**RWTH Aachen** **WS 2011/12**
**Lehrgebiet Theoretische Informatik** Tutorial 12
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# Parameterized Algorithms Tutorial

## Tutorial Exercise T31

The problem Red-Blue Dominating Set is defined as follows: given a graph $G$ whose vertex set is partitioned into two color sets $R \cup B = V(G)$ and an integer $k$, decide whether there exists a set of $k$ red vertices that dominate all blue vertices.

Express the above problem as a $\text{MSO}_1[L]$ formula, where $L = \{\text{red,blue}\}$ is the set of allowed labels. Can this problem be expressed in $\text{MSO}_2$ *without* labels? What does this mean for the logics $\text{MSO}_1[L]$ and $\text{MSO}_2$?

## Tutorial Exercise T32

Recall the definition of $\text{MSO}_1$ and $\text{MSO}_2$. In the following, let $G$ be a graph and $A$ be some vertex subset of $G$. Which one of the following properties are expressible in either logic?

1. $A$ forms a cycle
2. $A$ forms an induced cycle
3. $G$ has some hereditary graph property $\mathcal{P}$ characterized by a finite set of forbidden subgraphs
4. $G$ has some hereditary graph property $\mathcal{P}$ characterized by an infinite set of forbidden subgraphs

What consequence do items 1 and 2 have for Hamiltonian Cycle?

## Tutorial Exercise T33

Develop dynamic programming algorithms for the following problems on graphs of bounded treewidth:

- 3-Colorability
- Triangle Packing (vertex disjoint)

State the runnning time of each algorithm.