Hack 11.0

Computer Science I
Encapsulation

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Introduction

Hack session activities are small weekly programming assignments intended to get you started on full programming assignments. Collaboration is allowed and, in fact, *highly encouraged*. You may start on the activity before your hack session, but during the hack session you must either be actively working on this activity or *helping others* work on the activity. You are graded using the same rubric as assignments so documentation, style, design and correctness are all important. This activity is due at 23:59:59 on the Monday following the hack session in which it is assigned according to the CSE system clock.

Problem Statement

There are thousands of commercial, military, and local airports in the US and around the world. The International Civil Aviation Organization maintains a database of current and inactive airports around the world. The database uniquely identifies each airport by an alphanumeric GPS code. Further, each record contains the following pieces of data on each airport:

- The name of the airport
- Its latitude in degrees in the range $[-90, 90]$ with negative values corresponding to the southern hemisphere
- Its longitude in degrees in the range $[-180, 180]$ with negative values corresponding to the western hemisphere
- The type of airport
- Its elevation in (whole) feet above sea level
- Its municipality and its country

You will design a C structure to encapsulate these attributes to model an airport record from the ICAO database. You will also design several functions to support your structure including factory functions, functions to create a string representation, print records, etc. You will also implement several utility functions that use your structure to compute the air distance(s) between airport locations using their latitude and longitude. Recall that the air distance d between two latitude/longitude points can be estimated using the Spherical Law of Cosines.

$$d = \arccos\left(\sin(\varphi_1) \cdot \sin(\varphi_2) + \cos(\varphi_1)\cos(\varphi_2)\cos(\Delta)\right) \cdot R$$

where

- φ_1 is the latitude of location A, φ_2 is the latitude of location B
- Δ is the difference between location B's longitude and location A's longitude
- R is the (average) radius of the earth, 6,371 kilometers

This formula assumes that latitude and longitude are in radians r, $-\pi \leq r \leq \pi$. To convert from degrees d ($-180 \leq d \leq 180$) to radians r, you can use the simple formula:

$$r = \frac{d}{180}\pi$$

More details have been provided in a header file, `airport.h`. You will need to design your structure and implement all of the specified functions.

Instructions

- Place all of your function definitions in a source file named `airport.c` and hand it in with your header file, `airport.h`. You may add any utility functions you wish but you must *not* change any of the signatures of the required functions.
- In addition, you must create a main test driver program that demonstrates at least 3 cases per function. Name this file `airportTester.c` and hand it in.
- You are encouraged to collaborate any number of students before, during, and after your scheduled hack session.
- You may (in fact are encouraged) to define any additional "helper" functions that may help you.
- Include the name(s) of everyone who worked together on this activity in your source file's header.
- Turn in all of your files via webhandin, making sure that it runs and executes correctly in the webgrader. Each individual student will need to hand in their own copy and will receive their own individual grade.