Lab sesssion-3

ID NO:2100030414

PRE-LAB

1. What are the principles of OOP? ANS:

1.Encapsulation
2.Abstraction
3.Inheritance
4.Polymorphism **IN-LAB:**

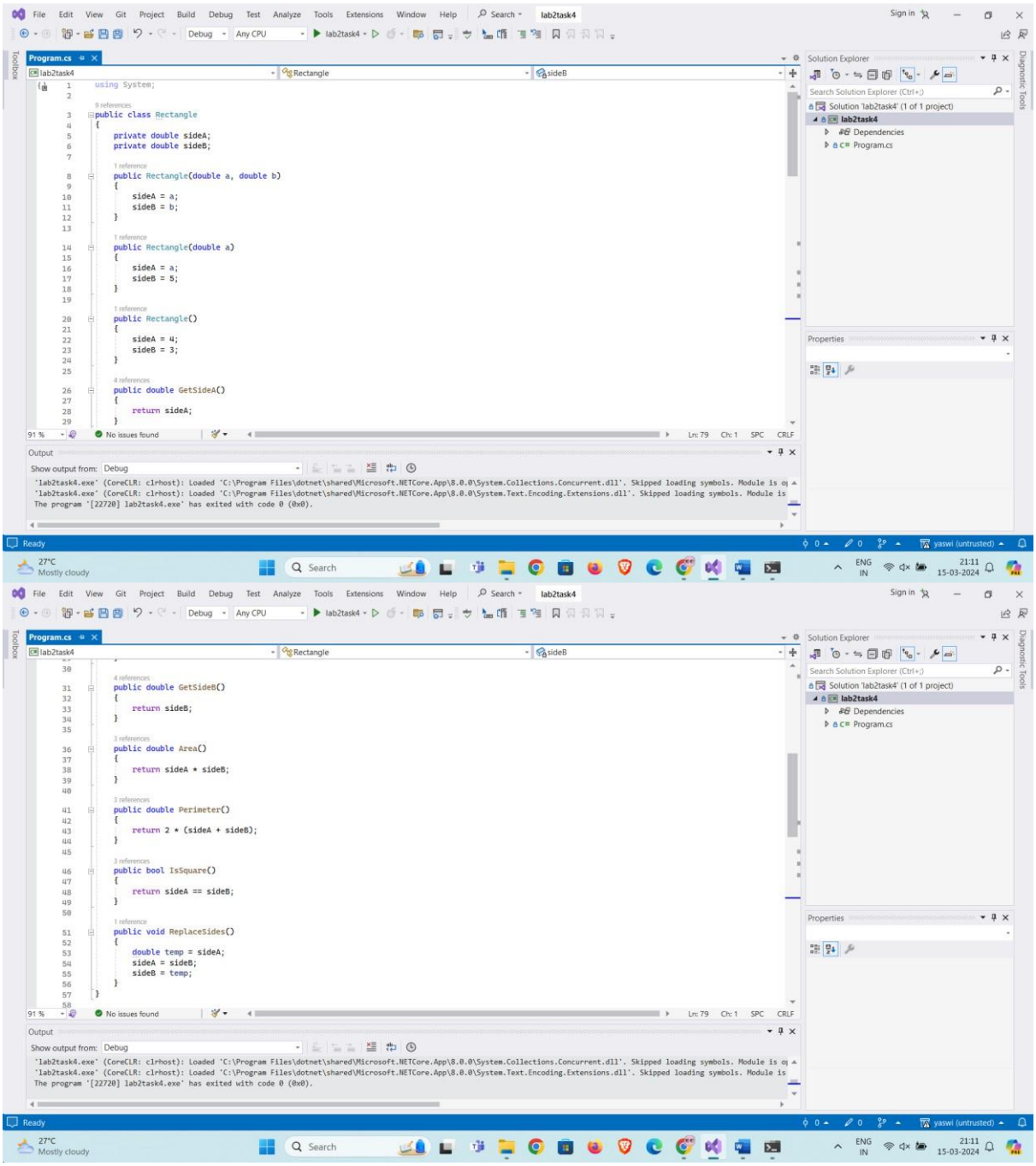
1. Develop **Rectangle** and **ArrayRectangles** with a predefined functionality.

Low level Task:

TASK 1: To develop **Rectangle** class with following content:

- 2 closed real fields **sideA** and **sideB** (sides A and B of the rectangle)
- Constructor with two real parameters **a** and **b** (parameters specify rectangle sides)
- Constructor with a real parameter **a** (parameter specify side A of a rectangle, side B is always equal to 5)
- Constructor without parameters (side A of a rectangle equals to 4, side B - 3)
- Method **GetSideA**, returning value of the side A
- Method **GetSideB**, returning value of the side B
- Method **Area**, calculating and returning the area value
- Method **Perimeter**, calculating and returning the perimeter value
- Method **IsSquare**, checking whether current rectangle is shape square or not. Returns true if the shape is square and false in another case.
- Method **ReplaceSides**, swapping rectangle sides

Solution:


