

**General Instructions:** Same as in Homework 1.

**Honor Principle:** Same as in Homework 1.

4. We proved in class that  $\overline{\text{STCON}} \in \text{NL}$ , thereby concluding  $\text{NL} = \text{coNL}$ . We remarked that our proof in fact shows that  $\text{NSPACE}(f(n)) = \text{coNSPACE}(f(n))$  for any function  $f : \mathbb{N} \rightarrow \mathbb{N}$  with  $f(n) \geq \log_2 n$ . Prove this remark rigorously.

At some point, you will have to take care of the technical difficulty that computing the value of  $f(n)$  might require more than  $O(f(n))$  space — after all, you have no idea what kind of crazy function  $f(n)$  is. Consult the proof of Savitch's theorem in Sipser's book for a hint on how to handle this. [2 points]

5. Prove that  $\{\langle G \rangle : G \text{ is a strongly connected directed graph}\}$  is NL-complete. [2 points]