Problem Set 10

This problem set is due on Friday Apr 23, by 4:00pm.

Use the CS172 drop box.

Write your name and your student ID number on your solution. Write legibly. The description of your proofs should be as clear as possible (which does not mean long – in fact, typically, good clear explanations are also short.) Be sure to be familiar with the collaboration policy, and read the overview in the class homepage www.cs.berkeley.edu/~luca/cs172.

1. Define the language

\[ \text{ShortestPath} = \{(G,k,s,t) \mid \text{the shortest path from } s \text{ to } t \text{ in } G \text{ has length } k \} \]

(a) Prove that \text{ShortestPath} is in \text{NL}.
(b) Prove that \text{ShortestPath} is in \text{L} if and only if \text{L} = \text{NL}.

2. Define the language

\[ \text{\#SAT} = \{ (\varphi,k) \mid \varphi \text{ is a 3CNF that has precisely } k \text{ satisfying assignments } \} \]

Prove that if \text{\#SAT} \in \text{NP} then \text{NP} = \text{coNP}.

3. Prove that \text{E DFA} is \text{NL}-complete.

4. Define \text{EQNFA} = \{ (N_1,N_2) \mid N_1, N_2 \text{ are NFAs and } L(N_1) = L(N_2) \}. Prove that \text{EQNFA} \in \text{PSPACE}.