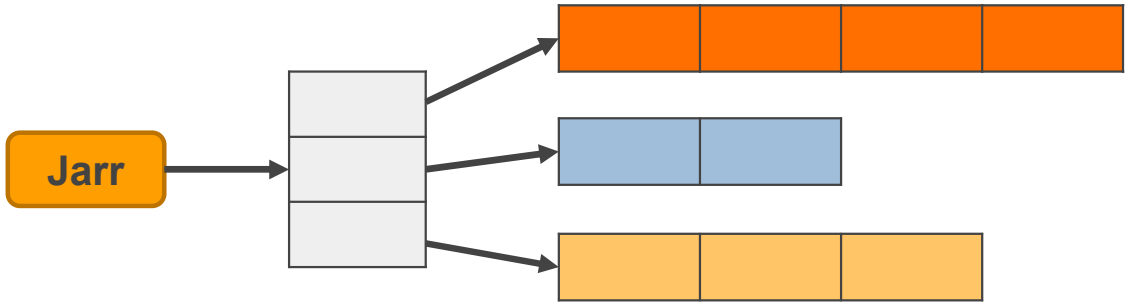
Multi Dimensional Array

- Jagged Array (Array of Arrays)



- Declare Jagged Array Reference

```
int[][]Jarr ;
```

Multi Dimensional Array

- Initialization reference

```
int[][] jarr = new int[3][];
jarr[0] = new int[4] { 1, 2, 3 ,4 };
jarr[1] = new int[2] { 4, 5};
jarr[2] = new int[3] { 10, 15, 20};
```

  - Using array initializer

```
int[][] jArray = new int[][] {
          new int[] { 1, 2, 3 ,4 },
          new int[] { 4, 5},
          new int[] { 10, 15, 20}
            };
```

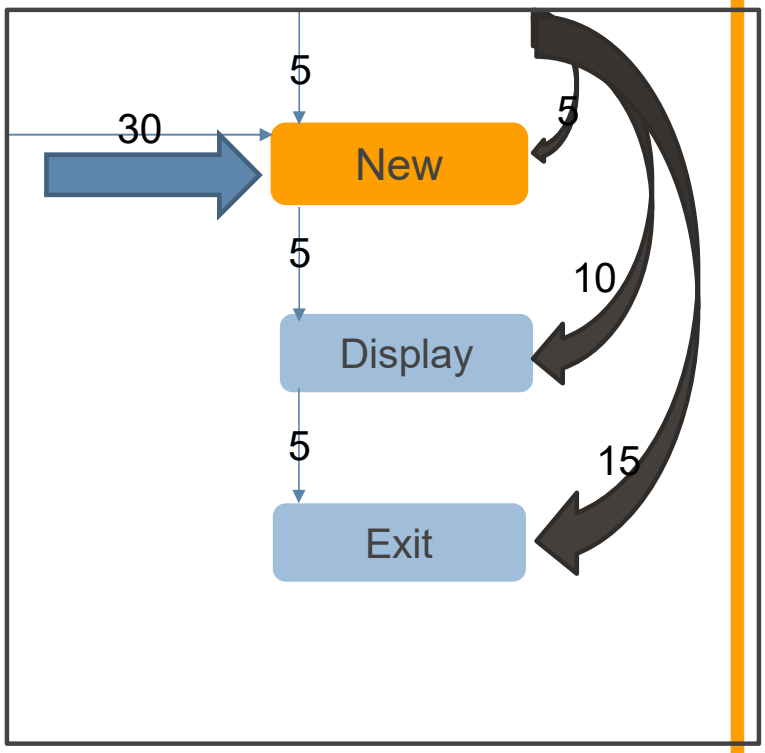
Assignment

- Design a program that get from user input
  - Number of class room
  - Number of student in each class
  - Mark for each student
- Then calculate the
  - Average mark for each class room

Application on Arrays and Control Statements (Menu Program)

Menu Program

```
String[] Menu = { " New" , "Display " , " Exit " };
…
Console.SetCursorPosition(x, y);
…
Console.Write(Menu[i]);
…
Console.BackgroundColor = ConsoleColor.Blue;
…
ConsoleKeyInfo k=  Console.ReadKey();
```



