Day 4 – C# & Collections

Date: 12-10-2025

Topic: Collections, Strings, Exception Handling

1. ARRAYS IN C#

Definition:

An **array** is a collection of elements of the same data type stored in contiguous memory locations. It allows easy access to elements using an index.

Syntax:

```
int[] numbers = new int[5];          // Declaration

int[] values = {1, 2, 3, 4, 5};      // Initialization
```

Key Properties and Methods:

Property/Method	Description	Example
Length	Returns total number of elements	arr.Length
Sort()	Sorts elements in ascending order	Array.Sort(arr)
Reverse()	Reverses order of elements	Array.Reverse(arr)
IndexOf()	Returns index of specific value	Array.IndexOf(arr, value)

Types of Arrays in C#

Type	Declaration	Description
Single Dimensional	int[] arr = new int[5];	One-dimensional (like list)
Multi-Dimensional	int[,] matrix = new int[2,3];	2D or 3D matrix-type arrays
Jagged Array	int[][] jagged = new int[3][];	Array of arrays (each sub-array can have different lengths)

Example:

```
int[] marks = { 90, 85, 80 };

foreach (int mark in marks)

{

   Console.WriteLine(mark);

}
```

2. STRINGS IN C#

Definition:

A **string** is a sequence of characters enclosed within double quotes.
In C#, strings are **immutable**, meaning their value cannot be changed after creation.

Characteristics:

- Stored as objects of the System.String class.
- Supports operators like +, ==, and !=.
- Strings can be manipulated using various built-in methods.

Common String Methods:

Method	Description	Example	Output
Length	Returns string length	"Hello".Length	5
ToUpper()	Converts to uppercase	"hello".ToUpper()	HELLO
ToLower()	Converts to lowercase	"HELLO".ToLower()	hello
Substring(start, len)	Extract substring	"Dhruv".Substring(0,3)	Dhr
Replace(old, new)	Replace characters	"C#".Replace("#","Sharp")	CSharp
Split(' ')	Splits string into array	"Hello World".Split(' ')	["Hello","World"]
Trim()	Removes whitespace	" hello ".Trim()	"hello"
Contains()	Checks substring	"Hello".Contains("He")	True

Example:

```
string company = "Dhruv Compusoft";

Console.WriteLine(company.ToUpper());

Console.WriteLine(company.Replace("Compusoft", "Technology"));
```

String Interpolation

String interpolation makes it easy to embed variables directly inside strings.

```
string name = "Udaya";

Console.WriteLine($"Welcome {name} to .NET training!");
```

StringBuilder (Mutable String)

For frequent string modifications, use StringBuilder (from System.Text).

```
using System.Text;


StringBuilder sb = new StringBuilder("Hello");
sb.Append(" World");
sb.Replace("World", "Dhruv");
Console.WriteLine(sb.ToString());
```

Reason: StringBuilder is mutable → better performance for loops or concatenations.

3. COLLECTIONS IN C#

Definition:

Collections are **dynamic data structures** that store, retrieve, and manipulate groups of related objects efficiently.
They are part of the **System.Collections** and **System.Collections.Generic** namespaces.

Types of Collections:

Type	Description	Namespace	Example
List<T>	Dynamic array of specific type	System.Collections.Generic	List<int>
Dictionary<TKey,TValue>	Stores key-value pairs	System.Collections.Generic	Dictionary<string,int>
Queue<T>	FIFO (First In, First Out)	System.Collections.Generic	Queue<string>
Stack<T>	LIFO (Last In, First Out)	System.Collections.Generic	Stack<int>
HashSet<T>	Stores unique elements only	System.Collections.Generic	HashSet<int>

Example: List

```
List<string> names = new List<string>() {"Udaya", "Shetty"};
names.Add("Dhruv");
foreach (string n in names)
{
   Console.WriteLine(n);
}
```

Example: Dictionary

```
Dictionary<string, int> ages = new Dictionary<string, int>();
ages["Udaya"] = 24;
ages["Suresh"] = 26;

foreach (var pair in ages)
{
   Console.WriteLine($"{pair.Key} - {pair.Value}");
}
```

Example: Queue & Stack

```
Queue<int> queue = new Queue<int>();
queue.Enqueue(1);
queue.Enqueue(2);
Console.WriteLine("Dequeued: " + queue.Dequeue());

Stack<int> stack = new Stack<int>();
stack.Push(10);
stack.Push(20);
Console.WriteLine("Popped: " + stack.Pop());
```

Example: HashSet

```
HashSet<int> set = new HashSet<int>() {1, 2, 2, 3};
foreach (var item in set)
{
   Console.WriteLine(item);
}
```

Output:

1

2

3

(duplicates are ignored)

4. EXCEPTION HANDLING IN C#

Definition:

An **exception** is a runtime error that disrupts program execution.
C# provides structured exception handling using try, catch, finally, and throw.

