

Exercise Sheet 04

(Datalog Herbrand Models)

Please note: The exercises will be neither collected, nor corrected, or graded.

Exercise 1

- What is a least Herbrand model?
- What are minimal Herbrand models?
- What are perfect Herbrand models?
- In general, why aren't there least Herbrand models for Datalog^{neg}?

Exercise 2

Provide the following Datalog^f program:

```
edge(3, 2).  
edge(2, 6).  
edge(2, 5).  
edge(5, 3).  
path(X, Y) :- edge(X, Y).  
path(X, Z) :- edge(X, Y), path(Y, Z).
```

Compute the least model step by step using the fixpoint iteration.

Exercise 3

Provided is the following Datalog^{neg} program:

```
q(1, 2).  
q(2, 3).  
s(1, 3).  
r(X, Y) :- s(X, Y).  
p(X, Y) :- q(X, Y), ¬r(X, Y).  
p(X, Y) :- q(X, Y), ¬s(X, Y).  
p(X, Y) :- p(X, Y), p(X, Y).
```

- Provide all minimal Herbrand models of the program.
- Provide a program connection graph and stratification for the program.
- Partition the program according the stratification into $\mathcal{P} := \mathcal{P}_0 \cup \dots \cup \mathcal{P}_k$
- Compute the perfect model step by step using the iterated fixpoint iteration.
- Datalog^f is supposed to be computationally complete. Thus, the above program should be able to be expressed in Datalog^f. Provide an equivalent version of the program without negation.