Assignment

- Using Menu Program
  - New
    - Let user input one employee Data
      - ID
      - Name
      - Salary
  - Display
    - Display Employee Data
  - Exit
    - Close the program

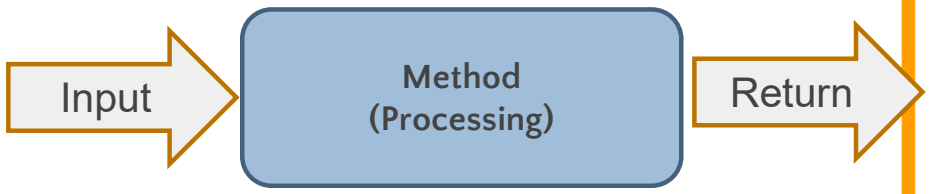
Methods

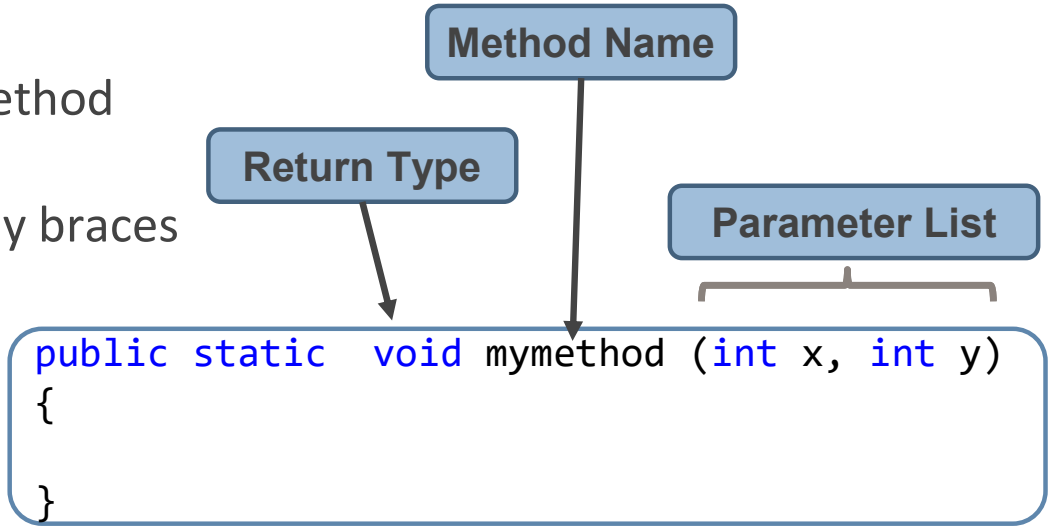
Methods

- A method is a group of statements put together to preform a certain task
- Every C# Application has at least one method ***main***
- Method execute through calling

Methods

- Method Definition
  - Contains
    - Method name
    - Return type
    - Parameters List
- Local variables
  - Variables declared within method
  - Variables passed to method
  - Its Scope within method curly braces





Methods

- Method calling
  - Method definition always within a class
  - Method calling would be through *Namespace.ClassName.MethodName (static Method)*

```
myspace.myclass.mymethod();
```

  - Method calling would be through *ClassName.MethodName*

```
using myspace;
…
myclass.mymethod();
```

```
namespace myspace
{
  class myclass // data Type
  {
    public static  void mymethod()
    {

    }
  }
}
```

