Revision Note

Commenting

Comments are ignored when your code compiles or execute.
It mainly documents what your code does.

`// This is an example` - Single Line Comments
`/* This is an example*/` - Span Multiple Lines Comments

Statements

All statements in C# ends with `;`

```
Console.WriteLine;
```

Class & Methods

Both Class & Methods begins with `{` and ends with `}`

All C# console program must contain Main Method.
Main Method is the starting and ending of C# Console Program

```
using System;

namespace Example
{
        class Program
        {
            static void Main(string[] args)
            {
                Console.WriteLine("This is an example")
            }
        }
}
```

Using Statement

The `using` statement helps to simplify code written.

Example without `using` statement :

```
namespace Example
{
        class Program
        {
            static void Main(string[] args)
            {
                System.Console.WriteLine("Hello World!")
            }
        }
}
```

Example with `using` statement :

```
using System;

namespace Example
{
        class Program
        {
            static void Main(string[] args)
            {
                Console.WriteLine("Hello World!")
            }
        }
}
```

Namespace

The `namespace` keyword is used to declare namespace and help to control the cope of class and method names in larger programming projects

Example :

```
using System;

namespace SimpleHelloWorld
```

```
{
        class Program
        {
            static void Main(string[] args)
            {
                Console.WriteLine("Hello World!")
            }
        }
}
```

Console Input & Output Method

`Write()` - Write in the same line
`WriteLine()` - Write in a new line

`ReadLine()` - Read a line (string)

`ReadKey()` - Read a character or function key pressed

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Date Types

Data Type	Description
int	integer number
double	decimal number
string	word or setences
char	single character

Data Type	Description
bool	true or false

Variables

- Store data during program execution
- Has name and data type
- Declared before used
- Must begin with a letter
- Can contain letters, digits and underscore
- Cannot exceed 255 characters
- Reserved words such as `int`,`string`,`if`,`for`,`main` cannot be used
- Blank spaces are not allowed
- Must be unique within its scope

Example :

```
int x;
int y = x * 2;
string message1 = "PRG 2";
```

Constants

- Does not change during the execution of the program
- Declared with `const` keyword

Example :

```
const int c1 = 5;
const string message = "You can't get rid of me!";
```

If you try to change a constant value,
you will prompted with an error

Type Conversion Methods

Method	Example
ToInt32()	int numBook = Convert.ToInt32(Console.ReadLine()); * Create a variable `numBook` with data type of `int` and convert user input to integer type
ToDouble()	double rentalRate = Convert.ToDouble(Console.ReadLine()); * Create a variable `rentalRate` with data type of `double` and convert user input to double type
ToString()	double amount = 1234.5678; Console.WriteLine(amount.ToString("$#,##0.00")); * Create a variable `amount` with data type of `double` and convert user input to string type with specified pattern and display it

Arithmetic Operators

Operator	Description	Example `int a = 10, b = 20;`
`+`	Adds two operands	`a + b` will give `30`
`-`	Subtracts second operand from the first	`a - b` will give `-10`
`*`	Multiplies both operands	`a * b` will give `200`
`/`	Divides numerator by denominator	`b / a` will give `2`
`%`	Modulus Operator and remainder of after an integer division	`b & a` will give `0`
`++`	Increment operator increases integer value by one	`a++` will give `11`
`--`	Decrement operator decreases integer value by one	`a--` will give `9`

Relational Operators

Operator	Description	Example `int a = 10, b = 20;`
`==`	Checks if values of two operands are equal or not, if yes then condition becomes true	`(a == b)` is `false`
`!=`	Checks if the values of two operands are equal or not, if values are not equal then condition becomes true	`(a != b)` is `true`
`>`	Checks if the value of left operand is greater than the value of right operand, if yes then condition becomes true	`(a > b)` is `false`
`<`	Checks if the value of left operand is less than the value of right operand, if yes then condition becomes true	`(a < b)` is `true`
`>=`	Checks if the value of left operand is greater than or equal to the value of right operand, if yes then condition becomes true	`(a < b)` is `false`
`<=`	Checks if the value of left operand is greater than or equal to the value of right operand, if yes then condition becomes true	`(a <= b)` is `true`