File Edit View Git Project Build Debug Test Analyze Tools Extensions Window Help
Search
lab2task4
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lab2task4
Program.cs
lab2task4
Rectangle
sideB
Solution Explorer
Search Solution Explorer (Ctrl+;)
Solution 'lab2task4' (1 of 1 project)
lab2task4
Dependencies
Program.cs
Properties
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Diagnostic Tools
using System;
9 references
public class Rectangle
{
private double sideA;
private double sideB;
1 reference
public Rectangle(double a, double b)
{
sideA = a;
sideB = b;
}
1 reference
public Rectangle(double a)
{
sideA = a;
sideB = 5;
}
1 reference
public Rectangle()
{
sideA = 4;
sideB = 3;
}
4 references
public double GetSideA()
{
return sideA;
}
91 %
No issues found
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Output
Show output from: Debug
'lab2task4.exe' (CoreCLR: clrhost): Loaded 'C:\Program Files\dotnet\shared\Microsoft.NETCore.App\8.0.0\System.Collections.Concurrent.dll'. Skipped loading symbols. Module is o
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Program.cs
lab2task4
Rectangle
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Search Solution Explorer (Ctrl+;)
Solution 'lab2task4' (1 of 1 project)
lab2task4
Dependencies
Program.cs
Properties
Toolbox
Diagnostic Tools
4 references
public double GetSideB()
{
return sideB;
}
3 references
public double Area()
{
return sideA * sideB;
}
3 references
public double Perimeter()
{
return 2 * (sideA + sideB);
}
3 references
public bool IsSquare()
{
return sideA == sideB;
}
1 reference
public void ReplaceSides()
{
double temp = sideA;
sideA = sideB;
sideB = temp;
}
}
91 %
No issues found
Ln: 79 Ch: 1 SPC CRLF
Output
Show output from: Debug
'lab2task4.exe' (CoreCLR: clrhost): Loaded 'C:\Program Files\dotnet\shared\Microsoft.NETCore.App\8.0.0\System.Collections.Concurrent.dll'. Skipped loading symbols. Module is o
'lab2task4.exe' (CoreCLR: clrhost): Loaded 'C:\Program Files\dotnet\shared\Microsoft.NETCore.App\8.0.0\System.Text.Encoding.Extensions.dll'. Skipped loading symbols. Module is
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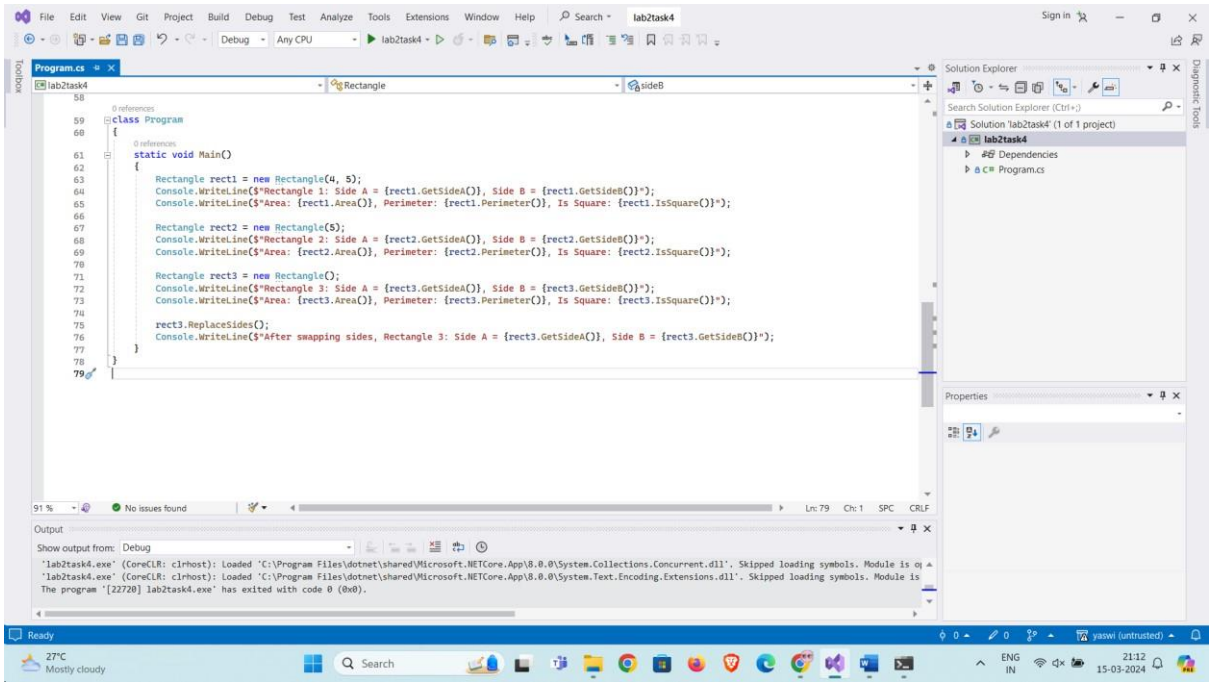


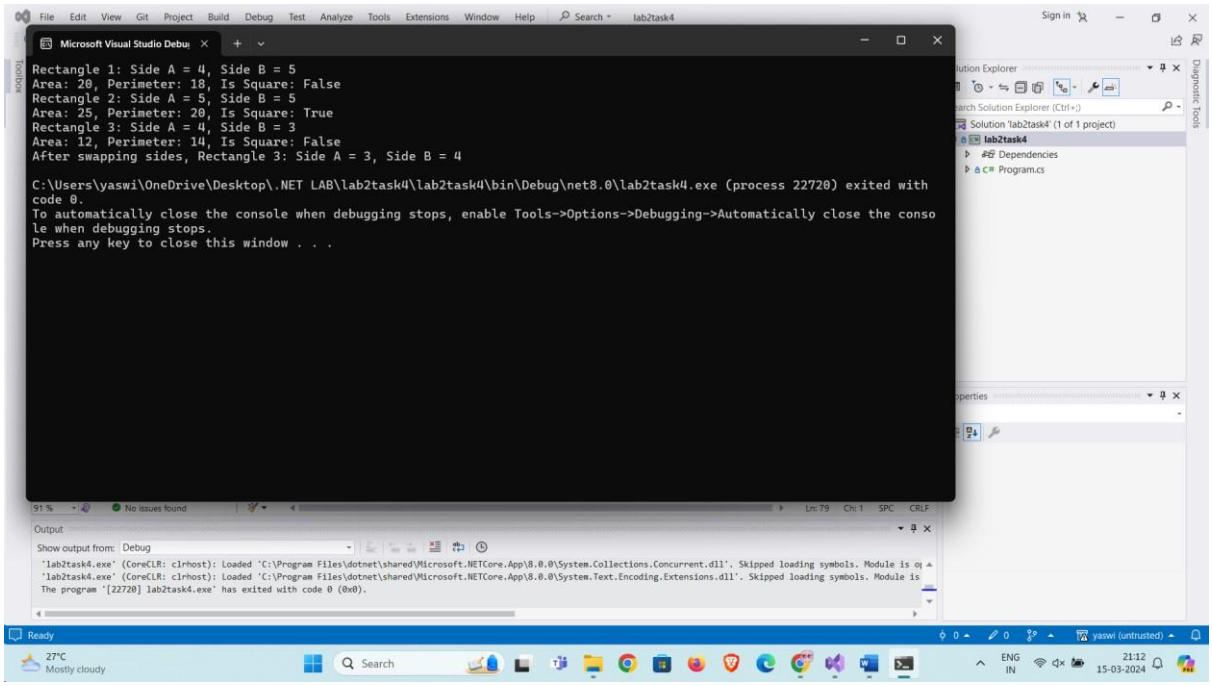
```
class Program
{
    static void Main()
    {
        Rectangle rect1 = new Rectangle(4, 5);
        Console.WriteLine($"Rectangle 1: Side A = {rect1.GetSideA()}, Side B = {rect1.GetSideB()}");
        Console.WriteLine($"Area: {rect1.Area()}, Perimeter: {rect1.Perimeter()}, Is Square: {rect1.IsSquare()}");

        Rectangle rect2 = new Rectangle(5);
        Console.WriteLine($"Rectangle 2: Side A = {rect2.GetSideA()}, Side B = {rect2.GetSideB()}");
        Console.WriteLine($"Area: {rect2.Area()}, Perimeter: {rect2.Perimeter()}, Is Square: {rect2.IsSquare()}");

        Rectangle rect3 = new Rectangle();
        Console.WriteLine($"Rectangle 3: Side A = {rect3.GetSideA()}, Side B = {rect3.GetSideB()}");
        Console.WriteLine($"Area: {rect3.Area()}, Perimeter: {rect3.Perimeter()}, Is Square: {rect3.IsSquare()}");

        rect3.ReplaceSides();
        Console.WriteLine($"After swapping sides, Rectangle 3: Side A = {rect3.GetSideA()}, Side B = {rect3.GetSideB()}");
    }
}
```