Methods and memory

- When program starts
  - Main method pushed to stack

```
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```
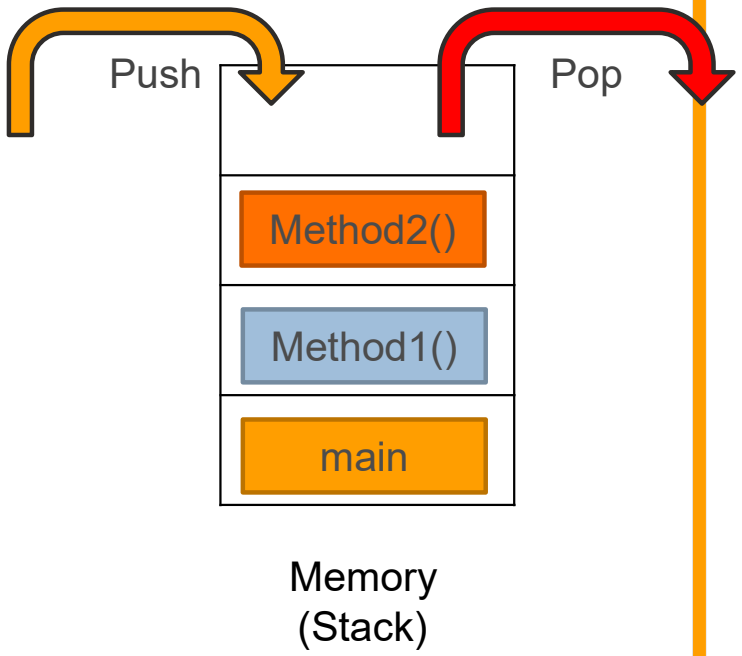

Push

Push

Pop

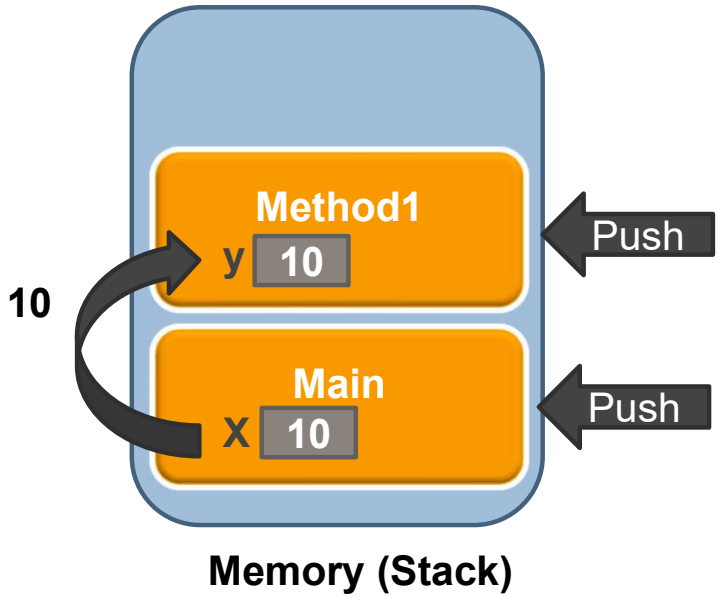
Pop



Method Calling

- ***Call by value***
  - ***Value type***
- Pass value from variable to another
  - Value type Data type

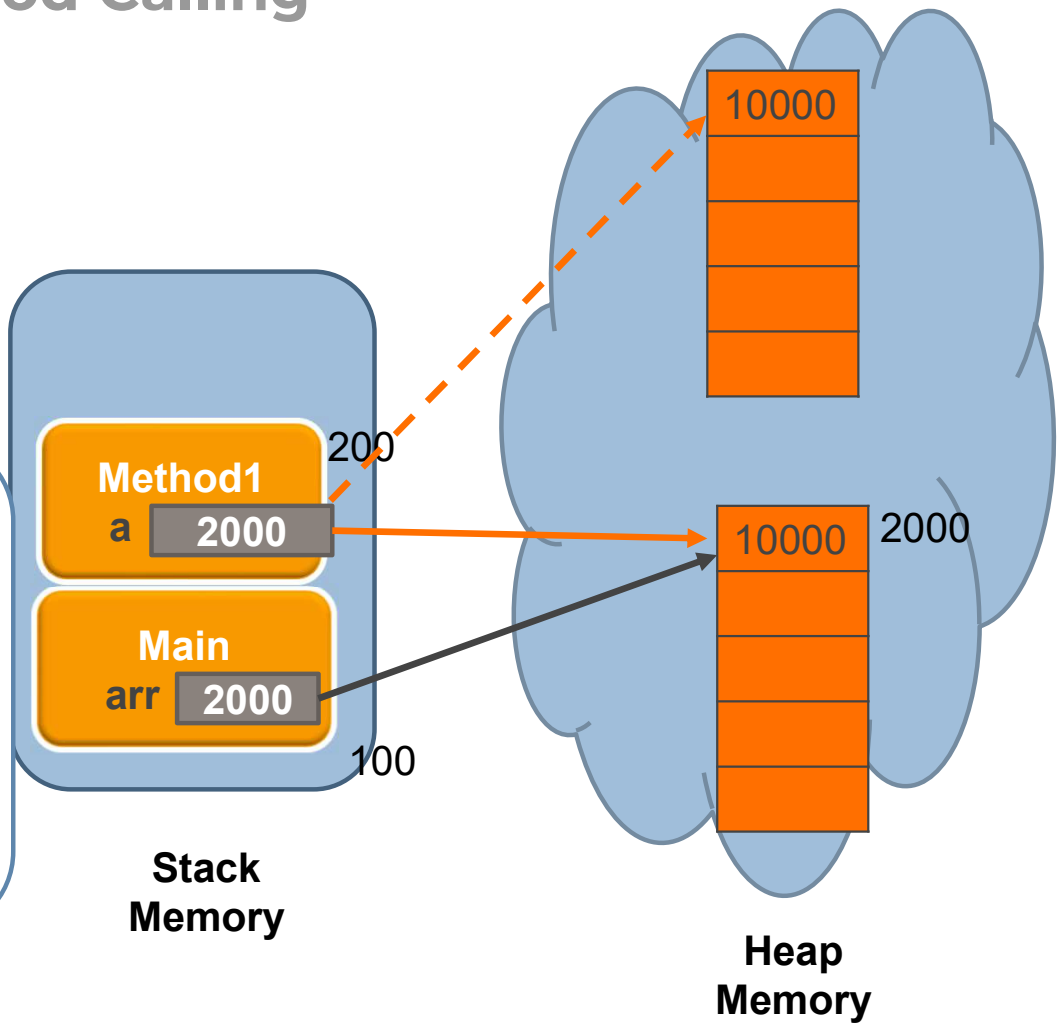
```
static void Main(string[] args)
