

Exercise Sheet 1
CS 2210 Logic for Computer Scientists - Spring 2017
Solutions due: January 27, 2017 - 12:20 pm

Exercise 1 Can you derive the following from (1) to (14) in Example 1.1.1? Justify your answers.

- (a) Michelle is a parent of Malia.
- (b) Ann is a grandmother of Natasha.

Exercise 2 In the context of (1) to (14) of Example 1.1.1, write Datalog rules

- (a) which define what an aunt is
- (b) and which define what a niece is.

In addition to the predicate symbols from Example 1.1.1, use also the following predicate symbols: `auntOf` (arity 2), `sisterOf` (arity 2), `daughterOf` (arity 2), and `nieceOf` (arity 2) for the predicate symbols.

Exercise 3 In the context of (1) to (14) of Example 1.1.1,

- (a) define `siblingOf` and
- (b) state that `siblingOf` is symmetric.

Here, assume that someone can be a sibling of her/himself.

Exercise 4 Write a Datalog program which captures the following natural language sentences. Use the predicates: `orphan` (of arity 1), `parentOf` (of arity 2), `dead` (of arity 1), `fatherOf` (of arity 2), and the constants: `harrypotter`, and `jamespotter`.

- (a) Every orphan is a human being.
- (b) Somebody's father is also that person's parent.
- (c) If somebody is an orphan, then all his parents are dead.
- (d) Harry Potter is an orphan.
- (e) James Potter is the father of Harry Potter.

Exercise 5 Let $L = (V, C, R)$ be a Datalog language with the set of variables $V = \{w, y\}$, constants $C = \{d, e\}$, and predicate symbols $R = \{r, s\}$ where r has arity 1 and s has arity 2. Which of the following are atoms over L ? Which are ground atoms? Justify your answers.

- (a) $d(w, w)$ (b) $r(d, e)$ (c) $s(w, w)$ (d) $r(y)$

Exercise 6 Let $L = (V, C, R)$ be a Datalog language with the set of variables $V = \{x, y\}$, constants $C = \{\text{barack, michelle, craig, malia}\}$, and predicate symbols $R = \{\text{motherOf, parentOf, grandmotherOf}\}$, all with arity 2. Which of the Datalog facts (1) to (9) from Example 1.1.1 are atoms over L ? Justify your answers. (Note that the language L is different from the language used in Example 1.1.1)