OUTPUT:



```
Rectangle 1: Side A = 4, Side B = 5
Area: 20, Perimeter: 18, Is Square: False
Rectangle 2: Side A = 5, Side B = 5
Area: 25, Perimeter: 20, Is Square: True
Rectangle 3: Side A = 4, Side B = 3
Area: 12, Perimeter: 14, Is Square: False
After swapping sides, Rectangle 3: Side A = 3, Side B = 4

C:\Users\yaswi\OneDrive\Desktop\.NET LAB\lab2task4\lab2task4\bin\Debug\net8.0\lab2task4.exe (process 22720) exited with code 0.
To automatically close the console when debugging stops, enable Tools->Options->Debugging->Automatically close the console when debugging stops.
Press any key to close this window . . .
```

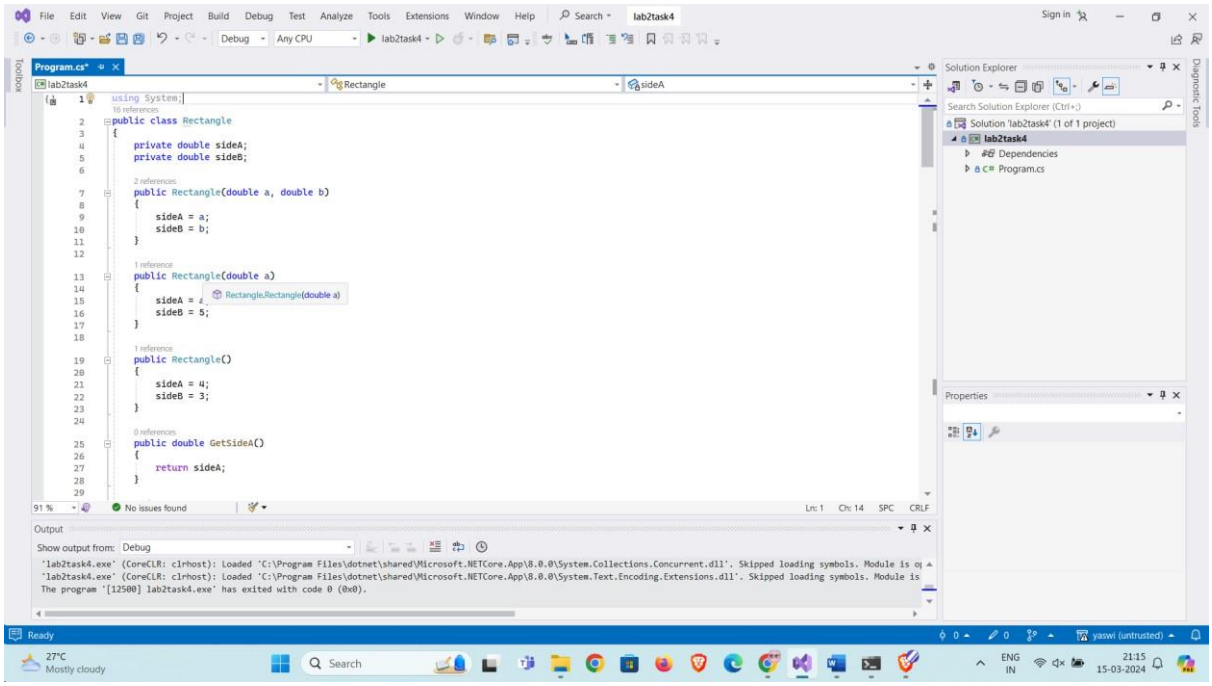
Advanced level Task:

