CSE 431/531: Algorithm Analysis and Design Spring 2019

Homework 5

Instructor: Shi Li **Deadline: 5/12/2019**

Your Name: _____ Your Student ID: _____

Problems	1	2	Total
Max. Score	40	40	80
Your Score			

Problem 1 (40 points) For each of the following problems, state (1) whether the problem is known to be in NP, and (2) whether the problem is known to be in Co-NP. If your answer is yes, you should briefly describe the efficient certifier.

(a) Given a graph $G = (V, E)$ and $s \leq |V|$, the problem asks whether G contains an independent set of size s.

(b) Given two circuits C_1 and C_2, each with m input variables $z_1, z_2, \cdots, z_m$, decide if the two circuits compute the same function. That is, whether C_1 and C_2 give the same output for every boolean assignment of z-variables.

(c) Given a graph $G = (V, E)$, decide if G is 3-colorable.

(d) Given a graph $G = (V, E)$, decide if G is 2-colorable.

(e) An undirected graph $G = (V, E)$ is called a 1-expander if for every $S \subseteq V$, the number of edges between S and $V \setminus S$ in G is at least $\min\{|S|, |V \setminus S|\}$. Given a graph G, decide if G is a 1-expander.

Problem 2 (40 points) In the class, we proved that HP (Hamiltonian Path) $\leq_P$ HC (Hamiltonian Cycle). Prove the other direction, i.e, HC $\leq_P$ HP.