CPSC 535 Advanced Algorithms

Project 1: Electric Car Traveler

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Summary

This project has been implemented using python 3.8.2. We installed python from https://www.python.org/downloads/. We used visual studio code as our IDE. The code is expecting 3 inputs, capacity integer, comma-separated name of cities and distance between each city.

Pseudocode

1. Take cities and distance inputs from the user and put in the array
2. Take c capacity input from user

3. if c < distance[0]:
   return 'Fuel capacity low, cant complete journey'
4. available capacity = c - distance[0]
   Initialize a pointer j=1 which points to the current cities

5. While (j< len (cities)-1 && cities! =0)
   if distance[j] * 2 <= available capacity:
   available capacity = available capacity - distance[j]
   j++
   else
   append traversed cities to the output array
   make available capacity = c
   if j != len(distance)-1 and availCap < distance[j+1] * 2:
   return "Cant travel to next city after city:" +cities[j]

6. Append last stop in list
7. Print output array

How to execute code

To execute code, we need to navigate to the code directory, which in this case is *Users/JanhviGuha/Desktop*, and then execute the code in the terminal using the command *python3 electriccar.py* and then provide all the required inputs in order to get output.

Code

```
#cities[str]: entered by user comma separated
#distance[int]:integer distance from city 0 to city 1....city N
#c: capacity of the electric car to travel in full tank
def electricCar(cities: list[str],distance: list[int],c: int) -> list[str]:
    #Initializing and additng the starting city in the output Traversed array
    traversed = [cities[0]]
    c = int(c)
    #if the distance from city 0 to city 1 is less than capacity
    if len(distance) >0 and c < distance[0]:
        return 'Fuel capacity low, cant complete journey'
    #Available capacity after subtracting the distance of city 0
    availCap = c - distance[0]
    j = 1
    #while we have not traversed all the cities Do
    while j < len(cities)-1:
        # calculate if we can travel to next city and come back if pump is broken
        if distance[j] * 2 <= availCap:
            #decrease capacity and increase pointer to next city
            availCap -= distance[j]
            j+=1
        else:
            #if we dont have capacity to go to next city and come back then refill on current city
            traversed.append(cities[j])
            #restore capacity
            availCap = c
            #if after refilling also the capacity is not enough to reach next city then return error msg
            if j != len(distance)-1 and availCap < distance[j+1] * 2:
                return "Cant travel to next city after city:" +cities[j]
    #add the last city to traversed list
    traversed.append(cities[-1])
    #return result
    return traversed

cap = input('please enter capicity of car: ')
cityList = input("please Enter cities (Comma Separated): ")
cityList = cityList.split(",")
distanceList = []
for i in range(1,len(cityList)):
```

```
    distanceList.append(int(input("please enter distance from city " +cityList[i-1]+ " to city "+
cityList[i] + ": ")))

print("The miniumum number of stops to reach the destination is : "
,electricCar(cityList,distanceList,cap))
```

Time Complexity

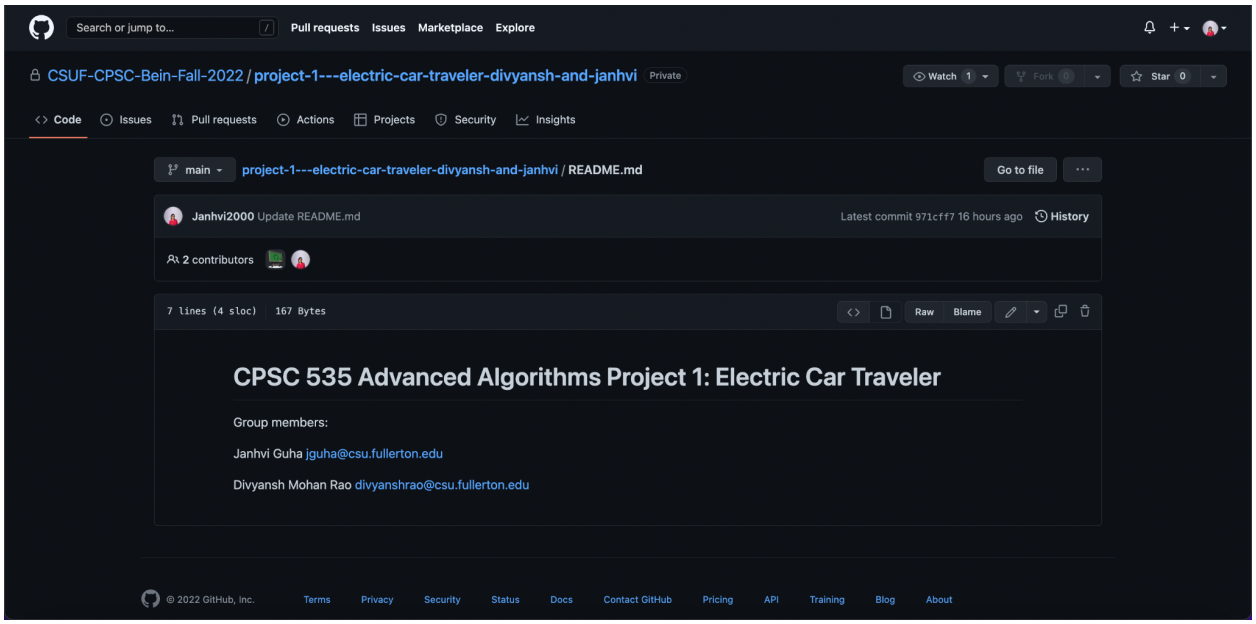
The time complexity of this algorithm is asymptotically O(n) because the while loop will run for n-2 unit of time in worst case.