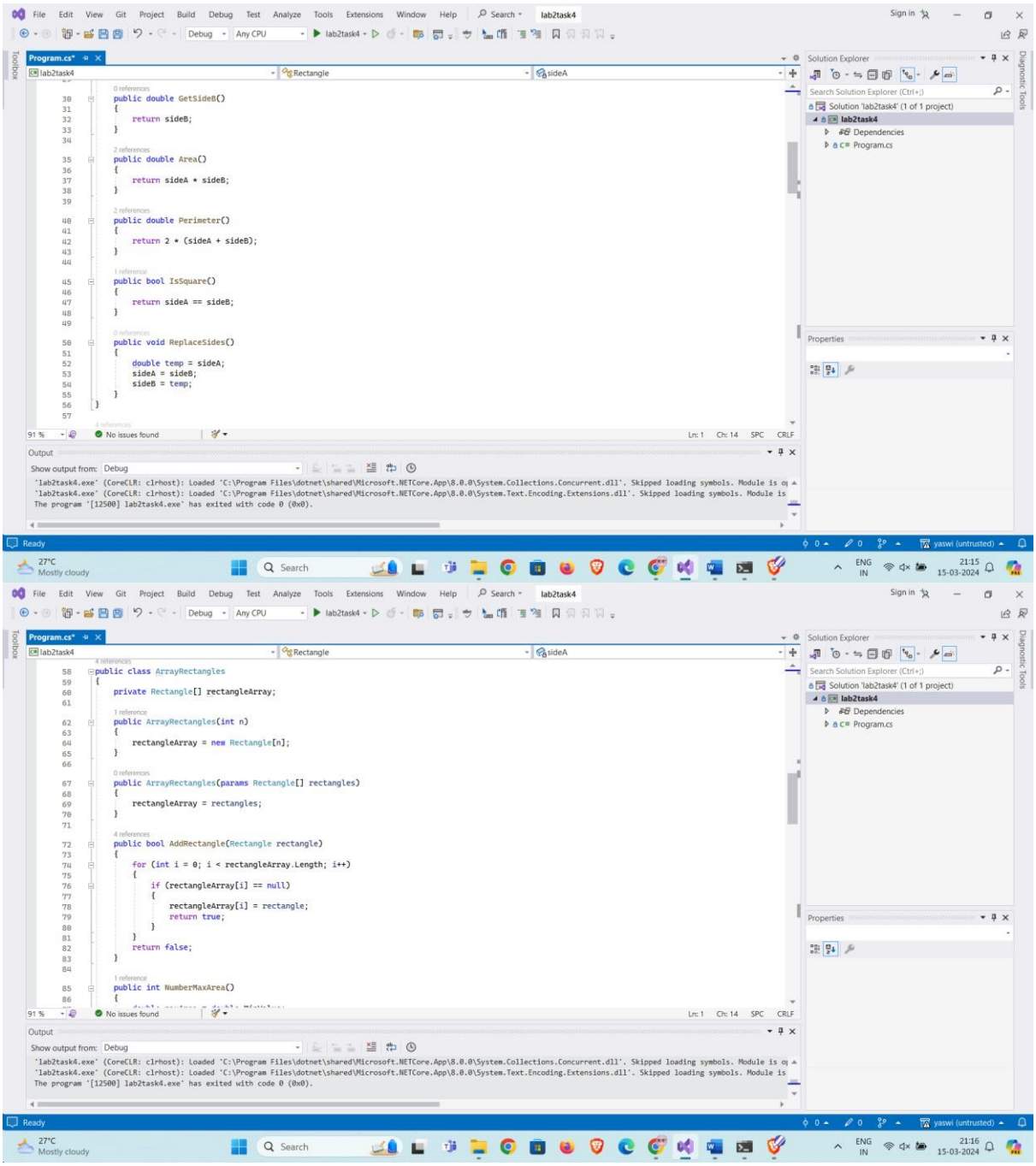
TASK 2: Develop class **ArrayRectangles**, in which declare:

- Private field **rectangle_array** - array of rectangles
- Constructor creating an empty array of rectangles with length n
- Constructor that receives an arbitrary amount of objects of type **Rectangle** or an array of objects of type **Rectangle**.

- Method **AddRectangle** that adds a rectangle of type Rectangle to the array on the nearest free place and returning true, or returning false, if there is no free space in the array
- Method **NumberMaxArea**, that returns order number (index) of the rectangle with the maximum area value (numeration starts from zero)
- Method **NumberMinPerimeter**, that returns order number(index) of the rectangle with the minimum area value (numeration starts from zero)
- Method **NumberSquare**, that returns the number of squares in the array of rectangles

Solution:




