EE599 FINAL PROJECT TROJANMAP

GROUP NAME: RUNTIME TERROR

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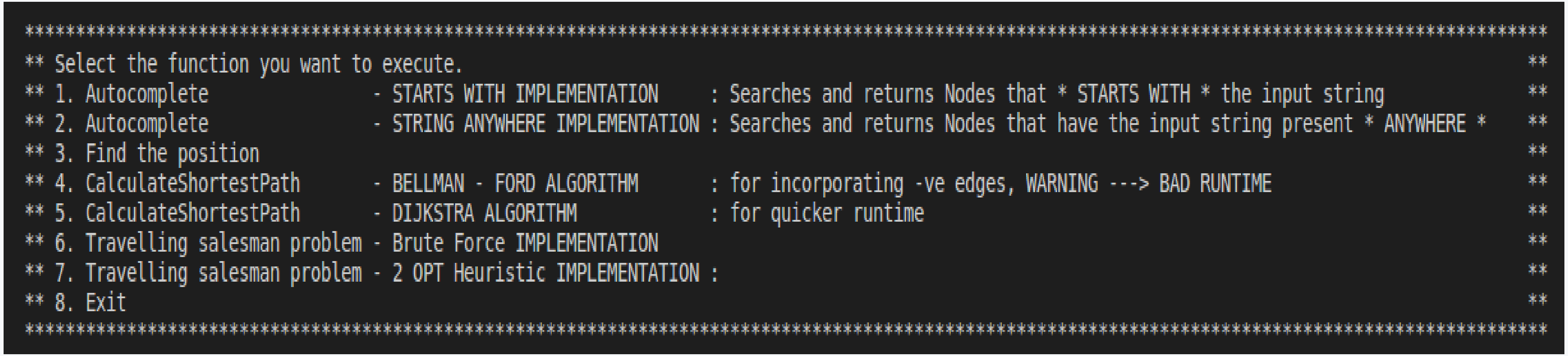
MAIN MENU

Modifying the Menu to incorporate all the helper functions

Modified the code for user adaptability.



```
****************************************************************************************************************************************************
** Select the function you want to execute.                                                                                                       **
** 1. Autocomplete                - STARTS WITH IMPLEMENTATION     : Searches and returns Nodes that * STARTS WITH * the input string            **
** 2. Autocomplete                - STRING ANYWHERE IMPLEMENTATION : Searches and returns Nodes that have the input string present * ANYWHERE *  **
** 3. Find the position                                                                                                                           **
** 4. CalculateShortestPath       - BELLMAN - FORD ALGORITHM       : for incorporating -ve edges, WARNING ---> BAD RUNTIME                        **
** 5. CalculateShortestPath       - DIJKSTRA ALGORITHM             : for quicker runtime                                                          **
** 6. Travelling salesman problem - Brute Force IMPLEMENTATION                                                                                    **
** 7. Travelling salesman problem - 2 OPT Heuristic IMPLEMENTATION :                                                                              **
** 8. Exit                                                                                                                                        **
****************************************************************************************************************************************************
```

AUTO COMPLETE

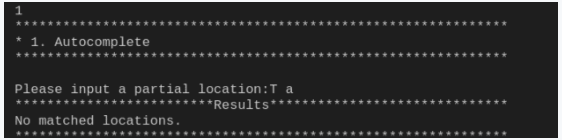
Generating all the possible Nodes, according to the partial search data

