

Problem Statement:

In order to understand the concepts of dynamic binding and static binding in C++ programming, you are tasked with designing a program that simulates a car rental service. Your program should use both dynamic and static binding to implement various functionalities of the car rental system.

Real World Scenario:

Imagine you are working for a car rental company that provides different types of vehicles such as sedans, SUVs, and sports cars. The company has a rental management system that allows customers to book and rent vehicles online.

Your task is to design a C++ program that simulates the rental management system. The program should have the following features:

A base class "**Vehicle**" that contains common data members and member functions of all vehicles. The class should have data members such as "**make**", "**model**", "**year**", "**rentalFee**", and member functions such as "**displayVehicleDetails**" and "**calculateRentalFee**" (you can use any formula or value to assign dummy rental fee).

Three derived classes "**Sedan**", "**SUV**", and "**SportsCar**" that inherit from the Vehicle class and add specific data members and member functions. For example, the "**Sedan**" class could have a data member "**numDoors**" and a member function "**displaySedanDetails**".

A "**RentalSystem**" class that manages the rental process, including booking, returning, and payment. The class should have data members such as "**customerName**", "**rentalDays**", "**totalFee**", and member functions such as "**bookVehicle**" and "**returnVehicle**".

The **RentalSystem** should have two member functions, "**bookVehicle**" and "**returnVehicle**", that accept a Vehicle object as a parameter.

The "**bookVehicle**" member function should use dynamic binding to determine the rental fee based on the type of the vehicle. For example, if the vehicle object passed to the function is of type "**Sedan**", the function should call the "**calculateRentalFee**" member function of the "**Sedan**" class.

The "**returnVehicle**" member function should use static binding to calculate the total fee, which includes the rental fee and any additional charges such as fuel or damage. The function should use the "**rentalDays**" data member of the **RentalSystem** class and the "**rentalFee**" data member of the Vehicle class to calculate the rental fee, and add any additional charges to get the total fee.

The program should provide a user prompt on console that allows customers to select a vehicle, book it, and return it.

Let's explain the classes in a bit more detail if mandatory:

The "**Vehicle**" class is the base class that contains the common data members and member functions for all vehicles. The class has the following data members:

"**make**" - a string that stores the make of the vehicle.

"**model**" - a string that stores the model of the vehicle.

"**year**" - an integer that stores the year of the vehicle.

"**rentalFee**" - a double that stores the base rental fee for the vehicle.

The class also has the following member functions:

"**displayVehicleDetails**" - a member function that displays the make, model, and year of the vehicle.

"**calculateRentalFee**" - a virtual member function that calculates the rental fee for the vehicle based on the type of the vehicle. This function will be overridden by the derived classes.

The "**RentalSystem**" class is responsible for managing the rental process, including booking, returning, and payment. The class has the following data members:

"**customerName**" - a string that stores the name of the customer who rented the vehicle.

"**vehicle**" - a pointer to a Vehicle object that stores the vehicle that was rented.

"**rentalDays**" - an integer that stores the number of days the vehicle was rented.

"**totalFee**" - a double that stores the total fee for renting the vehicle.

The class also has the following member functions:

"**bookVehicle**" - a member function that takes a pointer to a Vehicle object as a parameter and books the vehicle for the specified number of days. This function should use dynamic binding to calculate the rental fee based on the type of the vehicle. The function should set the "**vehicle**" and "**rentalDays**" data members accordingly.

"**returnVehicle**" - a member function that calculates the total fee for renting the vehicle and displays it to the user. This function should use static binding to calculate the rental fee based on the "**rentalDays**" data member and the "**rentalFee**" data member of the "**vehicle**" object. The function should also add any additional charges such as fuel or damage to get the total fee. Finally, the function should display the total fee to the user.

"**displayRentalDetails**" - a member function that displays the details of the rental, including the customer's name, vehicle details, rental days, and total fee.