Syntax:

```
try
{
   // Code that may throw exception
}
catch (Exception ex)
{
   Console.WriteLine(ex.Message);
}
finally
{
   Console.WriteLine("Execution finished.");
}
```

Key Terms:

Keyword	Description
try	Contains code that may cause an error
catch	Handles the exception
finally	Executes regardless of exception
throw	Manually raises an exception

Common Exception Types:

Exception	Description
DivideByZeroException	Division by zero
NullReferenceException	Accessing a null object
IndexOutOfRangeException	Invalid array index
FormatException	Invalid input format
FileNotFoundException	File not found
InvalidOperationException	Invalid operation for state

Example:

```
try  {
   int x = 10, y = 0;
   int z = x / y;
}
catch (DivideByZeroException)
{
   Console.WriteLine("Error: Division by zero is not allowed.");
}
finally
{
   Console.WriteLine("Program execution complete.");
}
```

Custom Exception Example

You can create your own exception by extending the Exception class.

```
class InvalidAgeException : Exception  {
   public InvalidAgeException(string message) : base(message) {}
}


class Demo  {
   static void Main()
   {
      try
      {
         int age = 15;
         if (age < 18)
            throw new InvalidAgeException("Age must be 18 or above.");
      }
      catch (InvalidAgeException ex)
      {
         Console.WriteLine("Custom Exception: " + ex.Message);
      }
   }
}
```

5. THE VAR, DYNAMIC, AND OBJECT KEYWORDS

These are **data typing mechanisms** that define how variable types are decided.

Keyword	Type Decided	Compile Time Check	Example
var	At compile time	Yes	var x = 10;
dynamic	At runtime	No	dynamic a = 10; a = "Text";
object	Base type for all data	Needs casting	object obj = 10;

Example:

```
var a = 10;          // int
dynamic b = "Hello";  // runtime
object c = 25;       // must cast later: (int)c
```

6. FOREACH LOOP

Used to iterate over arrays, lists, or collections.

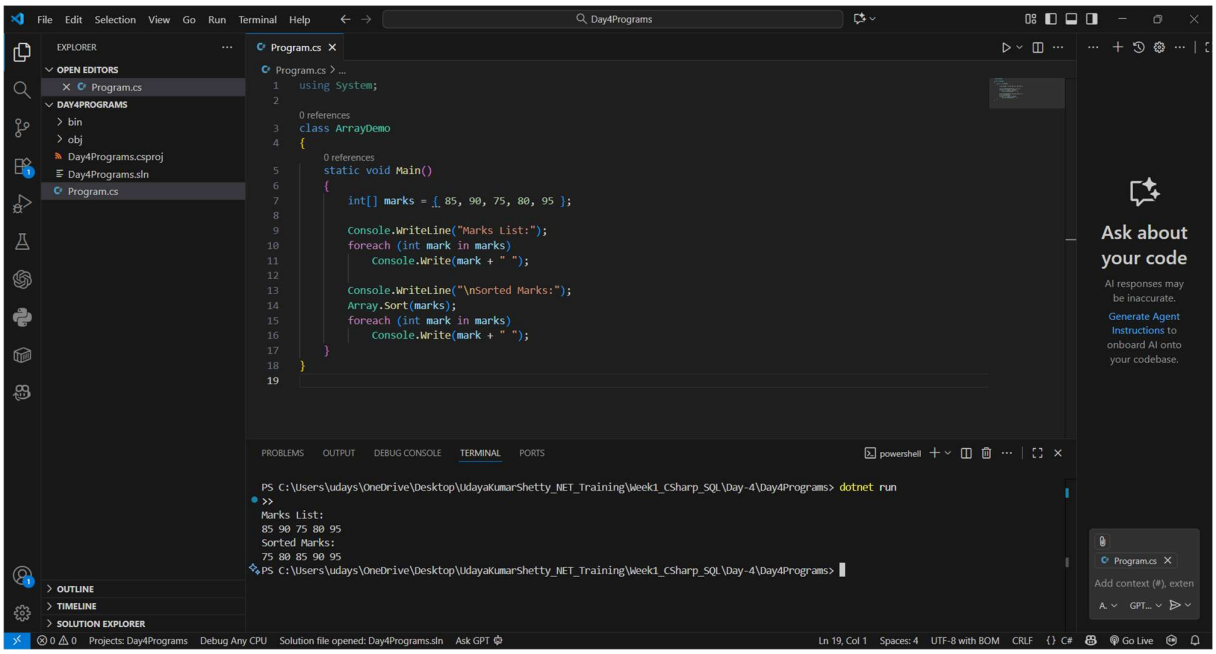
```
int[] arr = {10, 20, 30};
foreach (int num in arr)
{
   Console.WriteLine(num);
}
```

