Visual C# .Net using framework 4.5

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Lecture 04

Indexer

An indexer allows an object to be indexed like an array. When you define an indexer for a class, this class behaves like a virtual array. You can then access the instance of this class using the array access operator ([ ])
Declaration of behavior of an indexer is to some extent similar to a property. Like properties, you use get and set accessors for defining an indexer.
Indexers are not defined with names, but with the this keyword, which refers to the object instance.

Indexer

```
class IndexedNames
{
        private string[] namelist;
        private int size;
        public IndexedNames(int s)
        {
                size = s;
                namelist = new string[size];
                for (int i = 0; i < size; i++)
                        namelist[i] = "N. A.";
        }
        public int Size
        {
                get{return size;}
        }
```

Indexer

```
public string this[int index]
{
        get
        {
                string tmp;
                if( index >= 0 && index <= size-1 )
                {
                        tmp = namelist[index];
                }
                else
                {
                        tmp = "";
                }
                return ( tmp );
        }//end the get
```

Indexer

```
        set
        {
                if( index >= 0 && index <= size-1 )
                {
                        namelist[index] = value;
                }
        }//end the set
}//end the Indexer
```

Indexer

```
        public static void Main(string[] args)
        {
                IndexedNames names = new IndexedNames(7);
                names[0] = “Aly";
                names[1] = “Amr";
                names[2] = “Ahmed";
                names[3] = “Mohamed";
                names[4] = “Tarek";
                names[5] = “Ziad";
                names[6] = “Waleed";
                for ( int i = 0; i < names.Size; i++ )
                        Console.WriteLine(names[i]);
        } //end Main
} //end the class
```

Collections

Collection classes are specialized classes for data storage and retrieval. These classes provide support for stacks, queues, lists, and hash tables. Most collection classes implement the same interfaces.

1)ArrayList:

It represents an ordered collection of an object that can be indexed individually.

It is basically an alternative to an array. However unlike array you can add and remove items from a list at a specified position using an index and the array resizes itself automatically.

It also allow dynamic memory allocation, adding, searching and sorting items in the list.

We can Store any data type and different data type in the same ArrayList.

Arraylist belongs to System.Collection namespaces

Collections

```
class Program
{
        static void Main(string[] args)
        {
                ArrayList al = new ArrayList();
                Console.WriteLine("Adding some numbers:");
                al.Add(45);
                al.Add(78);
                al.Add(9);
                Console.Write("Sorted Content: ");
                al.Sort();
                foreach (int i in al)
                {
                        Console.Write(i + " ");
                }
        }
}
```

Collections

2)List

It is a generic class. It supports storing values of a specific type without casting to or from object. All the data in a list are from the same data type.
List belongs to System.Collections.Generic;

```
List<int> list1 = new List<int>();
list1.Add(1);
int total = 0;
foreach (int num in list1 )
{
 total += num;
}
```

Collections Initializer

It enables initialization of collections with an initialization list rather than specific calls to Add or another method. This initialization has the same effect as using the Add method with each collection element.

```
public class Person
{
        string name;
        List<string> intersets = new List<string>();
        public string Name { get { return name; } set { name =value; }
        public List<string> Interests { get { return intersets; } }
}
```

Collections Initializer

```
class Test
{
        static void Main(string[] args){
        List<Person> PersonList = new List<Person>();
        Person p1 = new Person();
        p1.Name = "Ahmed";
        p1.Interests.Add("Reading");
        p1.Interests.Add("Running");
        PersonList.Add(p1);
        Person p2 = new Person();
        p2.Name = "Aly";
        p2.Interests.Add("Swimming");
        PersonList.Add(p2);
    }
}
```

