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

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

# **Lab 12 B. Problem-Based Learning in C++**

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

Checked on: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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

## **Objective**

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

## **Equipment and Component**

|  |  |  |
| --- | --- | --- |
| **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**

The use of templates allows the program to work with different data types, while the use of maps allows for efficient data storage and retrieval. File handling enables the program to store data in a persistent manner, making it available across different sessions. Exception handling ensures that the program can handle and recover from unexpected errors, preventing it from crashing. Finally, the association between classes models the real-world relationship between vehicles and owners, where each vehicle is associated with one owner.

Overall, this task combines several important concepts in programming and provides a practical example of how they can be used to develop a useful application for a real-world scenario.

**Lab Task**

**Task A [Marks: 5]**

Please follow the following steps before starting the 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 the class and other driving codes.

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

To design a program in C++ that simulates a vehicle registration system used by a government agency using object-oriented programming, exception handling, file handling, an association between classes, template classes and functions, and mapping.

Task Description:

Step 1: Define a class Vehicle with the following attributes: vehicle ID, vehicle type, owner name, owner ID, and registration date. Define a class Owner with the following attributes: owner ID, owner name, and contact details.

Step 2: Implement a template class Registry that uses a map to store the vehicle and owner information. The map should be indexed by the vehicle ID.

Step 3: Implement a menu-driven program that allows the user to:

* Register a new vehicle and owner to the system.
* Renew the registration of a vehicle.
* Display the registration details of a specific vehicle.
* Display the registration details of all vehicles.
* Generate a report of the number of registered vehicles by vehicle type.
* Exit the program.

Step 4: Implement error handling using exception handling to ensure that the user inputs valid data and that the program does not crash. Implement file handling to store the vehicle and owner data in a file and read it back from the file.

Step 5: Implement a function that reads the vehicle and owner data from a file and stores them in the Registry. Implement a function to calculate and display the registration fee for each vehicle type. Implement an association between the Vehicle and Owner classes, where each Vehicle object is associated with one Owner object.

|  |
| --- |
| // 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)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_