

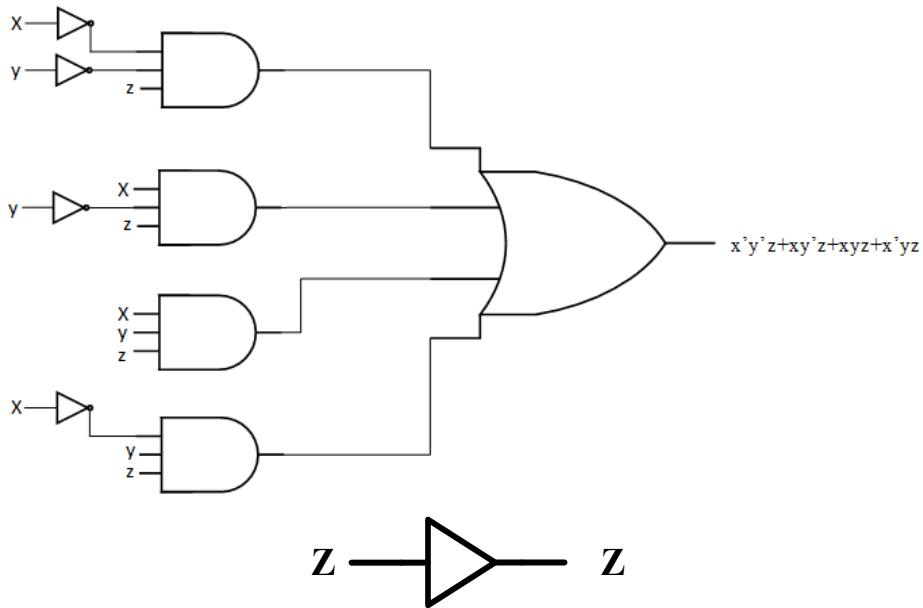
HW2 solution 2016

1.

(a)

$$x'y'z + xy'z + xyz + x'yz$$

$$x'y'z + xy'z + xyz + x'yz = x'z(y+y') + xz(y+y') = x'z + xz = z$$

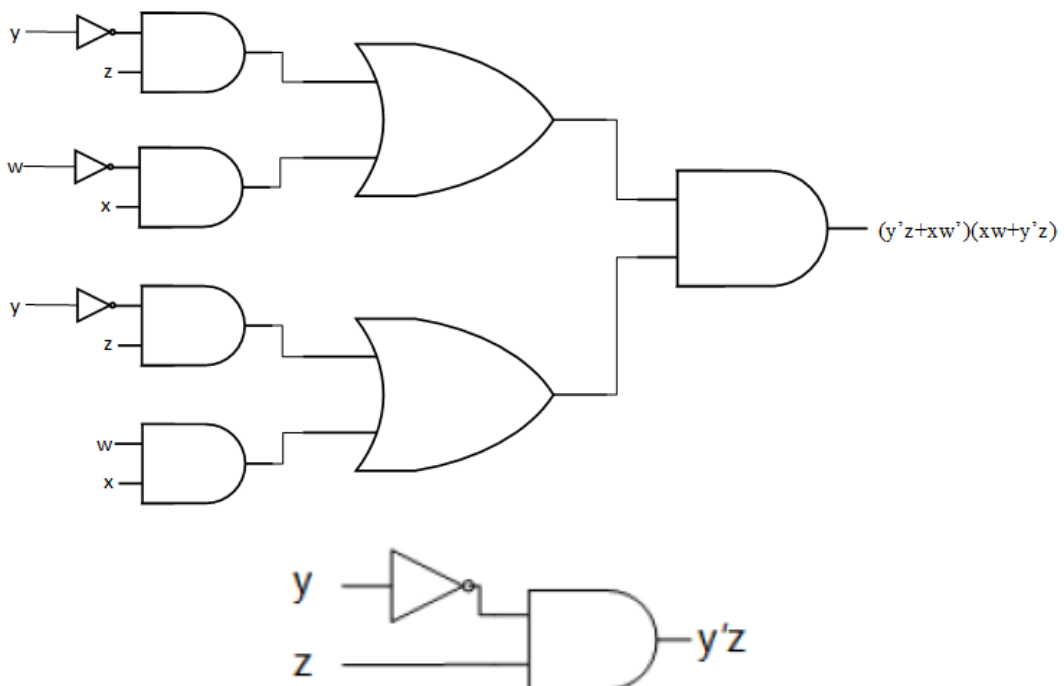


(b)

$$(y'z + xw')(xw + y'z)$$

$$(y'z + xw')(xw + y'z) = y'zxw + y'zy'z + xw'xw + xw'y'z = y'zxw + y'z + xw'y'z =$$

$$y'z(xw + 1 + xw') = y'z$$



2.

