HW

2-(1) ① vector

Closure $\vec{x}, \vec{y} \in N \quad \vec{z} = \vec{x} + \vec{y} \in N$

Distribute law $a \times (\vec{x} + \vec{y}) = a\vec{x} + a\vec{y}$

② integer

Closure $x, y \in N \quad x + y \in N$

Associate law $x \times (y \times z) = (x \times y) \times z$

2-(2) ①Boolean algebra only has $\{0, 1\}$, while real number algebra has the space of R

②in Boolean algebra, $1+1=1$ while in real number numbers add together equals to a new number

2-(3) Postulate 2

$x + 0 = 0 + x = x$

x	$0+x$	$x+0$
1	1	1
0	0	0

$x \cdot 1 = 1 \cdot x = x$

x	$1 \cdot x$	$x \cdot 1$
1	1	1
0	0	0

Postulate 4

(a) $x \cdot (y+z) = (x \cdot y) + (x \cdot z)$

x	y	z	$x \cdot (y+z)$	$(x \cdot y) + (x \cdot z)$
1	1	1	1	1
0	1	1	0	0
1	0	1	1	1
1	1	0	1	1
0	0	1	0	0
1	0	0	0	0
0	1	0	0	0
0	0	0	0	0

(b) $x + (y \cdot z) = (x+y) \cdot (x+z)$

x	y	z	$x + (y \cdot z)$	$(x+y) \cdot (x+z)$
1	1	1	1	1
0	1	1	1	1
1	0	1	1	1
1	1	0	1	1
0	0	1	0	0
1	0	0	1	1
0	1	0	0	0
0	0	0	0	0

2-(4) $x(x+y) = xx + xy = x + xy = x(1+y)$

$= x \cdot 1 = x$

2-(5) ASIC: A custom-designed integrated circuit optimized for specific application, offering high efficiency but limited flexibility

FPGA: A programmable chip configurable for various functions via hardware description languages, known for flexibility and used in prototyping or dynamic application

PLD: A basic programmable hardware for simple logic functions, suitable for small-scale embedded systems or early circuit designs.

2-(6) in the sum of minterms, the function is written as an OR minterms, each representing a condition where the output is 1

In the Products of maxterms, it's written as an AND of maxterms, each representing a condition where the output is 0

2.1 1. $(x+y+z)' = x'y'z'$

x	y	z	$(x+y+z)'$	$x'y'z'$	$(xyz)'$	$x'+y'+z'$
1	1	1	0	0	0	0
0	1	0	0	0	1	1
1	0	1	0	0	1	1
1	1	0	0	0	1	1
0	0	1	0	0	1	1
1	0	0	0	0	1	1
0	1	0	0	0	1	1
0	0	0	1	1	1	1

2. $x + yz = (x+y)(x+z)$

x	y	z	$x + yz$	$(x+y)(x+z)$
1	1	1	1	1
0	1	0	0	0
1	0	1	1	1
1	1	0	1	1
0	0	1	0	0
1	0	0	1	1
0	1	0	0	0
0	0	0	0	0

3. $x(y+z) = xy + xz$

x	y	z	$x(y+z)$	$xy+xz$
1	1	1	1	1
0	1	0	0	0
1	0	1	1	1
1	1	0	1	1
0	0	1	0	0
1	0	0	0	0
0	1	0	0	0
0	0	0	0	0

4. $x + (y+z) = (x+y)+z$

x	y	z	$x+(y+z)$	$(x+y)+z$
1	1	1	1	1
0	1	0	1	1
1	0	1	1	1
1	1	0	1	1
0	0	1	1	1
1	0	0	1	1
0	1	0	1	1
0	0	0	0	0

5. $x(yz) = (xy)z$

x	y	z	$x(yz)$	$(xy)z$
1	1	1	1	1
0	1	0	0	0
1	0	1	0	0
1	1	0	0	0
0	0	1	0	0
1	0	0	0	0
0	1	0	0	0
0	0	0	0	0

