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| **Computer Engineering Department - ITU** |
| **CE101L: Object-Oriented Programming Lab** |

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| **Course Instructor: Usama Bin Shakeel** | **Dated:** |
| **Teaching Assistant: Zain** | **Semester: Spring 2023** |
| **Lab Engineer: Rana Hamza Shakil** | **Batch: BSCE2022** |

# **Lab 10 A. Array Implementation Through Templates in Class**

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| **Name** | **Roll number** | **Report**  **(out of 100)** | **Scaled to 10** | **Total**  **(out of 10)** |
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Checked on: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## **Objective**

The objective of this lab is to observe the basic knowledge of programming in C++.

## **Equipment and Component**

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| **Component Description** | **Value** | **Quantity** |
| Computer | Available in lab | 1 |

## **Conduct of Lab**

1. Students are required to perform this experiment individually.
2. In case the lab experiment is not understood, the students are advised to seek help from the course instructor, lab engineers, assigned teaching assistants (TA) and lab attendants.

## **Theory and Background**

In C++, a template class is a class that is defined with generic types, rather than specific types. It allows you to define a class that can be used with different data types, without having to define a separate class for each data type.

A template class is defined using the template keyword followed by the class definition. Inside the class definition, one or more type parameters can be declared using the type name or class keyword, followed by a name for the parameter.

**Lab Task**

**Task A [Marks: 5]**

Please follow the following steps before starting below tasks:

1. Create a separate header file (**.h file**) for each class declaration of data members and member functions

2. Create a separate source file (**.cpp file**) for the implementation of the class member functions.

3. Create **main.cpp** file for creating objects of class and other driving code.

**Task B: Template Classes [Marks: 35]**

**Problem statement:**

Design a program in C++ that uses template classes to implement a simple inventory management system for a grocery store. The program should be able to handle items of different types, such as fruits, vegetables, and meats, and keep track of their quantity and price using an array. The program should also have error handling for invalid inputs.

**Step 1: Define the template class**

First, we need to define the template class that will hold the array of items in the inventory. The class should have private data members that hold the array of items, and a public member function that allows the user to add items to the inventory.

**Step 2: Implement inventory management operations**

Next, we need to implement the member functions that allow the user to remove and update items in the inventory. The remove function should remove the specified item from the inventory. The update function should update the quantity and/or price of the specified item.

**Step 3: Implement error handling**

Finally, we need to implement error handling for invalid inputs. If the user tries to add an item with an invalid quantity or price, the program should throw an exception. If the user tries to remove an item that does not exist in the inventory, the program should throw an exception.

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| // Paste your code here |

### Assessment Rubric for Lab

**Method for assessment:**

Lab reports and instructor observation during lab sessions. Outcome assessed:

a. Ability to conduct experiments, as well as to analyze and interpret data (P) b. Ability to function on multi-disciplinary teams (A)

c. Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (P)

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| **Performance metric** | **Task** | **CLO** | **Description** | **Max marks** | **Exceeds expectation** | **Meets expectation** | **Does not meet expectation** | **Obtained marks** |
| 1. Realization of experiment (a) | 1 | 1 | Functionality | 40 | Executes without errors excellent user prompts, good use of symbols, spacing in output. Through testing has been completed (35-40) | Executes without errors, user prompts are understandable, minimum use of symbols or spacing in output. Some testing has been completed (20-34) | Does not execute due to syntax errors, runtime errors, user prompts are misleading or non-existent. No testing has been completed (0-19) |  |
| 2. Teamwork (b) | 1 | 3 | Group Performance | 5 | Actively engages and cooperates with other group member(s) in effective manner (4-5) | Cooperates with other group member(s) in a reasonable manner but conduct can be improved (2-3) | Distracts or discourages other group members from conducting the experiment (0-1) |  |
| 3. Conducting experiment (a, c) | 1 | 1 | On Spot Changes | 10 | Able to make changes (8-10) | Partially able to make changes (5-7) | Unable to make changes (0-4) |  |
| 1 | 1 | Viva/Quiz | 10 | Answered all questions (8-10) | Few incorrect answers (5-7) | Unable to answer all questions (0-4) |  |
| 4. Laboratory safety and disciplinary rules (a) | 1 | 3 | Code commenting | 5 | Comments are added and does help the reader to understand the code (4-5) | Comments are added and does not help the reader to understand the code (2-3) | Comments are not added (0-1) |  |
| 5. Data collection (c) | 1 | 3 | Code Structure | 5 | Excellent use of white space, creatively organized work, excellent use of variables and constants, correct identifiers for constants, No line-wrap (4-5) | Includes name, and assignment, white space makes the program fairly easy to read. Title, organized work, good use of variables (2-3) | Poor use of white space (indentation, blank lines) making code hard to read, disorganized and messy (0-1) |  |
| 6. Data analysis (a, c) | 1 | 4 | Algorithm | 20 | Solution is efficient, easy to understand, and maintain (15-20) | A logical solution that is easy to follow but it is not the most efficient (6-14) | A difficult and inefficient solution (0-5) |  |
| 7. Computer use (c) | 1 | 2 | Documentation & GitHub Submissions | 5 | Timely (4-5) | Late (2-3) | Not done (0-1) |  |
|  | Max Marks (total): | | | 100 | Obtained Marks (total): | | |  |

Lab Engineer Signature\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_