

CECS 342-07 Spring 2021

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 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. You can work on this assignment in a group of up to 5 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 6 April 2021*** at the beginning of lecture.