

Programming Assignment 5 - Rishab Dudhia (SID: 862141444)

- a. To solve this problem, I took in the input of the graph and stored it as an adjacency list. Then, passing in the adjacency list, a vector initialized to infinity with n elements to represent the tentative distances from the starting point, start and end points, and the max distance value (infinity). Beginning with the starting node, we put its tentative distance to zero and add it to the vector Q which contains nodes that have been visited but not settled. Then we enter the while loop which terminates when Q is empty at the end of the while loop. We mark the node in Q with the smallest tentative distance as current and remove it from Q (in the beginning starting will be removed leaving Q to be empty) and add current to the vector of settled nodes. Then we run the final for loop of Dijkstra's algorithm which takes the current node and checks all of its neighbors. If the neighbors have never been checked (tent dist is still infinity) the tent distance will be the weight of the edge from current to neighbor plus the tentative distance of current. If the neighbor has already been checked, we see if it is settled or if we can rest the tentative distance of the neighbor. The loop runs until Q is empty. Finally, we return the element in the tentative distance vector that represents the destination node.
- b. Using the same input storage as part a, we pass in the same graph, tentative distance vector, and max length to our function MakeMST. We choose to pass in node 0 as the starting node but this can be changed to any node. Then we run Prim's algorithm in our MakeMST function. Similarly to part a we have a settled vector, however this time we initialize the size to the number of nodes and initialize the values to 0, representing not settled. We also have a vector Q which will act exactly as it did in part a. Then we extract the current node in Q and add its neighbors to Q or rest their tentative distances if they

are already in Q . The current node's respective value in the settled vector is changed to one when the node is removed from Q , and the node in Q with the lowest weight will become the new current node in the next iteration of the while loop. This continues until Q is empty. Then we return the sum of all the values in the tentative distances vector.