Logical Operators

Operator	Description	Example `bool a = true, b = false;`
`&&`	Logical AND operator. If both the operands are true then condition becomes true	`(a && b)` is `false`
`&&`	Logical OR Operator. If any of the two operands true then condition becomes true	`(a || b)` is `true`
`!`	Logical NOT Operator. Use to reverse the logical state of its operand. If a condition is true then Logical NOT operator will be false.	`!(a && b)` is `true`

Concatenation Operators

- Join multiple strings into a single string
- Concatenation operators, `+`

```
string str;
str = "School of" + " " + "InfoComm Technology";
// str equals "School of InfoComm Technology"
```

- Operators can also concatenate string variables

```
string code = "EW23" ;
string name  = "Clementi" ;
string station;
station = code + name;
//station equals "EW23Clementi"
```

Control Structures - `if`

```
if (condition_1)
{
    statement_1
}

else if (condition_2)
{
    statement_2.1;
    statement_2.2
}

else
{
    statement_n
}
```

The `if` evaluate one or more condition.

- Along with a statement or statements to be executed if the condition is determined to be true, and
- Optionally, other sattements to be executed if the condition is determined to be false

Example :

```
int mark=67;
string result;

if (mark < 50)
    result = "Grade is F";
else if (mark < 60)
    result = "Grade is D";
else if (mark < 70)
     result = "Grade is C";
else if (mark < 80)
     result = "Grade is B";
else
     result = "Grade is A";
```

Control Structures - `while`

`while` executes a group of statements so long if the condition is true.
while Loop first tests condition

- If condition is `false`, it skips past all the statements
- If the condition is `true`, it executes the statements and goes back to the `while` statement and test the condition again

Loop can execute any number of times until the condition is `false`.

Statements never execute if condition is initially `false`.

Example :

```
int count = 1, sum = 0;
string result;

while (count < 10)
{
    sum += count;
    count++;
}
result = "1 + 2 + …+ 9 = " + sum;
```

Control Structures - `do-while`

It executes a group of statements so long if the condition is true

The statement will be executed at least once

Example :

```
do
{
    // statements;
} while (condition);
```

Control Structures - `for`

Executes a group of statements for a specific number of times

```
for ( initialization; conditional; increment/decrement )
{
    // statements to be executed
}
```

Example :

```
int sum = 0;
    string result;
        for (int count=1; count<10; count++)
        {
        sum += count;
        }
        result = "1 + 2 + …+ 9 = " + sum;
```

Control Structures - `foreach`

Executes a group of statements for a specific number of times

```
foreach ( initializer in string )
{
    // statements to be executed
}
```

Example :

```
string title = "programming";
    foreach (char c in title)
    {
        Console.WriteLine(c);
    }
```

List

- Zero indexed
- Initializing a list that contains number

```
List<int> numbers = new List <int> { 8, 3, 2 };
```

- Initializing an empty list and adding item subsequently

```
List<string> names = new List <string>();
names.Add("Matt");
names.Add("Joanne");
names.Add("Robert");
```

- Count property tells the number of items in List

```
int numberOfNames = names.Count;
```

Given `List<string> names = new List<string> {"Peter", "John", "Mary", "David"};`

You can display the content of list by using `for` or `foreach`.

Example :

```
for (int i=0; i<names.Count; i++)
{
   Console.WriteLine(names[i]);
}
```

```
foreach (string n in names)
{
   Console.WriteLine(n);
}
```

To modify the list content, `(listname)[list content number] = (value);`

Example :

```
List<int> marks = new List <int> {89, 77, 55, 69};

for (int i=0; i<marks.Count; i++)
{
   marks[i] = marks[i] + 5;
}
```

Array

- Stores fixed-size sequential collection of elements of the same type
- To declare and create an array

  ```
  int[] numbers = new int[10];
  ```

- To assign value into an array element

  ```
  numbers[0] = 99;
  ```

- You can also assign value into an array while declaring it

  ```
  int[] numbers = {1,2,3,4};
  ```

Given `string[] names ={"Peter", "John", "Mary", "David"};`

You can display the content of list by using `for` or `foreach`.

