CSCE 669-601 Computational Optimization

Spring 2024

Instructor: Dr. Jianer Chen
Office: PETR 428
Phone: (979) 845-4259
Email: chen@cse.tamu.edu
Office Hours: MW 11:30 am–1:00 pm

Assignment #2

(Due April 3)

1. Metric-TSP. Write detailed algorithm and analysis for the approximation algorithm based on minimum spanning trees for the METRIC TRAVELING SALESMAN Problem (in which edge weights for any three vertices x, y, and z satisfy $wt(x, y) \leq wt(x, z) + wt(z, y)$). Your algorithm should contain the details of how the traveling salesman tour (i.e., the permutation of the vertices) is constructed, and your analysis should give the details on why the tour is at most twice of the optimal tour.

2. Planar Vertex-Cover. The problem PLANAR VERTEX COVER is to find a smallest set S of vertices in a given planar graph G such that every edge in G has at least one end in S. The problem is NP-hard. Develop a PTAS for the problem. You can use Lipton-Tarjan's Planar Graph Separator Theorem. Also, you can assume that a minimum vertex cover of a graph of n vertices contains at least $n/2$ vertices (this condition can be achieved via a non-trivial polynomial time preprocessing).

3. (a,b)-Shifted Dissection. Let S be an ϵ-disciplined instance of the EUCLIDEAN TSP problem that is a set of points contained in the bounding square of size $2^{h_0} \times 2^{h_0}$, where $h_0 = \lceil \log(n/\epsilon) \rceil$. Let a and b be two non-negative integers not larger than 2^{h_0}. Write an algorithm of time $O(n^2 \log n)$ that constructs the quad-tree T for the (a, b)-shifted dissection of S. The set of points in a square should be attached to the corresponding node in the quad-tree T. Explain why your algorithm runs in time $O(n^2 \log n)$.