File Edit View Git Project Build Debug Test Analyze Tools Extensions Window Help
Search
lab2task4
Sign in
Debug
Any CPU
lab2task4
Program.cs*
lab2task4
Rectangle
sideA
0 references
public double GetSideB()
{
return sideB;
}
2 references
public double Area()
{
return sideA * sideB;
}
2 references
public double Perimeter()
{
return 2 * (sideA + sideB);
}
1 reference
public bool IsSquare()
{
return sideA == sideB;
}
0 references
public void ReplaceSides()
{
double temp = sideA;
sideA = sideB;
sideB = temp;
}
}
Solution Explorer
Search Solution Explorer (Ctrl+;)
Solution 'lab2task4' (1 of 1 project)
lab2task4
Dependencies
Program.cs
Properties
91 %
No issues found
Ln: 1 Ch: 14 SPC CRLF
Output
Show output from: Debug
'lab2task4.exe' (CoreCLR: clrhost): Loaded 'C:\Program Files\dotnet\shared\Microsoft.NETCore.App\8.0.0\System.Collections.Concurrent.dll'. Skipped loading symbols. Module is o
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The program '[12500] lab2task4.exe' has exited with code 0 (0x0).
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Search
lab2task4
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Any CPU
lab2task4
Program.cs*
lab2task4
Rectangle
sideA
public class ArrayRectangles
{
private Rectangle[] rectangleArray;
1 reference
public ArrayRectangles(int n)
{
rectangleArray = new Rectangle[n];
}
0 references
public ArrayRectangles(params Rectangle[] rectangles)
{
rectangleArray = rectangles;
}
4 references
public bool AddRectangle(Rectangle rectangle)
{
for (int i = 0; i < rectangleArray.Length; i++)
{
if (rectangleArray[i] == null)
{
rectangleArray[i] = rectangle;
return true;
}
}
return false;
}
1 reference
public int NumberMaxArea()
{
Solution Explorer
Search Solution Explorer (Ctrl+;)
Solution 'lab2task4' (1 of 1 project)
lab2task4
Dependencies
Program.cs
Properties
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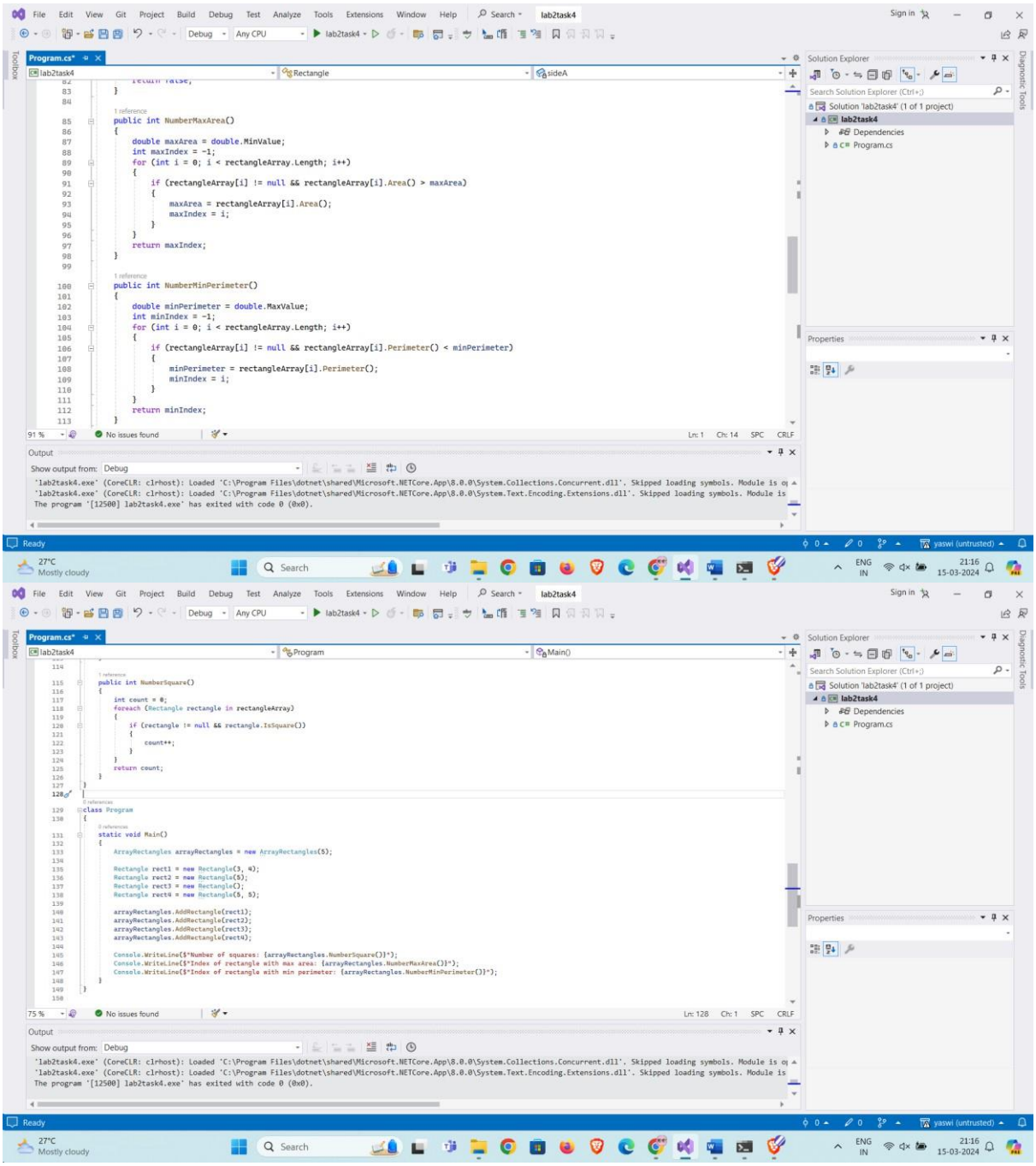
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Program.cs*
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Rectangle
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Solution 'lab2task4' (1 of 1 project)
lab2task4
Dependencies
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public int NumberMaxArea()
{
double maxArea = double.MinValue;
int maxIndex = -1;
for (int i = 0; i < rectangleArray.Length; i++)
{
if (rectangleArray[i] != null && rectangleArray[i].Area() > maxArea)
{
maxArea = rectangleArray[i].Area();
maxIndex = i;
}
}
return maxIndex;
}
public int NumberMinPerimeter()
{
double minPerimeter = double.MaxValue;
int minIndex = -1;
for (int i = 0; i < rectangleArray.Length; i++)
{
if (rectangleArray[i] != null && rectangleArray[i].Perimeter() < minPerimeter)
{
minPerimeter = rectangleArray[i].Perimeter();
minIndex = i;
}
}
return minIndex;
}
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No issues found
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Output
Show output from: Debug
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Program.cs*
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Program
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Search Solution Explorer (Ctrl+;)
Solution 'lab2task4' (1 of 1 project)
lab2task4
Dependencies
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Toolbox
Diagnostic Tools
public int NumberSquare()
{
int count = 0;
foreach (Rectangle rectangle in rectangleArray)
{
if (rectangle != null && rectangle.IsSquare())
{
count++;
}
}
return count;
}
}
class Program
{
static void Main()
{
ArrayRectangles arrayRectangles = new ArrayRectangles(5);
Rectangle rect1 = new Rectangle(3, 4);
Rectangle rect2 = new Rectangle(5);
Rectangle rect3 = new Rectangle();
Rectangle rect4 = new Rectangle(5, 5);
arrayRectangles.AddRectangle(rect1);
arrayRectangles.AddRectangle(rect2);
arrayRectangles.AddRectangle(rect3);
arrayRectangles.AddRectangle(rect4);
Console.WriteLine($"Number of squares: {arrayRectangles.NumberSquare()}");
Console.WriteLine($"Index of rectangle with max area: {arrayRectangles.NumberMaxArea()}");
Console.WriteLine($"Index of rectangle with min perimeter: {arrayRectangles.NumberMinPerimeter()}");
}
}
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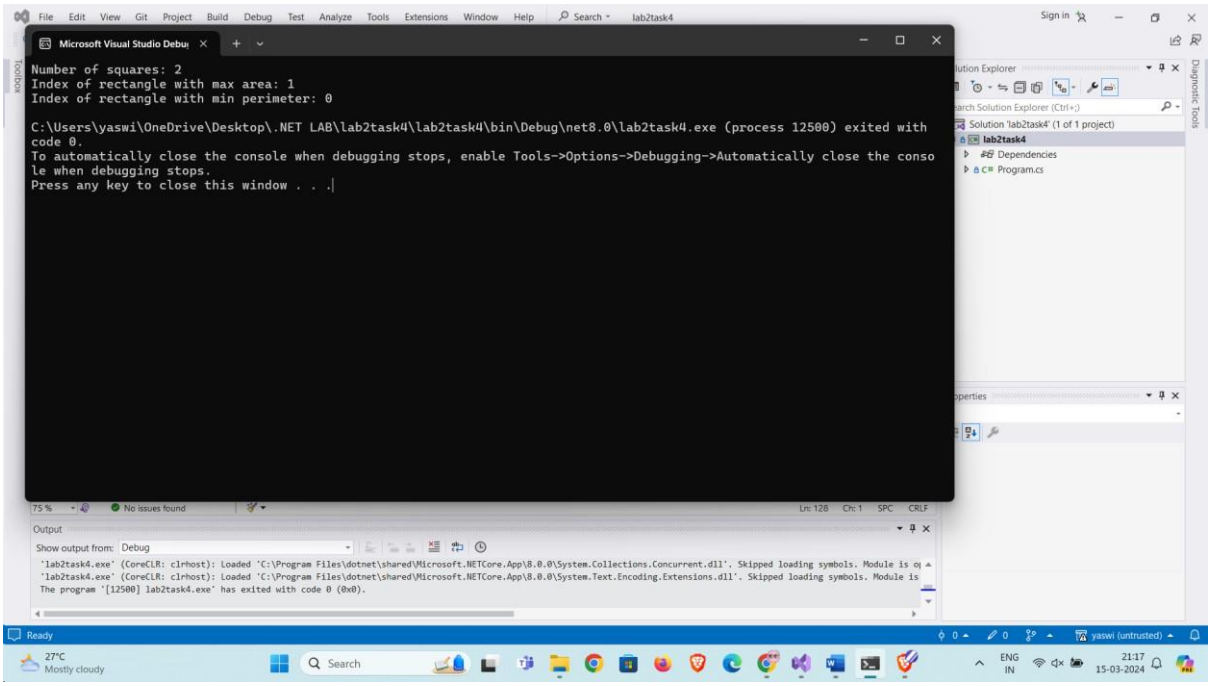
OUTPUT