Summary Table

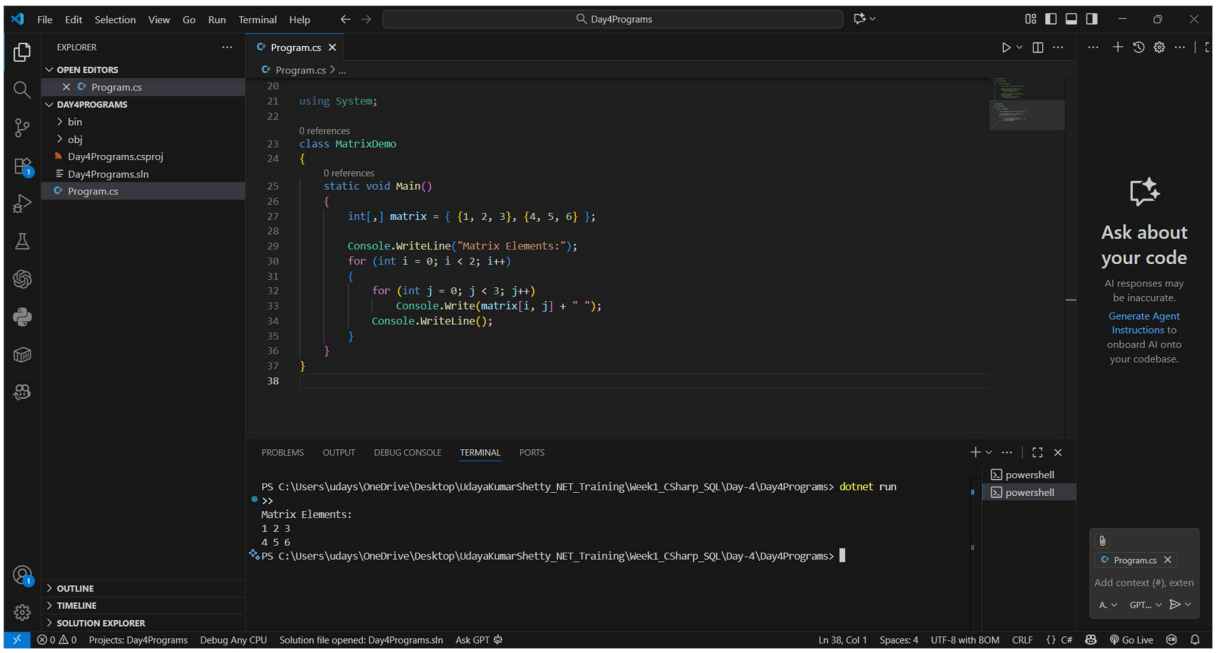
Concept	Description	Example
Array	Fixed-size same-type data collection	int[] nums = new int[5];
String	Immutable text data	"Dhruv".ToUpper()
StringBuilder	Mutable string class	sb.Append("Text")
List	Dynamic array	List<int>
Dictionary	Key-value pairs	Dictionary<string,int>
Stack	LIFO collection	Push(), Pop()
Queue	FIFO collection	Enqueue(), Dequeue()
Exception Handling	Handling runtime errors	try-catch-finally
Custom Exception	User-defined errors	class MyException : Exception
var/dynamic/object	Variable typing system	Compile-time / Runtime

Snapshots:

