

5 Warp Gates

Assume that humanity has learned to travel among the stars. However, as it is clearly impossible to violate relativity, humans must travel through hyperspace in order to cover the interstellar distances. To this end, warp gates need to be constructed. However, there are serious restrictions on how many gates can be constructed and where.

Because of their expense, the Galactic Council will only allow you to construct a maximum of k gates throughout the galaxy (where k will be a parameter that will be passed to you). Also, because of the physics of hyperspace travel, warp gates can only be constructed within a small fixed distance d of wormholes in space.

It is possible to warp from any warp gate to any other warp gate instantly. You should think of the distance from one warp gate to another as being 0. However, it is important to note that the shortest distance between two stars may *not* pass through a warp gate at all.

Your overall goal will be to minimize the worst case travel time between any two stars in the galaxy. All spaceships in humanity's fleet travel at the same constant velocity.

You will be given a star map of the entire galaxy and the parameters k and d in a text file called `galaxy.txt`. The first two lines will be the values of k and d respectively. The first will be a positive integer and the second will be a double precision floating point number. The rest of the lines in the file will be points in three-dimensional space, one point per line; each represents the center of a star in three dimensional space. The second file you will be given will be called `wormholes.txt`. This file will hold the three-dimensional coordinates of the positions of the wormholes, one point per line as in the `galaxy.txt` file.

Your output file `warp.txt` will consist of exactly k points, one per line as above. Each line will correspond to the position of a single warp gate. Each of these points must be within a distance d of a wormhole. Your grade will be based on the worst case travel time between any two stars in the galaxy, given your selection of gate locations.