Case Sensitivity, Starts with

Added Functionality: String anywhere in the Nodes

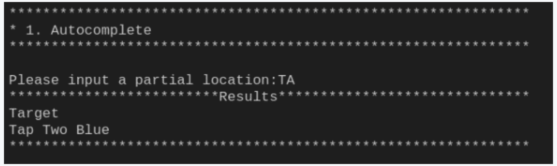
Time complexity: O(n) - Vectors

Corner Cases – empty strings, unknown strings



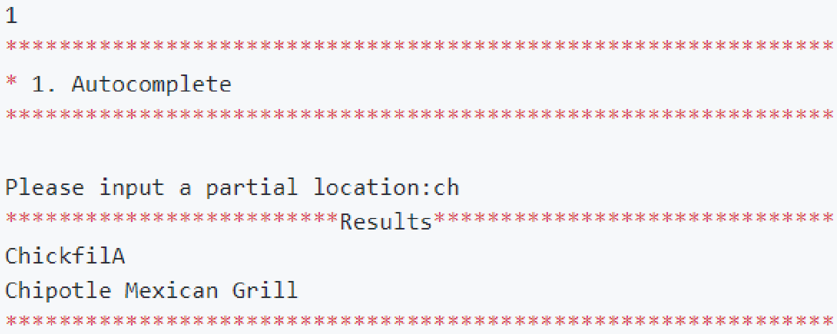
```
1
***************************************************************
* 1. Autocomplete
***************************************************************

Please input a partial location:T a
************************Results*****************************
No matched locations.
***************************************************************
```



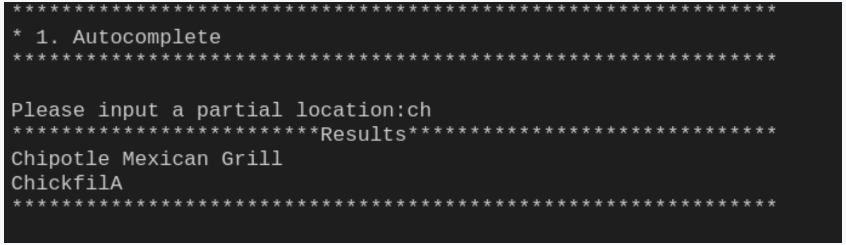
```
***************************************************************
* 1. Autocomplete
***************************************************************

Please input a partial location:TA
************************Results*****************************
Target
Tap Two Blue
***************************************************************
```



```
1
***************************************************************
* 1. Autocomplete
***************************************************************

Please input a partial location:ch
*************************Results******************************
ChickfilA
Chipotle Mexican Grill
***************************************************************
```



```
***************************************************************
* 1. Autocomplete
***************************************************************

Please input a partial location:ch
*************************Results******************************
Chipotle Mexican Grill
ChickfilA
***************************************************************
```

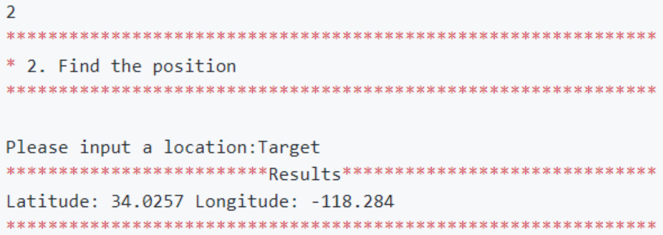
GET POSITION

Returning Position (Latitude and Longitude) for a given Nodes

Matches exact Output mentioned

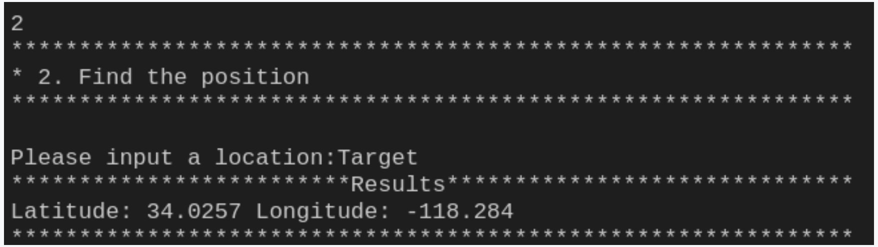
Runtime : O(logn) - Maps

Corner Cases – empty, unknown strings



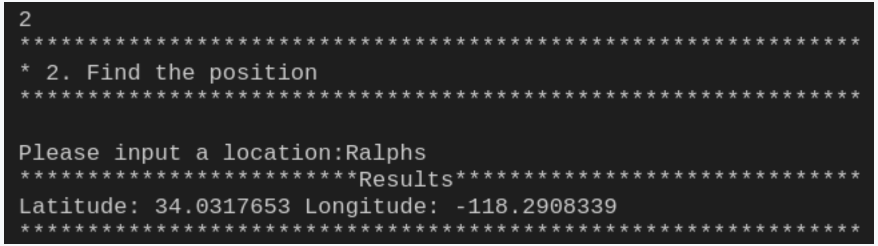
```
2
**************************************************************
* 2. Find the position
**************************************************************

Please input a location:Target
*************************Results******************************
Latitude: 34.0257 Longitude: -118.284
**************************************************************
```



