CSCE-629 Analysis of Algorithms

Fall 2019

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Assignment # 6
(Due December 3, 2019)

1. A *vertex cover* in an undirected graph G is a set C of vertices in G such that every edge in G has at least one end in C. Consider the following two versions of the VERTEX-COVER problem:

VC-D: Given a graph G and an integer k, decide whether G contains a vertex cover of at most k vertices.

VC-O: Given a graph G, construct a minimum vertex cover for G

Prove: VC-D is solvable in polynomial time if and only if VC-O is solvable in polynomial time.

2. Prove that the VC-D problem given in Question 1 is in $\mathcal{NP}$.

3. Using the fact that the INDEPENDENT SET problem is $\mathcal{NP}$-complete, prove that the following problem is $\mathcal{NP}$-complete:

CLIQUE: Given a graph G and an integer k, is there a set C of k vertices in G such that for every pair v and w of vertices in C, v and w are adjacent in G?

4. Prove: if the problem VC-O is solvable in polynomial time then $\mathcal{P} = \mathcal{NP}$. *Hint*: you may use the result in Question 1.