10.0-Introduction to Inheritance

Program

```
using System;

class Rectangle
{
    protected double length;
    protected double width;

    public void SetLength(double l)
    {
        length = l;
    }

    public double GetLength()
    {
        return length;
    }

    public void SetWidth(double w)
    {
        width = w;
    }

    public double GetWidth()
    {
```

```
        return width;
    }
}

class AreaCalculator : Rectangle
{
    protected double area;

    public void CalculateArea()
    {
        area = length * width;
    }

    public double GetArea()
    {
        return area;
    }
}

class VolumeCalculator : AreaCalculator
{
    protected double height;
    protected double volume;

    public void SetHeight(double h)
    {
        height = h;
```

```
    }

    public double GetHeight()
    {
        return height;
    }

    public void CalculateVolume()
    {
        volume = area * height;
    }

    public double GetVolume()
    {
        return volume;
    }
}

class Program
{
    static void Main()
    {
        VolumeCalculator rectangle = new VolumeCalculator();

        Console.Write("Enter the length of the rectangle: ");
        double length = Convert.ToDouble(Console.ReadLine());
```

```
        Console.Write("Enter the width of the rectangle: ");
        double width = Convert.ToDouble(Console.ReadLine());

        Console.Write("Enter the height of the rectangle: ");
        double height = Convert.ToDouble(Console.ReadLine());

        // Set dimensions using methods from base class
        rectangle.SetLength(length);
        rectangle.SetWidth(width);
        rectangle.SetHeight(height);

        // Calculate area and volume using methods from derived classes
        rectangle.CalculateArea();
        rectangle.CalculateVolume();

        // Display results
        Console.WriteLine($"Length of the rectangle: {rectangle.GetLength()}");
        Console.WriteLine($"Width of the rectangle: {rectangle.GetWidth()}");
        Console.WriteLine($"Height of the rectangle: {rectangle.GetHeight()}");
        Console.WriteLine($"Area of the rectangle: {rectangle.GetArea()}");
        Console.WriteLine($"Volume of the rectangle: {rectangle.GetVolume()}");
    }
}
```

Exercise

Write a C# program that

create a class hierarchy to represent rectangles and calculate their area and volume.

Rectangle: Represents a rectangle with properties for length and width. Provides methods to set and get these properties.

AreaCalculator: Inherits from Rectangle and calculates the area of the rectangle using its length and width. It provides methods to calculate and get the area.

VolumeCalculator: Inherits from AreaCalculator and extends it by adding a height property. It calculates the volume of the rectangle using its area and height. Provides methods to set and get the height, calculate and get the volume.

The program prompts the user to enter the dimensions of a rectangle: length, width, and height.

It then creates an instance of VolumeCalculator to perform calculations.

The user inputs the dimensions, and the program sets them using the appropriate methods from the base class Rectangle.

The program then calculates the area and volume of the rectangle using methods inherited from the derived classes AreaCalculator and VolumeCalculator.

Finally, it displays the dimensions, area, and volume of the rectangle.

The user is prompted to input the length, width, and height of the rectangle.

The program outputs the entered dimensions along with the calculated area and volume of the rectangle.

The program starts by instantiating a VolumeCalculator object.

It then prompts the user to input the dimensions of the rectangle.

After receiving the input, it sets the dimensions of the rectangle using the appropriate setter methods.

Next, it calculates the area and volume of the rectangle using the inherited methods.

Finally, it displays the dimensions, area, and volume of the rectangle to the user.

Hint

Examine the relationship between the classes Rectangle, AreaCalculator, and VolumeCalculator. Understand how they are related through inheritance.

Review the properties and methods in each class (SetLength, GetLength, SetWidth, GetWidth, etc.) to understand their purpose and how they are used to calculate area and volume.

Understand how user input is obtained for the length, width, and height of the rectangle using Console.ReadLine().

Focus on the CalculateArea() and CalculateVolume() methods in the AreaCalculator and VolumeCalculator classes respectively. Understand how these methods use the length, width, and height properties to calculate area and volume.

Pay attention to how dimensions (length, width, height) are set using setter methods (SetLength, SetWidth, SetHeight) and retrieved using getter methods (GetLength, GetWidth, GetHeight).

Understand the concept of inheritance and how it allows derived classes (AreaCalculator and VolumeCalculator) to reuse properties and methods from the base class (Rectangle).

Explanation

This program is designed to calculate the area and volume of a rectangular prism based on user-provided dimensions for its length, width, and height. It's structured using object-oriented principles in C#. Here's how it works:

Firstly, there are three classes defined: Rectangle, AreaCalculator, and VolumeCalculator.

The Rectangle class serves as the base class and contains properties for the length and width of a rectangle, along with methods to set and get these dimensions.

The AreaCalculator class inherits from Rectangle and adds functionality to calculate the area of a rectangle. It contains methods to compute the area based on the length and width provided.

The VolumeCalculator class extends AreaCalculator to incorporate the concept of volume. It introduces a new property for the height of the rectangular prism and includes methods to set, get, and compute the volume using the previously calculated area and the added height.

In the Main method, an instance of VolumeCalculator is created to represent the rectangular prism. The user is prompted to input the length, width, and height of the prism, which are then obtained and converted to double data types.

The dimensions are set using the setter methods inherited from the Rectangle class. Next, calculations for both the area and volume are performed using methods inherited from the respective derived classes (AreaCalculator and VolumeCalculator).

Finally, the program displays the input dimensions, calculated area, and volume using Console.WriteLine() statements.