CSCI 338: Assignment 5 (6 points)

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This assignment is due on **Monday, April 28, 11:30pm**. It is strongly encouraged that you use Latex to generate a single pdf file and upload it under *Assignment 6* on D2L. But there will NOT be a penalty for not using Latex (to finish the assignment). This is **not** a group-assignment, so you must finish the assignment by yourself.

Problem 1

Problem 7.9 (page 323).

PROOF.

We construct a TM that decides $TRIANGLE$ in polynomial time.

So if there is a triangle between nodes a, b, c then $\exists (a, b), (a, c), (b, c) \in E$. In other words, there is an edge between each vertex. We can check if these edges exist by considering combinations of the edge set. There are $\binom{|E|}{3}$ combinations of the edge set. Let m be the number of edges in G, $m = |E|$. Well $\binom{m}{3} = \frac{m!}{3!(m-3)!} = \frac{m*(m-1)*(m-2)}{6} = \frac{1}{6}m^3 - 3m^2 + 2m$. Then we can iterate the list of combinations until we find one that matches the form $(a, b), (a, c), (b, c)$.

If there is a combination that fits this form, then accept. Otherwise reject.

This runs in polynomial time since the number of combinations is polynomial with respect to the size of the edge set. So we can perform this operation in $O(m^3) = O(|E|^3)$. Therefore, we have an algorithm that decides $TRIANGLE$ in polynomial time, so $TRIANGLE \in P$ by defintion.

$\square$

Problem 2

Problem 7.21 (page 324).

Problem 3

Problem 7.22 (page 324).

Problem 4

Problem 7.35 (page 326).