$$F=(x+y'+z')(y+z)(x'+z)=x'yz'+x'y'z+xz$$

$$F'=(x+y'+z')(y+z)(x'+z)]'=(x+y'+z')'+(y+z)'+(x'+z)' =x'yz+y'z'+xz'$$

$$FF'=(x'yz'+x'y'z+xz)(x'yz+y'z'+xz')$$

$$=x'yz'z+x'y'z'y'+x'y'z'x+x'y'zy+x'y'zz'+x'y'z'xz'+x'xz'y+xzy'z'+xzz'=0$$

$$F+F'=(x'yz'+x'y'z+xz)+(x'yz+y'z'+xz')$$

$$=x'y(z'+z)+y'(z'+zx')+x(z+z')$$

$$=x'y+x+y'(z'+x')$$

$$=x'y+x'y'+x+y'z'$$

$$=x'(y+y')+x+y'z'$$

$$=x'+x+y'z'$$

$$=1+y'z'=1$$

3.

(a)

$$((x+w')y+wy'z+xz(x+y))'$$

$$=((x+w')y)'(wy'z)'(xz(x+y))'$$

$$=((x+w')'+y')(w'+y+z')(x'+z'+(x+y)')$$

$$=(x'w+y')(w'+y+z')(x'+z'+x'y')$$

$$=(x'yw+x'z'w+y'w'+y'z')(x'+z')$$

$$=x'wy+x'wz'+x'y'w'+x'y'z'+x'wyz'+x'wz'+y'w'z'+y'z'$$

$$=x'wy+x'wz'+x'w'y'+y'z'$$

(b)

$$(x(y+z)+y'z(x+w))'$$

$$=(x(y+z))'(y'z(x+w))'$$

$$=(x'+(y+z)'*)((y'z)'+(x+w)')$$

$$=(x'+y'z')(y+z'+x'w')$$

$$=x'y+x'z'+x'w'+y'z'+y'z'x'w'$$

$$=x'y+x'z'+x'w'+y'z'$$

(c)

$$(x(y'+y(z+w)))'$$

$$=x'+(y'+y(z+w))'$$

$$=x'+y(y(z+w))'$$

$$=x'+y(y'+(z+w)')$$

$$=x'+y(y'+z'w')$$

$$=x'+yz'w'$$

(d)

$$\begin{aligned}
& (xy+y(x+z))' \\
& = (xy)'(y(x+z))' \\
& = (x'+y')(y'+x'z') \\
& = x'y'+x'z'+y'+y'x'z' \\
& = x'z'+y'
\end{aligned}$$

4.

$$A=11000101,$$

$$B=01010101$$

(a)

AB的8個bit分別做 \longrightarrow AND AB=01000101

(b)

AB的8個bit分別做XNOR

$$XOR=A \oplus B=10010000, XNOR=(A \oplus B)'=01101111$$

(c)

$$A' = 00111010,$$

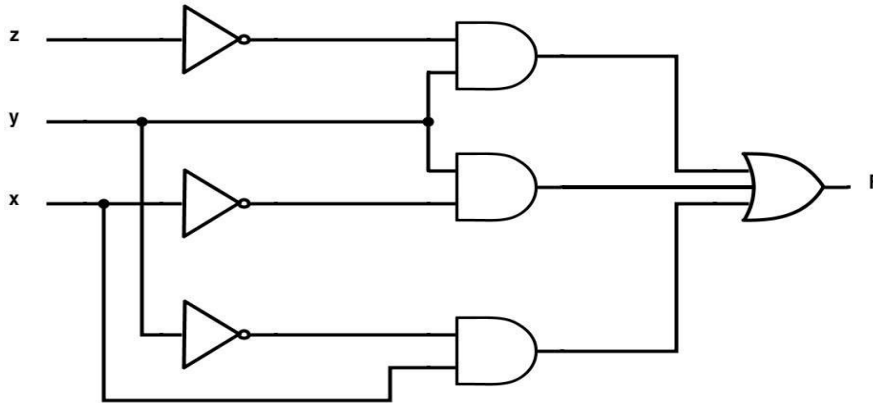
5.

