

Theory of Computer Science

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Exercise meeting 1

Exercise 1.1 (Expressing Formulas in Propositional Logic)

Write down the following statements as propositional logic formulas. In order to do so, also define appropriate atomic propositions.

- (a) "If the traffic light is red, then the car may not drive."
- (b) "The car may drive if and only if the traffic light is not red and there is no pedestrian on the street."

Exercise 1.2 (Truth tables)

Let $A = \{X, Y, Z\}$ be a set of propositional variables and $\varphi = ((X \wedge Y) \rightarrow Z)$ be a propositional formula over A . Specify the truth table for φ .

Use the truth table to decide whether φ is satisfiable, unsatisfiable, valid and/or falsifiable.

Exercise 1.3 (Semantics of Propositional Logic)

Let $\varphi = ((X \wedge Y) \vee \neg X)$ be a propositional formula over $\{X, Y\}$. Consider interpretation $\mathcal{I} = \{X \mapsto 1, Y \mapsto 1\}$ for $\{X, Y\}$ and show by applying the semantics of propositional logic that \mathcal{I} is a model of φ (i.e. $\mathcal{I} \models \varphi$).

Exercise 1.4 (Properties of Propositional Logic Formulas)

Show *without* a truth table that $\varphi = (A \rightarrow (B \leftrightarrow C))$ is falsifiable. Is φ valid?