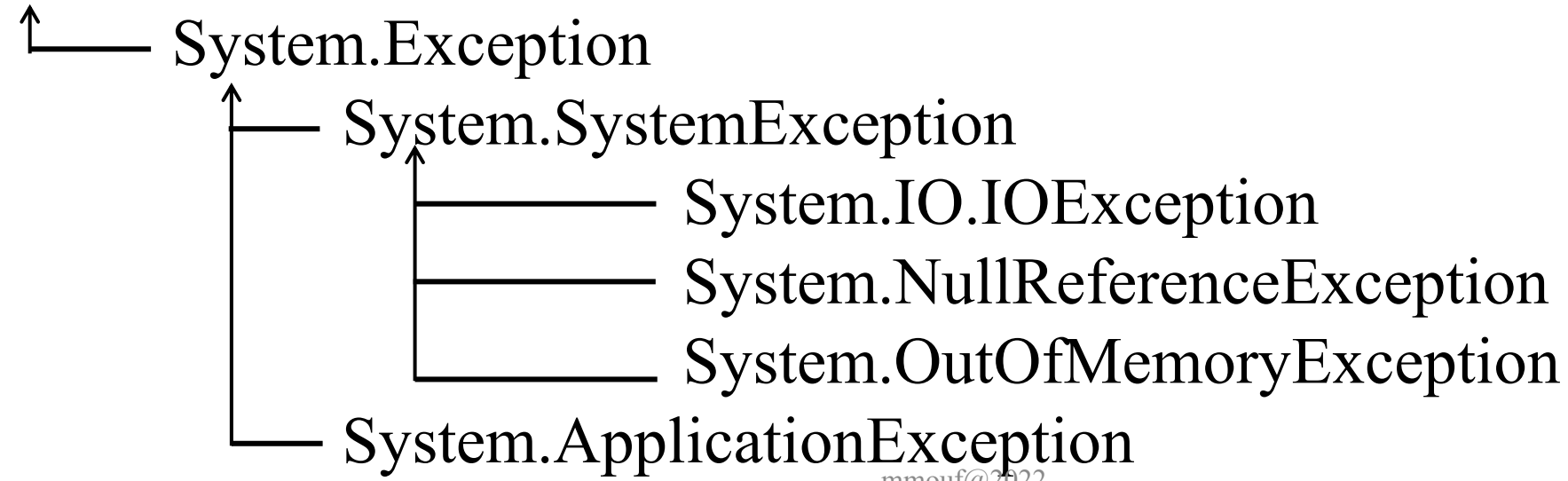
Collections Initializer

```
class Test
{
        static void Main(string[] args)
        {
                var PersonList = new List<Person>{
                 new Person{ Name = "Ahmed", Interests = { "Reading",
                                "Running" } },
                new Person { Name = "Aly", Interests = { "Swimming"} }};
        }
}
```

Exception Handling

Exceptions are errors that occur in run time (Run time error), it may happen or it may not happen

To begin to understand how to program using exception, we must first know that exceptions are objects. All System and user-defined exceptions are derived from System.Exception (which in turn is derived from System.Object).



Exception Handling

The idea is to physically separate the core program statements from the error handling statements. So, the core code that might throw exceptions are placed in a try block and the code for handling exception is put in the catch block.

try
{ … }
catch(exception_class obj)
{ …}

The try block is a section of code that is on the lookout for any exception that may be encountered during the flow of execution.

If the exception occurs, the runtime stops the normal execution, terminates the try block and start searching for a catch block that can catch the pending exception depending on its type.

Exception Handling

If the appropriate catch object is found:

- It will catch the exception
- It will handle the exception (execute the block of code in catch)
- Continue executing the program

If the appropriate catch object is not found:

- The runtime will unwind the call stack, searching for the calling function
- Re-throw the exception from this function
- Search for a catch block in

and repeat till it found an appropriate catch block or reach the Main

If it happens, the exception will be considered as uncaught and raise the default action

Exception Handling

A try block contains more than one statement. Each could raise one or more exception object. So, the try block can raise more than one exception.
The catch block catches only one exception depending on its parameter.
Then, the try block can have multiple catch blocks.

Exception Handling

```
try
{
        Console.WriteLine("Enter first Number");
        int I = int.Parse(Console.ReadLine());
        Console.WriteLine("Enter second number");
        int j = int.Parse(Console.ReadLine());
        int k = I / j;
}
catch(OverflowException e)
{
        Console.WriteLine(e);
}
catch(DivideByZeroException e)
{
        Console.WriteLine(e);
}
```

Exception Handling

The general catch block

The general catch block, is the catch block that can catch any exception regardless of its class. There are 2 ways to define the general catch block.

•catch
{
……
}
•catch(System.Exception e)
{
……
}

Any try can have only one general catch block and if it exist, it must be the last catch.

