DATA STRUCTURE AND ALTHOGITHMS

LAB 2:

RECURSION AND LINKED LIST

Today, ride hailing platforms are extremely popular with people. Many companies like Grab, Uber, … had succeeded in investing in this industry. Assuming that singly linked list is used to store a route from start to end, you have to complete all following tasks:

Task 1. Using `struct` to define a structure to store each *position* in one route (like a node in linked list). In each position, we have *latitude, longitude*, *point of time* (an integer, represents the number of milliseconds since midnight Jan 1, 1970).

Task 2.

2.1. Implement a function to append a position to route list with prototype:

```
void append(Position* &start, Position* new_position)
```

2.2. Implement a function to read data of one route from a CSV file, return a pointer to first element of position list (Sample file `sample.csv` is attached in lab directory). Prototype: `Position* readFromFile(string filename)`

Task 3.

Write a function to sort ascending position list by time.

Task 4.

Write a function to calculate the length of path this driver travelled in two ways (the return value is in meter):

4.1. Repetition.

4.2. Recursion.

The length of path is a summary of all distances between a position and next one. No need to calculate accurately the distance between 2 position. We apply this formula like the following example:

Let position A(10.772653; 106.6577), B(10.77349, 106.6573).

Distance between A and B:

$$10^5 \times \sqrt{(10.77349 - 10.772653)^2 + (106.6573 - 106.6577)^2} \approx 91.39283 \text{ (m)}$$

Hint: You need to sort position list by time before calculating.

Task 5.

Write a function to check two drivers if they had met together in two routes.

Prototype: `bool checkMeeting(Position* start_1, Position* start_2);`

Driver A meet driver B if the distance between them is less than or equal 50 meter at the same time or in 5 seconds.

For example:

- A have position with latitude 10.772653, longitude 106.6573 at t_1 = 1536401105000.

- B have position with latitude 10.772654, longitude 106.6574 at t_2 = 15364011059000.

We have conclusion that A and B had met because the distance between them is approximately 10 m in 4 seconds ($t_2 - t_1$ = 4000 milliseconds).

NOTE: To manage a position list (a route), you only use ONE pointer to the first element (first position) in list.