Example :

```
for (int i=0; i<names.Length; i++)
{
   Console.WriteLine(names[i]);
}
```

```
foreach (string n in names)
{
   Console.WriteLine(n);
}
```

Method

- Code block that contains a series of statement
- Allows programmer to modularize the program

Structure :

```
[static] return_type method_name ( [parameters] )
{
   …
}
```

Method which does not return a value, specify `void` as the `return_type`

```
static void Main(string[ ] args)
{
   DisplayMenu();
    //calling method that does not return value
}

static void DisplayMenu()
{
   Console.WriteLine("Menu");
   Console.WriteLine("1. Circle");
   Console.WriteLine("2. Square");
   Console.WriteLine("3. Triangle");
}
```

Method which returns a value, specify the `data type` as the `return_type`

```
static void Main(string[ ] args)
{
   int total = Sum(3, 5);        // calling method with return value
    // and stored in variable total
}

static int Sum(int n1, int n2)
{
    return (n1 + n2);
}
```

Method with Optional Parameter

- Allow calling of method with varying number of arguments to pass

- Optional parameter must specify a default value
- All optional parameters must be placed after the non-optional parameters

Example :
Method heading with default value defined for 2nd parameter

```
static int Sum( int n1, int n2 = 2 )
```

To call the method

```
int result = Sum(); // COMPILATION ERROR as int n1 value is not specified
int result = Sum(10); // int n1 will be 10 while int n2 will use the default value of 2
int result = Sum(10, 3); // int n1 will be 10 and int n2 will be 3, default value will be overridden
```

Date

To set dates in C#, we use `DateTime` class

- DateTime value is between 12:00:00 midnight Jan 01,0001 to 11:59:59PM Dec 31 9999.
- To create a specfic date and store it in a variable

  ```
  DateTime exampleDate = new DateTime(2021,1,1);
  ```

- To create the current date and time and store it in a variable

  ```
  DateTime currentDate = DateTime.Now;
  ```

- To print the date

  ```
  Console.WriteLine(exampleDate.ToString());
  Console.WriteLine(currentDate.ToString("dd/MM/yyy"));
  ```

You can use `Convert.ToDateTime(s)` to convert the string `s` into format of `yyyy/mm/dd` to a `DateTime` object

Example :

```
Console.Write("Enter date of birth (yyyy/mm/dd): ");
DateTime dob = Convert.ToDateTime(Console.ReadLine());
Console.WriteLine("Your birthdate is " + dob.ToString("dd/MM/yyyy");
```

AddDays() method in DateTime class

- Returns a new DateTime object that adds the specified number of days to the value of a DateTime object

Example :

```
DateTime currentDate = DateTime.Now;
DateTime oneWeekLater = currentDate.AddDays(7);
Console.WriteLine("Current Date: " + currentDate.ToString("dd/MM/yyyy"));
Console.WriteLine("One week later: " + oneWeekLater.ToString("dd/MM/yyyy"));
```

Subtract() method in DateTime class

- Returns a new TimeSpan object after subtracting the DateTime object specified in the parameter from the value of the DateTime

Example :

```
DateTime currentDate = DateTime.Now;
DateTime xmas = new DateTime(2020,12,25);
int diff = xmas.Subtract(currentDate).Days;
Console.WriteLine("Today is" + currentDate.ToString("dd/MM/yyyy"));
Console.WriteLine("There is " + diff + " days to xmas");
```

Reading Date from Text File

To read the whole text file into one string

```
using System.IO;
....
string text = File.ReadAllText("testing.txt");
Console.WriteLine(text);
```

To read the whole text file into a string array

```
using System.IO;
....
string[] lines = File.ReadAllLines("testing.txt");
foreach (string line in lines)
{
```

```
    Console.WriteLine("\t"+line);
}
```