{
        int x=10;
        Method1(x);
}
static void Method1 (int y)
{
}
```



Method Calling

- ***Call by value***
  - ***Reference type***
  - Ex: reference to array

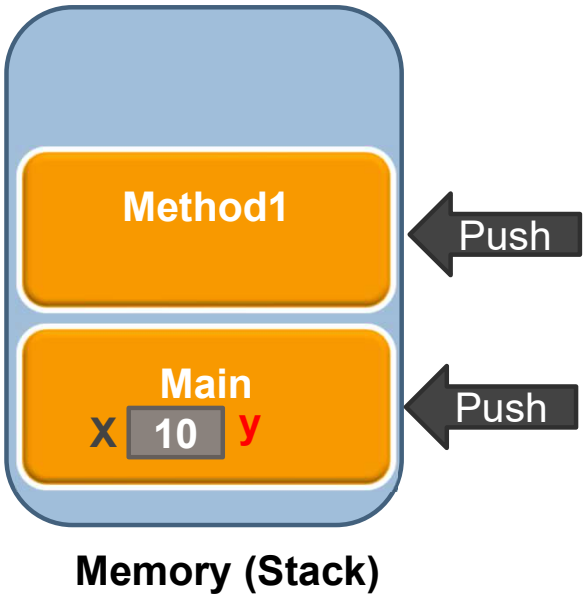
```
static void Main(string[] args)
{
        int[] arr = new int[]{1,2,3} ;
        Method1(arr);
}
static void Method1 (int[] a)
{
        a=new int[]{5,6}
}
```



Method Calling

- *Call by reference (ref)*
  - *Value type*