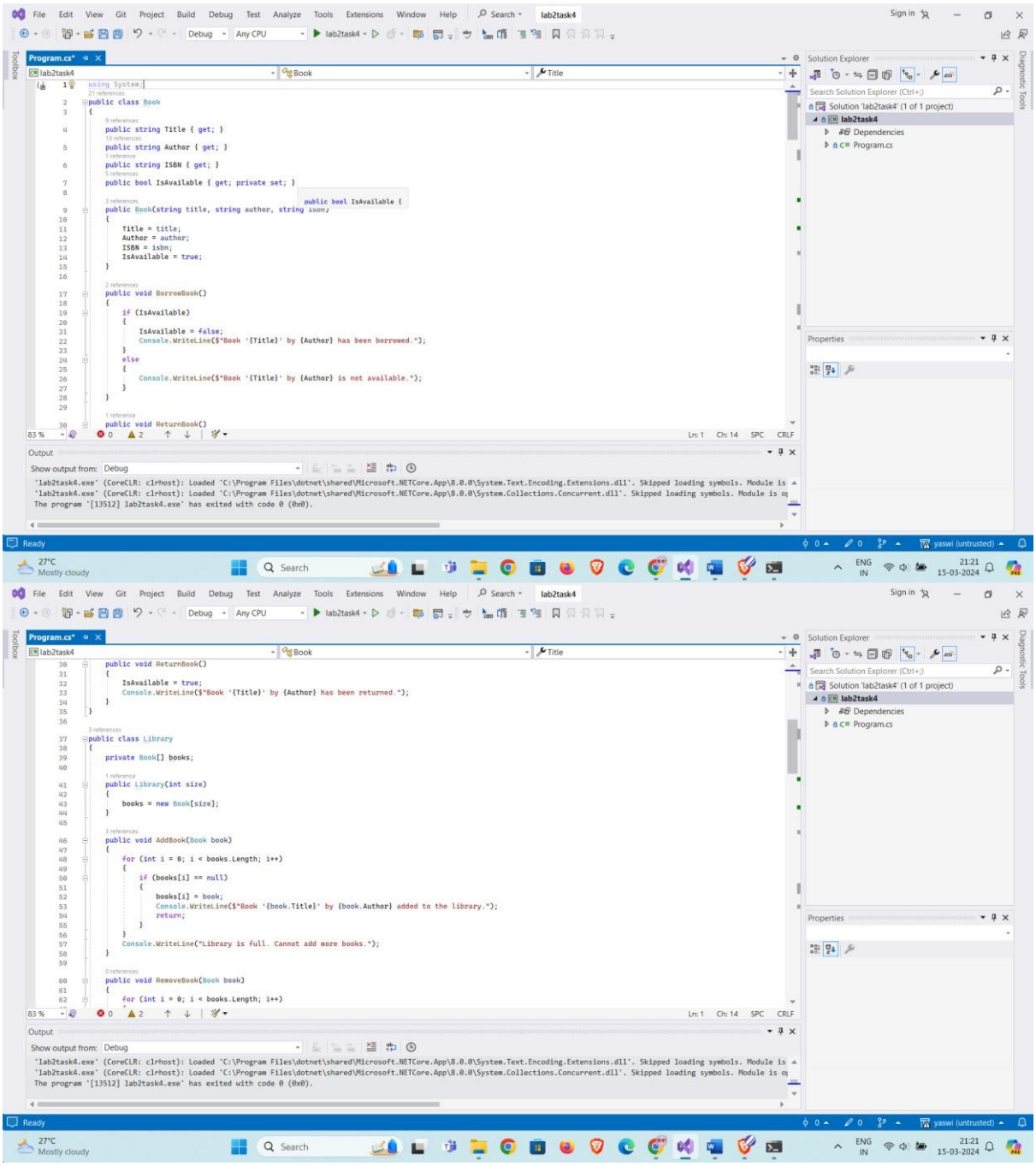


POST-LAB

1. What are the building blocks of an OOP Application ,Design an Application and find the low-level and Advanced classes in that Application along with specifications?

Note: here you can take any real time user defined class and supporting methods to implement low level and advanced level classes.

