

C++ Programming

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We covered

- Bool and wchar_t
- Structure in C and CPP
- Access specifiers
- Class and object (data member, member functions)
- Live examples of class and object
- this pointer
- Types of Member Functions within class
- Constructor
- Destructor
- Setter
- Getter
- Facilitator



Scope Resolution Operator (::)

- **Scope resolution Operator is used to :**
 - to call global functions / to access global variables
 - to define member functions of class outside the class [Modular Approach]
 - to access members of namespaces
 - to give global definition of static data member



Namespace

- To prevent name conflicts/ collision / ambiguity in large projects
- Used to group code .
- If we want to define namespace then we should use **namespace** keyword.
- We can not instantiate namespace.
- We can not define namespace inside function/class.
- 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 want to access members of namespace frequently then we should use “using” directive.



cin and cout

- C++ provides an easier way for input and output.
- Console Output :
 - `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 :
 - `cin` is an external object of `istream` class.
 - `cin` is a member of `std` namespace and `std` namespace is declared in `iostream` header file.
 - `cin` uses Extraction operator(`>>`)
- The output:
 - `cout << "Hello C++";`
- The input:
 - `cin >> var;`



Complex class :- Ex = 5+j7

Data member = real , imaginary

member functions = complex()

complex(int r,int i)

acceptComplexNumber()

printComplexNumber()

~complex()



Example Scope Resolution

```
class complex {  
    int real, imag;  
public: complex();  
    void show();  
};
```

complex.h

```
complex::complex() {  
    real = imag = 0;  
}  
void complex::show() {  
    cout<<real<<imag;  
}
```

complex.cpp

```
main()  
{  
    complex obj;  
    obj.show();  
}
```

Program.cpp



Modular Approach

- "/usr/include" directory is called standard directory for header files.
- It contains all the standard header files of C/C++
- If we include header file in angular bracket (e.g #include<filename.h>) then preprocessor try to locate and load header file from standard directory only(/usr/include).
- If we include header file in double quotes (e.g #include"filename.h") then preprocessor try to locate and load header file first from current project directory if not found then it try to locate and load from standard directory.

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Constant in C++

- We can declare a constant variable that cannot be modified in the app.
- If we do not want to modify value of the variable then const keyword is used.
- constant variable is also called as read only variable.
- The value of such variable should be known at compile time.
- In C++ , Initializing constant variable is mandatory
- `const int i=3; //VALID`
- `Const int val; //Not ok in c++`

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Constant data member

- Once initialized, if we do not want to modify state of the data member inside any member function of the class including constructor body then we should declare data member constant.
- If we declare data member constant then it is mandatory to initialize it using constructors member initializer list.

```
class Test
{
private:
    const int num1;
public:
    Test( void ) : num1( 10 ) //OK
    {
        //this->num1 = 10; //Not OK
    }
};
```



Const member function

- The member function can be declared as const. In that case object invoking the function cannot be modified within that member function.
- We can not declare global function constant but we can declare member function constant.
- If we do not want to modify state of current object inside member function then we should declare member function as constant.
- `void display() const; , void printData() const;`
- Even though normal members cannot be modified in const function, but *mutable* data members are allowed to modify.
- In constant member function, if we want to modify state of non constant data member then we should use **mutable keyword**.
- We can not declare following function constant:
 1. Global Function
 2. Static Member Function
 3. Constructor
 4. Destructor



Reference

- Reference is derived data type.
- It alias or another name given to the existing memory location / object.
 - Example : `int a=10; int &r = a;`
 - In above example a is referent variable and r is reference variable.
 - It is mandatory to initialize reference.
- Reference is alias to a variable and cannot be reinitialized to other variable
- When '&' operator is used with reference, it gives address of variable to which it refers.
- Reference can be used as data member of any class



Reference

- We can not create reference to constant value.
 - `int &num2 = 10; //can not create reference to constant value`
- Reference is internally considered as constant pointer hence referent of reference must be variable/object.

```
int main( void )  
{  
    int num1 = 10;  
    int &num2 = num1;  
    cout<<"Num2 : "<<num2<<endl;  
    return 0;  
}
```



pass arguments to function, by value, by address or by reference.

