

Approximation Algorithms Midterm

Please solve these questions on your own **without consulting any paper/internet/book**. You can however consult the book by Vazirani and your lecture notes. The exam should be submitted to me by **10pm Wednesday**.

1. A balanced cut in a graph is a cut (S, \bar{S}) such that $|S| = |\bar{S}|$. Give a local search based approximation algorithm for finding the maximum balanced cut. (10)
2. Consider the following 2-approximation algorithms for the vertex cover problem. Find a depth first search tree in the given graph, G , and output the set, S , of non-leaf vertices of this tree. Show that S is indeed a vertex cover for G and $|S| \leq 2OPT$. (10)
3. Obtain a PTAS for the Euclidean Steiner tree problem. Given n points in the plane, find the minimum length tree containing all n points and any other subset of points. The latter points are called *Steiner* points. The distance between two points is assumed to be their Euclidean distance. (20)
4. Give a greedy algorithm that achieves an approximation guarantee of $O(\log n)$ for set multicover, which is a generalization of set cover in which an integral coverage requirement is also specified for each element and sets can be picked multiple number of times to satisfy all coverage requirements. Assume that the cost of picking α copies of set S_i is $\alpha \cdot cost(S_i)$. (20)