

Algorithms Qualifying Exam Sample Exam 1

Fall 2014

In the VERTEX-COVER problem, one is given a graph $G = (V, E)$ and an integer k . The goal is to determine if G has a vertex cover of size at most k , where a vertex cover is a subset of the vertices C such that for every $\{u, v\} \in E$ we have either $u \in C$ or $v \in C$. The problem is well known to be NP-Complete.

Suppose we know that the graph G is a *bipartite* graph. That is, V can be partitioned into two sets X and Y so that all edges in G connect a vertex in X with a vertex in Y .

Propose algorithms for the vertex cover problem on bipartite graphs that solve the problem (exactly or approximately) using one or more approaches (such as divide-and-conquer, greedy, dynamic programming, graph traversal, shortest path, max flow, etc). The goal should be to clearly demonstrate strong critical thinking skills regarding algorithms. Argue why a some approach may be reasonable, why some approaches may not be reasonable, and provide a critique of your solution.