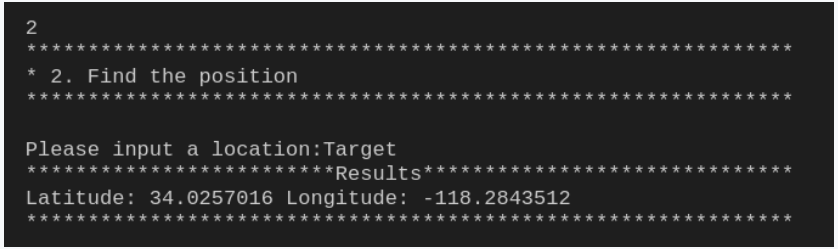
```
2
**************************************************************
* 2. Find the position
**************************************************************

Please input a location:Target
*************************Results******************************
Latitude: 34.0257 Longitude: -118.284
**************************************************************
```



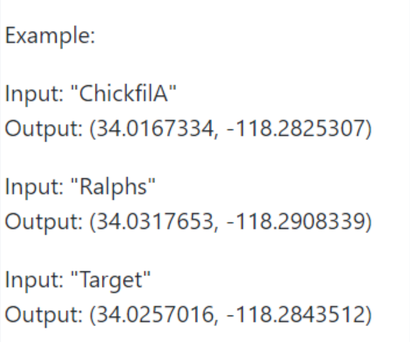
```
2
**************************************************************
* 2. Find the position
**************************************************************

Please input a location:Ralphs
*************************Results******************************
Latitude: 34.0317653 Longitude: -118.2908339
**************************************************************
```



```
2
**************************************************************
* 2. Find the position
**************************************************************

Please input a location:Target
*************************Results******************************
Latitude: 34.0257016 Longitude: -118.2843512
**************************************************************
```



Example:

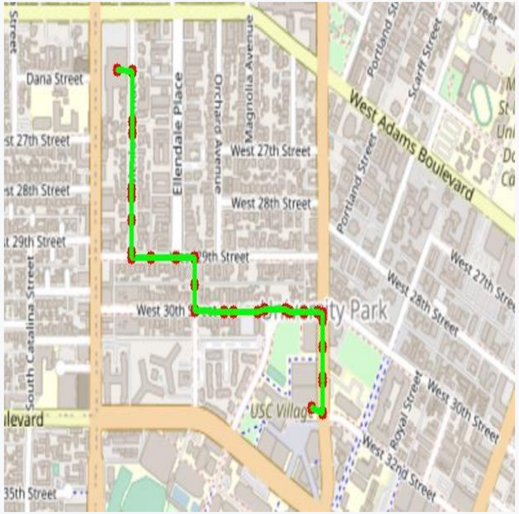
Input: "ChickfilA"
Output: (34.0167334, -118.2825307)

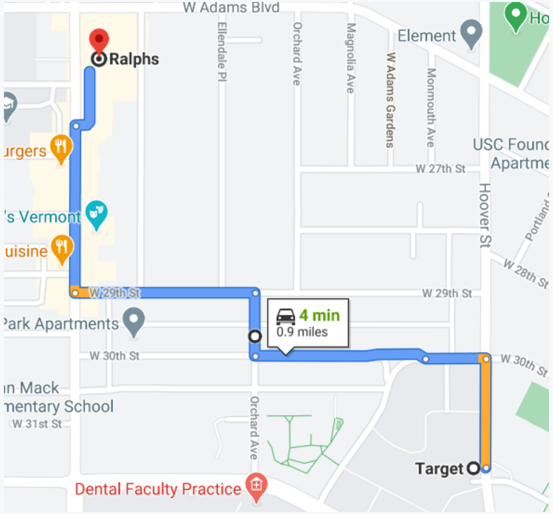
Input: "Ralphs"
Output: (34.0317653, -118.2908339)

