# C# DOCUMENT

* **Visual Studio 2022 Overview**
  + Visual studio is an Integrated Development Environment developed by Microsoft.
  + It provides support for 36 different programming languages. It is available for Windows as well as for macOs.

# Different types of windows

* + The IDE has two basic window types, tool windows and document windows. Tool window include solution explorer, server explorer, output window, error list, the designers, the debugger windows.
  + When you have to view or edit two locations at once in a document, you can split the windows.

# Solution and Projects

* + A solution is simply a container visual studio uses to organize one or more related projects.
  + Create a solution
    1. Open visual studio.
    2. On the start window, select Create a new project.
    3. On the Create a new project page, enter blank solution into the search box, select the Blank Solution template, and then select Next.
    4. Name the solution and then select Create.

# Code Editor Features

* + The visual studio editor provide many features that make it easier for you to write and manage your code and next.
  + Features are :-

1. Syntax Coloring
2. Error and Warning Marks
3. Brace matching
4. Selecting code and text
5. Change tracking

# Shortcuts

|  |  |
| --- | --- |
| **Task** | **Shortcut** |
| Maximize floating window | Double click on title bar |
| Maximize/ minimize window | Win + Up arrow /  Win + Down Arrow |
| Close Active document | Ctrl + F4 |
| Start new Project | Ctrl + Shift + n |
| Open Project | Ctrl + Shift + o |
| Shown open file list | Ctrl + Alt + Down Arrow |
| Comment | Ctrl + k, Ctrl + c |
| Uncomment | Ctrl + k, Ctrl + u |
| Formatting | Ctrl + k, Ctrl + d |

**Project Types**

# Windows app, Class Library

* + A class library defines types and methods that are called by an application.
  + If the library targets .NET standard 2.0, it can be called by any .NET implementations that supports .NET standard 2.0
  + We can use a class library in our app or project by passing reference into it and then in the file using its namespace
  + Windows app is an app that can be run only on windows platform and can be executed by the operating system on the system directly.
  + Windows app in installed in windows platform using windows operating system.
  + Its interface is shown in the form of windows form.

# Web application

* + A consistent web development environment that is also used for creating the other components of the application.
  + Availability, performance, and scalability of web processing.
  + Access to the integrated .NET security model.

# Create first C# program “Hello World”

* **What is namespace?**
  + Namespaces are used to logically arrange classes, structs, interfaces, enums, and delegates.
  + The namespace in c# can be nested.
  + The .NET framework already contains number of standard namespaces like System, System.Net, System.IO, etc.

# Declaring a namespace

* + The C3 language provide a keyword namespace to create a user defined namespace. The general form of declaring the namespace is as follows.

namespace <namespace\_name>

{

// Classes or interface or struct etc.

}

* + It is not possible to use any access specifiers like private, public, etc. with a namespace declaration. The namespace in C# are implicitly have public access and this is not modifiable.
  + The namespace elements can’t be explicitly declared as private or protected. The namespace allows only public and internal elements as it members. The default is internal.

# What is class?

* + A class is like a blueprint of a specific object. In the real world, every object has some color, shape and functionalities.
  + In C#, class can be defined by using the class keyword.

public class <class name>

{

// Fields, methods, properties, etc.

}

# Variable and method declaration

1. Method :
   * A method is a group of statements that together perform a task. Every C# program has at least one class with a method named Main.
   * The Main method is the entry point for every C# application and it’s called by the common language runtime when the program is started.

<Access specifier> <Return type> <Method name> (parameter list)

{

// Method body

}

Following are the various elements of the method –

* Access specifier – This determines the visibility of a variable or a method from another class.
* Return type – a method may return a value. The return type is the data type of the value of method returns.
* Method name – method name is unique identifier and it is case sensitive.
* Parameter list – parameters are optional, enclosed between parenthesis, the parameters are used to pass and receiver data from a method/
* Method body – this contains the set of instructions needed to complete the required activity.

