NAND Form

Please do the following exercises individually.

NAND Form

Please find the NAND form of the following logical functions.

$(A\wedge\neg B) \vee (\neg A\wedge C) = \ldots$

$(C\wedge D) \vee (\neg C\wedge\neg D) = \ldots$

$D \vee (B\wedge C) = \ldots$

$D \vee (\neg B\wedge D) \vee (A\wedge B\wedge\neg C) = \ldots$[1]

Compound NAND

Please prove that $\neg(a\wedge b\wedge c) \nleftrightarrow a|b|c$.

[1] Two 3-input NAND gates are used to realize this truth function. There is no logical operator for this kind of operation. So $\neg(a\wedge b)$ can be contracted to $a|b$ but $\neg(a\wedge b\wedge c)$ cannot. Please see the next exercise for a proof.

NAND Form

Please do the following exercises individually.

NAND Form

Please find the NAND form of the following logical functions.

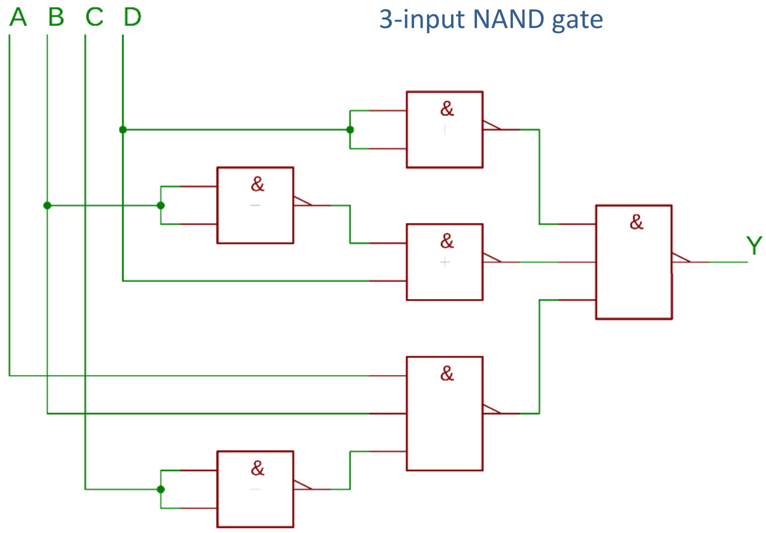
$(A\land\neg B) \lor (\neg A\land C)$ = … $(A|(B|B))|((A|A)|C)$

$(C\land D) \lor (\neg C\land\neg D)$ = … $(C|D)|((C|C)|(D|D))$

$D \lor (B\land C)$ = … $(D|D)|(B|C)$

$D \lor (\neg B\land D) \lor (A\land B\land\neg C)$ = … $\neg(\, (D|D) \land ((B|B)|D) \land \neg(A\land B\land(C|C))\,)$

3-input NAND gate



Compound NAND

Please prove that $\neg(a\land b\land c) \not\leftrightarrow a|b|c$.

			①	②	¬(a∧b∧c)	③	(a|b)|c	④	a|(b|c)
a	b	c	a∧b	①∧c	¬②	a|b	③|c	b|c	a|④
0	0	0	0	0	1	1	1	1	1
0	0	1	0	0	1	1	0	1	1
0	1	0	0	0	1	1	1	1	1
0	1	1	0	0	1	1	0	0	1
1	0	0	0	0	1	1	1	1	0
1	0	1	0	0	1	1	0	1	0
1	1	0	1	0	1	0	1	1	0
1	1	1	1	1	0	0	1	0	1

AND is associative (order does not matter, $(a\land b)\land c \leftrightarrow a\land(b\land c)$) but NAND is not (order matters, $(a|b)|c \not\leftrightarrow a|(b|c)$). This is another reason why both operations cannot be logical equivalent.