

# Advanced Topics in Computational Complexity

## Exercise Session 3

Due 2.11.2015.

### Exercise 1

Read Theorems 4.14 and 4.16 from the distributed document or Theorems 4.3.3 and 4.3.5 from the thesis of Jarmo Kontinen <http://dare.uva.nl/document/2/77418>

### Exercise 2

Let  $\mathfrak{A} = (A, P, Q)$  be a model and  $P$  and  $Q$  relation symbols of arity 1. Write a sentence  $\varphi$  of dependence logic such that  $\mathfrak{A} \models \varphi$  if and only the size of  $P$  is the same as the size of  $Q$ .

### Exercise 3

Which of the following formulas are logically equivalent to a first-order formula?

1.  $\neg(x_0, x_1, x_2) \wedge x_0 = x_1$
2.  $\forall x_0 \exists x_2 (\neg(x_0, x_2) \wedge x_2 = x_1)$
3.  $\forall x_0 \forall x_1 \exists x_2 (\neg(x_0, x_2) \wedge x_2 = x_1)$

### Exercise 4

A graph is 2-colorable if its elements can be divided into two disjoint parts so that all edges are between elements of different parts. Write a sentence of dependence logic which is true in a graph iff the graph is 2-colorable.