Problem 3 - Trains

Problem: The local commuter railroad services a number of towns in Kiwiland. Because of monetary concerns, all of the tracks are 'one-way.' That is, a route from Kaitaia to Invercargill does not imply the existence of a route from Invercargill to Kaitaia. In fact, even if both of these routes do happen to exist, they are distinct and are not necessarily the same distance!

The purpose of this problem is to help the railroad provide its customers with information about the routes. In particular, you will compute the distance along a certain route, the number of different routes between two towns, and the shortest route between two towns.

Input: A directed graph where a node represents a town and an edge represents a route between two towns. The weighting of the edge represents the distance between the two towns. A given route will never appear more than once, and for a given route, the starting and ending town will not be the same town.

Output: For test input 1 through 5, if no such route exists, output 'NO SUCH ROUTE'. Otherwise, follow the route as given; do not make any extra stops! For example, the first problem means to start at city A, then travel directly to city B (a distance of 5), then directly to city C (a distance of 4).

1. The distance of the route A-B-C.

2. The distance of the route A-D.

3. The distance of the route A-D-C.

4. The distance of the route A-E-B-C-D.

5. The distance of the route A-E-D.

6. The number of trips starting at C and ending at C with a maximum of 3 stops. In the sample data below, there are two such trips: C-D-C (2 stops). and C-E-B-C (3 stops).

7. The number of trips starting at A and ending at C with exactly 4 stops. In the sample data below, there are three such trips: A to C (via B,C,D); A to C (via D,C,D); and A to C (via D,E,B).

8. The length of the shortest route (in terms of distance to travel) from A to C.

9. The length of the shortest route (in terms of distance to travel) from B to B.

10. The number of different routes from C to C with a distance of less than 30. In the sample data, the trips are: CDC, CEBC, CEBCDC, CDCEBC, CDEBC, CEBCEBC, CEBCEBCEBC.

Test Input:

For the test input, the towns are named using the first few letters of the alphabet from A to D. A route between two towns (A to B) with a distance of 5 is represented as AB5.

Graph: AB5, BC4, CD8, DC8, DE6, AD5, CE2, EB3, AE7

Expected Output:

Output #1: 9

Output #2: 5

Output #3: 13

Output #4: 22

Output #5: NO SUCH ROUTE

Output #6: 2

Output #7: 3

Output #8: 9

Output #9: 9

Output #10: 7

Part 2 (THIS PART OF THE QUESTION IS NOT SENT OUT, IT'S FOR IN OFFICE USE, MAINLY IN INDIA)

A train travelling along any given route will stop in a station for two minutes. Assuming one unit of distance travelled takes 1 minute, the 10 questions in Part 1 have been added to to include duration.

1. The duration of the route A-B-C.

2. The duration of the route A-D.

3. The duration of the route A-D-C.

4. The duration of the route A-E-B-C-D.

5. The duration of the route A-E-D.

6. The number of trips starting at C and ending at C with a maximum duration of 30 minutes. In the sample data below, there are four such trips: C-D-C (18), C-E-B-C (13), C-D-E-B-C (27) and C-E-B-C-E-B-C (28)

7. The number of trips starting at A and ending at C with a duration of exactly 30. In the sample data below, there is one such trip: A-D-C-E-B-C

8. The duration of the quickest route from A to C.

9. The duration of the quickest route from B to B.

10. The number of different routes from C to C with a duration of less than 35. In the sample data, the trips are: CDC, CEBC, CEBCDC, CDCEBC, CDEBC, CEBCEBC.

Expected output:

Output #1: 11

Output #2: 5

Output #3: 15

Output #4: 28

Output #5: NO SUCH ROUTE

Output #6: 4

Output #7: 1

Output #8: 11

Output #9: 13

Output #10: 6