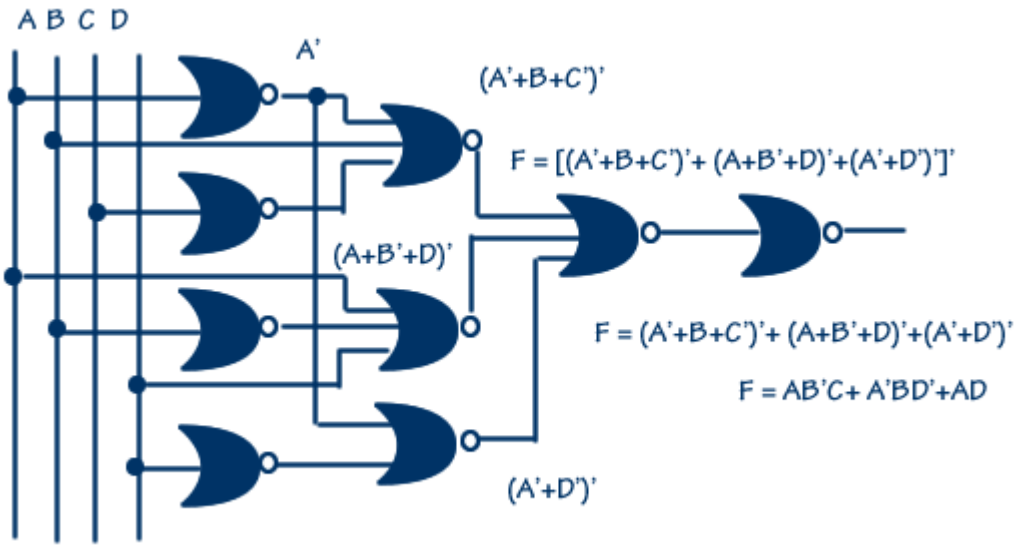


F =(B+D+E)(B+C+E')(A+C+D+E)(B'+D'+E)(A+B+E')(A+C'+D+E')(A'+C+D+E')

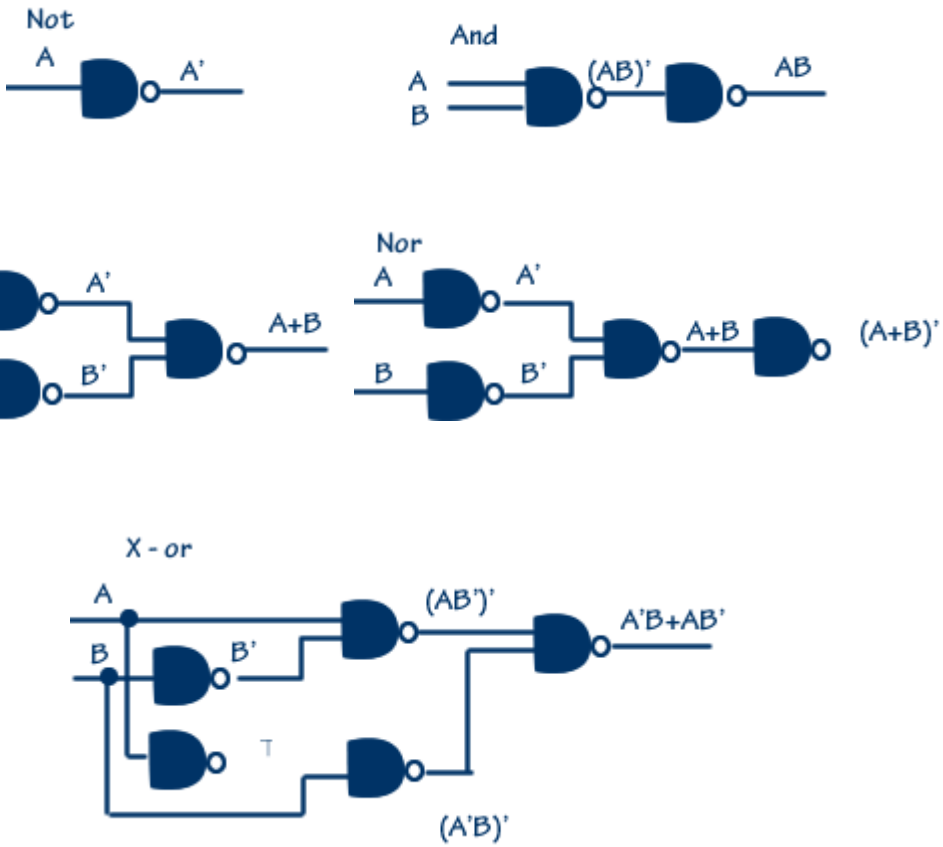
5.7.-

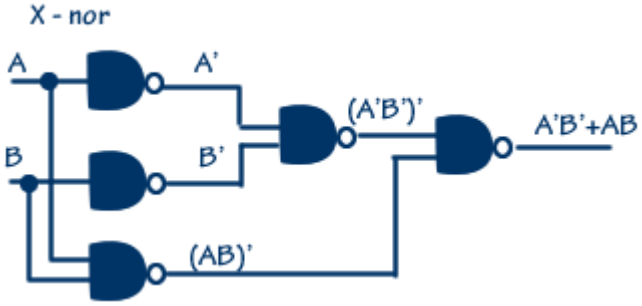





A B C D
A'
(A'+B+C')'
F = [(A'+B+C')'+ (A+B'+D)'+(A'+D')']'
(A+B'+D)'
F = (A'+B+C')'+ (A+B'+D)'+(A'+D')'
F = AB'C+ A'BD'+AD
(A'+D')'