1. Variable :
   * C# variable contains a data value of the specific data type.
   * Variable declaration in C# is as follows – [Modifier] [Data type] [Variable name] = value;
   * Variable name must be unique.
   * Variable name can contain letters, digits, and the underscore (\_) only.
   * Variable name must start with a letter.
   * Variable names are case-sensitive, num and Num are considered different names.
   * Variable names cannot contain reserved keywords. Must prefix @ before keyword if want reserve keywords as identifiers.

# Understanding C# Program

* **Program Flow**
  + C# program consists of the following parts –

1. Namespace declarations
2. A class
3. Class methods
4. Class attributes
5. A main method
6. Statements and expressions
7. Comments
   * C# is case sensitive.
   * All statements and expression must end with a semicolon (;).
   * The program execution starts at the main method.
   * Unlike java, program file names could be different from class name.

# Understanding syntax

Using System;

Namespace HelloWorldApplication

{

Class HelloWorld

{

static void Main(string[] args)

{

Console.WriteLine(“Hello World”);

}

}

}

* The first line of the program using System; - the using keyword is used to include the System namespace in the program. A program generally has multiple using statements.
* The next line has the namespace declaration. A namespace is a collection of classes. The HelloWorldApplication namespace contains the class HelloWorld.
* The next line has a class declaration, the class HelloWorld contains the data and method definitions that your program uses. Classes generally contain multiple methods. Methods define the behavior of the class. However, the HelloWorld class has only one method Main.
* The next line defines the Main method, which is the entry point for all C# programs. The Main method states what the class does when executed.
* The Main method specifies its behavior with the statement Console.WriteLine(“Hello World”);
* WriteLine is a method of the Console class defined in the System namespace. This statement causes the message “Hello World” to be displayed on the screen.

# Working with the code files, Projects and solutions

* **Understanding structure of solution**
  + Solution is collections of projects which are related each other and are containing information of dependencies between them.
  + A solution can contain multiple projects and a project can be part of multiple solutions.
  + A solution contains projects, projects contain source files and solution also contains solutionName.sln file.

# Understanding structure of project

* + Structure of windows forms app file name is same as app name and [appname].csproj file contains references of other projects and of packages used and also version of project etc.
  + It has got dependencies which has all the server side NuGet Packages and other third-party packages required in the project.
  + It has a .cs file which contains code of windows form that we create.
  + It also contains Program.cs file which has Main method as required to run app as console application. The configuration for app is in CreateHostBuilder Method called in Main method.

# Structure of web app

* + File name is same as app name and [appname].csproj file contains references of other projects and of packages used and also version of project etc.
  + It contains connected services folder which is used to connect project to services like Azure and is basically used during deployment.
  + It has got dependencies which has all the server side NuGet packages and other third party packages required in the project.
  + Then there is properties folder which contains launchSettings.json which contains debug settings.
  + Then it contains pages folder which contains some demo interface pages.
  + wwwroot folder contains static files like’s images, css, JavaScript, etc. These are the only files which are served over http request.
  + It also contains Program.cs file which has Main method as required to run app as console application.
  + It also contains Startup.cs file which runs always first when the project is executed and it contains appSettings.json is an application configuration file and contains configurations like database settings, any global variables for whole application.

# Structure of class library

* + File name is same as app name and [appname].csproj file contains reference of other projects and of packages used and also version of project etc.
  + It has got dependencies which has all the server side NuGet packages and other third party packages required in the project.
  + It has a .cs file which contains code of particular class that we define in it.

# File extensions

* + .sln – It contains information of the projects contained in the solution as it is the solution file.
  + .csproj – It contains the reference of other projects and of packages used and also version of project etc.
  + .cs – Class file of C#.
  + .json – JavaScript Object Notation file which stores simple objects and data structures.

# Data types and Variables with Conversion

* + C# is strongly-typed language.
  + It means we must declare the type of a variable that indicates the kind of values it is going to store, such as integer, float, decimal, text, etc.

# Value Data type:

* + Assigns a value directly in both signed / unsigned form and the system allocates memory to store the value.
  + They are derived from the class System.
  + The value types directly contain data which stores numbers, alphabets, and floating-point numbers etc.

1. Pre-defined data type:

These are the already defined data types in C#

* + Integer – int
  + Decimal – decimal
  + Float – float
  + Character – char
  + Double – double

1. User defined data type:

It is a data type which is defined and used by the users.

