

Data Structures and Algorithms

LAB #2 - Templates

Fall 2018

Objectives

After this lab, the student should be able to:

- Define and use function template.
- Differentiate between function template and function overloading.
- Define and use class template.

What is a Template?

- A template is a technique for code reuse.
- It enables the same code logic to be executed on different data types.

Types of templates

There are two types of templates:

- Function Template.
 - Class Template.
- Examples of templates include:
 - A function that sorts an array of "any" data type. (Function Template)
 - A list that is required to store "any" data type. (Class Template)

Why use Template?

- If you have the same code logic to be used for different data types, you can use templates instead of rewriting the same code for each new type.
- This would save code writing and maintenance time.

To Do

- Open "Examples" solution (Examples.sln).
- Run the examples in the order mentioned in the "Lab Outline" section below
- **Don't forget to activate any example before running it.**
- For each example, make sure to read the comments, answer the questions inside it and ask about answers you're not sure about.

Lab Outline

1- Get Max Example:

- a. Using function templates instead of function overloading
- b. Defining a template function (GetMax) that takes different types of arguments
- c. A call statement to the function (e.g. GetMax(x, y, z)) makes the compiler generate a version of the function by replacing generic type T with type of arguments x, y, and z.

2- My Array Example:

- Using class templates to store any data type in a class object
- How to define functions of a class template outside the class prototype

Practice Exercises

Exercise 1

Write a function template that returns the minimum element in an array. The arguments of the function should be the array name and its size.

In main(), exercise the function with arrays of type int, long, double, and char.

Exercise 2

Write a class template **Matrix** to represent a 5x7 matrix that can store int, double, or char data types.

Provide the following member functions:

- AddValue(row, col, Value): that adds a new value given the row, column, and the value to be added
- bool BelongTo(Value): checks whether a given value belongs to the matrix or not
- PrintRow(row): Prints values in a given row
- Print(): Prints all values in the matrix
- MaxValue: returns the maximum value in the array