- In C++, we can pass argument to the function using 3 ways:

1. By Value
2. By Address
3. By Reference

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Difference between Pointers and reference

Pointer

- It is a variable that points to another variable.
- To access the value of a variable with the help of a pointer, we need to do dereferencing explicitly.
- We can create a pointer to pointer
- We can create a pointer without initialization.
Create a NULL pointer.

Eg `int n=5; int* ptr=&n;`

Reference

- It is an alias / secondary name to an already existing memory.
- No need of dereferencing to access a value of a variable with ref.
- We can't create a reference to reference.
- We can't create a ref without initialization NULL ref can't be created.

Eg : `int n=5; int& ref=n;`



Sum function and Copy Constructor

- Copy constructor is a single parameter constructor hence it is considered as parameterized constructor
- Example: sum of two complex number

Complex sum(const Complex &c2)

Copy constructor

Complex c2(c1)

or

Complex c2=c1

C1 $\rightarrow 7 + j 6$

\downarrow \downarrow

C2 $\rightarrow 7 + j 6$

Write a function in complex class
to add 2 complex numbers

C1 $\rightarrow 7+j6$

+

C2 $\rightarrow 3+j2$

C3 $\rightarrow 10+j8$



Dynamic Memory Allocation

To allocate memory dynamically then we should use new operator

To deallocate that memory we should use delete operator.

Dangling pointer :- The pointer which contains, address of deallocated memory.

Memory leakage :- When we allocate space in memory, and if we loose pointer to reach to that memory then such wastage of memory is called memory leakage.

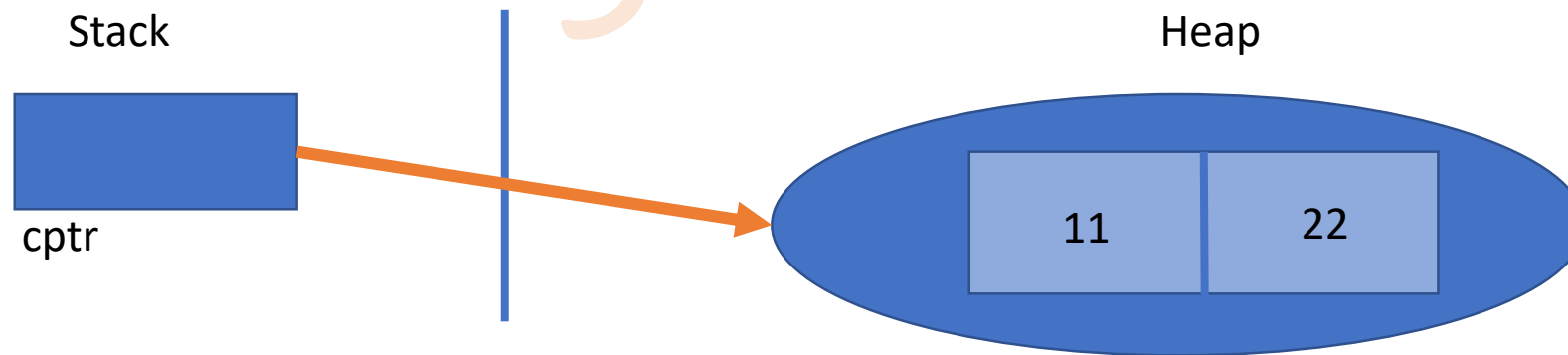
```
int main()
{
    int *ptr = new int;           // allocate memory
    *ptr = 125;                   //Dereferencing
    cout<<"Value:"<<*ptr<<endl; //Dereferencing
    delete ptr;                   // deallocate memory
    ptr = NULL;
    return 0;
}
```



Heap Based object

```
Complex *cptr=new Complex (11,22) ;  
delete cptr;
```

- By using new we are allocating dynamic memory for complex class object .
- Object get created on heap section hence this object is call Heap based or dynamic object.
- Cptr is complex type pointer which is holding the address of that dynamic object.