Exception Handling

The finally statement

Sometimes, throwing an exception and unwinding the stack can create a problem.

In the event, however, that there is some action you must take regardless of whether an exception is thrown such as closing a file.

When finally is executed:

If the try block executes successfully, the finally block executes immediately after the try block terminates.

If an exception occurs in the try block, the finally block executes immediately after a catch handler completes exception handling.

If the exception is not caught by a catch handler associated with that try block or if a catch handler associated with that try block throws an exception, the finally block executes, then the exception is processed by the next enclosing try block

Example:

```
class Test
{       static int I;
        private static void Welcome()
        {       WriteLine("Welcome to Our Test Class");     }
        private static void GoodBye()
        {       WriteLine("This is the end of our Class");     }
        public static void PrintMessage()
        {       WriteLine("This Message from Test Class");
                Welcome();
        }
        public static void Main()
        {       I = int.Parse(Console.ReadLine());
                PrintMessage();
        }
}
```

Creating and Using Delegates

In the Last example: assume we want the PrintMessage() to call either the Welcome() or the GoodBye() dependent on the value of I (if I < 5, call the Welcome otherwise call GoodBye).

This means that we don't know actually which function to be called when the Print Message execute.

So, Here, we need to pass the function (Welcome or GoodBye) to PrintMessage().

But, How to Pass the function?

The function itself couldn't be passed, But, we know that the function is loaded into the memory(have an reference). So, if we can pass the reference to the function that will be great.

This is done through the Delegate which allows the programmer to encapsulate a reference to a method inside a delegate object.

Creating and Using Delegates

```
public delegate void MyDelegate();
class Test
{
        static int I;
        private static void Welcome()
        {               WriteLine("Welcome to Our Test Class");     }
        private static void GoodBye()
        {               WriteLine("This is the end of our Class");     }
        public static void PrintMessage(MyDelegate m)
        {
                WriteLine("This Message from Test Class");
                m();
        }
```

Creating and Using Delegates

```
        public static void Main()
        {
                I = int.Parse(Console.ReadLine());
                if(I < 5)
                {
                        MyDelegate m_Delegate = new MyDelegate(Test.Welcome);
                        PrintMessage(m_Delegate);
                }
                else
                {
                        MyDelegate m_Delegate = new MyDelegate(Test.GoodBye);
                        PrintMessage(m_Delegate);
                }
        }
}//end class
```

Creating and Using Delegates

Note:

We can create a delegate object that is not attached at any function, and then we can attach the function

We can assign more than one function to the same delegate, and when invoking this delegate, it will execute all the functions assigned to it in the same order that it was added.

Both are done through the += operator

We can also, delete a function from the delegate object by using the -= operator

Example

A Common Code developer wants to create a generic method for filtering an array of integers, but with the ability to specify the algorithm for filtration to the Application developer

Solution

The Common Code Developer:

```
public delegate bool IntFilter(int i);
public class Common
{
    public static int[] FilterArray(int[] ints, IntFilter filter)
    {
        ArrayList aList = new ArrayList();
        foreach(int i in ints)
        {
            if(filter(i))
            {aList.Add(i);}
        }
        return((int[])aList.ToArray(typeof(int)));
    }
}
```

Solution

The Application Code Developer (I)

```
Class MyApplication
{
        public static bool IsOdd(int i)
        {
                return ((i % 2)==1);
        }
        public static void Main()
        {
                int[] nums = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10};
                int[] fnum = Common.FilterArray(nums, MyApplication.IsOdd);
                foreach(int i in fnum)
                        Console.WriteLine(i);
        }
}
```

Solution

The Application Code Developer, Anonymous method “C#2.0” (II)

```
Class MyApplication
{
        public static void Main()
        {
                int[] nums = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10};
                int[] fnum = Common.FilterArray(nums, delegate(int i)
                                        {return((i%2)==1);});
                foreach(int i in fnum)
                        Console.WriteLine(i);
        }
}
```

Solution

The Application Code Developer, Lambda Expression “C#3.0” (III)

```
Class MyApplication
{
        public static void Main()
        {
                int[] nums = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10};
                int[] fnum = Common.FilterArray(nums, j=>((j % 2)==1));
                foreach(int i in fnum)
                        Console.WriteLine(i);
        }
}
```