```
static void Main(string[] args)
{
        int x=10;
        Method1(ref x);
        Console.WriteLine(x);
}
static void Method1 (ref int y)
{
        y=200;
}
```



Method Calling

- ***Call by reference (out)***
  - Same as ***ref*** and allow a variable to be passed without initialization
  - Enforce called method to initialize the passed variable

```
static void Main(string[] args)
{
        int x;
        Method1(out x);
        Console.WriteLine(x);
}
static void Method1 (out int y)
{
        y=200;
}
```

Method Calling

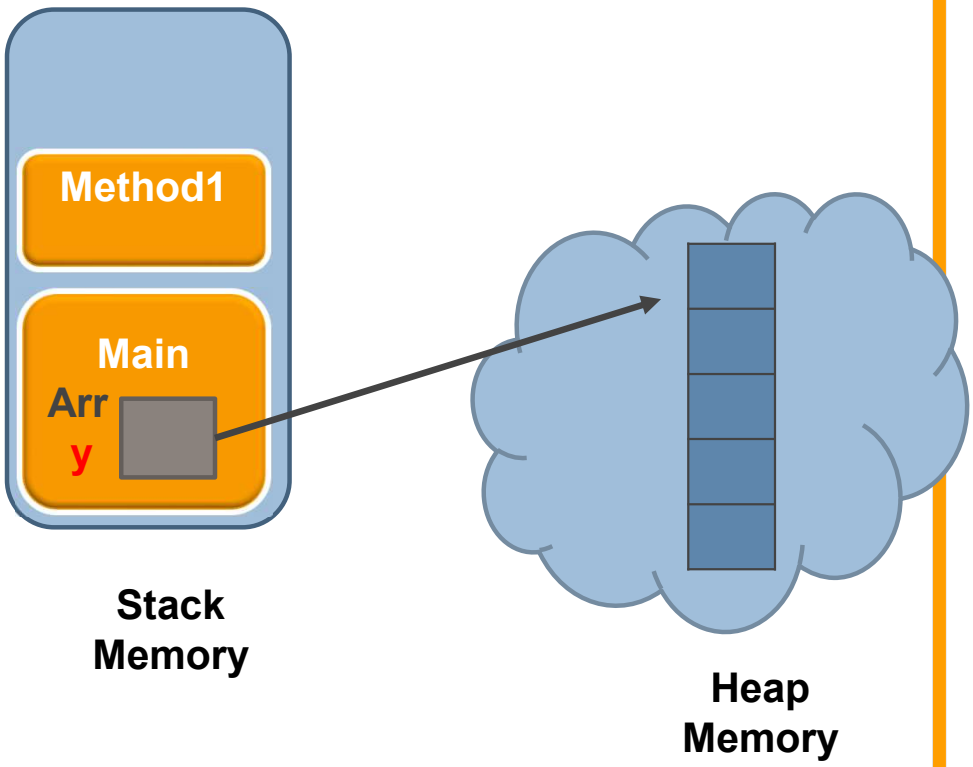
- ***Call by reference (in)***
  - Same as ref but modifying passed parameter is not allowed
  - Used for performance optimization (passing large structure)

