METU Dept. of Computer Engineering - CENG315
Fall 2013-2014 – Homework 3
(Deadline: 23th December 2013, Monday)

December 14, 2013

1 Problem Definition

In this assignment, you are employed by the mayor of a metropolitan city as a computer engineer. As one of his election promises, he rolled up on his sleeves for the construction of an underground railway system which connects the central locations of the city. However, construction of a railway system is very costly and since he is expected to fulfill other promises, finding the most cost efficient routes for the railway system is crucial. Your job is to find these routes by connecting adjacent locations with railways.

Between some locations that are not necessarily adjacent, the traffic might be too heavy. In finding the best railway system, you should guarantee that such pairs of locations with heavy traffic between them are connected (via possibly other intermediate locations) with shortest possible route.

Given the distance between adjacent locations, your task is to find the railway system with minimum total length by also taking into consideration the heavy traffic constraint.

2 Input and Output Specifications

From a file named "hw3.inp", you are going to read the number of central locations (N), the number of practicable railway segments (M), the number of pairs with heavy traffic (K), name of each central location, end points of practicable railway segments and their expected lengths and pairs with heavy traffic. Paremeters N, M, K are integers, names are strings and lengths are real numbers (use double data type):

$N\ M\ K$
$location_1$
$location_2$
$\vdots$
$location_N$
$location_{i11}\ location_{i12}\ length_1$
$location_{i21}\ location_{i22}\ length_2$
$\vdots$
$location_{iM1}\ location_{iM2}\ length_M$
$location_{j11}\ location_{j12}$
$location_{j21}\ location_{j22}$
$\vdots$
$location_{jK1}\ location_{jK2}$

To a file named "hw3.out", just write the segments to be constructed:

$location_{t11}$ $location_{t12}$
$location_{t21}$ $location_{t22}$
$\vdots$
$location_{t(N-1)1}$ $location_{t(N-1)2}$

3 Example

Content of an example hw3.inp:

8 10 1
A
B
C
D
E
F
G
H
A B 6
B C 7
A E 2
E D 2
C D 8
E F 1
G D 2
F G 1
H F 1
H G 2
A C

Content of the corresponding "hw3.out":

A B
D C
A E
E D
E F
F G
H F

4 Other Instructions

- Railway system is bidirectional.
- All the work should be done individually. Your homeworks will be checked for cheating.
- Submit a single file called "hw3.cpp" through the COW system.
- You are not allowed to use the algorithms library or any external library for graph algorithms.

- For some cases, paramater K can be zero.
- In the output, pairwise ordering of locations for each segment and between segment ordering are not important.
- There will be a unique solution for each input.
- Since black box evaluation method is going to be used, be careful about input/output specifications. You should use space as a delimiter and do not print any unnecessary characters, white spaces etc.