$$F=x'y+xy'+y'z,$$

x	y	z	x'	xy	yz	x'y+xy'+y'z
0	0	0	0	0	0	0
0	0	1	0	0	0	0
0	1	0	1	0	1	1
0	1	1	1	0	0	1
1	0	0	0	1	0	1
1	0	1	0	1	0	1
1	1	0	0	0	1	1
1	1	1	0	0	0	0

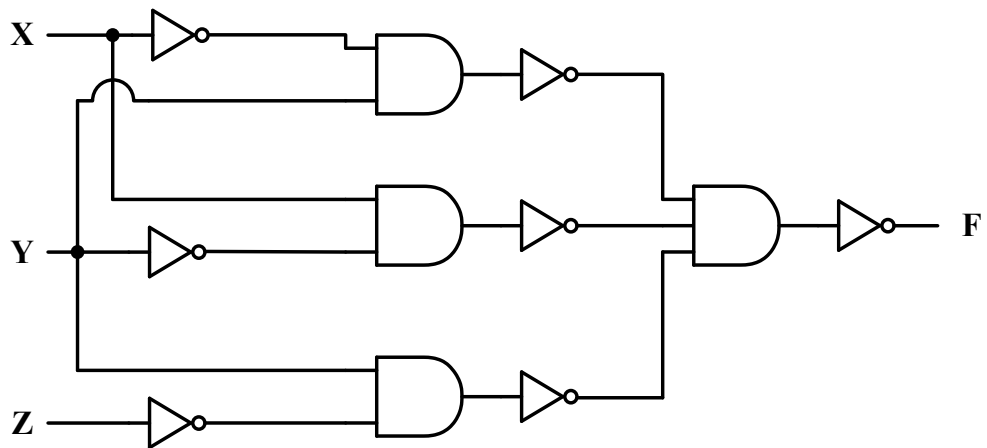
(a) With AND, OR, and inverter gates

$$F = x'y + xy' + y'z,$$



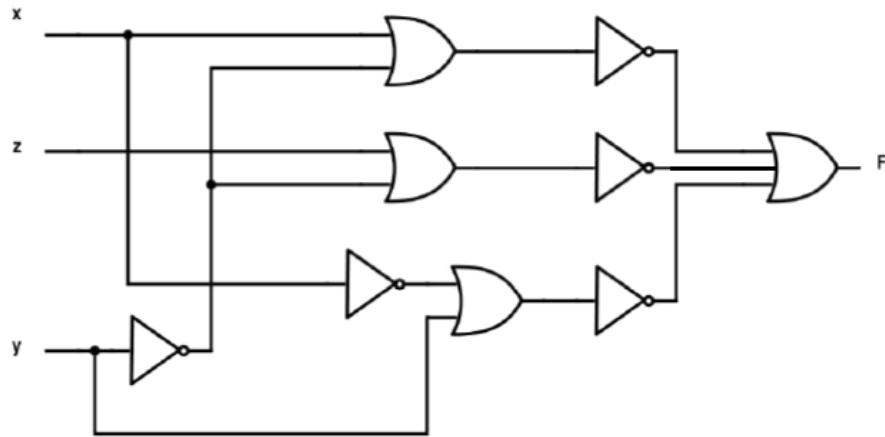
(b) With AND and inverter gates

$$F = ((x'y + xy' + y'z)')' = ((xy)'(x'y)'(yz)')',$$



(c) With OR and inverter gates

$$F=(x+y)'+(x'+y)'+(y'+z)'$$



6.