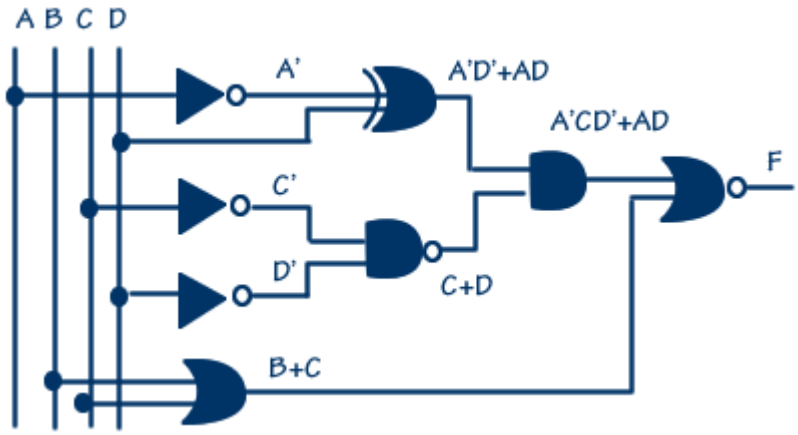
5.9.-


Not
A
A'
And
A
B
(AB)'
AB
Or
A
A'
B
B'
A+B
Nor
A
A'
B
B'
A+B
(A+B)'
X - or
A
B
B'
(AB')'
A'B+AB'
(A'B)'



5.11.-

a) La función booleana de salida es F = [(A'CD'+AD)+(B+C)]' y los parciales de cada una de las compuertas se muestran en el siguiente diagrama (En algunas de las salidas se hicieron algunas operaciones para reducir un poco la expresión).



b) La función booleana simplificada en sumas de productos es
F = B'C'D' + A'B'C', la cual es posible encontrar usando la función de salida y simplificándola por medio de teoremas o bien mapas de Karnaugh.

c) La función booleana simplificada en productos de sumas, es
F = B'C'(A' + D').

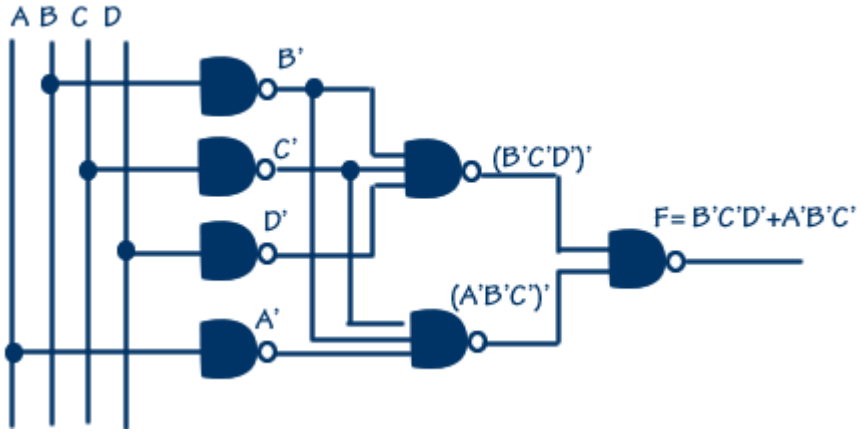
d)

A	B	C	D	A'	B'	C'	D'	B'C'D'	A'B'C'	B'C'D'+A'B'C'	A'CD'	A'CD'+AD	B+C	F
0	0	0	0	1	1	1	1	1	1	1	0	0	0	1
0	0	0	1	1	1	1	0	0	1	1	0	0	0	1
0	0	1	0	1	1	0	1	0	0	0	1	1	1	0
0	0	1	1	1	1	0	0	0	0	0	0	0	1	0
0	1	0	0	1	0	1	1	0	0	0	0	0	1	0
0	1	0	1	1	0	1	0	0	0	0	0	0	1	0
0	1	1	0	1	0	0	1	0	0	0	1	1	1	0
0	1	1	1	1	0	0	0	0	0	0	0	0	1	0
1	0	0	0	0	1	1	1	1	0	1	0	0	0	1
1	0	0	1	0	1	1	0	0	0	0	0	1	0	0
1	0	1	0	0	1	0	1	0	0	0	0	0	1	0
1	0	1	1	0	1	0	0	0	0	0	0	1	1	0
1	1	0	0	0	0	1	1	0	1	0	0	0	1	0
1	1	0	1	0	0	1	0	0	0	0	0	1	1	0
1	1	1	0	0	0	0	1	0	0	0	0	0	1	0
1	1	1	1	0	0	0	0	0	0	0	0	1	1	0

Donde F= [(A'CD'+AD)+(B+C)]'

En la tabla de verdad anterior se puede observar que efectivamente las expresiones boolenas [(A'CD'+AD)+(B+C)]' y B'C'D' + A'B'C' son lógicamente equivalentes ya que coinciden en todas sus líneas.

e) Expresión F = B'C'D'+A'B'C' con compuertas Nand



f) Diagrama de la expresión booleana obtenida en el inciso c, usando para ello exclusivamente compuertas Nor.