2.3 1. $xyz + x'y + xyz' = xy(z+z') + x'y$

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

2. $x'yz + xz = (x'y + x)z = (x+x')(x+y)z$

$= 1 \cdot (x+y)z = xz + yz$

3. $(x+y)'(x'+y') = x'y'(x'+y')$

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

4. $xy + x(wz + wz') = xy + xw(z+z')$

$= xy + xw$

5. $(yz' + x'w)(xy' + zw')$

$= xyy'z' + yzz'w' + x'xy'w + x'zww' = 0$

6. $(x'+z')(x+y'+z') = x'x + x'y' + x'z' + xz' + z'y' + z'z'$

$= 0 + x'y' + z'y' + z'(x'+x) + z'$

$= 0 + x'y' + z'y' + z' = x'y' + z'(y'+1)$

$= x'y' + z'$

2.9 1. $(xy' + x'y)' = (xy')' \cdot (x'y)' = [x' + (y')'][(x')' + (y)']$

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

2. $[(a+c)(a+b')(a'+b+c')]'$

$= (a+c)' + (a+b')' + (a'+b+c')'$

$= a'c' + a'b + ab'c$

3. $[z + z'(v'w + xy)]'$

$= z'[z'(v'w+xy)]'$

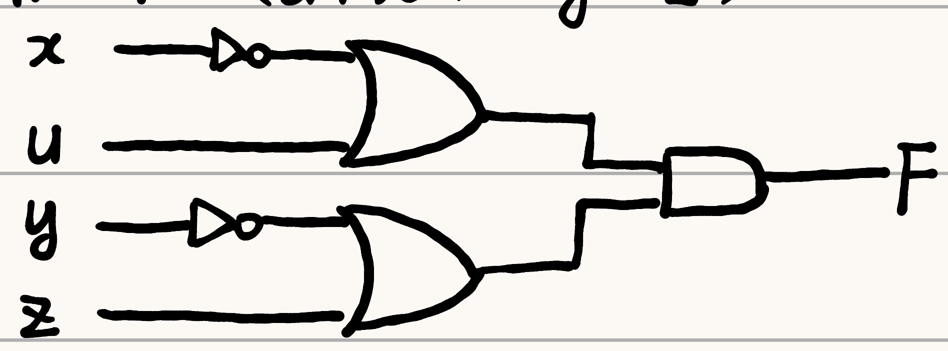
$= z'[(z')' + (v'w+xy)']$

$= z'[z + (v'w)'(xy)']$

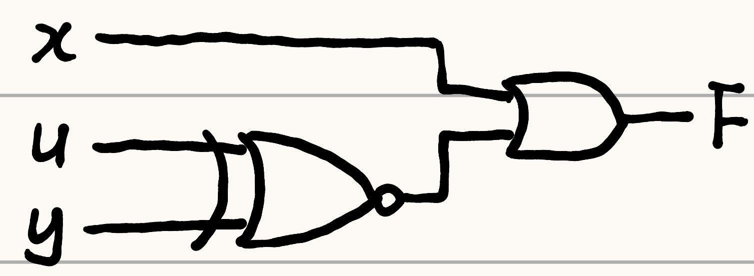
$= z'[z + (v+w')(x'+y')]$

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

2.13 1. $F = (u+x')(y'+z)$



2. $F = (u \oplus y)' + x$

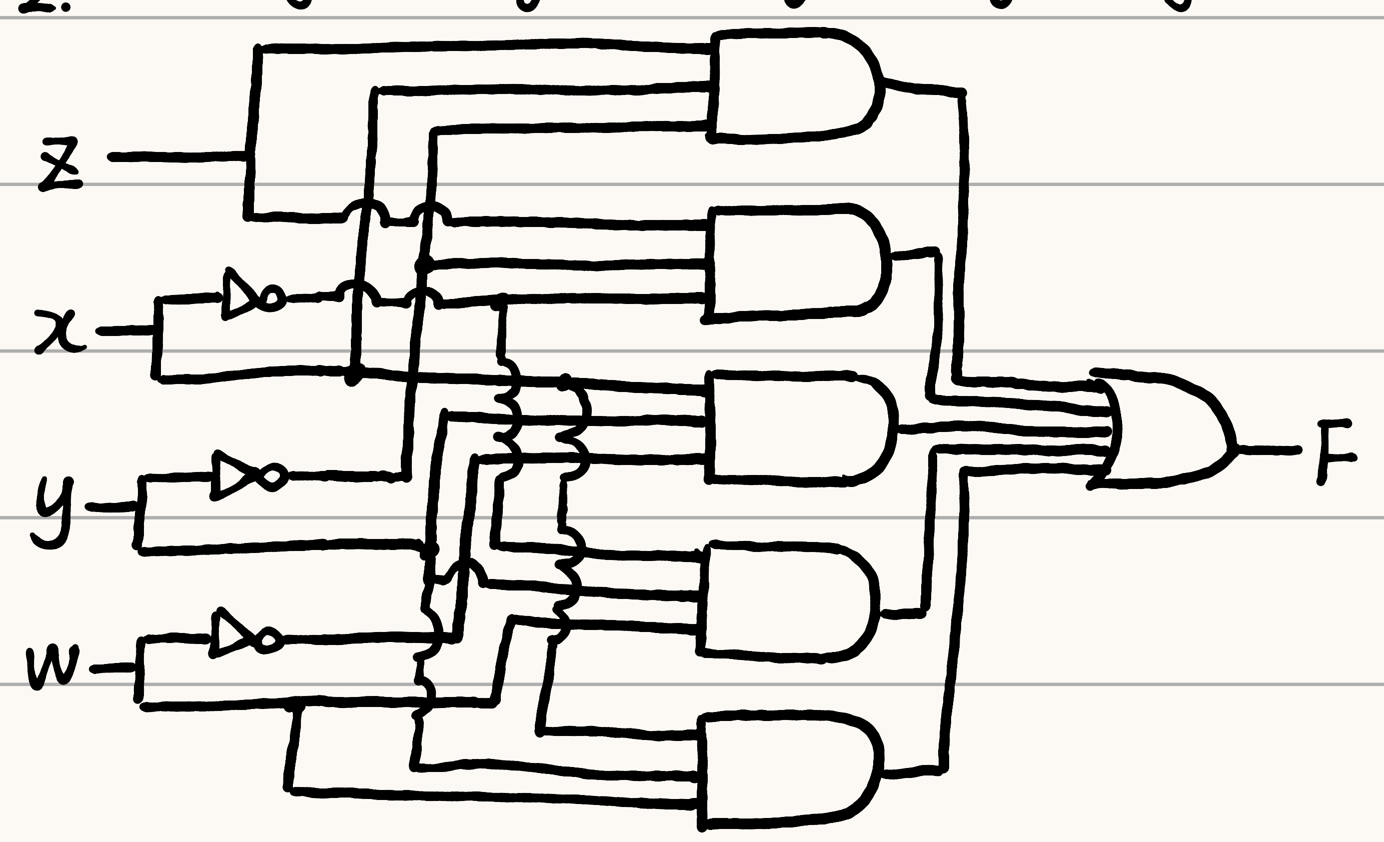


$F = xy'z + x'y'z + w'xy + wx'y + wxy$

2.18

x	y	z	w	$F = xy'z + x'y'z + w'xy + wx'y + wxy$
1	1	1	1	1
0	1	1	1	1
1	0	1	1	1
1	1	0	1	1
1	1	1	0	1
0	0	1	1	1
0	1	0	1	1
0	1	1	0	0
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
0	0	0	1	0
0	0	1	0	1
0	1	0	0	0
1	0	0	0	0
0	0	0	0	0

2. $F = xy'z + x'y'z + w'xy + wx'y + wxy$



3. $F = xy'z + x'y'z + w'xy + wx'y + wxy$

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

$= y'z + xy + wx'y$

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

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

$= y'z + xy + wy$

2.21 $F(x,y,z) = \Pi(0,2,4,6,7)$

$F(A,BC,D) = \Sigma(0,1,2,4,6,7,9,10,12,13,14,15)$

2.28 (a) $y = [(a(bcd)'e)']'$

a	b	c	d	e	$(bcd)'$	y
1	1	1	1	1	0	0
0	1	1	1	1	0	0
1	0	1	1	1	1	1
1	1	0	1	1	1	1
1	1	1	0	1	1	1
1	1	1	1	0	0	0
0	0	1	1	1	1	0
0	1	0	1	1	1	0
0	1	1	0	1	1	0
0	1	1	1	0	0	0
1	0	0	1	1	1	0
1	0	1	0	1	1	1
1	0	1	1	0	1	0
1	1	0	0	1	1	1
1	1	0	1	0	1	0
1	1	1	0	0	1	0
1	1	0	0	0	1	0
1	0	1	0	0	1	0
1	0	0	1	0	1	0
1	0	0	0	1	1	1
0	1	1	0	0	1	0
0	1	0	1	0	1	0
0	1	0	0	1	1	0
0	0	1	1	0	1	0
0	0	1	0	1	1	0
0	0	0	1	1	1	0
1	0	0	0	0	1	0
0	1	0	0	0	1	0
0	0	1	0	0	1	0
0	0	0	1	0	1	0
0	0	0	0	1	1	0
0	0	0	0	0	1	0

(b) $y_1 = a'(c+d+e) + a(c+d+e)'$

a	c	d	e	$(c+d+e)$	y_1
1	1	1	1	1	0
0	1	1	1	1	1
1	0	1	1	1	0
1	1	0	1	1	0
1	1	1	0	1	0
0	0	1	1	1	1
0	1	0	1	1	1
0	1	1	0	1	1
1	0	0	1	1	0
1	0	1	0	1	0
1	1	0	0	1	0
0	0	0	1	1	1
0	0	1	0	1	1
0	1	0	0	1	1
1	0	0	0	0	1
0	0	0	0	0	0

$y_2 = [(b'(c+d+e)f)']'$

b	c	d	e	f	$c+d+e$	$b'f$	y_2
1	1	1	1	1	1	0	0
0	1	1	1	1	1	1	1
1	0	1	1	1	1	0	0
1	1	0	1	1	1	0	0
1	1	1	0	1	1	0	0
1	1	1	1	0	1	0	0
0	0	1	1	1	1	1	1
0	1	0	1	1	1	1	1
0	1	1	0	1	1	1	1
0	1	1	1	0	1	1	1
1	0	0	1	1	1	0	0
1	0	1	0	1	1	0	0
1	0	1	1	0	1	0	0
1	1	0	0	1	1	0	0
1	1	0	1	0	1	0	0
1	1	1	0	0	1	0	0
1	1	0	0	0	1	0	0
1	0	1	0	0	1	0	0
1	0	0	1	0	1	0	0
1	0	0	0	1	0	0	0
0	1	1	0	0	1	0	0
0	1	0	1	0	1	0	0
0	1	0	0	1	1	1	1
0	0	1	1	0	1	0	0
0	0	1	0	1	1	1	1
0	0	0	1	1	1	1	1
1	0	0	0	0	0	0	0
0	1	0	0	0	1	0	0
0	0	1	0	0		0	0
0	0	0	1	0	1	0	0
0	0	0	0	1	0	1	0
0	0	0	0	0	0	0	0

2.32

a	b	c	$a'b$	$a'c'$	abc	y
1	1	1	0	0	1	1
0	1	1	1	0	0	1
1	0	1	0	0	0	0
1	1	0	0	0	0	0
1	0	0	0	0	0	0
0	1	0	1	1	0	1
0	0	1	0	0	0	0
0	0	0	0	1	0	1

$(a'+b+c')(a'+b'+c)(a'+b+c)(a+b+c')$