Space complexity

The space complexity of this algorithm will be equal to size N in worst case when all cities needs to traverse.

Corner Cases

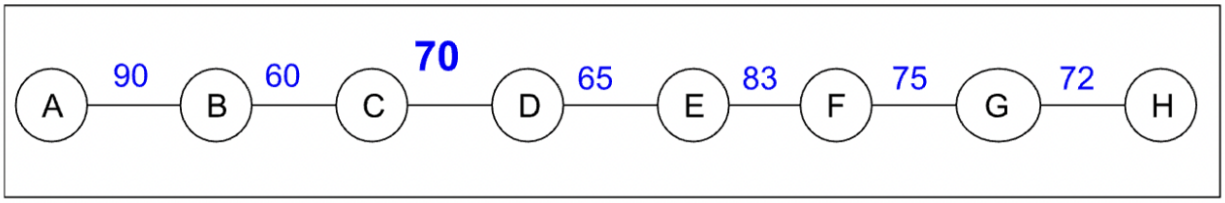
1) If the capacity of the car is less than distance between the first city and second city, then return appropriate error msg
2) If the capacity of the car even after refill is not able to reach the next city and back, then show appropriate error msg



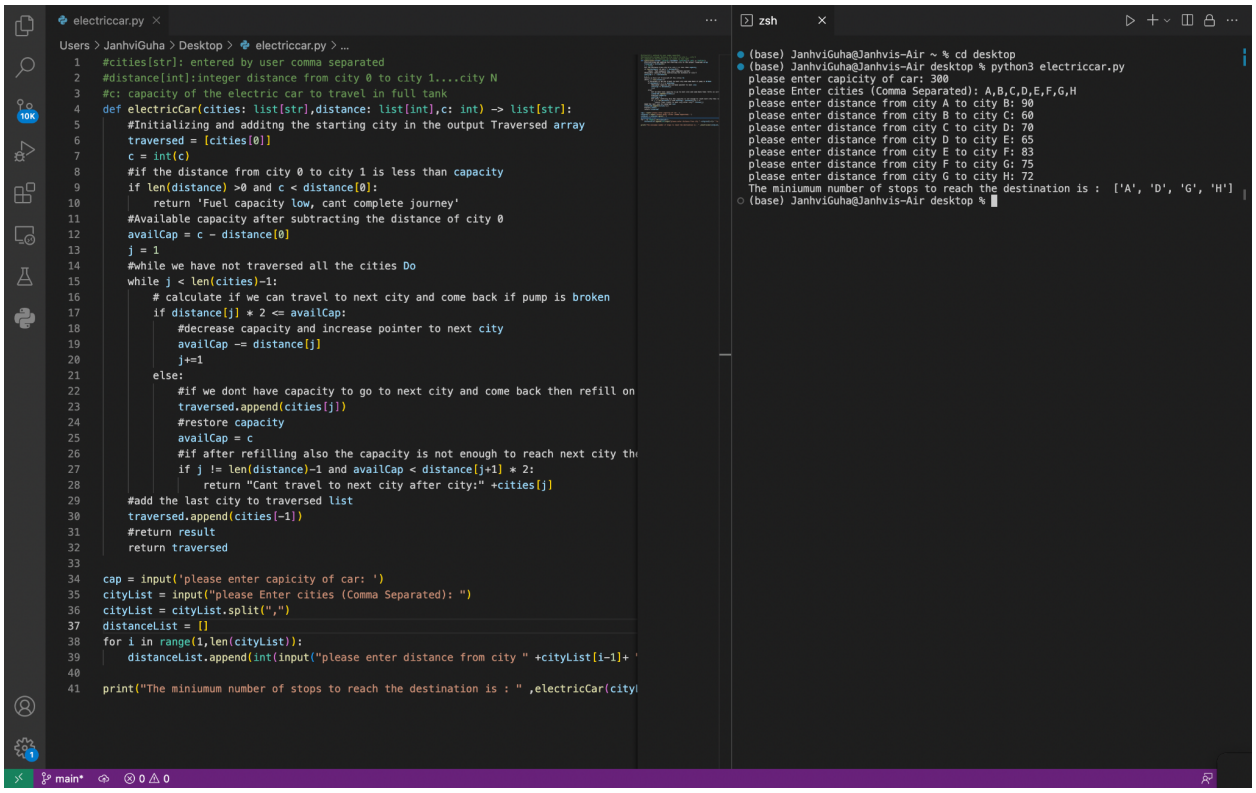
Test Cases

Case 1:

Input:

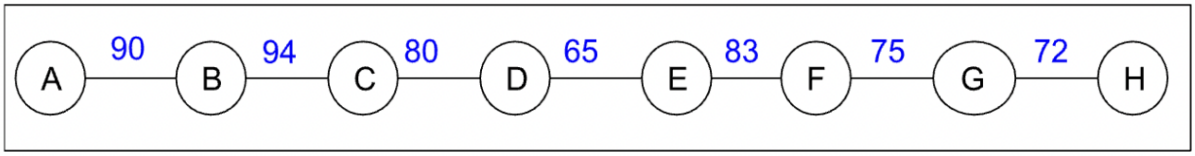


Output:

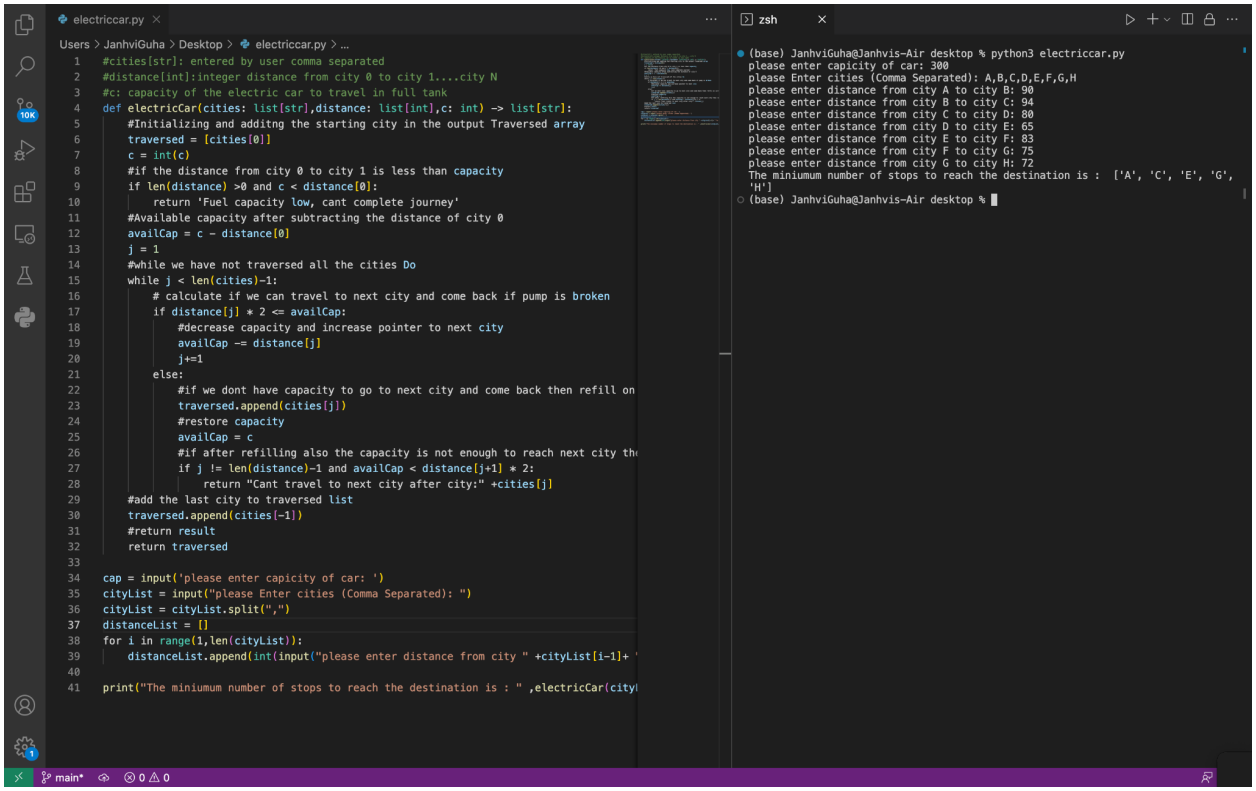


Case 2:

Input:

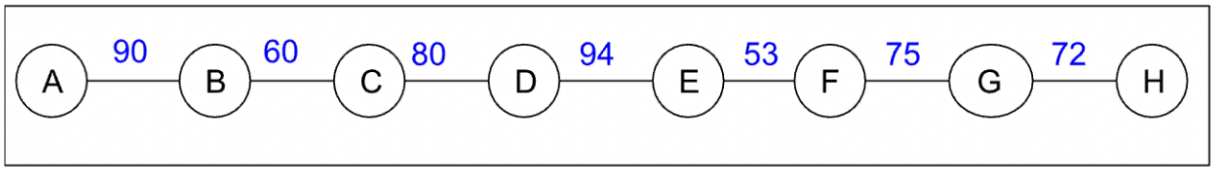


Output:



Case 3:

Input:



Output: