Exercises to the lecture
Complexity Theory
Sheet 4

Prof. Dr. Roland Meyer

Dr. Prakash Saivasan   Delivery until 22.11.2016 at 10h

Exercise 4.1 (Immerman and Szelepcsényi)

In the lecture we have shown that $\overline{PATH}$ is in NL. Use this to prove the theorem of Immerman and Szelepcsényi:
For $s : \mathbb{N} \to \mathbb{N}$ with $s(n) \geq \log n$, we have:

$$\mathsf{NSPACE}(s(n)) = \text{co-}\mathsf{NSPACE}(s(n)).$$

Exercise 4.2 (NL)

Recall that $PATH = \{\langle G, s, t \rangle \mid G$ is a directed graph that has a path from s to $t\}$. Show that $PATH$ is in NL.

Exercise 4.3 (Hierarchies and Padding)

Show the following statements, using the hierarchy and transfer results from the lecture:

a) $\mathsf{P} \subsetneq \mathsf{EXP}$,

b) $\mathsf{NL} \subsetneq \mathsf{PSPACE}$,

c) If $\mathsf{NL} = \mathsf{P}$ then we also have: $\mathsf{PSPACE} = \mathsf{EXP}$.

Delivery until 22.11.2016 at 10h into the box next to room 343 in the Institute for Theoretical Computer Science, Muehlenpfordstrasse 22-23