```
static void Main(string[] args)
{
        int x=10;
        Method1(in x);
        Console.WriteLine(x);
}
static void Method1 (in int y)
{
        y=200; //Error
}
```

Method Calling

- *Call by reference (ref)*
  - *Reference type*

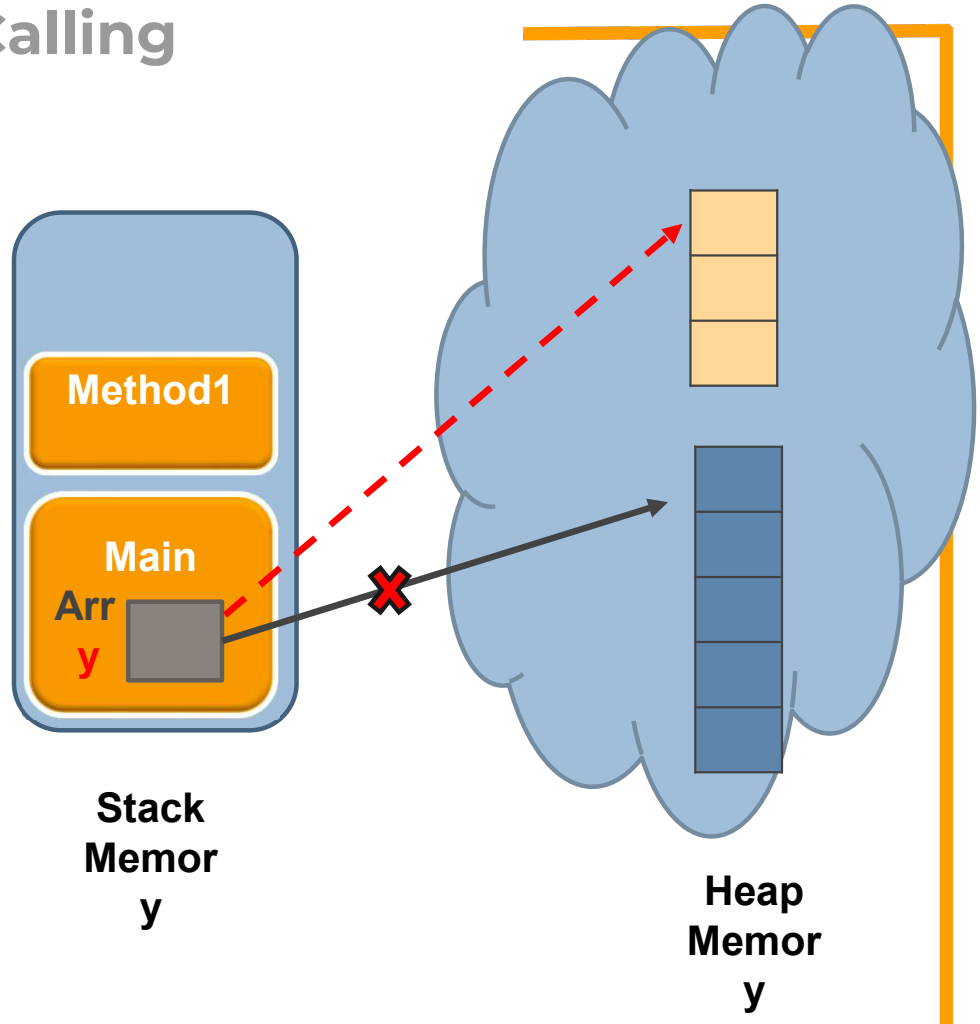
```
static void Main(string[] args)
{
        int[] arr=new int[]{1,2,3} ;
        Method1(ref arr);
}
static void Method1 (ref int[] y)
{
}
```



Method Calling

Special Case

```
static void Main(string[] args)
{
        int[] arr=new int[]{1,2,3} ;
        Method1(ref arr);
}
static void Method1 (ref int[] y)
{
        y=new int [3];
}
```



Method Calling

- ***Sequence of passing argument***
  - Which argument is passed first??

