EECS 4115/5115

Homework Assignment #7 Due: Friday, November 20, 2020 at 5:00 p.m.

1. Consider the special case of the REACHABILITY problem where every vertex in the directed graph has at most one incoming edge. Show that this problem is in $SPACE(\log n)$.

For this problem, you may assume that the input graph has vertices labelled $\{1, 2, 3, \ldots, |V|\}$.

2. Show the complement of 2SAT is in NSPACE($\log n$).

For this problem, we should be more precise about how formulas are represented as an input string using the input alphabet { (,), x, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, \lor , \land , \neg }. A variable is written as the character x followed by a decimal number. So the following are examples of 2CNF formulas.

- $(x1 \lor x4) \land (\neg x4 \lor x7) \land (x13 \lor \neg x8).$
- (x826389127803671292107461291 ∨ x72323106912316239146213)

Your answer should be quite detailed to explain how your algorithm can be implemented on a non-deterministic Turing machine that uses $O(\log n)$ space, where n is the length of the input string. (Depending on how you design your algorithm, there may be some details of the implementation that are a little tricky.)