

CSCE 629 NP-Completeness sample questions

1. (short questions) (a) Suppose you are given an instance of the travelling salesman problem in which all edge weights are 1, 2, or 3. Is the problem still NP-hard? Is the triangle inequality necessarily satisfied? What bound would you expect to get if you used the MST approach to find an approximation to the optimal solution of an instance of this problem?

(b) Why is it difficult to prove that the following version of the vertex cover problem is NP-complete?

Given an undirected graph, G , and a positive integer, k , is the minimum vertex cover in G of size $= k$?

(c) Suppose you have a polynomial time reduction from problem X to problem Y. What can you say about X if you know that problem Y is NP-complete? What can you say about Y if you know that problem X is NP-complete?

2. (long question) Carefully show that the directed Hamiltonian circuit problem is NP-complete, given that the undirected Hamiltonian circuit problem is NP-complete.