School of Computer Science and Technology

University of Science and Technology of China

Exercise Sheet 4 for

Design and Analysis of Algorithms
Autumn 2022
Due 12 Nov 2022 at 16:59

Exercise 1 *30*

Let G be a complete undirected graph in which all edge lengths are either 1 or 2 (clearly, G satisfies the triangle inequality). Give a 4/3-approximation algorithm for TSP in this special class of graphs.

Hint: Start by finding a minimum 2-matching in G. A 2-matching is a subset S of edges so that every vertex has exactly 2 edges of S incident at it. You can assume that finding such a minimum 2-matching can be done in polynomial time.

Exercise 2 *30*

Consider the following modification to the metric uncapacitated facility location problem. Define the cost of connecting client j to facility i to be c_{ij}^2. The c_{ij}'s still satisfy the triangle inequality (but the new connection costs, of c_{ij}^2, do not). Show that the algorithm LP-FACILITYLOCATION in Lecture 10 achieves a constant approximation ratio for this case.

Exercise 3 *40*

Consider the MAX 2SAT problem, in which every clause has at most two literals. As in the case of the maximum cut problem, we'd like to express the MAX 2SAT problem as an SDP, and then round its optimal solution to get an approximate solution to the MAX 2SAT problem. Derive a 0.878-approximation algorithm for the MAX 2SAT problem.