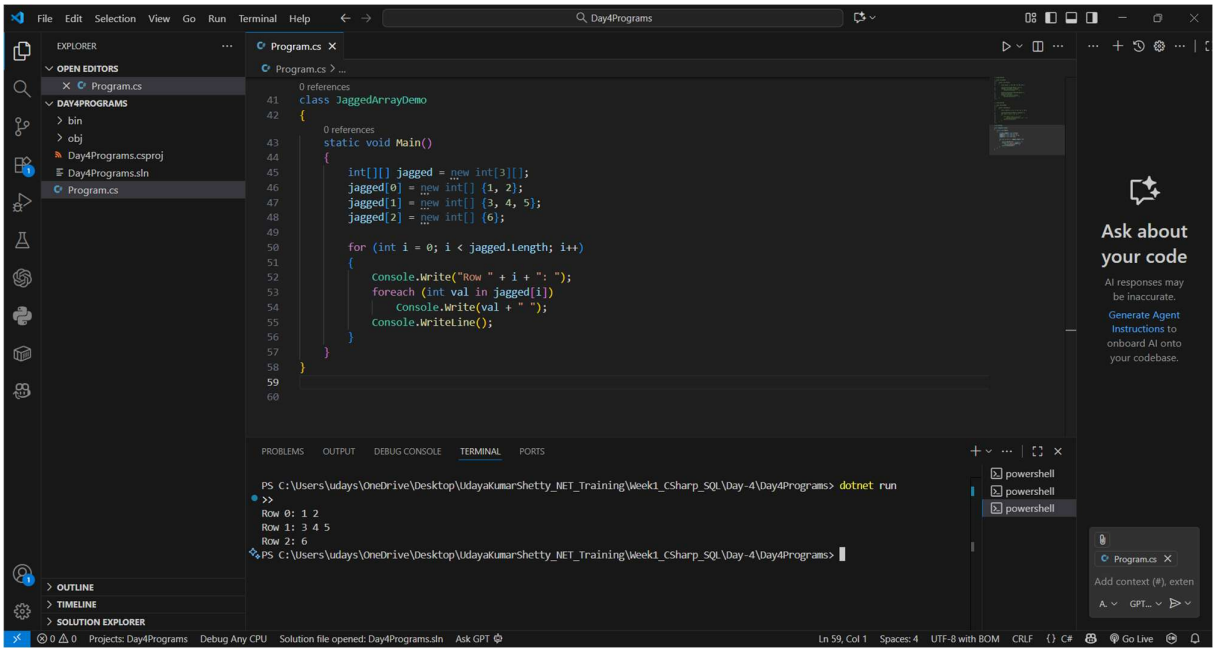
1. Single-Dimensional Array



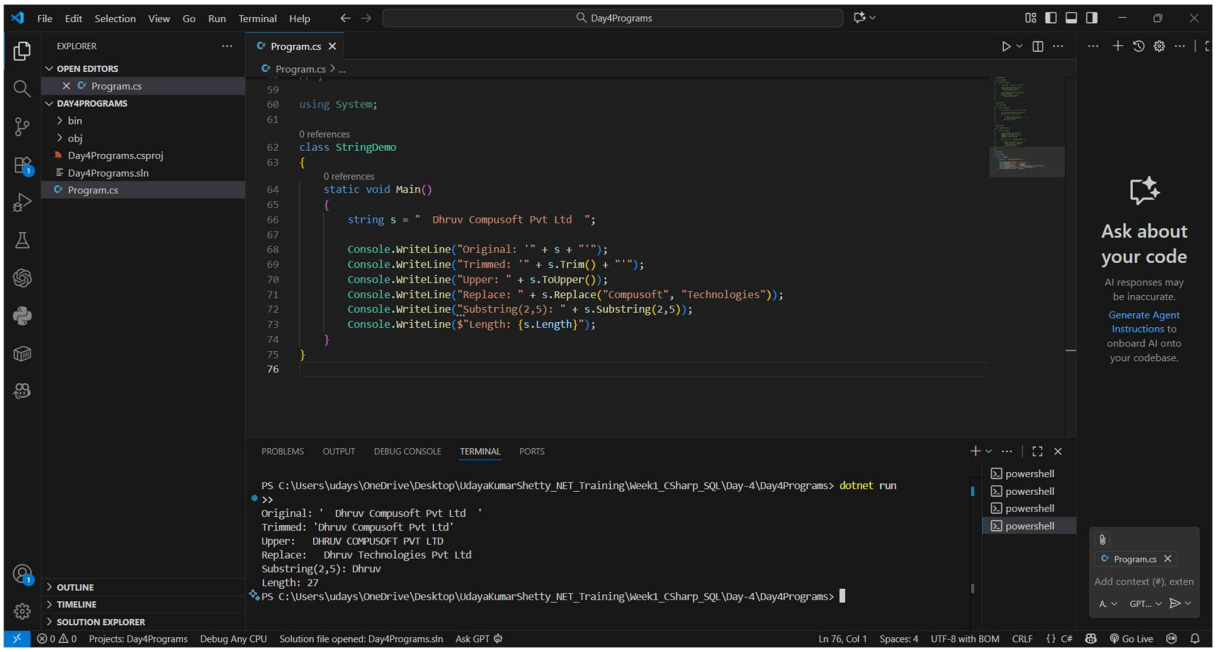
2. Multi-Dimensional Array



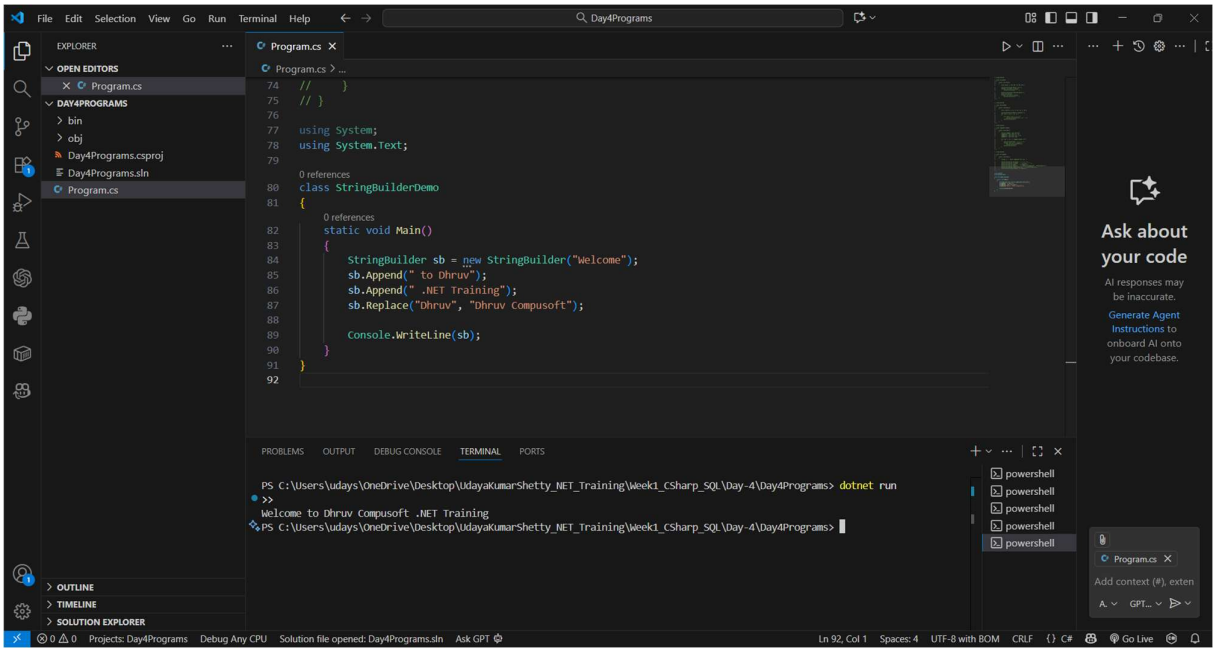
3. Jagged Array



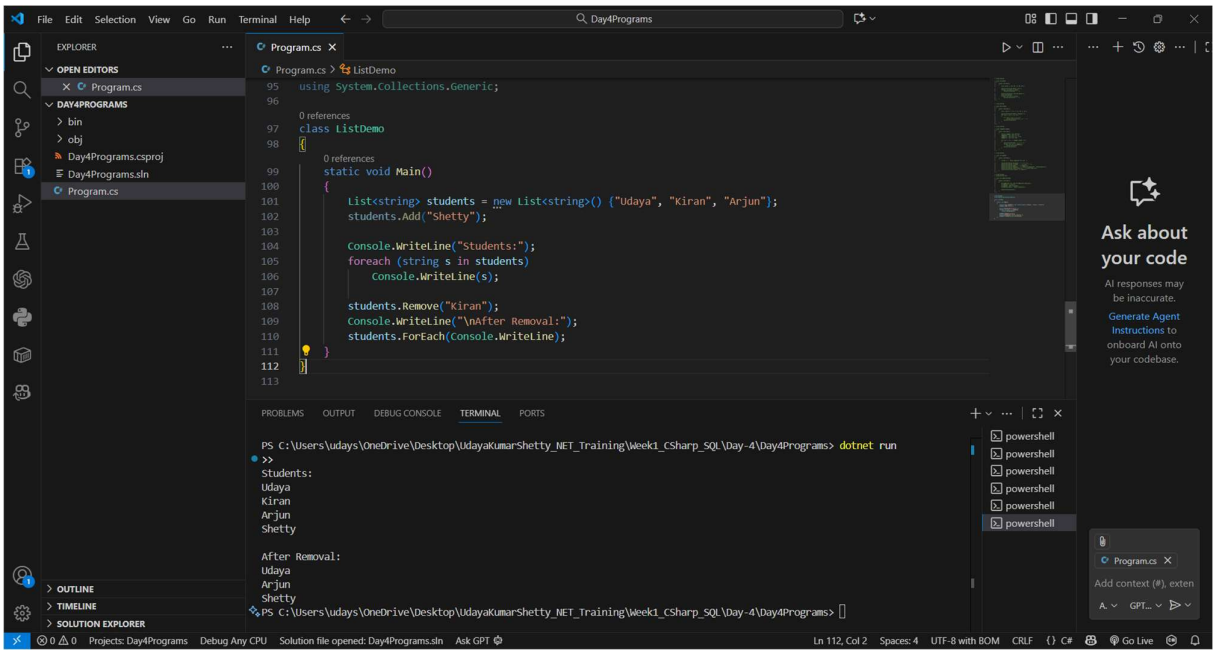
4. String Operations



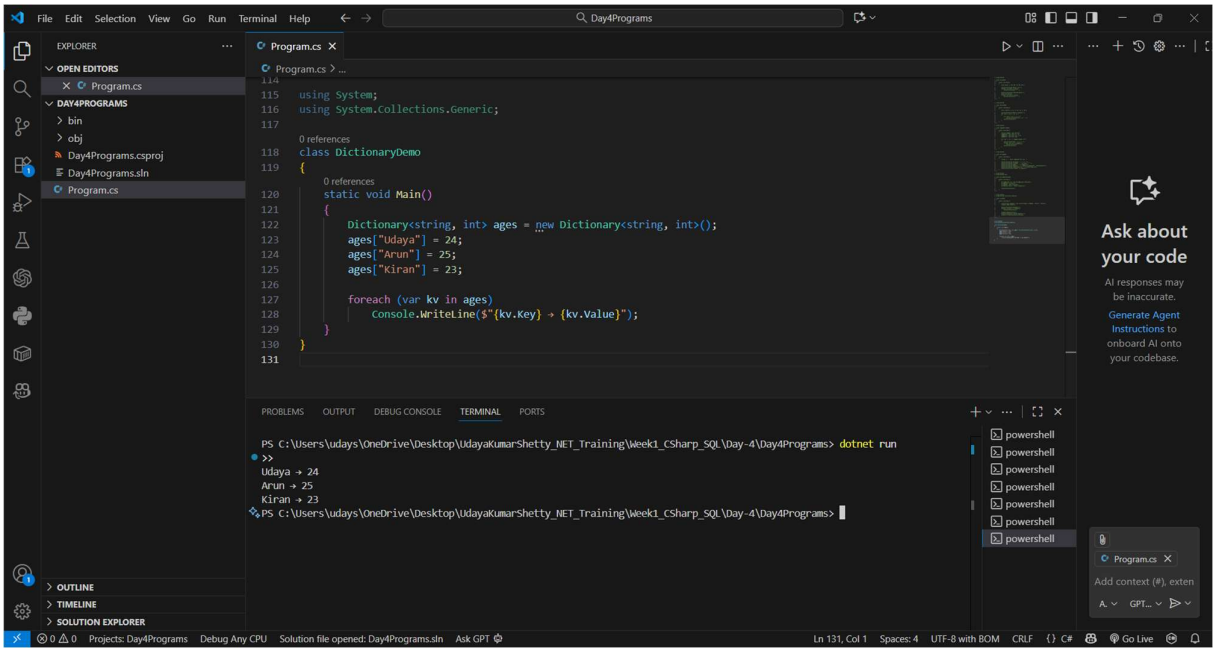
5. StringBuilder Example



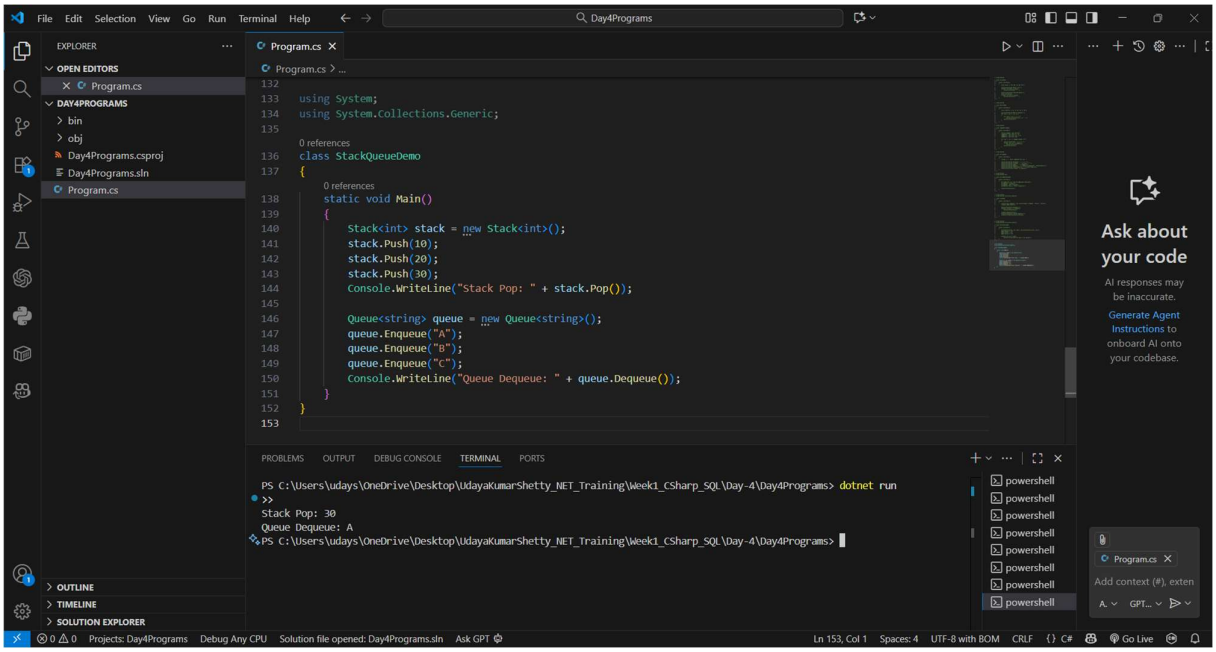
6. List Collection



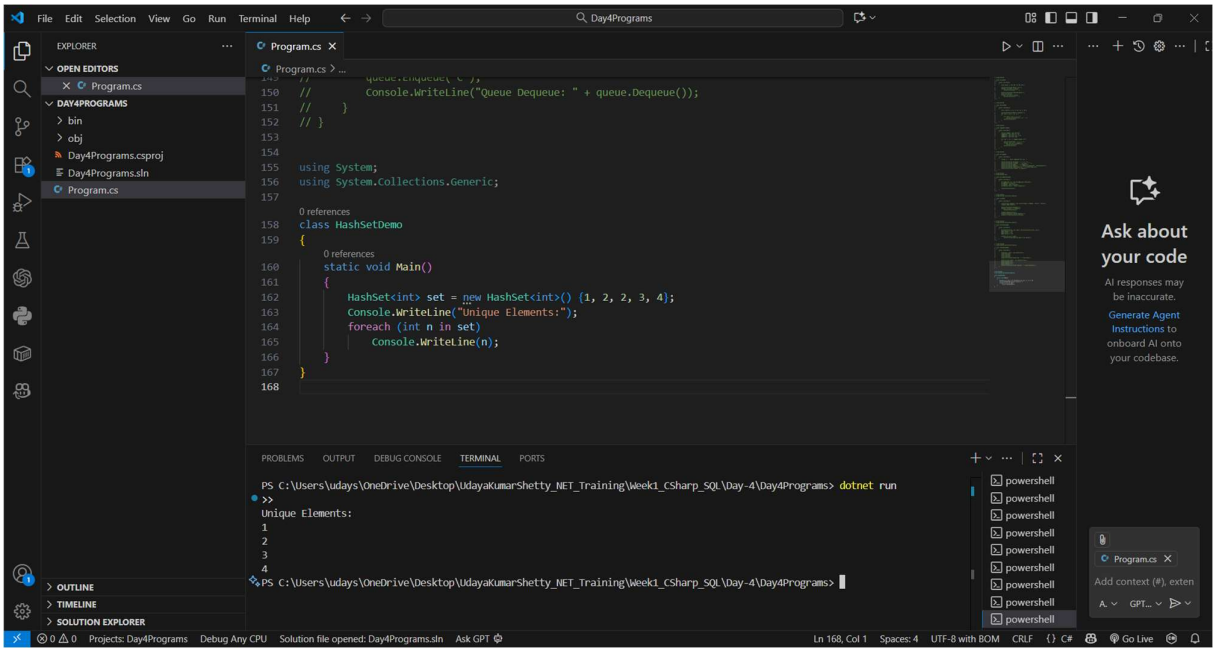
7. Dictionary Collection



8. Stack & Queue



9. HashSet (Unique Items)

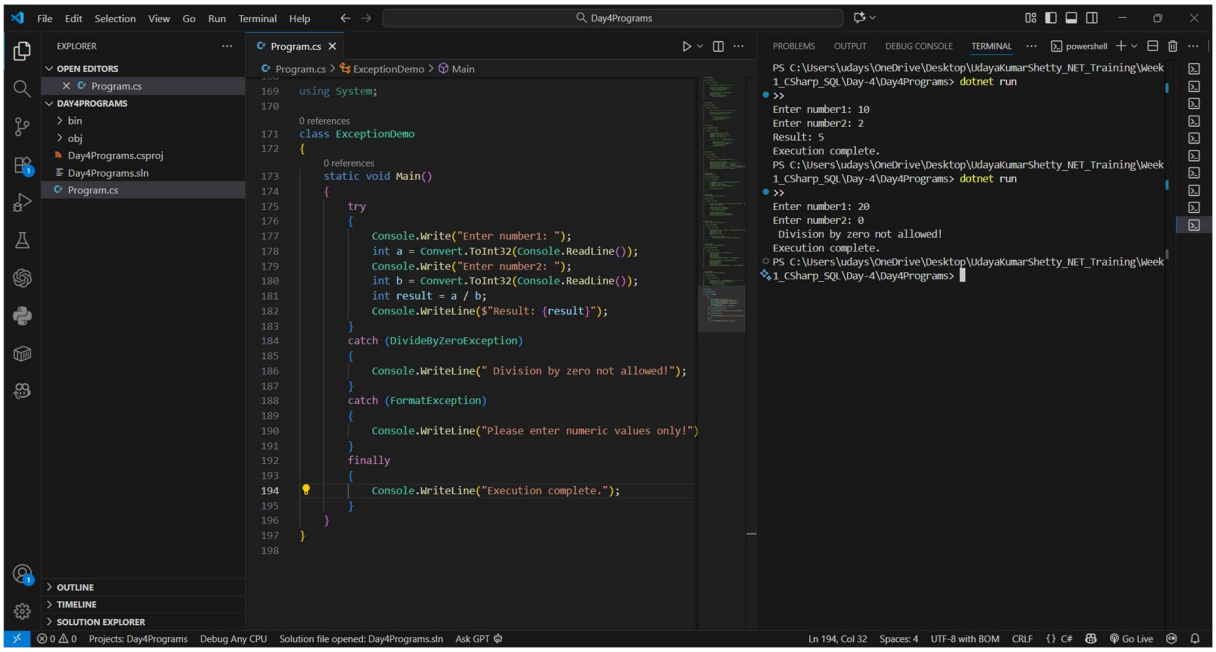


```
using System;
using System.Collections.Generic;

