

CECS 342-06 Spring 2022

Assignment 3

Overview

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

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

Homework 3

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 3

1. In this lab, you will use 5 different programming languages to solve the same problem: Use a 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), or any other type of values that can be compared.
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 following sequence of floating point numbers:

645.41, 37.59, 76.41, 5.31, -34.23, 1.11, 1.10, 23.46, 635.47, -876.32, 467.83, 62.25

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; Cassandra, 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 programming 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. Feel free to collaborate and to discuss the assignment with your fellow students.
2. The assignment will be graded with a **beachboard quiz** on (or after) the due date. This quiz will include specific questions about details of the assignment solution and in particular about differences between the implementations in different languages.
3. In addition you may voluntarily present your source code to the class to gain one extra credit.
4. *Due date:* **Friday 25 March 2022** at the beginning of lecture.