# C++ Programming

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# Namespace

- To prevent name conflicts/ collision / ambiguity in large projects
- to group/orgaize functionally equivalent / related types toghther.
- If we want to access value of global variable then we should use scope resolution operator ( ::)
- We can not instantiate namespace.
- It is designed to avoid name ambiguity and grouping related types.
- If we want to define namespace then we should use **namespace** keyword.
- We can not define namespace inside function/class.
- If name of the namespaces are same then name of members must be different.
- We can not define main function inside namespace.
- Namespace can contain:
  1. Variable
  2. Function
  3. Types[ structure/union/class]
  4. Enum
  5. Nested Namespace

Note :
- If we define member without namespace then it is considered as member of global namespace.
- If we want to access members of namespace frequently then we should use using directive.

# Class

- Building block that binds together data & code.
- Program is divided into different classes
- Class is collection of data member and member function.
- Class represents set/group of such objects which is having common structure and common behavior.
- Class is logical entity.
- Class has
  - Variables (data members)
  - Functions (member functions or methods)
- By default class members are private( not accessible outside class scope)
- Classes are stand-alone components & can be distributed in form of libraries
- Class is blue-print of an object

## Data Members

- Data members of the class are generally made as private to provide the data security.
- The private members cannot be accessed outside the class.
- So these members are always accessed by the member functions.

## Member Functions

- Member functions are generally declared as public members of class.
- Constructor : Initialize Object
- Destructor : De-initialize Object
- Mutators : Modifies state of the object
- Inspectors : Don’t Modify state of object
- Facilitator : Provide facility like IO

# Object

- Object is an instance of class.
- Entity that has physical existence, can store data, send and receive message to communicate with other objects.
- An entity, which get space inside memory is called object.
- Object is used to access data members and member function of the class
- Process of creating object from a class is called instantiation

- **Object has**
  - Data members (***state*** of object)
    - Value stored inside object is called state of the object.
    - Value of data member represent state of the object.
  - Member function (***behavior*** of object)
    - Set of operation that we perform on object is called behaviour of an object.
    - Member function of class represent behaviour of the object.
    - is how object acts & reacts, when its state is changed & operations are done
    - Operations performed are also known as messages
  - Unique address(***identity*** of object)
    - Value of any data member, which is used to identify object uniquly is called its identity.
    - If state of object is same the its address can be considered as its identity.

# Few Points to note

- Member function do not get space inside object.
- If we create object of the class then only data members get space inside object. Hence size of object is depends on size of all the data members declared inside class.
- Data members get space once per object according to the order of data member declaration.
- Structure of the object is depends on data members declared inside class.
- Member function do not get space per object rather it gets space on code segment and all the objects of same class share single copy of it.
- Member function's of the class defines behaviour of the object.

# this pointer

- To process state of the object we should call member function on object. Hence we must define member function inside class.
- If we call member function on object then compiler implicitly pass address of that object as a argument to the function implicitly.
- To store address of object compiler implicitly declare one pointer as a parameter inside member function. Such parameter is called this pointer.
- this is a keyword. "this" pointer is a constant pointer.
- this is used to store address of current object or calling object.
- The invoking object is passed as implicit argument to the function.
- *this* pointer points to current object i.e. object invoking the member function.
- Thus every member function receives *this* pointer.
- Following functions do not get this pointer:
  1. Global Function
  2. Static Member function
  3. Friend Function.

# Access Specifier

- If we want to control visibility of members of structure/class then we should use access Specifier.
- Defines the accessibility of data member and member functions

- **Access specifiers in C++**
  1. private( - )
  2. protected( # )
  3. public( + )

- 1. Private - Can access inside the same struct/class in which it is declared  Generally data members should declared as private. (data security)
- 2. Public -  Can access inside the same struct/class in which it is declared as well as inside outside function(like main()). Generally member functions should declared as public.
- 3. Protected - Can access inside the same class in which it is declared as well as inside Derived class.

# Constructor

- It is a member function of a class which is used to initialize object.
- Constructor has same name as that of class and don’t have any return type.
- Constructor get automatically called when object is created i.e. memory is allocated to object.
- If we don’t write any constructor, compiler provides a default constructor.
- Due to following reasons, constructor is considered as special function of the class:
  1. Its name is same as class name.
  2. It doesn't have any return type.
  3. It is designed to call implicitly.
  4. In the life time of the object , it gets called only once per object and according to order of its declaration.

# Types of Constructor

- Parameterless constructor
  - also called zero argument constructor or user defined default constructor
  - If we create object without passing argument then parameterless constructor gets called
  - Constructor do not take any parameter
- Parameterized constructor
  - If constructor take parameter then it is called parameterized constructor
  - If we create object, by passing argument then paramterized constructor gets called
- Default constructor
  - If we do not define constructor inside class then compiler generates default constructor for the class.
  - Compiler generated default constructor is parameterless.

# Facts About Constructor

- We can not call constructor on object, pointer or reference explicitly. It is designed to call implicitly.
- We can not declare constructor static, constant, volatile or virtual. We can declare constructor only inline.
- Constructor overloading means inside a class more than one constructor is defined.
- We can have constructors with
  - No argument : initialize data member to default values
  - One or more arguments : initialize data member to values passed to it
  - Argument of type of object : initialize object by using the values of the data members of the passed object. It is called as copy constructor.

# Constructor's member initializer list

- If we want to initialize data members according to users requirement then we should use constructor body.

```
class Test
{
private:
        int num1;
        int num2;
        int num3;
public:
        Test( void )
        {
        this->num1 = 10;
        this->num2 = 20;
        this->num3 = num2;
        }
};
```

- If we want to initialize data member according to order of data member declaration then we can use constructors member initializer list.

```
class Test
{
private:
        int num1;
        int num2;
        int num3;
public:
        Test( void ) : num1( 10 ), num2( 20 ),
num3( num2)
        { }
};
```

Except array we can initialize any member inside constructors member initializer list.

# Scope Resolution Operator ( : : )

- :: operator is used to bind a member with some class or namespace.
- It can be used to define members outside class.
- Also used to resolve ambiguity.
- It can also be used to access global members.
  - Example :- ::a =10; access global var.
- Scope resolution Operator is used to :
  - to call global functions
  - to define member functions of class outside the class
  - to access members of namespaces

# cin and cout

- C++ provides an easier way for input and output.
- Console Output : Monitor
  - iostream is the standard header file of C++ for using cin and cout.
  - cout is external object of ostream class.
  - cout is member of std namespace and std namespace is declared in iostream header file.
  - cout uses insertion operator(<<)
- Console Input : Keyborad
  - cin is an external object of istream class.
  - cin is a member of std namespace and std namespace is declared in header file.
  - cin uses Extraction operator( >> )
- The output:
  - cout << “Hello C++”;
- The input:
  - cin >> var;

# Other Member functions of class Setter & Getter

- **Mutator/setter :**
  - If we want to modify state of object i.e value of a private data member of the class outside the class using object then we should write a mutator.
  - It is recommended to start the mutator function name with set followed by data member name which will accept a single argument to change the respective single data member value.

- **Inspector/getter :**
  - If we want to read the state of object i.e value of a private data member of the class outside the class using object then we should write a Inspector
  - It is recommended to start the inspector function name with get followed by data member name which will return the respective single data member value.

- **Facilitator**
  - Any member function of a class that deals with all the data members of class and which are used to perform business logic operations are called as facilitators

# Thank You