

Problem set 2
Computational Complexity.

When describing a TM you are NOT expected to give an explicit delta function, but rather explain how your TM works, and show that it can be done within the constraints of the relevant class.

1. Consider the following problem:
Input: a directed graph with fan out (out degree) one.
Question: Does it have a cycle?
 - (a) Show how to solve it in L , when out-degree is at most 1.
 - (b) Show how to solve it in NL , if out-degree is unbounded.
2. Prove that if A is C -complete then \overline{A} is $co - C$ complete.
3. Prove that $\overline{stcon} \in NL$ implies $NL = coNL$.
4. Let PAL be the language of palindromes (over $\{0, 1\}$).
 - (a) Show that PAL can be decided using logarithmic space.
 - (b) Show that there is a non-deterministic TM that decides \overline{PAL} in linear time (i.e, $O(n)$) and logarithmic space (i.e, $O(\log n)$) .
5. Show the the sum of two numbers, given in binary representation, can be calculated in deterministic space $O(\log n)$. Note that n is the total *length* of the input (and not the value of the numbers).