



Universität Freiburg  
Institut für Informatik

Fang Wei-Kleiner

Georges-Köhler Allee, Geb. 51  
D-79110 Freiburg

fwei@informatik.uni-freiburg.de

**Advanced Databases and Information Systems**  
**Summerterm 2019**  
Discussion on 18/07/2019

## 11. Sheet: Datalog

### Exercise 1 (Datalog)

We are given two directed graphs  $G_{black}$  and  $G_{white}$  represented as binary relations over the same set of vertices  $V$ . Write a Datalog program that computes the set of  $pairs(a, b)$  of vertices such that there exists a path from  $a$  to  $b$  where *black* and *white* edges alternate, starting with a *white* edge.

### Exercise 2 (Datalog)

Given are the following three Datalog programs to calculate the transitive closure of a graph:

right-recursive:

$$C(X, Y) \leftarrow E(X, Y). \quad C(X, Y) \leftarrow E(X, Z), C(Z, Y)$$

left-recursive:

$$C(X, Y) \leftarrow E(X, Y). \quad C(X, Y) \leftarrow C(X, Z), E(Z, Y)$$

double-recursive:

$$C(X, Y) \leftarrow E(X, Y). \quad C(X, Y) \leftarrow C(X, Z), C(Z, Y)$$

Use the semi-naïve algorithm to calculate the results of the given three programs with respect to the following database:

$$E(1, 2), E(2, 3), E(3, 4), E(4, 5), E(5, 6), E(6, 7)$$

### Exercise 3 (Datalog)

Encode words over the alphabet  $\{a, b\}$  structures having the following relations:

- $Min(X)$ : expressing that  $X$  is the first position of the word.
- $Max(X)$ : expressing that  $X$  is the last position of the word.
- $Succ(X, Y)$ : expressing that the position  $Y$  is the successor position of  $X$ .
- $Pa(X)$ : position  $X$  contains letter  $a$ .
- $Pb(X)$ : position  $X$  contains letter  $b$ .

- Write a Datalog program that makes an atom *yes* true iff there are more  $a$ 's than  $b$ 's in the string.
- Write a Datalog program that makes an atom *yes* true iff the word is a palindrome.