Reading Data from csv File

To read the csv file with comma delimited into String Array

```
using System.IO;
....
string[] csvLines = File.ReadAllLines("testmarks.csv");

// Display the file contents together with average using a for loop
string[] heading = csvLines[0].Split(',');
Console.WriteLine("{0,10}  {1,10}  {2,10}  {3,10}",
        heading[0], heading[1], heading[2], "Average");
for (int i=1; i<csvLines.Length; i++)
{
    string[] marks = csvLines[i].Split(',');
    double average = (Convert.ToDouble(marks[1]) +
                Convert.ToDouble(marks[2])) / 2;
    Console.WriteLine("{0,10}  {1,10}  {2,10}  {3,10}", marks[0],
            marks[1], marks[2], average.ToString("0.00"));
}
```

Reading Data using StreamReader

```
using (StreamReader sr = new StreamReader("testmarks.csv"))
{
    string s = sr.ReadLine(); // read the heading
    // display the heading
    string[] heading = s.Split(',');
    Console.WriteLine("{0,10}  {1,10}  {2,10}  {3,10}",
            heading[0], heading[1], heading[2], "Average");
    // repeat until end of file
    while ((s=sr.ReadLine()) != null)
    {
        string[] marks = s.Split(',');
        double average = (Convert.ToDouble(marks[1]) +
            Convert.ToDouble(marks[2])) / 2;
```

```
        Console.WriteLine("{0,10}  {1,10}  {2,10}  {3,10}",
            marks[0], marks[1], marks[2], average.ToString("0.00"));
    }
}
```

Writing Data to Text File

To write an array of strings to a text file

```
using System.IO;
....
string[] lines = {"First line", "Second line", "Third line"};
File.WriteAllLines("WriteLines.txt", lines);
```

To write one string to a text file

```
using System.IO;
....
string text = "This is a string.";
File.WriteAllText("WriteText.txt",text);
```

Writing Data to Text File using StreamWriter

To write each string in a list to a text file

```
List<string> aList1 = new List<string> { "one", "two", "three" };
using (StreamWriter sw = new StreamWriter("WriteLines2.txt", false))
{
    foreach (string s in aList1)
    {
        sw.WriteLine(s);
    }
}
```

Append Data to Existing csv File

```
while (true)
{
```

```
    Console.Write("Enter student ID (or Exit to terminate): ");
    string id = Console.ReadLine();
    if (id == "Exit") break;
    Console.Write("Enter test 1 mark: ");
    string test1 = Console.ReadLine();
    Console.Write("Enter test 2 mark: ");
    string test2 = Console.ReadLine();
    string data = id + "," + test1 + "," + test2;
    using (StreamWriter sw = new StreamWriter("testmarks.csv", true))
    {
        sw.WriteLine(data);
    }
}
```

What are Classes

A class is like a "cookie-cutter", it defines the shape of objects.
Objects are like cookies; they are instances of the class.

In C#, To define a class we have

Characteristics

```
1. Name of a Class
2. Field(s)
3. Property or Properties
```

Responsibilities

```
4. Constructor(s)
5. Method(s)
```

Name of a Class

```
class Student
{

}
```

Field(s)

```
class Student
{
    private string firstname;
    private string lastname;
}
```

Property or Properties

```
class Student
{
    private string firstname;

    public string Firstname
    {
        get { return firstname; }
        set { firstname = value; }
    }
}
```

Constructors(s)

```
class Student
{
    private string firstname;

    public string Firstname
    {
        get { return firstname; }
        set { firstname = value; }
    }

    private string lastname;

    public string Lastname
    {
        get { return lastname; }
        set { lastname = value; }
    }

    public Student(string fn, string ln)
```

```
    {
        Firstname = fn;
        Lastname = ln;
    }
}
```

Method(s)

```
public Student(string fn, string ln)
{
    Firstname = fn;
    Lastname = ln;
}

public string StudentFullName()
{
    return Firstname + " " + Lastname;
}
```

