

LAB Assignment 10

CS205

Topic: Shortest Path

Lab Assignment: a,b

- a) In a city, there are multiple regions from people of different clans. All the regions have a name and color(out of three colors i.e. red, green, blue). The roads connecting these nodes are created according to the name of these regions. If the number of common characters between two regions is ≥ 2 , then there is a road. The road cost is calculated as sum of the total number of characters in both the names. For example: a region has name 'alpha' and another region has name 'betaa'. The direction of the road will be from 'alpha' to 'betaa' as per the lexicographic order of the first character of the name of region. Number of common characters is 2, so there will be a road in the same direction. The weight, representing the cost of the path of the edge will be $5+5=10$. Due to differences among some regions, few roads are marked as expensive depending upon the color of the region. For example, road that goes from green to blue are expensive, so you need to spend double for these roads. Additionally, few roads are cheaper like. a road between same color regions. The cost of these roads is negated cost of the calculated cost. For example, if the computed cost between two regions of the same colour is 10 then it will be negated and final cost will be considered as -10. Due to presence of negative cost roads, there is a chance of negative cycle. A negative cycle is one where total cost of a cycle is negative. Take input from user the number of regions, name of regions and color of regions and construct a graph. Print whether there is a negative cycle or not. NOTE: Final graph might be either connected or disconnected.

Input Format:

Number of regions: n

Next n line read following details

Name of the region, color of the region

Output Format: If there is any negative cycle then find out the cycle and print edges of that cycle in following style

V1->V2->V3->....->Vn->V1

Upload Ass10a.c

- b) The Reliance brothers have expanded their airline into outer space! They have a list of the f flights operated between the n spaceports in the solar system, where each flight is defined by a source spaceport, a destination spaceport, and the number of minutes of flying time. Unlike in PS6, flying times are now listed as arbitrary positive numbers, not restricted to bounded integers. But just like PS6, the flying time of a sequence of flights is the sum of the flying times of each flight in the sequence ignoring layovers. The Reliance brothers have discovered wormholes in deep space that take negative time to traverse! As a result, some of their new Negative Class flights take negative time to fly, but by the Consistent Timeline Hypothesis, they know they can never travel back in time to the same location.

The Reliance brothers want to move their headquarters somewhere else in the universe. They would like to choose somewhere that minimizes their average flying time to any other destination (still allowing Negative Class flights). Help the Reliance brothers find the spaceport that minimizes the sum of the minimum flying times to all other spaceports.

Hints:

Construct a weighted, directed graph G with a vertex for each of the n spaceports, and a directed edge for each of f flights connecting from its source spaceport to destination spaceport, weighted by the flight time. Since the graph has both positive and negative weights, we find the shortest path length between each pair of cities using Johnson's Algorithm. For each city, compute the sum of the shortest paths to all the other cities, and return any city which minimizes this quantity.

Upload Ass10b.c