* + Structure – struct
  + Enumerations – enum

# Reference Data type:

* + The reference data types do not contain the actual data stored in a variable, but they contain a reference to the variables.
  + In other words, they refer to a memory locations.
  + If the data in the memory location is changed by one of the variables, the other variable automatically reflects this change in value.

1. Predefined data type:
   * Such as Objects, string.
2. User defined data type:
   * Such as Classes, Interface

# Data type Conversion

* + **Implicit Conversion** :- No special syntax is required because the conversion always succeeds and no data will be lost. Examples include conversions from smaller to larger integral types, and conversions from derived classes to base classes.
  + **Explicit Conversion** :- Explicit conversions require a cast expression. Casting is required when information might get lost in the conversion, or when the conversion might not succeed for other reasons. Typical examples include numeric conversion to a type that has less precision or a smaller range, and conversion of a

base-class instance to a derived class.

* + **User defined conversions** :- User-defined conversions are performed by special methods that you can defined to enable explicit and implicit conversions between custom types that do not have a class-derived class relationship. For more information, see user-defined conversion operators.

# Boxing and Unboxing :-

o Boxing – Boxing is the process of converting a value type to the object type or any interface type implemented by this value type. Boxing is implicit.

Example :-

int numer1 = 100;

long number2 = number1;

o Unboxing – It is the process of converting a reference type to value type. Unboxing the value from the reference and assign it to a value type. Unboxing is explicit.

Example :-

string str = “45”;

int number = Convert.ToInt32(str); int number1 = int.Parse(str);

# Operators and Expressions

* + C# provides a number of operators. Many of them are supported by the built-in types and allow you to perform basic operations with values of those types. Those operators include the following groups:
* Arithmetic operators that perform arithmetic operations with numeric operands

o Arithmetic Operators - +, -, /, \*, %, ++(Incremental),

-- (Decremental) etc.

* Assignment Operators – They are used for assigning a value to a variable.

o Assignment Operators - =, +=, -=, \*=, /=, etc.

* Boolean logical operators that perform logical operations with bool operands.

o Logical Operators - &&, ||, !

* Bitwise and shift operators that perform bitwise or shift operations with operands of the integral types.

o Bitwise Operators - &, |, ^, >>, <<, etc.

* Relational Operators They are used to compare operands to obtain a result.

o Relational Operators - ==, !=, <, >, >=, <=, etc.

* Misc Operators –They perform miscellaneous tasks like giving type of operand, size of operand etc.

o Misc Operators – size of(), type of(), ?:(Ternary), etc.

# Expressions

* + Expressions are used to manipulate data. Like in Mathematics, expressions in programming languages, including C# are constructed from the operands and operators.

Example :- simpleInterest = principal \* time \* rate / 100;

* + Expressions in C# comprise one or more operators that performs some operations on variables.
  + An operations is an action performed on single or multiple values stored in variables in order to modify them or to generate a new value with the help of minimum one symbol and value.

# Understanding Decision making & statements

* If Statement: The if statement contains a boolean condition followed by a single or multi-line code block to be executed. At runtime, if a Boolean condition evaluates to true, then the code block will be executed, otherwise not.

if(condition)

{

// code block to be executed when if condition evaluates to true

}

* else if Statement: Multiple else if statements can be used after an if statement. It will only be executed when the if condition evaluates to false. So, either if or one of the else if statements can be executed, but not both.

if(condition1)

{

// code block to be executed when if condition1 evaluates to true

}

else if(condition2)

{

// code block to be executed when

// condition1 evaluates to false

//condition2 evaluates to true

}

* else Statement: The else statement can come only after if or else if statement and can be used only once in the if-else statements. The else statement cannot contain any condition and will be executed when all of the previous if and else if conditions evaluate to false.

if(condition)

{

// code block to be executed when if condition evaluates to true

}

else

{

// code block will executed when id condition evaluates to false

}

* switch Statement: The switch statement can be used instead of if else statement when you want to test a variable against multiple conditions. The switch statement starts with the switch keyword that contains a match expression or a variable in the bracket switch (match expression). The result of this match expression or a variable will be tested against conditions specified as cases, inside the curly braces {

}. Each case includes one or more statements to be executed. The case will be executed if a constant value and the value of a match expression/variable are equal. The switch statement also contains a default label. The default label will be executed if no cases executed. break keyword is used to exit the program control from a switch case.

