1. This exercise is related to the Immerman-Szelepcsényi theorem.

   Suppose that the membership in some language L can be determined by a nondeterministic TM M with time complexity $t_M(n)$ and space complexity $s_M(n)$.

   Furthermore, suppose that the number of strings in L of a given length is given by $f : \mathbb{N} \longrightarrow \mathbb{N}$, that requires time $t_f(n)$ and space $s_f(n)$.

   Under these assumptions give a nondeterministic TM for $\overline{L}$, and determine upper bounds for the time and space complexity for such a TM.

2. Suppose that the language L in the previous question is context-sensitive. Let $T_{n,i} := \{x : |x| \le n, S \overset{i}{\Rightarrow} x\}$, so that for some m we will have $T_{n,m} = T_{n,m+1}$. Let $g(n) := |T_{n,m}|$ for this m.

   Show that g can be computed in nondeterministic linear space.

   Conclude that if L is context-sensitive, so is $\overline{L}$.

3. Do exercises 3.14, 3.15, 3.16 in the textbook. These are exercises related to interactive proof systems.