Difference between malloc and new

new

new is an operator.

new returns a typecasted operator, so no need to do explicit typecasting.

We must mention the datatype while allocating the memory with new.

When memory is allocated with new, constructor gets called for the object.

malloc

malloc is a function.

malloc returns void pointer, malloc returns void pointer, cast it explicitly, before use.

malloc accepts only the exact no. of bytes required, so no need to mention datatype.

When memory gets allocated by malloc function, constructor function does not gets called.



Difference between malloc and new

new

Memory allocated by new is released by the operator delete.

Destructor is called when memory is released with delete.

To release memory for array syntax is
delete[]

In case new fails to allocate memory, it raises a Run time exception called as bad_alloc.

malloc

Memory allocated by malloc is released by function free.

Destructor is NOT called when the memory is released with free.

To release memory for array syntax is
free(ptr);

In case malloc fails to allocate memory it returns a NULL.



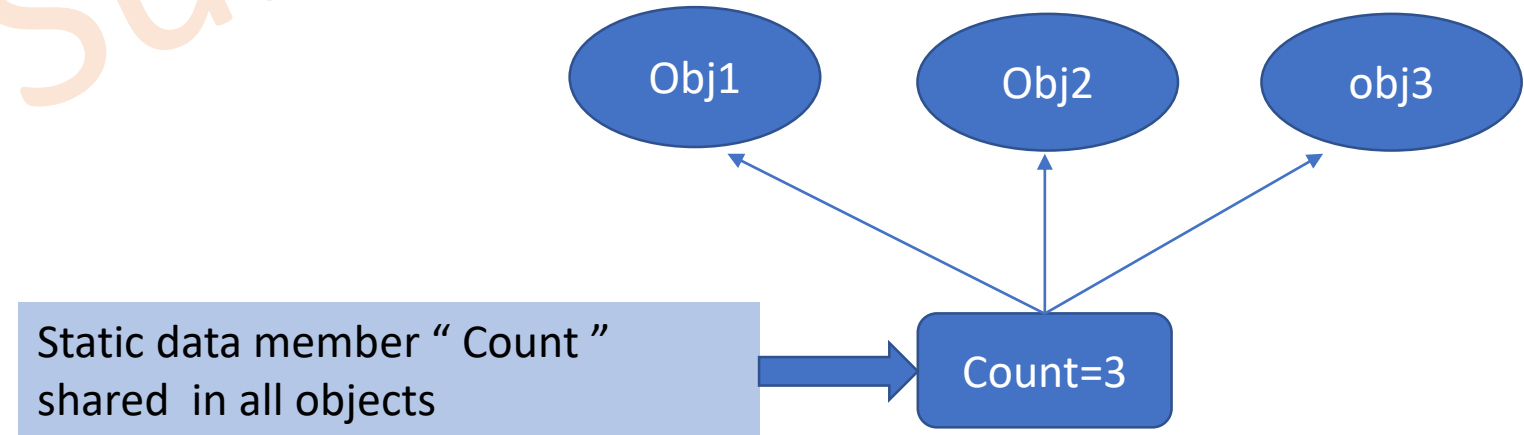
Static Variable

- All the static and global variables get space only once during program loading / before starting execution of main function
- Static variable is also called as shared variable.
- Initialized static and global variable get space on Data segment.
- Default value of static and global variable is zero.
- Static variables are same as global variables but it is having limited scope.



Static Data member

- If we want to share value of data member between all objects of same class then we should declare that data member as static data member.
- It is mandatory to provide global definition of static data member otherwise linker generates error.
- Static data member get space during class loading per class so it is called as **class-level variable**



Thank You

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