class HashSetDemo
{
    static void Main()
    {
        HashSet<int> set = new HashSet<int>() {1, 2, 2, 3, 4};
        Console.WriteLine("Unique Elements:");
        foreach (int n in set)
            Console.WriteLine(n);
    }
}
```

```
PS C:\Users\udays\OneDrive\Desktop\UdayaKumarShetty_NET_Training\Week1_CSharp_SQL\Day-4\Day4Programs> dotnet run
>>
Unique Elements:
1
2
3
4
PS C:\Users\udays\OneDrive\Desktop\UdayaKumarShetty_NET_Training\Week1_CSharp_SQL\Day-4\Day4Programs>
```

10. Exception Handling (try–catch–finally)

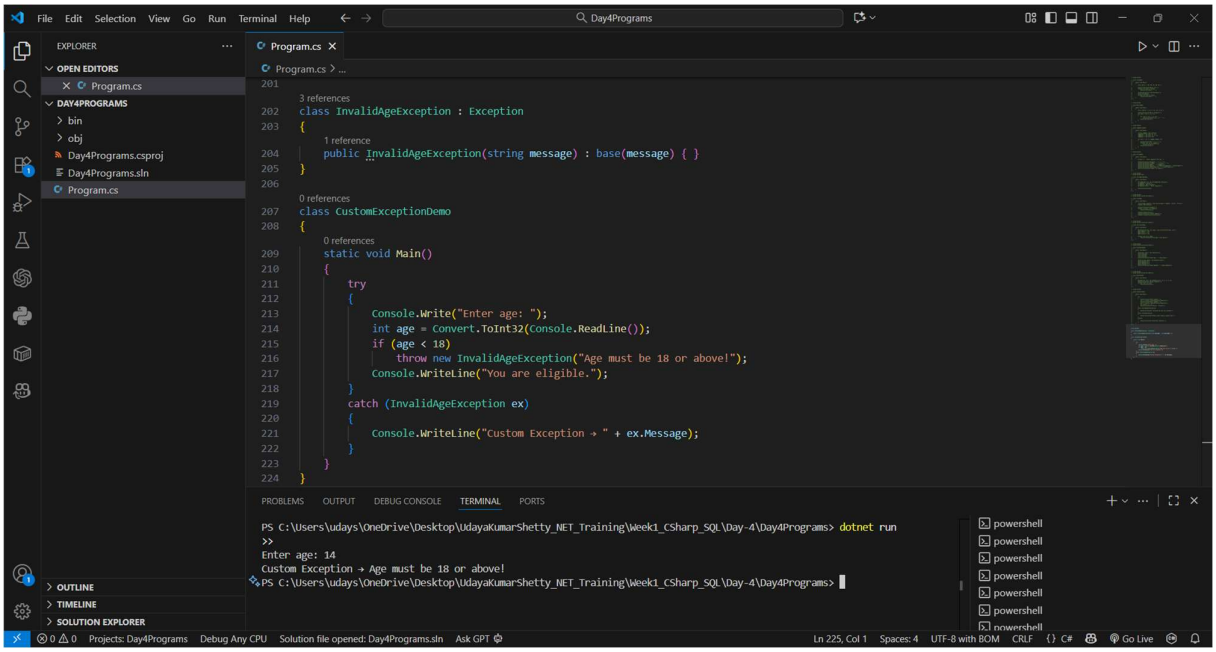


```
using System;

