

1. **Minimizing Formulas** Minimize the following formulas using the properties of propositional logic as given in class (Commutativity, Distributivity, ...). For each step of your calculation give the property you used.

(a) $(A \vee B) \wedge \neg B$

(b) $\neg(A \vee B) \wedge (\neg A \vee \neg B)$

2. **Transformation Rules** Prove that the following formulas are tautologies. For each step of your transformation give the property you used (Associativity, Commutativity, ...).

Beweisen Sie, dass die folgenden Formeln Tautologien sind. Geben Sie für jeden Beweisschritt die Eigenschaften/Gesetze an, die Sie benötigen (z. B. Assoziativität, Kommutativität, ...).

(a) $((A \Rightarrow B) \wedge \neg B) \Rightarrow \neg A$.

3. **Equivalence and Tautology** Proof by using the laws of propositional logic that the following propositions hold. For each step of your calculation give the property you used (Associativity, Commutativity, ...).

(a) $A \Rightarrow (B \Rightarrow \neg C)$ and $\neg(A \wedge B \wedge C)$ are equivalent.

(b) $A \Rightarrow (B \Rightarrow \neg C) \Leftrightarrow \neg(A \wedge B \wedge C)$ is a tautology

4. **Quine Mc-Cluskey Understanding** Given the following truth table:

A	B	C	D	$P(A, B, C, D)$
f	f	f	f	f
f	f	f	t	f
f	f	t	f	f
f	f	t	t	f
f	t	f	f	t
f	t	f	t	t
f	t	t	f	t
f	t	t	t	f
t	f	f	f	t
t	f	f	t	f
t	f	t	f	t
t	f	t	t	f
t	t	f	f	f
t	t	f	t	t
t	t	t	f	f
t	t	t	t	f

- (a) Formulate the propositional logic formula which fulfills this truth table.
 (b) Minimize the formula using a KV-diagram.
 (c) Minimize the formula using the Quine-McCluskey algorithm.