Input: "Target"
Output: (34.0257016, -118.2843512)

SHORTEST PATH ALGORITHM(DIJKSTRA’S ALGORITHM)

- Min heap implementation helped to get the shortest path in a greedy manner, because in each step we pick the vertex with minimum distance from current vertex.
- Feed Distance, and Nodes to the Priority Queue. And receive the min distance node → from the top of the priority Queue.
- Time Complexity: O(m+logn) - Priority Queue
- Corner Cases: empty location id, unknown location id
- Comparison with google maps(next slide)





SHORTEST PATH ALGORITHM(BELLMAN FORD'S ALGORITHM)

- Recursive algorithm iterating all the edges in the graph.
- Time Complexity: O(m*n) – 2D vectors
- Corner Cases: empty location id, unknown location id
- Graph generated is like that of Dijkstra's.

TRAVELLING TROJAN (BRUTE FORCE - DFS)

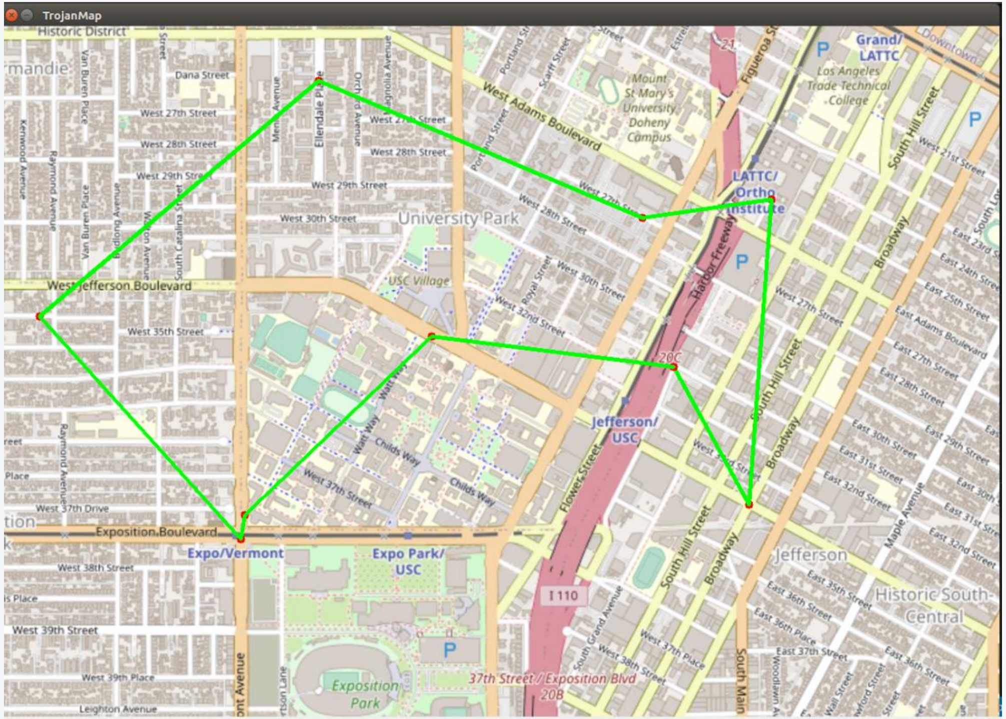
Returning Position (Latitude and Longitude) for a given Nodes

- In this method we try each and every possible permutations.
- Further, whenever the current path length is larger than the current optimal result, we need to return
- Graph data structure is used, and that graph is a cyclic one meaning that the starting point and the ending point is the same. Note, any point can be selected as a starting point.
- Finally after calculating the weight, we return the most minimum weight of all.
- Time complexity: O(n!)
- Not good for large data sets as the time to execute the code is very large

TRAVELLING TROJAN (OUTPUT - BRUTE FORCE - DFS)

