

Exception Handling

.NET

The C# language's exception handling features help you deal with any unexpected or exceptional situations that occur during runtime. Exception handling uses the try, catch, and finally keywords to try actions that may not succeed.

Exceptions vs. Errors

https://docs.microsoft.com/en-us/dotnet/api/system.exception?view=net-5.0#errors-and-exceptions

Run-time errors can occur for a variety of reasons, but not all errors should be handled as exceptions in your code. There are three main types of run-time errors:

• <u>Usage Errors</u>

 An error in program logic that should be addressed not through exception handling but by modifying the faulty code.

Program Errors

 a run-time error that cannot necessarily be avoided by writing bug-free code.

System Failures

 a run-time error that cannot be handled programmatically in a meaningful way.



Errors – Usage Errors

https://docs.microsoft.com/en-us/dotnet/api/system.exception?view=net-5.0#errors-and-exceptions

Usage errors occur due to faulty program logic and should be addressed though correction of the code rather than in handling an exception when it's thrown.

The override of the Object. Equals (Object) method in the following example assumes that the obj argument must always be non-null.

These errors should be caught in development and handled with thrown exceptions so that the code can be corrected before deployment.

```
public override bool Equals(object obj)
{
    // This implementation contains an error in program logic:
    // It assumes that the obj argument is not null.
    Person p = (Person) obj;
    return this.Name.Equals(p.Name);
}
```

```
public override bool Equals(object obj)
{
    // This implementation handles a null obj argument.
    Person p = obj as Person;
    if (p == null)
        return false;
    else
        return this.Name.Equals(p.Name);
}
```

Program Errors, System failures

https://docs.microsoft.com/en-us/dotnet/api/system.exception?view=net-5.0#errors-and-exceptions

Program Errors -

May reflect a routine error condition. Avoid using exception handling to deal with program errors. Instead prevent the exception by trying the action first.

USE => DateTime.TryParseExact (returns a
Boolean)

DO NOT USE => DateTime.ParseExact (throws a FormatException exception)

System failures -

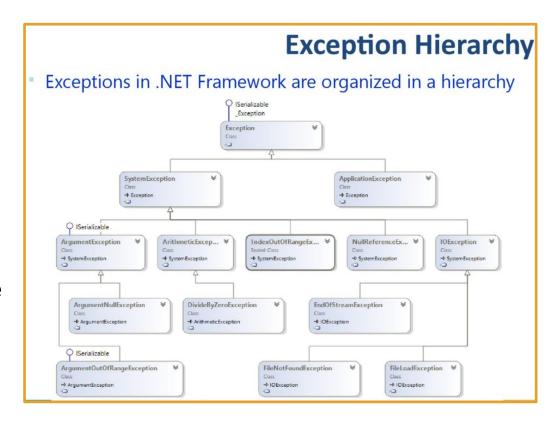
Should not be handled by using exception handling. Any method can throw an OutOfMemoryException class exception if the CLR is unable to allocate additional memory. You may be able to use an event such as AppDomain.UnhandledException and call the Environment.FailFast method to notify the user before the application terminates.

Exception Class

https://docs.microsoft.com/en-us/dotnet/csharp/programming-guide/exceptions/

The Exception *Class* is the base class for <u>all</u> exceptions. When any error occurs, the system or the application throws an *exception* that contains information about the error.

When an **exception** is thrown by a method far down the call stack, the **CLR** will unwind the stack, looking for a method with a **catch** block for that specific **exception** type and execute the first matching **catch** block. If it finds no **catch** block in the call stack, it terminates the process and displays a message to the user.



Exception Class – Hierarchy

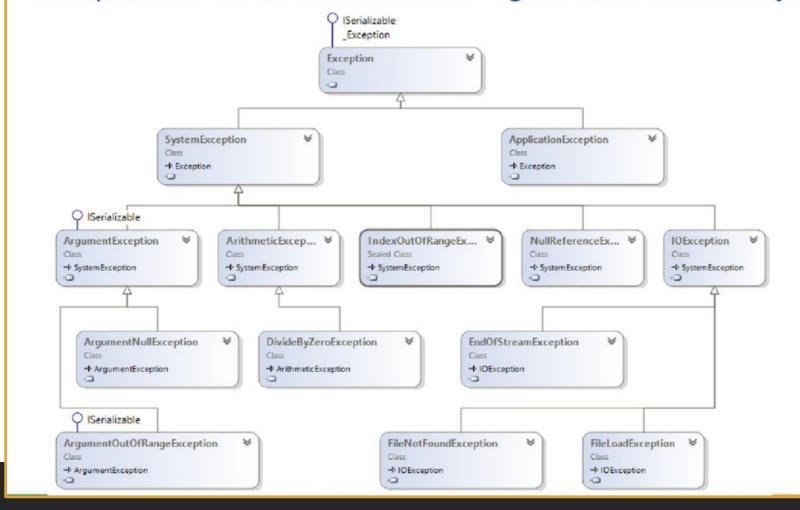
https://en.ppt-online.org/89884

All exceptions inherit from the Exception Class.

All run-time
exceptions inherit
from the
SystemException
Class.

Exception Hierarchy

Exceptions in .NET Framework are organized in a hierarchy



Exception Example

https://docs.microsoft.com/en-us/dotnet/api/system.exception?view=net-5.0#examples

This catch block will handle
ArithmeticException and
DivideByZeroException errors
because DivideByZeroException
derives from ArithmeticException.

Without the exception handling, this program would terminate with the 'DivideByZeroException was unhandled' error.

```
using System;
class ExceptionTestClass
  public static void Main()
      int x = 0;
      try
         int y = 100 / x;
      catch (ArithmeticException e)
         Console.WriteLine($"ArithmeticException Handler: {e}");
      catch (Exception e)
         Console.WriteLine($"Generic Exception Handler: {e}");
```

Exceptions – Try/Catch Block

https://docs.microsoft.com/en-us/dotnet/csharp/language-reference/keywords/try-catch

- Generally, when an *exception* is thrown, the CLR unwinds the stack looking for the appropriate *catch* statement. If no *catch* block is found, then the CLR displays an *unhandled exception* message to the user and stops execution of the program.
- The try/catch statement consists of a try block followed by one or more catch blocks. Catch blocks specify different exceptions. The try block contains the code that may cause the exception. The block is executed until an exception is thrown or it is completed successfully.

```
try
{
    ProcessString(s);
}
catch (Exception e)
{
    Console.WriteLine("{0} Exception caught.", e);
}
```

Using multiple catch arguments is a way to filter for the exceptions you want to handle.

Exceptions - Try/Catch/Finally

https://docs.microsoft.com/en-us/dotnet/csharp/language-reference/keywords/try-catch-finally

Usage of *try/catch/finally* block is to:

- obtain and use resources in a try block
- deal with exceptional circumstances in a catch block
- release the resources in the *finally* block

The finally block always runs.

```
public class EHClass
   void ReadFile(int index)
       string path = @"c:\users\public\test.txt";
       System.IO.StreamReader file = new System.IO.StreamReader(path);
       char[] buffer = new char[10];
           file.ReadBlock(buffer, index, buffer.Length);
       catch (System.IO.IOException e)
           Console.WriteLine("Error reading from {0}. Message = {1}", path, e.Message);
           if (file != null)
               file.Close();
       // Do something with buffer...
```

Exceptions - Throw

https://docs.microsoft.com/en-us/dotnet/csharp/language-reference/keywords/throwhttps://docs.microsoft.com/en-us/dotnet/csharp/language-reference/keywords/try-catch

A *throw* statement can be used in a *catch* block to *re-throw* the *exception* that is caught by the *catch* statement so that the next method up the stack receives it, too.

You can *catch* one *exception* and *throw* a different *exception*. When you do this, specify the *exception* that you caught as the inner *exception*, as shown in the following example.

```
catch (FileNotFoundException e)
{
    // FileNotFoundExceptions are handled here.
}
catch (IOException e)
{
    // Extract some information from this exception, and then
    // throw it to the parent method.
    if (e.Source != null)
        Console.WriteLine("IOException source: {0}", e.Source);
    throw;
}
```

```
catch (InvalidCastException e)
{
    // Perform some action here, and then throw a new exception.
    throw new YourCustomException("Put your error message here.", e);
}
```

Exceptions 'throw' and Unwind The Stack

https://docs.microsoft.com/en-us/dotnet/csharp/language-reference/keywords/throw

```
using System;
using System;
                                                                public class NumberGenerator
public class Example
                                                                   int[] numbers = { 2, 4, 6, 8, 10, 12, 14, 16, 18, 20 };
  public static void Main()
                                                                   public int GetNumber(int index)
     var gen = new NumberGenerator();
                                                                      if (index < 0 || index >= numbers.Length) {
     int index = 10;
                                                                         throw new IndexOutOfRangeException();
     try -
         int value = gen.GetNumber(index);
                                                                      return numbers[index];
         Console.WriteLine($"Retrieved {value}");
     catch (IndexOutOfRangeException e)
        Console.WriteLine($"{e.GetType().Name}: {index} is outside the bounds of the array");
   The example displays the following output:
         IndexOutOfRangeException: 10 is outside the bounds of the array
```

User-Defined Exceptions

https://docs.microsoft.com/en-us/dotnet/standard/exceptions/how-to-create-user-defined-exceptions

To create custom exceptions, you must:

- create your own exception classes
- Derive(inherit) from the *Exception* class.
- End the class name with the word "Exception".
- Implement the three common constructors(example).

Custom Exceptions

https://dotnettutorials.net/lesson/create-custom-exception-csharp/#:~:text=

- 1. Create a new class inheriting from *Exception*.
- 2. Override Exception's *virtual property* (Message()) with your chosen error message.
- 3. Throw the custom exception manually.

```
class Program
   static void Main(string[] args)
       int x, y, z;
       Console.WriteLine("ENTER TWO INTEGER NUMBERS:");
       x = int.Parse(Console.ReadLine());
       y = int.Parse(Console.ReadLine());
       try
           if (y \% 2 > 0)
               //throw ONE;
               throw new OddNumberException();
           z = x / y;
           Console.WriteLine(z);
       catch (OddNumberException one)
           Console.WriteLine(one.Message);
       Console.WriteLine("End of the program");
       Console.ReadKey();
```