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Homeworks for

Komplexitätstheorie

A. Y. 13/14

Sheet 9

Exercise 9.1 Show that the problem LINEAR SPACE ACCEPTANCE is PSpace-hard.

Hint: It is easy to see that every language that can be recognized by a DTM with space bound $O(n)$ can be polynomially reduced to LINEAR SPACE ACCEPTANCE. Use a "padding argument" (padding = making an input string longer by adding redundant symbols) to show that this generalizes to languages that can be recognized within polynomial space.

Exercise 9.2 Show that the language GM – related to the game "Go-Moku" – belongs to PSpace. See the end of Section 17.3 of the Lecture Notes for a definition of Go-Moku and GM.

Exercise 9.3 Find a class $\mathcal{C}$ of languages for which the statement $\mathcal{C} \subseteq (\exists)_{pol}[\mathcal{C}]$ is false (and argue why).

Hint: You can find such a class exploiting the natural encoding function introduced in the lecture.

Exercise 9.4 During the lecture, we discussed the closure property

$$L \in \mathcal{C} \implies L_\varepsilon \in \mathcal{C}.$$

Show that the complexity classes Σ_k, Π_k actually have this closure property for each choice of $k \geq 0$.