Creating an Object from a Class

To create an object from a class, you need to invoke a constructor of the class using the new operator as follows

```
ClassName ObjectName = new ClassName(argument…);
```

Example :

```
Student student1 = new Student("Peter", "Pan");
Student student2 = new Student("John", "James");
```

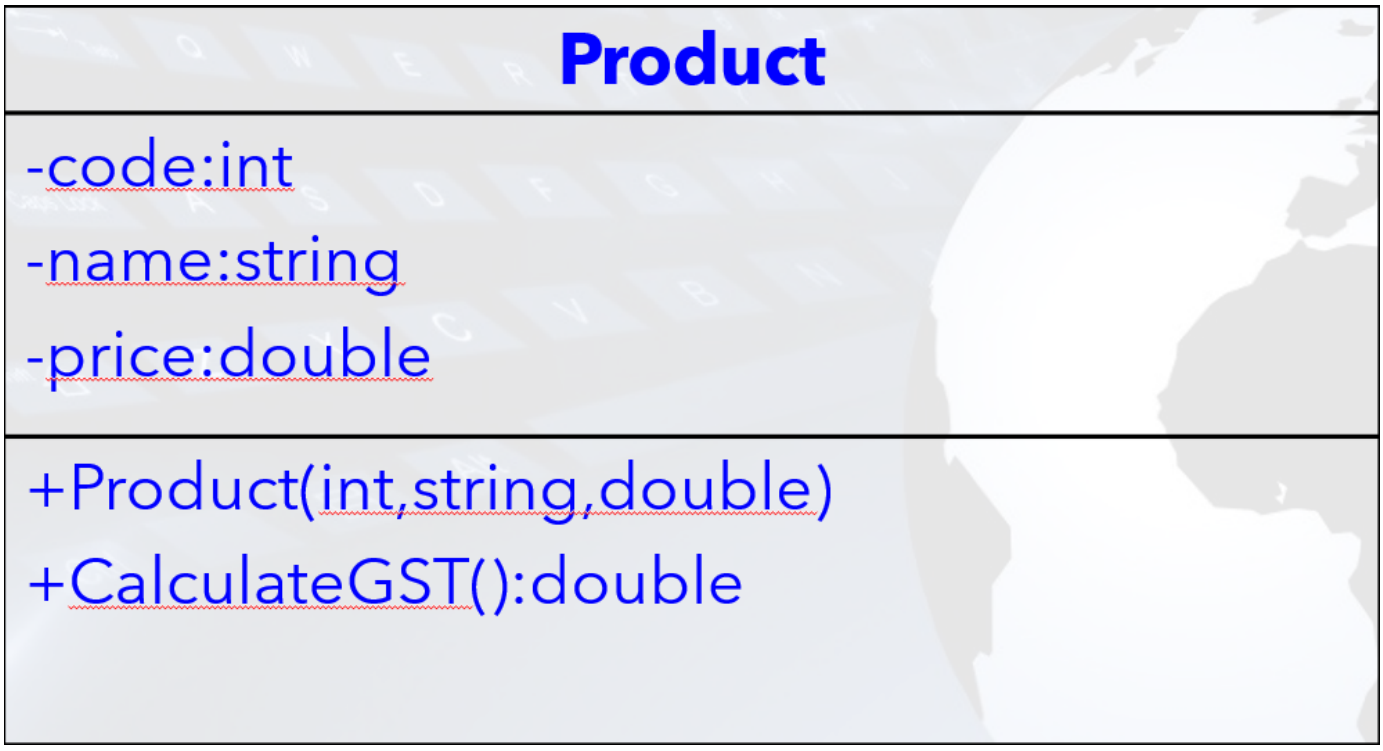
Both student1 and student2 object are instances of Student Class

---

Class Diagram

A Class can be represented using the Class Element diagram in the UML notation as shown below

Example :



`- private` (not acessible by other class, only accessible by it's own methods)
`+ public` (accessible by other classes)

