

Propositional and Predicate Logic – Second Homework

The deadline for the homework is November 13, 2018 at 23:55 (11:55 pm). Please, send the solution via e-mail to Martin.Pilat@mff.cuni.cz (a scan/photo of your handwriting is OK).

The points obtained for this homework count towards the points required to obtain the credit for the seminar.

In questions 1–3, φ and ψ are defined as propositions over $\mathbb{P} = \{p, q, r, s\}$

$$\varphi : (\neg p \vee q) \rightarrow (p \wedge r)$$

$$\psi : (s \rightarrow q)$$

1. **[0.5 points]** Use the tableau method to find all models of theory $T = \{\varphi, \psi\}$. *Hint:* $|M(T)| = 4$
2. **[0.5 points]** Write formulas τ_C in CNF and τ_D in DNF (over $\mathbb{P}' = \{p, q, r\}$) such that $M(\tau_C) = M(\tau_D) = M(\varphi)$.
3. **[0.5 points]** Determine the number of
 - (a) non-equivalent propositions χ over $\mathbb{P} = \{p, q, r, s\}$ such that $\varphi \wedge \psi \models \chi$,
 - (b) non-equivalent complete theories T over $\mathbb{P} = \{p, q, r, s\}$ such that $T \models \varphi \wedge \psi$.
4. **[0.5 points]** Using the implication graph, decide if the formula

$$(a \vee \neg b) \wedge (\neg a \vee b) \wedge (\neg a \vee \neg b) \wedge (a \vee \neg c)$$

is satisfiable. If it is, give an example of a satisfying assignment.