Returning Position (Latitude and Longitude) for a given Nodes

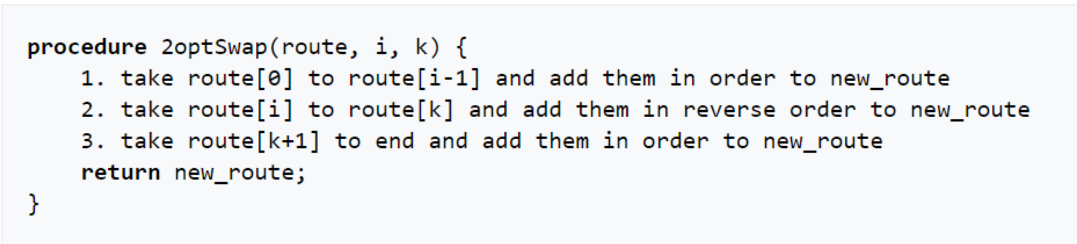
- Below is one such output from our implementation with the number of locations as ‘9’.



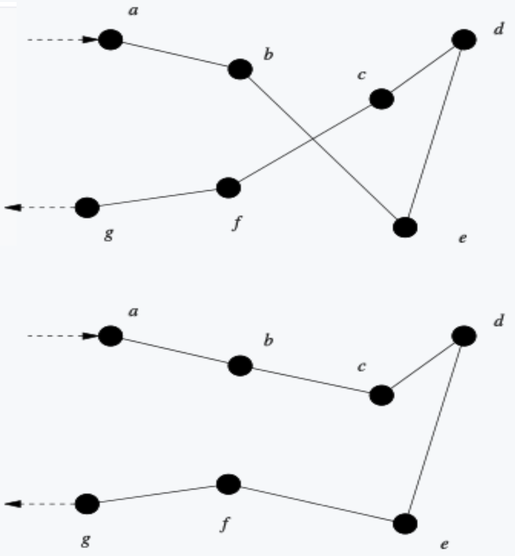
TRAVELLING TROJAN(2-OPT HEURISTIC)

Returning Position (Latitude and Longitude) for a given Nodes

- This method is a heuristic one as we keep swapping the nodes till the time there is no improvement.
- The time complexity is: O(n^2)
- Time taken of large sets of input locations is very less compared to that of brute force.



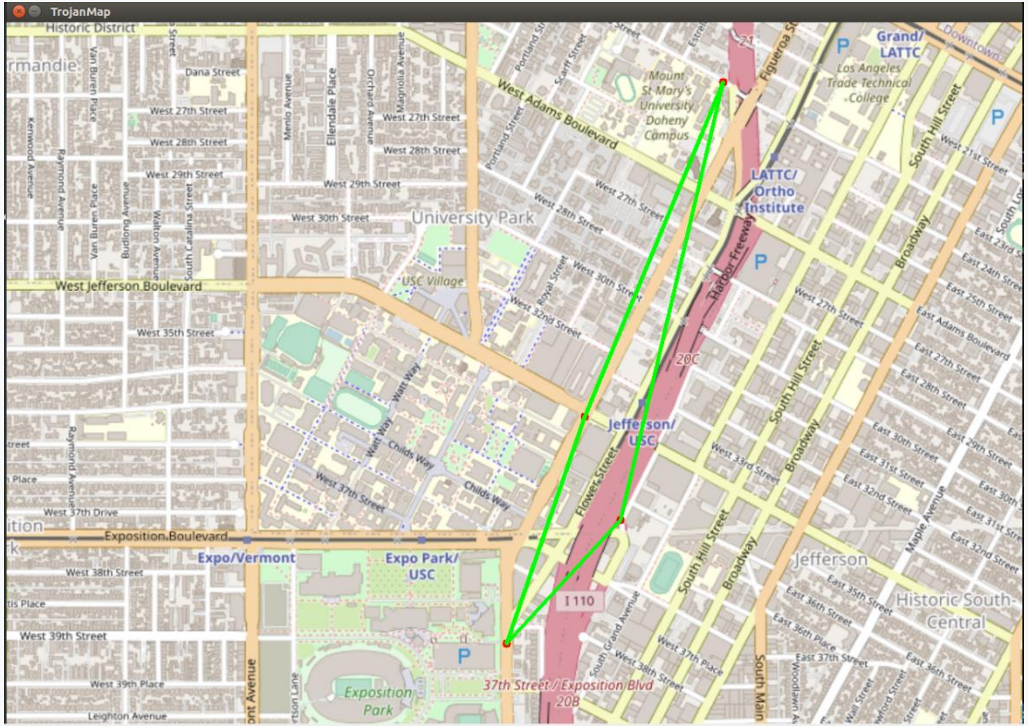
```
procedure 2optSwap(route, i, k) {
    1. take route[0] to route[i-1] and add them in order to new_route
    2. take route[i] to route[k] and add them in reverse order to new_route
    3. take route[k+1] to end and add them in order to new_route
    return new_route;
}
```



