CS345: Design and Analysis of Algorithms

Assignment 3

Due Date: 14th October

Total Number of Pages: 1 Total Points 20

Instructions-

1. For submission typeset the solution to each problem and compile them in a single pdf file. Hand-written solutions will not be accepted. You can use LaTeX or Word for typesetting.
2. Start each problem from a new page. Write down your Name, Roll number and problem number clearly for each problem.
3. For each question, give the pseudo-code of the algorithm with a clear description of the algorithm. Unclear description will receive less marks. Less optimal solutions will receive only partial marks.
4. Assume that sorting would have $O(n \log n)$ complexity.

Question 1. (10 points) There are n buses in a town and k stations. The position of each bus is specified by its (x, y) coordinates in the plane. Also, the position of each station is specified by its (x, y) coordinates.

For each bus, we wish to connect it to exactly one of the k stations. Our choice of connections is constrained in the following ways. There is a range-parameter r and a capacity parameter L. A bus can only be connected to a station that is within distance r, and no more than L buses can be connected to any single station.

Your goal is to design a polynomial time algorithm for the following problem. Given the position of a set of buses and a set of stations, as well as the range and load parameters, decide whether every bus can be connected simultaneously to a station, subject to the range and load conditions in the previous paragraph.

Question 2. (10 points) Let $G = (V, E)$ be a directed graph on n vertices and m edges. There are two vertices s, t in V . Two paths from s and t are said to be vertex disjoint if they do not share any vertex except s and t. Design a polynomial time algorithm to compute the maximum number of vertex disjoint paths from s to t.

Hint: Make use of the algorithm for edge-disjoint paths after a suitable modification on G.