

Deductive Databases & Knowledge Based Systems

Sheet 3

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. $\models A \rightarrow A$
 - b. $\models (A \rightarrow B) \rightarrow ((B \rightarrow C) \rightarrow (A \rightarrow C))$
 - c. $\models B \rightarrow ((B \rightarrow A) \rightarrow A)$
2. Can the following formulas be written **clauses**? If so, **provide** the corresponding clause. Is it also a Horn clause? (5 points)
 - a. $A \rightarrow ((B \wedge C) \rightarrow D)$
 - b. $(A \vee B \vee C) \rightarrow D$
 - c. $(\neg A) \rightarrow (\neg B)$
 - d. $(\neg A) \rightarrow C$
 - e. $B \wedge (C \vee D)$

...page 2

3. Which of the following Hilbert interpretation for the language

$\mathcal{L} := \{\{a, b, c\}, \{f, g\}, \{p, q\}, \{ \ \}\}$ is also a **Herbrand** model the formulas $\mathcal{W} := \{(p(a) \rightarrow p(b) \wedge p(b) \rightarrow p(c)) \rightarrow (p(a) \rightarrow p(c)), (p(a) \rightarrow p(b)) \rightarrow (p(b) \rightarrow p(a))\}$? (3 points)

- $I := \{p(a) \rightarrow p(b), p(b) \rightarrow p(c), p(a) \rightarrow p(c)\}$
- $I := \{p(a) \rightarrow p(b), p(b) \rightarrow p(a)\}$
- $I := \{p(a) \rightarrow p(b), p(a) \rightarrow p(c)\}$