class ExceptionDemo
{
    static void Main()
    {
        try
        {
            Console.Write("Enter number1: ");
            int a = Convert.ToInt32(Console.ReadLine());
            Console.Write("Enter number2: ");
            int b = Convert.ToInt32(Console.ReadLine());
            int result = a / b;
            Console.WriteLine($"Result: {result}");
        }
        catch (DivideByZeroException)
        {
            Console.WriteLine(" Division by zero not allowed!");
        }
        catch (FormatException)
        {
            Console.WriteLine("Please enter numeric values only!")
        }
        finally
        {
            Console.WriteLine("Execution complete.");
        }
    }
}
```

```
PS C:\Users\udays\OneDrive\Desktop\UdayaKumarShetty_NET_Training\Week1_CSharp_SQL\Day-4\Day4Programs> dotnet run
>>
Enter number1: 10
Enter number2: 2
Result: 5
Execution complete.
PS C:\Users\udays\OneDrive\Desktop\UdayaKumarShetty_NET_Training\Week1_CSharp_SQL\Day-4\Day4Programs> dotnet run
>>
Enter number1: 20
Enter number2: 0
 Division by zero not allowed!
Execution complete.
PS C:\Users\udays\OneDrive\Desktop\UdayaKumarShetty_NET_Training\Week1_CSharp_SQL\Day-4\Day4Programs>
```

