

# Advanced Data Modeling

Summer Semester 2009

- Exercises 3 -

*To be handed in before 2009-06-08, 23:59 via e-mail to [bercovici@uni-koblenz.de](mailto:bercovici@uni-koblenz.de) And [dividino@uni-koblenz.de](mailto:dividino@uni-koblenz.de), subject line: [ADM] ...*

- 1) What is the difference between an interpretation in general and an Herbrand interpretation? (1 point)
- 2) What is the difference between an interpretation and a model? (1 point)
- 3) Find an Herbrand model for each of the following formulas (3 points):
  1.  $\forall X (p(X) \rightarrow p(f(X)))$
  2.  $\forall X (p(X) \leftrightarrow \neg p(f(X)))$
  3.  $(\forall X (p(X, X) \rightarrow p(f(X), f(f(X)))) \wedge p(c, c)$
- 4) The Padovan Numbers are computed as follows: (4 points)

The 0<sup>th</sup>, 1<sup>st</sup>, 2<sup>nd</sup> Padovan Number is 1. The n<sup>th</sup> Padovan Number is the sum of the n-2<sup>nd</sup> and the n-3<sup>rd</sup> Padovan Number for n>1.

Write a logic program with a predicate pad/2, which computes Padovan Numbers, such that the goal pad(n, X) binds X to the n<sup>th</sup> Padovan Number. Model the Natural Numbers using only the constants 0 and 1 and the successor function f. Do not use any builtin arithmetic functions, but model the necessary operations yourself, for example using a predicate sum(X,Y,Z) for X+Y=Z.

  1. List the Herbrand universe of your program.
  2. List the Herbrand base of your program.
  3. Does your program have a smallest Herbrand model?
  4. If yes, describe the smallest Herbrand model of your program.
- 5) Find the **completed definition** of the following set of clause (1point)

person(X):-n(X).  
person(Y):- hasMember(X,Y).  
person(X):-hasPhoto(X,Y).  
person(mary).  
hasPhoto(mary, photo1).  
photo(photo1).