

Formal Logic — Exercise Sheet 2**Exercise 5: (Laws of Logic)**

Prove the following laws (for instance by truth tables), compare Theorem 1.1.

1. $F \wedge (F \vee G) \equiv F, F \vee (F \wedge G) \equiv F$ (Absorption)
2. $F \wedge (G \vee H) \equiv (F \wedge G) \vee (F \wedge H), F \vee (G \wedge H) \equiv (F \vee G) \wedge (F \vee H)$ (Distributivity)
3. $\neg(F \wedge G) \equiv \neg F \vee \neg G, \neg(F \vee G) \equiv \neg F \wedge \neg G$ (de Morgan's laws)

Exercise 6: (Two proofs)

Show that the following two formulas are equivalent (a) by truth tables, (b) by transforming one into the other using the identities in Theorem 1.1.

$$F = (\neg B \wedge \neg(B \wedge A)) \wedge \neg(C \vee (D \wedge C)), \quad G = \neg(\neg B \Rightarrow C) \wedge (D \Rightarrow \neg C)$$

Exercise 7: (CNF and DNF)

Transform the following formula into conjunctive normal form and into disjunctive normal form, using one of the algorithms shown in the lecture.

$$\neg\left(A \vee \neg(B \wedge \neg(C \vee D))\right) \wedge (A \Rightarrow B)$$

Exercise 8: (Switch and and or)

Let $F \equiv G$. Let neither F nor G contain any \Leftrightarrow or \Rightarrow . Let F' (respectively G') be the resulting formulas if one changes each \vee in F (respectively G) into \wedge and vice versa. Prove that $F' \equiv G'$.

Hand in your solutions until 30.10.2018 at 14:00 in post box 2183 in V3,
or via email to the tutor.

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