Due Date: September 16, 11:59pm

In all problems, prove the correctness of your algorithm and analyze its running time.

Problem 1: [10pts] Given an undirected graph $G = (V, E)$, describe an algorithm to detect whether G has a cycle of odd length.

Problem 2: [10pts] Given an undirected graph $G = (V, E)$, for a vertex $v \in V$, $G - v$ is obtained by removing v and its incident edges from G. Describe an $O(|V| + |E|)$ time algorithm to find a vertex $v \in V$ such that $G - v$ consists of more than one connected components, or report that no such vertex exists.

Problem 3: [10pts] Let $G = (V, E)$ be a directed graph with integral and non-negative edge weights. Suppose we have $s, t \in V$ such that the distance from s to t is $O(|V|)$. Describe an $O(|V| + |E|)$ time algorithm to find the length of the shortest path from s to t.