11. Custom Exception

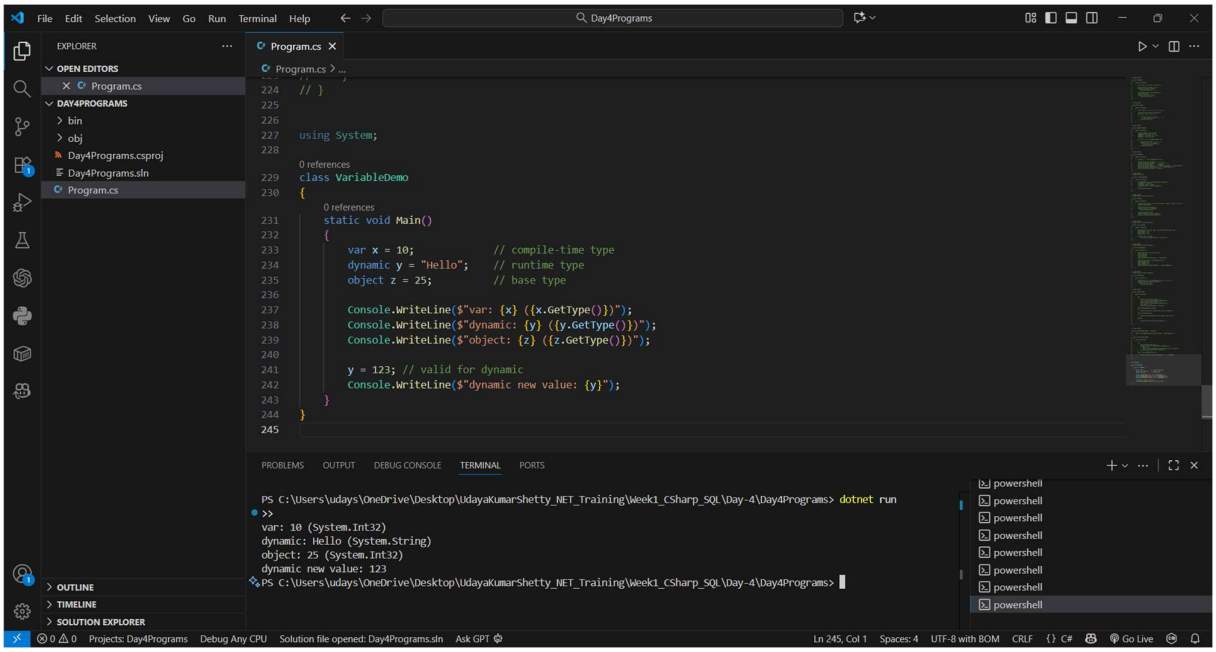


```
3 references
class InvalidAgeException : Exception
{
    1 reference
    public InvalidAgeException(string message) : base(message) { }
}

0 references
class CustomExceptionDemo
{
    0 references
    static void Main()
    {
        try
        {
            Console.Write("Enter age: ");
            int age = Convert.ToInt32(Console.ReadLine());
            if (age < 18)
                throw new InvalidAgeException("Age must be 18 or above!");
            Console.WriteLine("You are eligible.");
        }
        catch (InvalidAgeException ex)
        {
            Console.WriteLine("Custom Exception → " + ex.Message);
        }
    }
}
```

```
PS C:\Users\udays\OneDrive\Desktop\UdayaKumarShetty_NET_Training\Week1_CSharp_SQL\Day-4\Day4Programs> dotnet run
>>
Enter age: 14
Custom Exception → Age must be 18 or above!
PS C:\Users\udays\OneDrive\Desktop\UdayaKumarShetty_NET_Training\Week1_CSharp_SQL\Day-4\Day4Programs>
```

12. var / dynamic / object Demo



```
// }


using System;

0 references
class VariableDemo
{
    0 references
    static void Main()
    {
        var x = 10;             // compile-time type
        dynamic y = "Hello";    // runtime type
        object z = 25;          // base type

        Console.WriteLine($"var: {x} ({x.GetType()})");
        Console.WriteLine($"dynamic: {y} ({y.GetType()})");
        Console.WriteLine($"object: {z} ({z.GetType()})");

        y = 123; // valid for dynamic
        Console.WriteLine($"dynamic new value: {y}");
    }
}
```

```
PS C:\Users\udays\OneDrive\Desktop\UdayaKumarShetty_NET_Training\Week1_CSharp_SQL\Day-4\Day4Programs> dotnet run
>>
var: 10 (System.Int32)
dynamic: Hello (System.String)
object: 25 (System.Int32)
dynamic new value: 123
PS C:\Users\udays\OneDrive\Desktop\UdayaKumarShetty_NET_Training\Week1_CSharp_SQL\Day-4\Day4Programs>
```