Lab 05 Tasks:

1. Assuming that a year has 365 days, write a class named DayOfYear that takes an integer representing a day of the year and translates it to a string consisting of the month followed by day of the month. For example,
   Day 2 would be January 2.
   Day 32 would be February 1.
   Day 365 would be December 31.
   The constructor for the class should take as parameter an integer representing the day of the year, and the class should have a member function print() that prints the day in the month–day format. The class should have an integer member variable to represent the day and should have static member variables holding string objects that can be used to assist in the translation from the integer format to the month-day format. Test your class by inputting various integers representing days and printing out their representation in the month–day format.

2. A corporation has six divisions, each responsible for sales to different geographic locations. Design a DivSales class that keeps sales data for a division, with the following members:
   • An array with four elements for holding four quarters of sales figures for the division.
   • A private static variable for holding the total corporate sales for all divisions for the entire year.
   • A member function that takes four arguments, each assumed to be the sales for a quarter. The value of the arguments should be copied into the array that holds the sales data. The total of the four arguments should be added to the static variable that holds the total yearly corporate sales.
   • A function that takes an integer argument within the range of 0–3. The argument is to be used as a subscript into the division quarterly sales array. The function should return the value of the array element with that subscript.
   Write a program that creates an array of six DivSales objects. The program should ask the user to enter the sales for four quarters for each division. After the data are entered, the program should display a table showing the division sales for each quarter. The program should then display the total corporate sales for the year.
   Input Validation: Only accept positive values for quarterly sales figures.

A->W*
C->S

3. A library has several books, but each book can exist independently of the library. If the library is deleted, the books still exist. Write a C++ program to demonstrate an aggregation relationship between a Library and Book classes. Implement the Library class that contains a list of Book objects but does not manage their lifetimes. Ensure that deleting a Book object does not affect the existence of the Library object. Provide an explanation of how this relationship fits the concept of aggregation.

4. A car consists of an engine, and the engine cannot exist without the car. If the car is destroyed, the engine is destroyed as well. Write a C++ program to demonstrate a composition relationship between a Car and an Engine. Implement a Car class that has an Engine object. The Car class should control the lifecycle of the Engine object, such that if a Car object is destroyed, the Engine object is also destroyed. Explain how this relationship illustrates the concept of composition.

5. For this task you will design a set of classes that work together to simulate a police officer issuing a parking ticket. The classes you should design are:
• **The ParkedCar Class:** This class should simulate a parked car. The class's responsibilities are:
– To know the car's make, model, color, license number, and the number of minutes that the car has been parked
• **The ParkingMeter Class:** This class should simulate a parking meter. The class's only responsibility is:
– To know the number of minutes of parking time that has been purchased
• **The ParkingTicket Class:** This class should simulate a parking ticket. The class's responsibilities are:
– To report the make, model, color, and license number of the illegally parked car
– To report the amount of the fine, which is $25 for the first hour or part of an hour that the car is illegally parked, plus $10 for every additional hour or part of an hour that the car is illegally parked
– To report the name and badge number of the police officer issuing the ticket
• **The PoliceOfficer Class:** This class should simulate a police officer inspecting parked cars. The class's responsibilities are:
– To know the police officer's name and badge number
– To examine a ParkedCar object and a ParkingMeter object, and determine whether the car's time has expired
– To issue a parking ticket (generate a ParkingTicket object) if the car's time has expired
Write a program that demonstrates how these classes collaborate.