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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 11 A. Template Classes with Usage of Maps**

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| **Name** | **Roll number** | **Report**  **(out of 100)** | **Scaled to 10** | **Total**  **(out of 10)** |
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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 Backgrou****nd**

Template classes are a type of class that can be defined with one or more generic data types. This means that the class can be used with any data type, making it very flexibile and reusable. Maps, on the other hand, are a type of associative container in c++ those stores elements as key-value pairs. The map class is defined in the <map> header file, and is templated on two types: the key type and the value type.

**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 with Usage of Maps [Marks: 35]**

**Problem Statement:**

Step 1: Define a template class called CurrencyConverter that will hold information about conversion rates between currencies. The class should have the following public member functions:

* void addRate (const std::string& from, const std::string& to, const double rate): Adds a conversion rate for converting from the specified ‘from’ currency to the specified ‘to’ currency.
* double convert(const std::string& from, const std::string& to, const double amount) const: Converts the specified ‘amount’ of the ‘from’ currency to the ‘to’ currency using the conversion rates.
* void printRates() const: Prints the current conversion rates.

Step 2: Create a ‘map’ object called ‘rates’ that will hold the conversion rates. The key for each conversion rate should be a ‘std::pair’ of strings representing the currencies being converted, and the value should be a double representing the conversion rate.

Step 3: Implement a main function that demonstrates the usage of the CurrencyConverter class. The main function should do the following:

* Add at least two conversion rates to the converter using the addRate function.
* Convert an amount from one currency to another using the convert function.
* Print the current conversion rates using the printRates function.

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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\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_