ADS HOMEWORK 12

Problem 12.1

The algorithm proposed by the friend does not work. We will show this by a counterexample:

Let us consider a graph with three vertices and different connecting edge lengths. Let us label the vertices as 1, 2 and 3. Let us assume the distance from 1 to 2 to be 2 and for 2 to 3 to be 2 as well and the distance between 1 and 3 to be 6. Let us add a constant k. At first the shortest distance from 1 to 3 was (1 to 2 then to 3) which is 4 but after we add k it will be 4+2*k and the path from 1 to 3 will have distance 6+k. The distance between the nodes will increase which will counteract the intended shortest path outcome and even increase the original path distance between the nodes at larger k. This will have very negative effects and could also possibly make the original path even longer. As a result, this implementation to find the shortest path between the nodes is not optimal and the algorithm will not work.

Problem 12.3

A) Graph Representation:

The graph will be formed as a square matrix of size y^2 (y is the size of the board). The numbers entered as the puzzle values will be the nodes. They will be assigned indices from 0 to y^2-1. The graph matrix will be initialized as zero at first and a cell in the graph matrix G_{ij} is assigned the value 1 if a path exists from the values at indices i and j. The edges will be the connections between any two i and j where a path exists and will be used to form the shortest path. Finally, the shortest path (if it exists or if there is a solution) will be determined from the starting point of the game to the ending point based on the rules of the game.