```
static void Main(string[] args)
{
        int L=10;
        Method1(L++,L++,L++);
}
static void Method1 (int x,int y,int z)
{
        Console.WriteLine("x={0}",x);
        Console.WriteLine("y={0}",y);
        Console.WriteLine("z={0}",z);
}
```

Recursive method

- A method that contains a self calling
- Must have termination to self calling
  - Ex: power function 2^3 =8

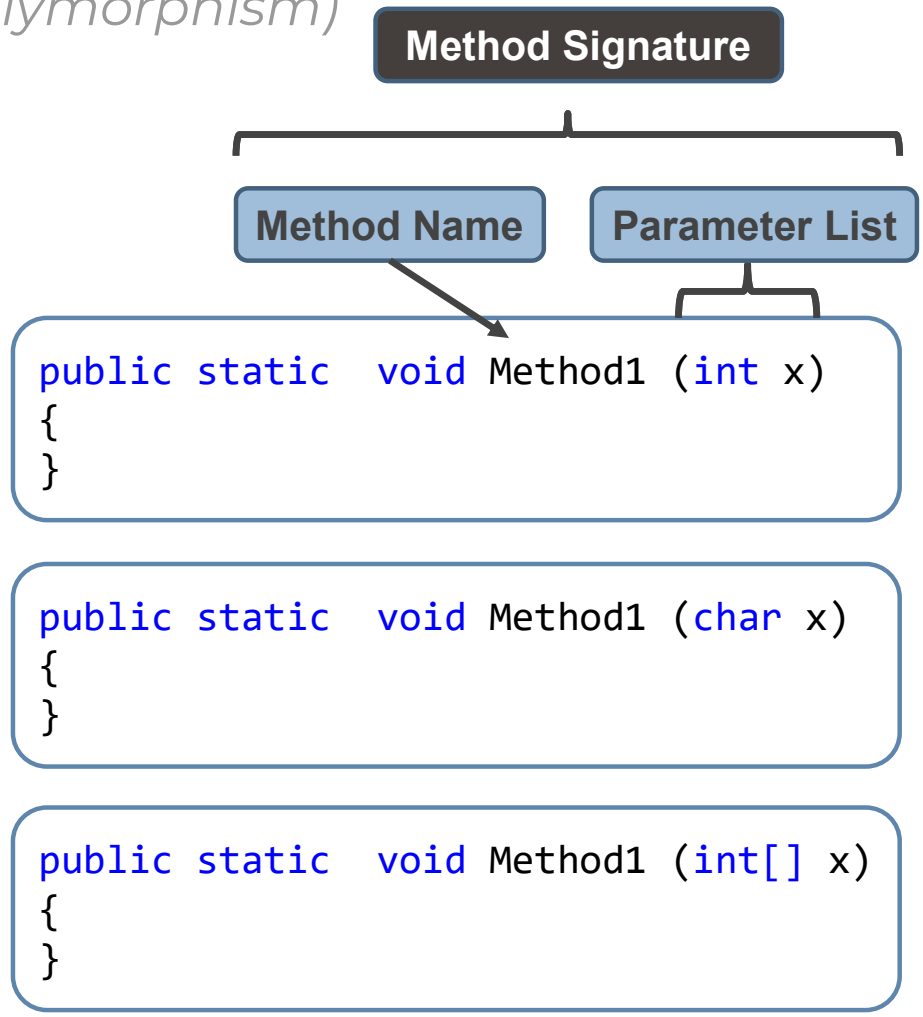
```
int power2(int number,int po)
{
        int result=1;
        if(po==0)
                return 1;
        result=number*power2(number,po-1);
        return result;
}
```

```
int power1(int number,int po)
{
  int result=1;
  if(po==0)
        return 1;
   for(i=0;i<po;i++)
   {
        result*=number;
   }
   return result;
}
```

Method Overloading

(compile-time polymorphism)

- Define many method with the same but different in parameter (number ,order or type)
- *ref*, *in* , *out* and return type not considered in method overloading



Methods

- ***params*** keyword
  - Allow passing *reference to array* to method OR passing the *elements of Array* as arguments
  - Definition

```
public static  void mymethod (params int[] x)
{
        x[0]=10;
}
```

  - Calling

```
Int []arr=new int[3];
Mymethod(arr);

mymethod(10);
mymethod(10,20);
```

Methods

- *Optional Arguments*
  - Set a default value to method parameter
  - It must be the last variable(s) at the right
  - Definition

```
public static void mymethod4(string name,string address="Giza")
{
}
```

  - Calling

```
mymethod4("www");
mymethod4("www", "Cairo");
```

Methods

- *Named Argument*
  - Specify the variable name On method call
  - Definition

```
public static void mymethod4(string name,string address)
{
}
```

  - Calling

```
mymethod4(“ahmed“, "haram street",);
mymethod4(address: "haram street",name:"ahmed");
```

Methods

- Passing Parameter to main Method
- Local Method
  - Declare a method within another method
  - Could be called ***only*** within the container method
  - No access modifier used for local method (already private)
  - Overriding is not allowed

Assignment

- Menu Program
  - Convert menu program to methods
    - Method for ***Display*** employee (takes 3 variables : Name , ID, Salary)
    - Method for ***Add*** new employee (takes 3 variables : Name , ID, Salary)
- Factorial Function (Recursive)