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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 5B. Operator Overloading and Relational Operators**

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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 Background**

**Operator Overloading, Stream in and out, Relational Operators**

In C++, we can make operators work for user-defined classes. This means C++ has the ability to provide the operators with a special meaning for a data type, this ability is known as operator overloading. For example, we can overload an operator ‘+’ in a class like String so that we can concatenate two strings by just using +. On the other hand, in case of input stream direction of flow of bytes is from the device (for example, Keyboard) to the main memory. If the direction of flow of bytes is opposite, i.e. from main memory to device (display screen) then this process is called output stream.

**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: Operator Overloading, Stream in and out, relational operator [Marks: 35]**

Create a class Rectangle that represents a rectangle with a length and a width. Overload the relational operators <, >, <=, >=, == and != to compare two rectangles based on their areas, and implement input and output stream operators to read and write rectangles.

Perform into Three Steps:

1. Define the Rectangle class:

* Define the data members length and width as private variables
* Define a constructor to initialize the data members with default values if no values are provided.
* Define accessor functions to get the values of length and width.

1. Operator Overloading:

* Overload the relational operators <, >, <=, >=, == and != to compare two rectangles based on their areas.
* Overload the input stream operator >> to read a rectangle from the input stream.
* Overload the output stream operator << to write a rectangle to the output stream.

1. Implement a main function to test the class and its overloaded operators:

* Create two Rectangle objects and initialize them using the input stream operator.
* Compare the two rectangles using the relational operators.
* Print the area of the two rectangles using the accessor functions.
* Write the two rectangles using the output stream operator.

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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: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_