Solution:


File Edit View Git Project Build Debug Test Analyze Tools Extensions Window Help
Search
lab2task4
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lab2task4
Program.cs*
lab2task4
Book
Title
using System;
public class Book
{
public string Title { get; }
public string Author { get; }
public string ISBN { get; }
public bool IsAvailable { get; private set; }
public Book(string title, string author, string isbn)
{
Title = title;
Author = author;
ISBN = isbn;
IsAvailable = true;
}
public void BorrowBook()
{
if (IsAvailable)
{
IsAvailable = false;
Console.WriteLine($"Book '{Title}' by {Author} has been borrowed.");
}
else
{
Console.WriteLine($"Book '{Title}' by {Author} is not available.");
}
}
public void ReturnBook()
Solution Explorer
Search Solution Explorer (Ctrl+;)
Solution 'lab2task4' (1 of 1 project)
lab2task4
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Output
Show output from: Debug
'lab2task4.exe' (CoreCLR: clrhost): Loaded 'C:\Program Files\dotnet\shared\Microsoft.NETCore.App\8.0.0\System.Text.Encoding.Extensions.dll'. Skipped loading symbols. Module is
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Search
lab2task4
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lab2task4
Program.cs*
lab2task4
Book
Title
public void ReturnBook()
{
IsAvailable = true;
Console.WriteLine($"Book '{Title}' by {Author} has been returned.");
}
}
public class Library
{
private Book[] books;
public Library(int size)
{
books = new Book[size];
}
public void AddBook(Book book)
{
for (int i = 0; i < books.Length; i++)
{
if (books[i] == null)
{
books[i] = book;
Console.WriteLine($"Book '{book.Title}' by {book.Author} added to the library.");
return;
}
}
Console.WriteLine("Library is full. Cannot add more books.");
}
public void RemoveBook(Book book)
{
for (int i = 0; i < books.Length; i++)
