

### Lab Objective

- Practice object-oriented analysis and design
- Practice writing UML class diagrams
- Practice object-based programming
- Practice collaborating on a programming project

### Introduction

This week you will start working with your group on a larger project that will span a week and a half (i.e., three lab meetings). Your final program is due by **11:59pm on Friday, October 14<sup>th</sup>**. The goal of this project is to practice object-oriented analysis and design and to write an object-based program. Before you start on this project, make sure you and your team members have read Chapter 7.15 “Introduction to Object-Oriented Analysis and Design.”

### Collaboration Policy

Work with your assigned team members from Lab 0. ***Please make sure to integrate your team members who – because of COVID requirements – have to participate remotely.*** You can use the MS Teams video conferencing feature to collaborate with a remote team member. Use the search bar on the top of the MS Teams app to search for your team member with their CU user name, then click the video icon in the top-right corner of the screen to start a video call.

You and your team members can work on the analysis and design part of the project together. You can also collaborate on the main program. But each student should individually work on the classes they have been assigned (see further details below).

For this lab, Canvas assignments will be submitted as team assignments, which means one member from a team can submit for all team members.

## **Description of the Problem Domain**

Clemson University's Parking and Transportation Services is responsible for selling parking permits to employees, students, visitors, and vendors. Currently, customers can select from different permit types, such as annual permits, semester permits, one-day permits, park-and-ride permits, etc. Different permits are also available for different types of vehicles, such as regular cars, low-emission vehicles, motorcycles and motor scooters, etc.

Parking and Transportation Services has hired your team to revise its existing permit system and to develop a program that customers can use to purchase a permit under the new system.

Your program must allow customers to:

- provide their personal information (e.g., name, address, etc.)
- select a vehicle type (e.g., car, motorcycle, etc.)
- provide vehicle-related information (e.g., make, model, license plate, etc.)
- select a permit type (e.g., annual, semester, etc.)
- receive an invoice that includes the price for the permit and a summary of the information they have entered

You are free to decide who is required to buy a permit, what types of vehicles can be selected, what types of permits are offered, and the price of each permit.

## **Class Requirements**

Your program must use the following classes, where  $N$  denotes the number of members in your team:

- At least  $N$  classes for  $N$  different types of customers. These classes must store name, address, email, and at least two class-specific attributes.
- At least  $N$  classes for  $N$  different types of vehicles. These classes must store make, model, year, and at least two class-specific attributes.
- A class named 'Invoice' which stores the price for the selected permit, at least one type of discount that you decide (cheaper permits for students or low-emission vehicles? free permits for CPSC 1020 professors and TAs?), and at least one service charge you decide. This class should include a member function that calculates the total price, and a member function that generates the invoice as a screen print-out that includes the total price and all information provided by the user.

## **Team Requirements**

Decide as a team what your final permit system will look like and how you will design and test your program. After Lab 5, "Design & Test Plan", each team member must be responsible for implementing one customer type class and one vehicle type class. In your final submission, clearly indicate who has worked on which part by adding the team member's name as a comment on the top of the .h and .cpp file.

## **Milestones**

The project is divided into four steps that should be completed by the following deadlines:

### **Lab 1 (10/3) – Analysis, Design & Test Plan**

By the end of the first lab, you should have:

- Identified the classes and objects you need for your project
- Defined each class's attributes
- Defined each class's behavior
- Written the UML class diagram for each class
- Written pseudocode for your client program
- Finished a test plan that you will use in Lab 5 to check your final program for correctness
- Split up the work between team members. Each team member must write code for at least one customer type class and one vehicle type class

### **Lab 2 (10/5) – Implementation**

By the end of the second lab, you should have:

- Completed the code for each class. This means each team member should have finished writing a class declaration (.h) and a class definition (.cpp) for each of the classes they were assigned.
- Written the Invoice class
- Written additional functions and code needed for your client program

### **Lab 3 (10/10) – Integration & Testing**

By the end of the third lab, you should have:

- Completed your client program, which means integrating all classes and functions into a single program
- Tested your program with the test plan you have completed in Lab 5
- Fixed bugs and errors revealed by your test plan