

assignment #1 (winter term 2005)

solutions will be presented Monday, 31-Oct-2005, 10 AM, o27/121

<http://www.informatik.uni-ulm.de/pm/index.php?id=112>

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- To register for the course, send an email with CPWS5 in the subject and your name in the body to **Marc.Meister** until 30-Oct-2005.
- Weekly assignments
  - Assignment presentation (except for #1): Tuesdays, 2 PM, o27/2203.
  - Assignments are not corrected and there is no “Schein”, however, you are encouraged to email interesting solutions to Marc (one day before the presentation at the latest) to be possibly discussed and presented during the presentation.
  - Solutions are sent by email to the (registered) participants after the presentation.

**Exercise 1.** For each pair of atomic formulae, give both a most general unifier and a unifier which is not most general. Otherwise show that a unifier cannot exist.

- (a)  $p(a, X, c, Y, Z)$  and  $p(Y, X, c, a, W)$   
(b)  $p(Y, g(Y, f(Y)), g(X, a))$  and  $p(f(U), V, g(h(U, V, W), U))$   
(c)  $p(g(X), h(a, X), h(Y, Y))$  and  $p(U, h(a, g(V)), h(V, g(U)))$   
(d)  $p(h(f(X), a), X, h(f(f(X)), f(f(X))))$  and  $p(h(V, a), U, h(W, f(V)))$

**Exercise 2.** Check for each of the following formulae which properties are true: validity, satisfiability, falsifiability, unsatisfiability.

- a)  $\neg(p(a) \rightarrow \exists X p(X))$   
b)  $(\exists X p(X)) \rightarrow p(a)$   
c)  $(\exists Y \forall X p(X, Y)) \rightarrow (\forall X \exists Y p(X, Y))$

**Exercise 3.** Prove or or disprove (by giving an counter example):

- a)  $\{\varphi_1, \varphi_2\} \models \psi$  iff<sup>1</sup>  $\varphi_1 \models \psi$  and  $\varphi_2 \models \psi$ .  
b) Given sentences  $\varphi, \psi$ , then  $\varphi \models \psi$  iff  $\varphi \not\models \neg\psi$ .  
c) If the sentence  $\varphi$  has no model, then  $\varphi \models \psi$  for any sentence  $\psi$ .  
Give an example for such a sentence  $\varphi$ .  
d) Given sets of sentences  $\mathcal{M}, \mathcal{M}'$ , with  $\mathcal{M} \subseteq \mathcal{M}'$  and a sentence  $\varphi$ , then  $\mathcal{M} \models \varphi$  iff  $\mathcal{M}' \models \varphi$ .

**Exercise 4.** Let  $\phi$  and  $\psi$  be formulae. Then  $\phi \models \psi$  iff  $\models \phi \rightarrow \psi$ .

This claim contains three kinds of “implications” on different language levels. Identify them.

**Exercise 5.** Make yourself familiar with SICStus Prolog, which is installed in the Linux pool:

- Prepare the environment with option `sicstus`.
- Go to [www.sics.se/sicstus/](http://www.sics.se/sicstus/) (or use the local documentation) for information regarding SICStus Prolog. Read the chapter “How to Run Prolog”.
- Install Emacs-Support for SICStus.
- Write a “Hello world!” program in SICStus Prolog, e.g.,  
`start :- write('Hello world!').`  
Compile the source in Emacs and call it with `start`.
- You can find more information on the course web site (in the exercise folder):
  - `firstStepsInProlog.pdf`
  - `howToUseSICStusProlog.pdf`

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<sup>1</sup>if and only if