Deductive Databases & Knowledge Based Systems

Sheet 3 (until 21.11.2008)

Please note that you need 50\% of all exercise points to be admitted for the final exams. Exercises have to be turned in until Tuesday before the next lecture and should be completed in teams of two students each. Write both names and “Matrikelnummer” on each page. If you have multiple pages, staple them together! Please hand in your solutions on paper into the mailbox at the IFIS floor (Mühlenpförtzstraße 23, 2nd floor, opposite of elevator), or bring it directly to the lecture. You may answer in either German or English.

Exercise 1
Please answer briefly, no novel-writing!

1. Explain unsatisfiable, satisfiable, universal. (3 points)
2. What is a model? What is a tautology? (2 points)
3. What is a semantic conclusion? What is semantic equivalence? (2 points)
4. What is an axiom? (1 point)
5. What is a clause? What is a Horn clause? (2 points)
6. What is special about the Herbrand interpretation? (3 points)

Exercise 2
1. Prove using the introduced Hilbert-style proof system following statement. (7 points)
   a. ⊨ A → A
   b. ⊨ (A → B) → ((B → C) → (A → C))
   c. ⊨ B → ((B → A) → A)

2. Can the following formulas be written clauses? If so, provide the corresponding clause. Is it also a Horn clause? (5 points)
   a. A → ((B ∧ C) → D)
   b. (A ∨ B ∨ C) → D
   c. (¬A) → (¬B)
   d. (¬A) → C
   e. B ∧ (C ∨ D)

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3. Which of the following Hilbert interpretation for the language
\[ \mathcal{L} := \{a, b, c, f, g, \{p, q, \emptyset\}\} \] is also a Herbrand model the formulas
\[ \mathcal{W} := \{(p(a) \rightarrow p(b) \land p(b) \rightarrow p(c)) \rightarrow (p(a) \rightarrow p(c)), (p(a) \rightarrow p(b)) \rightarrow (p(b) \rightarrow p(a))\}\]? (3 points)
   a. \[ I := \{p(a) \rightarrow p(b), p(b) \rightarrow p(c), p(a) \rightarrow p(c)\} \]
   b. \[ I := \{p(a) \rightarrow p(b), p(b) \rightarrow p(a)\} \]
   c. \[ I := \{p(a) \rightarrow p(b), p(a) \rightarrow p(c)\} \]