

Design and Analysis of Algorithms

Assignment 2

Semester: Spring 2023

Submission Date & Time: Sunday 09 July 2023 @ Time: 11:55PM

Total Marks: 10

Assignment Description

Please find the attached files containing “Pakistan Road Network” and “Distances city to city”. The “Pakistan Road Network” file contains 102 cities of Pakistan and showing road network connection among cities to cities. However, the distance is not mentioned over the edge that connects two cities. As shown in the figure below,



Figure 1: Pakistan Road Network

The “Distance city to city” file contains a chart that showing the distance of major cities of Pakistan to other cities. However, the chart is incomplete because it does not cover all cities of Pakistan. For example, Gilgit to Jaglot distance is not in the chart but you can compute the driving distance between two cities from following website,

	Karachi	Lahore	Faisalabad	Rawalpindi	Multan	Hyderabad	Gujranwala	Peshawar	Sheikhupura
Karachi		1234 km	1138 km	1477 km	888 km	163 km	1347 km	1370 km	1307 km
Lahore	1234 km		185 km	380 km	356 km	2137 km	71 km	512 km	43 km
Faisalabad	1138 km	185 km		325 km	259 km	1025 km	171 km	460 km	138 km
Rawalpindi	1477 km	380 km	325 km		555 km	1411 km	211 km	183 km	336 km
Multan	888 km	356 km	259 km	555 km		1691 km	418 km	687 km	367 km
Hyderabad	163 km	2137 km	1025 km	1411 km	1691 km		1239 km	1814 km	1159 km
Gujranwala	1347 km	71 km	171 km	211 km	418 km	1239 km		935 km	87 km
Peshawar	1370 km	512 km	460 km	183 km	687 km	1814 km	935 km		475 km
Sheikhupura	1307 km	43 km	138 km	336 km	367 km	1159 km	87 km	475 km	
Quetta	700 km	969 km	1122 km	1091 km	586 km	879 km	1228 km	840 km	919 km
Islamabad	1479 km	378 km	328 km	16 km	570 km	1323 km	220 km	185 km	340 km
Sargodha	1164 km	188 km	92 km	249 km	274 km	1786 km	175 km	385 km	158 km
Sialkot	1637 km	127 km	264 km	220 km	462 km	1424 km	55 km	398 km	140 km
Gujrat	1395 km	122 km	261 km	164 km	399 km	1246 km	50 km	341 km	108 km
Dera Ghazi Khan	863 km	496 km	332 km	626 km	98 km	702 km	499 km	510 km	462 km
Sahiwal	1115 km	171 km	93 km	529 km	175 km	958 km	241 km	604 km	291 km
Chiniot	1199 km	156 km	39 km	286 km	246 km	1038 km	521 km	459 km	122 km
Khanewal	993 km	295 km	206 km	531 km	64 km	875 km	360 km	665 km	415 km

https://distancecalculator.globefeed.com/Pakistan_Distance_Calculator.asp

Figure 2: Distance city to city

Task to do.

1. Prepare an Excel sheet that covers all cities of Pakistan (e.g., 102 cities) and their driving distances from city to city. For example,

City1	City2	Driving Distance (KM)
Gilgit	Jaglot	54.01
Jaglot	Dasu	132.92
Jaglot	Skardu	343.06

This chart will help you to create edge distances on each connected line from one city to the other.

2. Design (e.g., Pseudo code and formal Algo) and Implement (In Python) an algorithm that takes two cities of Pakistan and show you the all routs with their distances that connect the two cities by different paths (you can use Floyd's algorithms to discover the all possible interconnected paths) and also compute the shortest path to travel.
3. Suppose PTCL wants to lay down a Fiber optics communication network across the Pakistan that connects all cities but use minimum fiber optics cable, because it is expensive. You have to design a Minimum Spanning Tree (MST) using algorithms that you studied in the classroom (e.g., Prim, Kruskal, and Dijkstra). You will use your excel sheet or CSV file for generating graphs (e.g., vertices and edges) that will help you to create MST and shortest length of the cable.