Accessing data in Object

Data can be accessed via Property

```
Product p1 = new Product(1001, "iPhoneX", 1088.00);
double oldPrice = p1.Price;      // read (get) value
p1.Price = 888.00;               // update (set) value
```

Accessing methods in Object

Methods can be accessed directly by using the `.` operator

Example :

```
double gst = p1.CalculateGST();
Console.WriteLine("GST of p2 = " + p2.CalculateGST());
```

Encapsulation

- Hides irrelevant data from user
- Classes use encapsulation to hide its members that are not relevant for an outside class

Access Specifiers	Visible to objects of other classes
private	No
public	Yes

Example :

Not acceessible by objects of other classes

SavingAccount
-accountNo:string
-accountName:string

SavingAccount
-balance:double

Accessible by objects of other classes

SavingAccount
+SavingsAccount()
+SavingsAccount(string,string,double)
+Deposit(double)
Withdraw(double):bool
+ToString():string

Implementing the Attributes

- Implemented using instance variables
- Declared `private`

Example :

```
private string accountNo;
private string accountName;
private double balance;
```

Implementing the Properties

1 Property for each attribute.
Both have the same name.
Attribute name starts with lowercase.
Property name starts with Uppercase.

```
// private attributes
private string accountNo;
private string accountName;
private double balance;

// public properties
```

```
public string AccountNo
{
   get { return accountNo; }
   set { accountNo = value; }
}
public string AccountName
{
   get { return accountName; }
   set { accountName = value; }
}
public double Balance
{
   get { return balance; }
   set { balance = value; }
}
```

Simplified Version of Properties

```
// public properties
public string AccountNo { get; set; }
public string AccountName { get; set; }
public double Balance { get; set; }
```

Implementing the Behaviour

- 3 types of methods in a user-defined class
  - Constructors // for creating objects of the class
  - Other methods // for performing some specific task
  - ToString() method // for returning the information of an object if possible

---

Implementing the Constructor

- Special method of a class that is executed whenever an object is created from the class
  - Must have same name as the class
  - Constructors have NO return type (not even `void`)
  - No-argument constructor (default)
    - Constructor with no parameters
  - Parameterized constructor

    - Constructor with parameters
- Invoked using the new operator

Syntax

```
<access modifier> ClassName(){...}
```

Example :

```
// default constructor - does not have parameters
public SavingsAccount() { }

// parameterized constructor - with parameters
public SavingsAccount(string no, string name, double bal)
{
     AccountNo = no;
     AccountName = name;
     Balance = bal;
}
```

Implementing the other Methods

```
public void Deposit(double amount)
{
     Balance = Balance + amount;
}
public bool Withdraw(double amount)
{
     if (amount <= Balance)
     {
          Balance = Balance - amount;
          return true;
     }
     else
          return false;
}
```

Calling Methods of an Object

- Use the `.` notation to call your method

```
acc1.Withdraw(50);
```

- Able to accesss the methods because the methods have been declared `public`
  - `public` methods can be accessed by all classes
  - `private` data can be accessed only within the class itself

Implementing the `ToString()` method

- Converts an object to its stirng representation so that it is suitable for display
- Can override `ToString()` method to return values that are meaning for those types

Example :

```
public override string ToString()
{
    return "AccountNo:" + AccountNo +
          " AccountName:" + AccountName +
          " Balance:" + Balance;
}
```

To use `ToString()`

```
Console.WriteLine(acc1.ToString());
```

Accessing data and methods of an object

```
class Program
{
    static void Main(string[] args)
    {
        // create 2 objects, acc1 and acc2, of SavingsAccount class
        SavingsAccount acc1 = new SavingsAccount("111", "John", 200.0);
        SavingsAccount acc2 = new SavingsAccount("222", "Mary", 100.0);
        // withdraw $50 from acc1
        acc1.Withdraw(50);
        // print the balance of acc1
```

```
            Console.WriteLine("Balance of Account 1 : " + acc1.Balance);
            // deposit $100 to acc2
            acc2.Deposit(100);
            // print the detail of acc2
            Console.WriteLine(acc2.ToString());
        }
}
```