

CS 602 - Applied Algorithms:

Assignment 1

Total Marks - 50

Instructions. Please try to be brief, clear, and technically precise. Use pseudo-codes to describe the algorithms. To solve the problems, one may assume that the instances are in general position, unless stated otherwise. Novelty in the answer carries marks.

1. Given a point set P , we would like to perform a k -median clustering of it, where we are allowed to ignore m of the points. These m points are *outliers* which we would like to ignore since they represent irrelevant data. Unfortunately, we do not know the m outliers in advance. It is natural to conjecture that one can perform a local search for the optimal solution. Here one maintains a set of k centers and a set of m outliers. At every point in time the algorithm moves one of the centers or the outliers if it improves the solution.

Show that local search does not work for this problem; namely, the approximation factor is not a constant. [15 Marks]

2. Show that Sauer's lemma is tight. Specifically, provide a finite range space that has the number of ranges as claimed by the lemma. [15 Marks]

3. Given a set of n unit disks \mathcal{S} in the plane, we are interested in the problem of computing the minimum length TSP that visits all the disks. Here, the tour has to intersect each disk somewhere.

1. Let P be the set of centers of the disks of \mathcal{S} . Show how to get a constant factor approximation for the case that $\text{diam}(P) \leq 1$. [10 Marks]

2. Extend the above algorithm to the general case. [10 Marks]