CSCI 570 - Fall 2019 - HW 10

Due November 20th 11:59 p.m.

1 Graded Problems

1. State True/False.

- Assume P. Let A and B be decision problems. If $A \in NPC$ and $A \leq_p B$, then B.
- If someone proves $P = NP$, then it would imply that every decision problem can be solved in polynomial time.
- If $A \leq_p B$ and $B \in NP$, then $A \in NP$.

2. Given an n bit positive integer, the problem is to decide if it is composite. Here the problem size is n. Is this decision problem in NP?

3. State True/False. Assume you have an algorithm that given a 3-SAT instance, decides in polynomial time if it has a satisfying assignment. Then you can build a polynomial time algorithm that finds a satisfying assignment(if it exists) to a given 3-SAT instance.

4. Show that vertex cover remains $NP - Complete$ even if the instances are restricted to graphs with only even degree vertices.

2 Practice Problems

5. Given an integer mn matrix A and an integer m - $vectorb$, the 0-1integer programming problem asks whether there exists an integer n - $vectorx$ with elements in the set $\{0; 1\}$ such that $Ax = b$. Prove that 0-1integer programming is NP Complete. (*Hint*: Reduce from 3-CNF-SAT.)

6. Assume that you are given a polynomial time algorithm that decides if a directed graph contains a Hamiltonian cycle. Describe a polynomial time algorithm that given a directed graph that contains a Hamiltonian cycle, lists a sequence of vertices (in order) that forms a Hamiltonian cycle.