Ref: https://en.wikipedia.org/wiki/2-opt

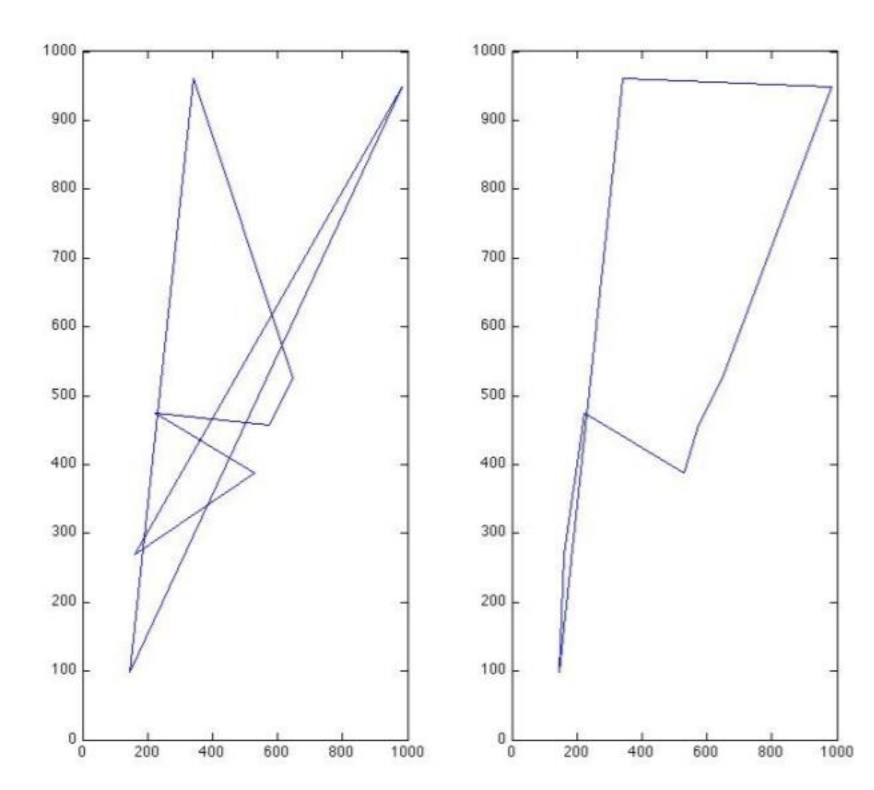
TRAVELLING TROJAN(OUTPUT – 2_OPT HEURISTIC)

- Below is the output of our one such implementation with number of locations as ‘4’.



TRAVELLING TROJAN(COMPARISON: BRUTE FORCE VS 2_OPT)

Returning Position (Latitude and Longitude) for a given Nodes



Shortest Path – Bellman Ford	127 sec
Shortest Path – Dijkstra Algorithm	0.2 sec

Travelling Trojan – Brute Force	0.314 sec
Travelling Trojan – 2 OPT	0.02 sec

Ref: http://cs.indstate.edu/~zeeshan/aman.pdf

Thank You

SAFE TOGETHER

TROJAN FAMILY

WE FIGHT
AS ONE

USC University of Southern California