Solution Explorer
Search Solution Explorer (Ctrl+;)
Solution 'lab2task4' (1 of 1 project)
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Show output from: Debug
'lab2task4.exe' (CoreCLR: clrhost): Loaded 'C:\Program Files\dotnet\shared\Microsoft.NETCore.App\8.0.0\System.Text.Encoding.Extensions.dll'. Skipped loading symbols. Module is
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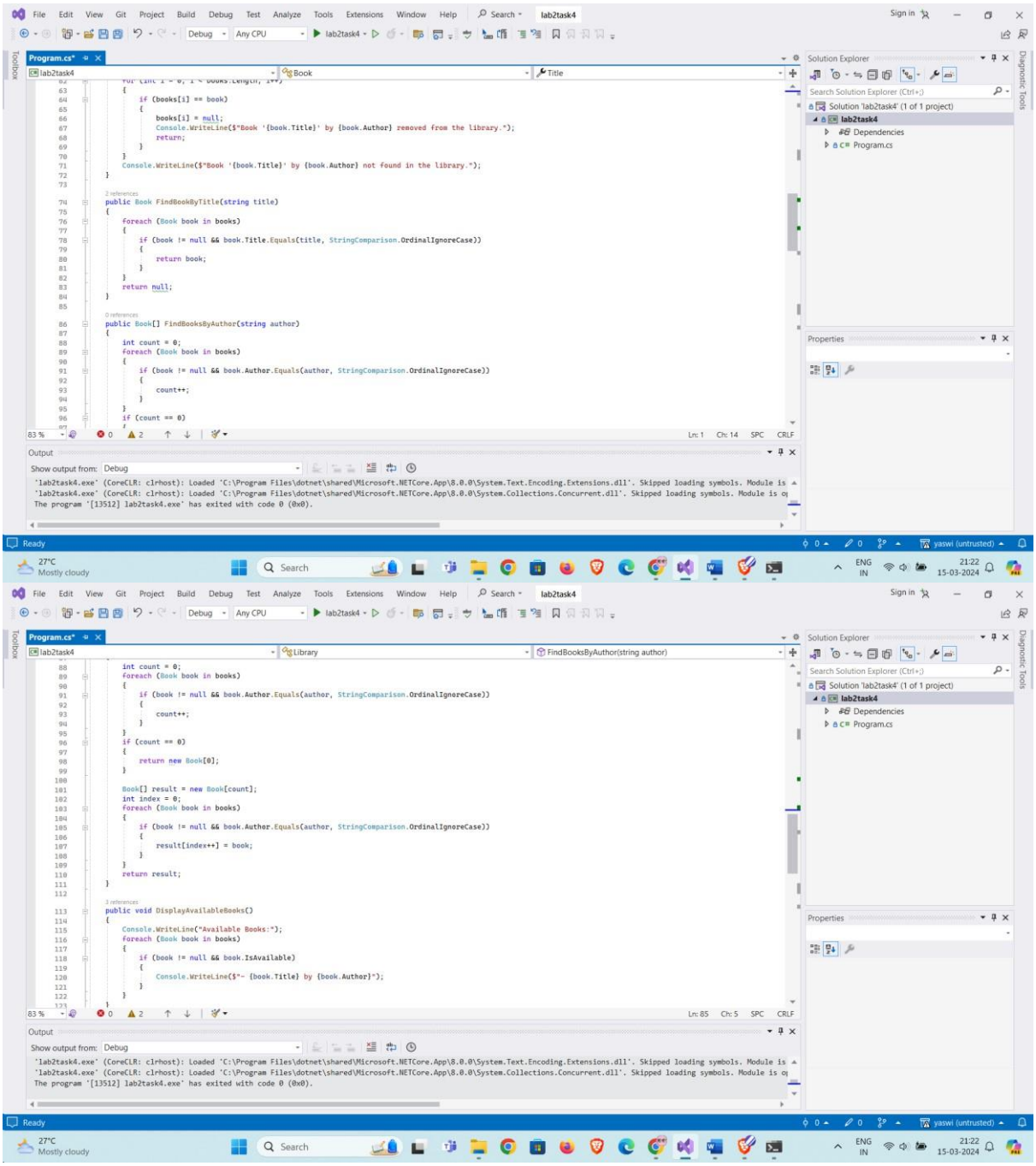
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Program.cs*
lab2task4
Library
FindBooksByAuthor(string author)
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lab2task4
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Show output from: Debug
'lab2task4.exe' (CoreCLR: clrhost): Loaded 'C:\Program Files\dotnet\shared\Microsoft.NETCore.App\8.0.0\System.Text.Encoding.Extensions.dll'. Skipped loading symbols. Module is
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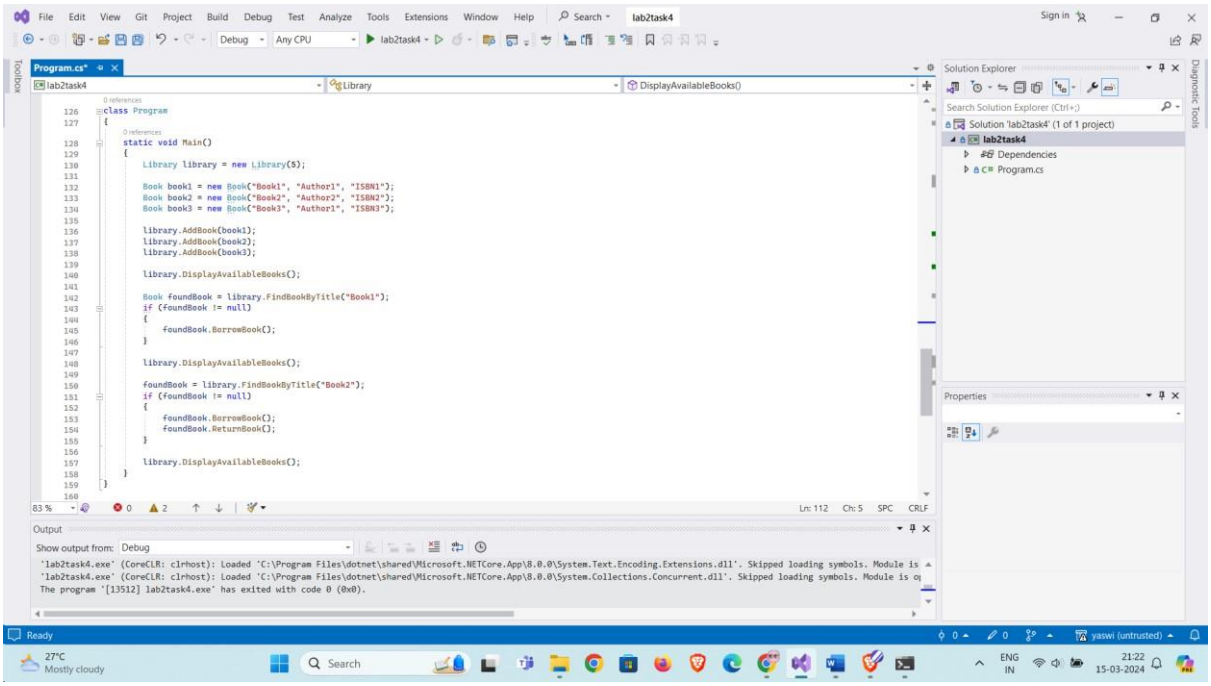
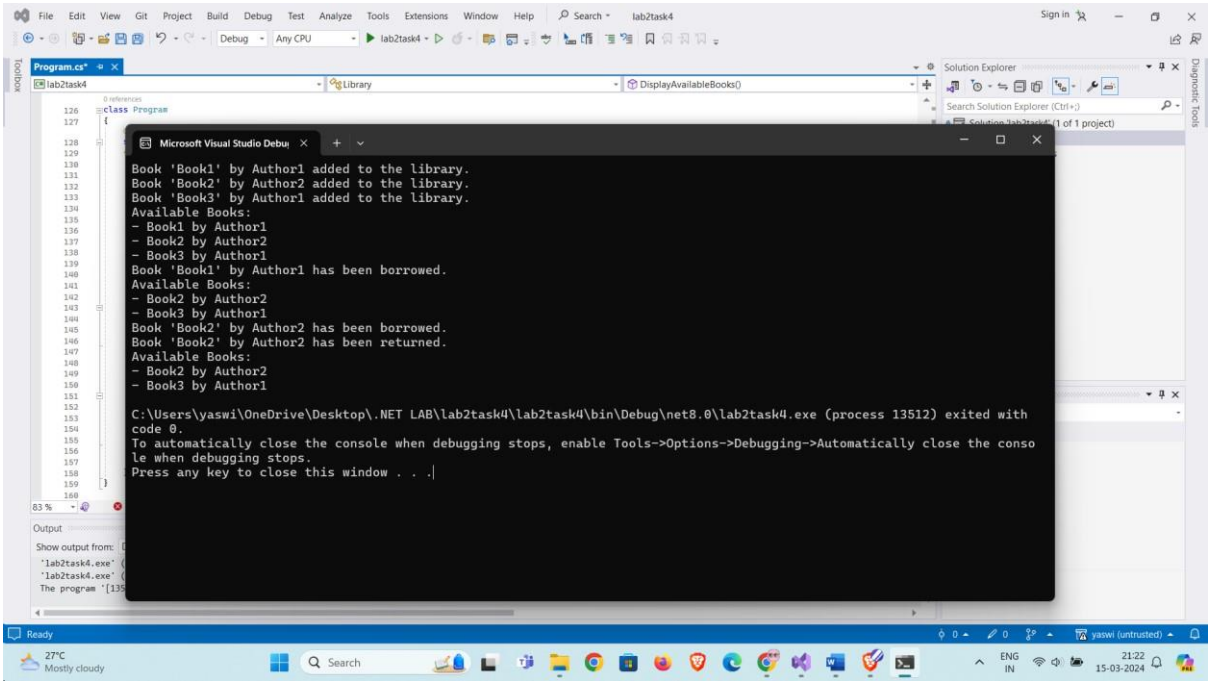


OUTPUT:


Microsoft Visual Studio Debu
Book 'Book1' by Author1 added to the library.
Book 'Book2' by Author2 added to the library.
Book 'Book3' by Author1 added to the library.
Available Books:
- Book1 by Author1
- Book2 by Author2
- Book3 by Author1
Book 'Book1' by Author1 has been borrowed.
Available Books:
- Book2 by Author2
- Book3 by Author1
Book 'Book2' by Author2 has been borrowed.
Book 'Book2' by Author2 has been returned.
Available Books:
- Book2 by Author2
- Book3 by Author1
C:\Users\yaswi\OneDrive\Desktop\.NET LAB\lab2task4\lab2task4\bin\Debug\net8.0\lab2task4.exe (process 13512) exited with code 0.
To automatically close the console when debugging stops, enable Tools->Options->Debugging->Automatically close the console when debugging stops.
Press any key to close this window . . .