Example:

switch(match expression/variable)

{

case constant-value:

statement(s) to be executed; break;

default:

statement(s) to be executed; break;

}

# Loop Iteration

The following statements repeatedly execute a statement or a block of statements:

* for statement: executes its body while a specified Boolean expression evaluates to true.

Syntax -

for (statement1; statement2; statement3;)

{

//code to be executed

}

* The foreach statement: enumerates the elements of a collection and executes its body for each element of the collection.

Syntax -

foreach (type variablename in arrayname)

{

//code to be executed

}

* The do statement: conditionally executes its body one or more times.

Syntax - do

{

//code to be executed

} while(condition)

* The while statement: conditionally executes its body zero or more times.

Syntax - while(condition)

{

// code to be executed

}

* break: It is used to jump out of a loop when a particular condition is met.
* Continue: It is used to continue the loop but breaking that particular iteration when continue statement is executed

# Understanding Arrays

* You can store multiple variables of the same type in an array data structure. You declare an array by specifying the type of its elements.
* An array can be single-dimensional, multidimensional or jagged.
* The number of dimensions and the length of each dimension are established when the array instance is created. These values can't be changed during the lifetime of the instance.
* The default values of numeric array elements are set to zero, and reference elements are set to null.
* A jagged array is an array of arrays, and therefore its elements are reference types and are initialized to null.
* Arrays are zero indexed: an array with n elements is indexed from 0 to n-1.
* Array types are reference types derived from the abstract base type Array. All arrays implement IList, and IEnumerable. You can use the foreach statement to iterate through an array. Single-dimensional arrays also implement IList<T> and IEnumerable<T>.

Syntax:

< Typeof array > [ ] < arrayName >;

* Here first we must specify the data type along with the brackets [].
* After that we must specify the Name of the Array.

# Defining and Calling Methods

* A method is a code block that contains a series of statements.
* A program causes the statements to be executed by calling the method and specifying any required method arguments.
* In C#, every executed instruction is performed in the context of a method.
* The Main method is the entry point for every C# application and it's called by the common language runtime.

Syntax:

< Access Specifier > < Return Type > < Method Type > (<Parameter List>)

{

// method body

}

* Access Specifier – describes the access of the method to classes in the program expublic, private, protected, Internal.
* Return Type – can be a type of value which a method returns or it also can be void if a method returns nothing.
* Method name – method receives a user defined name.
* Parameter list – it is the list of parameters passed on as argument when it is called.
* Different type of parameters in method
* Value type – It is the normal C# value parameter which means value is directly passed.
* Ref. Type – References of a variable is passed as an argument which are assigned first. Argument passed consists of ‘ref’ keyword first. Any changes made in this argument in method will reflect on the variable in the calling method.
* Optional or type – These are the type of arguments which may be passed only if operations on them are required otherwise the function consists default values of these parameters. This parameter should only be passed after required parameters

# Object Oriented Concepts

* **Static Constructor**
  + A static constructor is used to initialize static variable of the class and to perform a particular action only once.
  + Static constructor is called only once, no matter how many objects you create.
  + Static constructor is called before instance (default or parameterized) constructor.
  + A static constructor does not take any parameters and does not use any access modifiers.

# Key Points of static constructor

* + Only one static constructor can be created in the class.
  + It is called automatically before the first instance of the class created.
  + We cannot call static constructor directly. CLR

# Copy Constructor

* + The constructor which creates an object by copying variables from another object is called a copy constructor. The purpose of a copy constructor is to initialize a new instance of the values of an existing instance.
  + In C#, copy constructor is a parameterized constructor which contains a parameter of same class type. The copy constructor in C# is useful whenever we want to initialize a new instance of the values of an existing instance.
  + In simple words, we can say copy constructor is a constructor which copies a data of one object into another object.

