

CECS 451  
Assignment 1  
Total: 40 Points

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General Instruction

- Submit uncompressed file(s) in the Dropbox folder via BeachBoard (Not email).
  - Use **Python 3**, any other programming language is not acceptable.
  - You can import modules in the Python Standard Library (please check the full list *here*). If you want to use any other library, please consult with the instructor or TA.
  - Your submission may be evaluated automatically using a script file, so if would not follow the output format, you may receive zero point even though your program outputs correct answers.
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1. (40 points) Implement an optimal route finder program using **A\* algorithm**.

- Find `coordinates.txt` and `map.txt`. Figure 1 is attached for your information.
- `coordinates.txt` stores the longitude and latitude of each city.

City:(Longitude,Latitude)

- `map.txt` stores **actual** distances between connected cities in California. We assume each city is connected with limited number of nearby cities.

City-NearbyCity1(Distance),NearbyCity2(Distance),...

- You can compute the straight line distance between two cities using the Haversine formula.
  - You need to convert longitude and latitude to radian. ( $radian = \frac{\pi}{180} degree$ )
  - Let  $\varphi_1, \varphi_2$  be the latitude of point 1 and latitude of point 2 and  $\lambda_1, \lambda_2$  be the longitude of point 1 and longitude of point 2.
  - The straight line distance  $d$  is defined by

$$d = 2r \arcsin \left( \sqrt{\sin^2 \left( \frac{\varphi_2 - \varphi_1}{2} \right) + \cos \varphi_1 \cdot \cos \varphi_2 \cdot \sin^2 \left( \frac{\lambda_2 - \lambda_1}{2} \right)} \right)$$

, where  $r$  is the radius of the earth. Use  $r = 3,958.8$  mile.

- The program should be able to
  - parse `coordinates.txt` and `map.txt`
  - take a departing city and an arriving city as input arguments (an interactive style is not acceptable).
  - output an optimal route from the departing city to the arriving city.

vi. Please follow the output format below.

```
> python a-star.py SanFrancisco LongBeach
From city: SanFrancisco
To city: LongBeach
Best Route: SanFrancisco - SanJose - Fresno - LosAngeles - LongBeach
Total distance: 442 mi
```

vii. Submit a-star.py file.



Figure 1: A map of cities in California