	zx	nx	zy	ny	f	no	out=
1	0	1	1	1	1	1	x+1
2	1	1	0	1	1	1	y+1
3	0	0	1	1	1	0	x-1
4	1	1	0	0	1	0	y-1
5	0	0	0	0	1	0	x+y
6	0	1	0	0	1	1	x-y
7	0	0	0	1	1	1	y-x
8	0	0	0	0	0	0	x&y
9	0	1	0	1	0	1	x|y

zx setz $x = 0$, nx negiert x.
zy setzt $y = 0$, ny negiert y.
$f=1 \Rightarrow x+y$, no negiert out.
$f=0 \Rightarrow x \& y$

1. Zeile: $\underset{no=1}{\sim} [\underset{zx=0,\ nx=1}{\sim x} \underset{f=1}{+} \underbrace{(1,\dots,1)}_{16\text{-Stellen}}]$ (zy=1, ny=1)

$\sim x$: Einerkomplement von x

$(1,\dots,1)$: $1111\ 1111\ 1111\ 1111_2$

$$x_2 = 0010\ 0101\ 0001\ 0110_2 = 9494_{10}$$
$$x_{1k} = 1101\ 1010\ 1110\ 1001_{1k} = -x$$
$$+\ 1111\ 1111\ 1111\ 1111_2$$
$$1\ 101\ 1010\ 1110\ 1000_{1k} = -x-1$$

$$(-x-1)_{1k} \Rightarrow (-x-1)_2 = 0010\ 0101\ 0001\ 0111 = 9495_{10} = (x+1)_2$$ ✔

2. Zeile: $\underset{no=1}{\sim} [\underbrace{(1,\dots,1)}_{16\ \text{Stellen}} \underset{f=1}{+} \sim y] = \sim [\sim y + \underbrace{(1,\dots,1)}_{16\ \text{Stellen}}]$ (zx=1, nx=1; zy=0, ny=1)

$\Rightarrow$ Analog zu (Z. 1) ✔

3. Zeile: no=0 zx=0, nx=0 f=1 zy=1, ny=1

$$x + \underbrace{(1,\dots,1)}_{16\ \text{Stellen}} = x + (\sim 0)$$
$$= x + ((-0) - 1\ )$$
$$= x + (-1)$$
$$= x - 1$$ ✔

4. Zeile: $\underbrace{(1,\dots,1)}_{16\ \text{Stellen}} + y = y + \underbrace{(1,\dots,1)}_{16\ \text{Stellen}} \Rightarrow$ Analog zu (Z. 3) ✔

Zeile 5: $no = 0$ $\quad zx = 0, nx = 0, \quad f = 1, \quad zy = 0, ny = 0,$

$$x + y$$ ✓

Zeile 6: $no = 1$ $\quad zx = 0, nx = 1, \quad f = 1, \quad zy = 0, ny = 0,$

$$\sim[\sim x + y] \quad \text{mit } \sim(\ ) = -(\ ) - 1$$
$$= -[\sim x + y] - 1$$
$$= -[\sim x + y + 1] \quad \text{mit } \sim x = -x - 1$$
$$= -[-x - 1 + y + 1]$$
$$= -[-x + y]$$
$$= \underline{\underline{x - y}}$$ ✓

Zeile 7: $\sim[x + \sim y]$
$$= \sim[\sim y + x] \Rightarrow \text{Analog zu } (2.6)$$ ✓

<u>Zeile 8:</u> $no = 0$ $\quad zx = 0, nx = 0, \quad f = 0, \quad zy = 0, ny = 0,$

$$x \,\&\, y$$ ✓

<u>Zeile 9:</u> $no = 1$ $\quad zx = 0, nx = 1, \quad f = 0, \quad zy = 0, ny = 1,$

$$\sim[\sim x \,\&\, \sim y]$$

, da wir nicht rechnen sondern bitweise vgl.:

$$(\overline{\bar{x} \wedge \bar{y}}) = \bar{\bar{x}} \vee \bar{\bar{y}} = x \vee y = x \mid y$$

nicht NAND
sondern bitweises ODER!

Aufgabe 2:

zx	nx	zy	ny	f	no	out=
1	0	1	0	1	0	0
1	1	1	1	1	1	1
1	1	1	0	1	0	-1

Zeile 3: $(\underbrace{1,\dots,1}_{16\text{-Stellen}}) + 0 = 1111\ 1111\ 1111\ 1111_{2K} = -1_{10}$

Bsp1: $no = 0$ $\quad zx = 1,\ nx = 0 \quad f = 1 \quad zy = 1,\ ny = 1$

$$0 + (\underbrace{1,\dots,1}_{16\text{-Stellen}}) = (1,\dots,1)_{2K} = -1_{10}$$

Bsp2: $no = 1$ $\quad zx = 1,\ nx = 0 \quad f = 1 \quad zy = 1,\ ny = 0$

$$\sim[0 + 0] = \sim 0 = (1,\dots,1)_{2K} = -1_{10}$$

Bsp3: $no = 1$ $\quad zx = 1,\ nx = 0 \quad f = 0 \quad zy = 1,\ ny = 0$

$$\sim[0 \,\&\, 0] = \sim[0] = (1,\dots,1)_{2K} = -1_{10}$$

Bsp4: $no = 1$ $\quad zx = 1,\ nx = 1 \quad f = 0 \quad zy = 1,\ ny = 0$

$$\sim((1,\dots,1)_2 \,\&\, 0_{10}) = \sim(0) = (1,\dots,1)_{2K} = -1_{10}$$

Bsp5: $no = 1$ $\quad zx = 1,\ nx = 0 \quad f = 0 \quad zy = 1,\ ny = 1$

$$\sim(0_{10} \,\&\, (1,\dots,1)_2) = \sim(0) = (1,\dots,1)_{2K} = -1_{10}$$

Tabelle:

	zx	nx	zy	ny	f	no	out
1.	1	0	1	1	1	0	-1
2.	1	0	1	0	1	1	-1
3.	1	0	1	0	0	1	-1
4.	1	1	1	0	0	1	-1
5.	1	0	1	1	0	1	-1