# Private Constructor

* + When a constructor is created with private specifies, it is not possible for another classes to derive from this class, neither is it possible to create an instance of this class. They are usually used in classes that contain static members only. Some key points of a private constructor are:
* One use of a private constructor is when we have only static members.
* Once we provide a constructor that is either private or public or any, the compiler will not add the parameter-less public constructor to the class.
* In the presence of parameter less private constructor you cannot create a default constructor.
* We cannot inherit the class in which we have a private constructor.
* We can have parameters in private constructor.

# Static class in C#

* + Classes that cannot be instantiated or inherited are known as classes and the static keyword is used before the class name that consists of static data members and static methods.
  + It is not possible to create an instance of a static class using the new keyword. The main feature of static classes are as follows:
* They can only contain static members.
* They cannot be instantiated or inherited and cannot contain instance constructors. However, the developer can create static constructors to initialize the static members.

# Destructors in C#

* + A destructor is a special method which has the same name as the class but starts with the character ~ before the class name and immediately de-allocates memory of objects that are no longer required.
  + Following are the features of destructors:
* Destructors cannot be overloaded or inherited.
* Destructors cannot be explicitly invoked.
* Destructors cannot specify access modifiers and cannot take parameters.

# Inheritance in C#

* + The similarity in physical features of a child to that of its parent is due to the child having inherited these features from its parents.
  + Similarly, in C#, inheritance allows you to create a class by deriving the common attributes and methods of an existing class.
  + Inheritance provides reusability us to extend an existing class.
  + The reason behind OOP Programming is to promote the reusability of code and to reduce complexity in code and it is possible by using inheritance.
  + The inheritance concept is based on a base class and derived class.

Let us see the definition of a base and derived class.

* Base Class – is the class from which features are to be inherited into another class.
* Derived Class – it is the class in which the base class features are inherited.

# Single Inheritance

* + It is the type of inheritance in which there is one base class and one derived class.

# Hierarchical Inheritance

* + This is the type of inheritance in which there are multiple classes derived from one base class.
  + This type of inheritance is used when there is a requirement of one class feature that is needed in multiple classes.

# Multi-Level Inheritance

* + When one class is derived from another derived class then this type of inheritance is called multilevel inheritance.

# Constructor in inheritance

* + A constructor is a method with the same name as the class name and is invoked automatically when a new instance of a class is created.
  + Constructors of both classes must be executed when the object of child class is created.
  + Sub class’s constructor invoked constructor of super class.
  + Explicit call to the super class constructor from sub class’s can be made using base().
  + base() should be the first statement of child class constructor.
  + If u don’t write base() explicitly then java compiler implicitly write the base().

# Access modifiers

* + C# provides you with access modifiers that allow you to specify which classes can access the data members of a particular class.
  + In C#, there are four commonly used access modifiers
* public
* private
* protected
* internal

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Applicable | Applicable | Applicable | Applicable | Applicable |
| to the | to current | to the | to outside | to outside |
| Application | class | derived | the | the |
|  |  | class | namespace | namespace |
|  |  |  | / assembly | but in |
|  |  |  |  | derived |
|  |  |  |  | class |
| public | Yes | Yes | Yes | Yes | Yes |
| Private | No | Yes | No | No | No |
| protected | No | Yes | Yes | No | Yes |
| internal | Yes | Yes | Yes | No | No |

# Rules for access modifiers

* Members of same class can access each other.
* Only public and internal access modifiers are used with the class.

# Access Modifiers

* + **PUBLIC** – The public access modifier provides the most permissive access level.
  + The members declared as public can be accessed anywhere in the class as well as from other classes.
  + **PRIVATE** – The private access modifier provides the least permissive access level.
  + Private members are accessible only within the class in which they are declared.
  + **PROTECTED** – The protected access modifier allows the class members to be accessible within the class as well as within the derived classes.
  + **INTERNAL** – The internal access modifier allows the class members to be accessible only within the classes of the same namespace / assembly.
  + An assembly is a file that is automatically generated by the complier upon successful compilation of a .NET application.
  + The code declares a variable called NumOne as internal, which means it has only assembly-level-access.