$$F=x'yz'+w'y+wyz'$$

w	x	y	z	$x'yz'$	$w'y$	wyz'	F
0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0
0	0	1	0	1	1	0	1
0	0	1	1	0	1	0	1
0	1	0	0	0	0	0	0
0	1	0	1	0	0	0	0
0	1	1	0	0	1	0	1
0	1	1	1	0	1	0	1
1	0	0	0	0	0	0	0
1	0	0	1	0	0	0	0
1	0	1	0	1	0	1	1
1	0	1	1	0	0	0	0
1	1	0	0	0	0	0	0
1	1	0	1	0	0	0	0
1	1	1	0	0	0	1	1

1	1	1	1	0	0	0	0
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Sun-of-minterms=

$$m_2+m_3+m_6+m_7+m_{10}+m_{14}$$

$$= \Sigma(2,3,6,7,10,14)$$

Product-of-maxterms=

$$M_0+M_1+M_4+M_5+M_8+M_9+M_{11}+M_{12}+M_{13}+M_{15}$$

$$= \Pi(0,1,4,5,8,9,11,12,13,15)$$

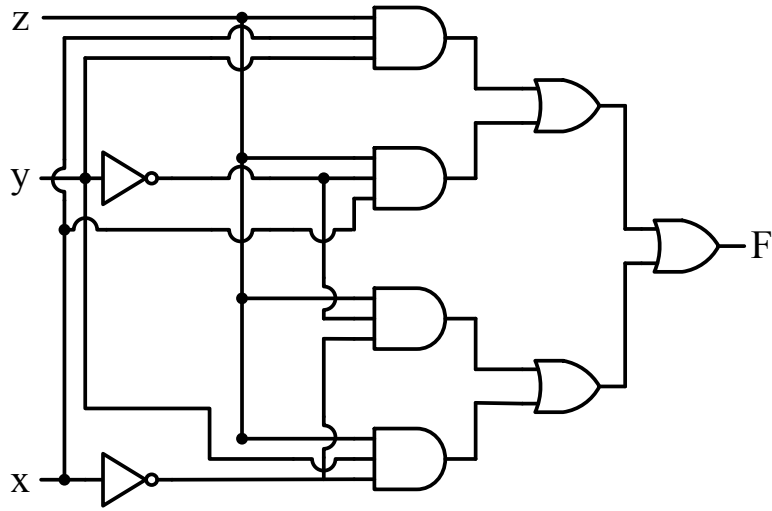
7.

$$F=x'y'z+xy'z+xyz+x'yz,$$

(a)

x	y	z	$x'y'z$	$xy'z$	xyz	$x'yz$	F
0	0	0	0	0	0	0	0
0	0	1	1	0	0	0	1
0	1	0	0	0	0	0	0
0	1	1	0	0	0	1	1
1	0	0	0	0	0	0	0
1	0	1	0	1	0	0	1
1	1	0	0	0	0	0	0
1	1	1	0	0	1	0	1

(b)



(c)

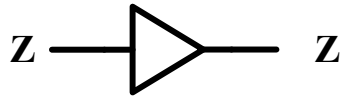
$$G = x'y'z + xy'z + xyz + x'yz = x'z(y+y') + xz(y+y') = x'z + xz = z$$

(d)

$$G = z,$$

x	y	z	z	G
0	0	0	0	0
0	0	1	1	1
0	1	0	0	0
0	1	1	1	1
1	0	0	0	0
1	0	1	1	1
1	1	0	0	0
1	1	1	1	1

(e)



Literal: $F = 9$, $G = 0$

8.

$$F = \Sigma(0,1,3,5,7,9,13,14,15) = \Pi(2,4,6,8,10,11,12)$$

A	B	C	D	F
0	0	0	0	1
0	0	0	1	1
0	0	1	0	0
0	0	1	1	1
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	1
1	0	0	0	0
1	0	0	1	1
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

Use K-map to simplify

Sum of products:

$$F(A,B,C,D) = A'B'C'D' + A'B'C'D + A'B'CD + A'BC'D + A'BCD + AB'C'D +$$

$$ABC'D + ABCD' + ABCD = A'B'C' + ABC + BC'D + A'CD + AB'C'D$$

Products of sum:

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

$$(A'+B+C'+D)(A'+B+C'+D')(A'+B'+C+D)$$