CS 2412 - Assignment #5: Carbon Footprint Calculator (60 points)

Overview

In this assignment, you are asked to design the class hierarchy and develop the windows front-end application of a carbon footprint calculator. You need to use ***interface***s, ***classe***s, ***inheritance***, ***polymorphism***, and ***windows form***s.

Introduction

Carbon footprints are annual releases of carbon dioxide into the atmosphere. Buildings burning various types of fuels for heat and vehicles burning fuels for power produce carbon dioxide. Many scientists blame these greenhouse gases for the phenomenon called global warming.

The following table lists some common sources of carbon dioxide emission. It also describes how to calculate carbon footprints for each case.

Category	**Carbon Footprint Calculator** (Annual CO2 Emissions in Pounds)
Household Energy	*Electricity:* (Average amount of electric bill per month / price per KWH) * EEF * 12 EEF (Electricity Emissions Factor) = 1.37 *Natural Gas:* (Average amount of natural gas bill per month / price per thousand cubic feet) * NGEF * 12 NGEF (Natural Gas Emissions Factor) = 120.61 *Fuel Oil:* (Average amount of fuel oil bill per month / price per gallon) * FOEF * 12 FOEF (Fuel Oil Emissions Factor) = 22.37 *Propane:* (Average amount of propane bill per month ÷ price per gallon) * PEF * 12 PEF (Propane Emissions Factor) = 12.17
Transportation	***Vehicles****:* ((Number of miles driven per week * weeks in a year) / fuel efficiency per vehicle) * POCEPG * EOGGOTC POCEPG (Pounds Of CO2 Emitted Per Gallon) = 19.4 EOGGOTC (Emissions Of Greenhouse Gases Other Than CO2) = 100 / 95 ***Air Travel:*** Air miles traveled per year * (AEPM * IWTPF * IARFF) * GTPC AEPM (Average Emissions Per Mile) = 223

	IWTPF (Indirect Well-to-pump Factor) = 1.2 IARFF (Indirect Atmospheric Radiative Forcing Factor) = 1.9 GTPC (Gram To Pound Conversion) = .0022
Diet and Eating Habits	Sum of food categories [(Dollars spent on each category per month * Emissions factor for each category * Months in a year) * GTPC] Meat, fish, & eggs emissions factor = 1452 Cereals & Bakery Products emissions factor = 741 Dairy emissions factor = 1911 Fruits & vegetables emissions factor = 1176 Eating out emissions factor = 368 Other foods emissions factor = 467 GTPC (Gram To Pound Conversion) = .0022
Services and Goods	Sum of services and goods categories [(Dollars spent on each category per month * Emissions factor for each category * Months in a year) * GTPC] Clothing emissions factor = 436 Furnishing & household items emissions factor = 459 Other goods emissions factor = 338 Services emissions factor = 178 GTPC (Gram To Pound Conversion) = .0022

This assignment has two parts:

1. Design the class hierarchy of a carbon calculator:
   Design and document the inheritance hierarchy of a carbon footprint calculator. Using interfaces, you can specify similar behaviors for possibly disparate classes. Notice that you need to calculate all footprints polymophically.

2. Design a GUI and implement the class hierarchy and the GUI:
   Implement the inheritance hierarchy and develop a windows application (using windows forms). You are supposed to some GUI controls (i.e. GroupBoxes, Panel, TextBoxes, Buttons, Labels, etc.). You should calculate the carbon footprint of each category separately. You might need to divide some categories into several sub-categories and then calculate the carbon footprints of each sub-categories separately.

You can find some extra information about carbon footprints in this link. There are also a lot of carbon footprint calculators online, which you can take a look to get some ideas about how to design the user interface of your application.

Grading Criteria

Criteria	Points
Document	10
Class implementations	20
GUI (Windows Forms)	30

Notes

- Due: Thursday February 19th at 11:59pm
- Submit your document and entire Visual Studio solution directory as a .zip file called hw5_<yourFullname>.zip.