Tuesday 22 September 2020

CECS 342-01 Spring 2020

Assignment 2

Overview

The objective of this assignment is to research how *generic programing* works in different programing languages.

The general idea of *generics* (or *polymorphism* as it is sometimes called in a functional programing context) is to reuse the same source code with different types.

Homework 2

1. Read about “Generic programming”:
   Start with https://en.wikipedia.org/wiki/Generic_programming
2. Review Lab Assignment 1. Remember that the sort functions in C and Haskell had different types: In C we sorted arrays of integers, in Haskell we sorted lists of arbitrary elements that had some notion of order. Why do you think did we restrict the type of the C sort functions in this way?

Lab Assignment 2

1. In this lab, you will use 5 different programming languages to solve the same problem:
   Use the same generic sort function to sort values of different types. The values to sort could be integers, floating point numbers, strings, pairs of values (say a string and a number), etc.
2. Write a console application in each of these 5 languages: C, C++, C#, Python and Haskell.
3. Each application has to use the following data:

   The sequence of floating point numbers:
   645.32, 37.40, 76.30, 5.40, -34.23, 1.11, -34.94, 23.37, 635.46, -876.22, 467.73, 62.26

   The following sequence of people with name and age of each person. The name is a string and the age an integer:
   Hal, 20; Susann, 31; Dwight, 19; Kassandra, 21; Lawrence, 25; Cindy, 22; Cory, 27; Mac, 19; Romana, 27; Doretha, 32; Danna, 20; Zara, 23; Rosalyn, 26; Risa, 24; Benny, 28; Juan, 33; Natalie, 25

   Use appropriate data structures to represent the data above in each of the 5 languages and define the variables **`numbers`** and **`people`**, respectively.

4. Find generic sort functions for *each* of the 5 languages.

   (i) The objective of this assignment is to understand generics (not sorting). You can use the sort functions from Lab Assignment 1 or just use a sort function provided in some standard library for the respective language.
   (ii) C doesn't really provide generics. However, a **`void*`** can be used to point to any value.
   (iii) One way to specify an order on a type is to define a comparison function that compares two values. This comparison function could be an argument to your sort function. Some languages might provide predefined comparison functions.
   (iv) Try to use everything we learned about these different programing languages, e.g., Python uses duck-typing, Haskell uses the type-class **`Ord`** to express order on a type, LINQ in C# includes the **`orderby`** operator, etc.
5. Use the generic sort functions of each language to
   (i) sort **`numbers`** ascending by numerical value,
   (ii) sort **`people`** alphabetically (lexicographically) by name, and to
   (iii) sort **`people`** descending by age, where people of the same age should be sorted alphabetically (lexicographically).
6. The point here is to reuse as much code as possible to perform all 3 different sort operations. Try to isolate the specific code that is needed for each of the three tasks.
7. Write a main function in each of the 5 languages to test your code by writing the sort results to the console.

Deliverable

1. You can work on this assignment in a group of up to 6 students.
2. At the due date you will take a brief quiz to test your understanding of the assignment.
3. During the lab session on the due date each group will do
   1. A brief demonstration of the running applications.
   2. A presentation explaining the source code.
4. *Due date:* **Tuesday 13 October 2020** at the beginning of lecture.