

OOP using C++ Programming

Trainer : Pradnyaa S. Dindorkar

Email: pradnya@sunbeaminfo.com

CCAT Exam : 9 Questions concept based



What we are going to cover in this module?

- 1 : Introduction to C++
- 2 : Function features
- 3 : class and object
- 4 : cin ,cout
- 5 : static, const, friend, reference
- 6 : memory management [new- delete]
- 7 : Object oriented concept
- 8 : Association
- 9 : Inheritance
- 10: virtual function
- 11: Advance C++ feature



Limitations of C Programming

- C is said to be process oriented, structured programming language.
- When program becomes complex, understating and maintaining such programs is very difficult.
- Language don't provide security for data.
- Using functions we can achieve code reusability, but reusability is limited. The programs are not extendible.



Classification of high level Languages

1. Procedure Oriented Programming language(POP)

- ALGOL, FORTRAN, PASCAL, BASIC, C etc.
- "FORTRAN" is considered as first high level POP language.
- All POP languages follows "TOP Down" approach

2. Object oriented programming languages(OOP)

- Simula, Smalltalk, Java, C++, C#, Python, R, PHP, Visual Basic.NET, Ruby, Perl, Objective-C, Swift, Scala, Kotlin
- "Simula" is considered as first high level OOP language.
- more than 2000 lang. are OO.
- All OOP languages follows "Bottom UP" approach

3. Object based programming languages -

Object based languages supports the usage of object.
e.g- VB, Javascript



History of C++

- @1960 ← OOP designed by Alen Kay American computer scientist these are concept, theory not any programing language. It is a process / programming methodology which is used to solve real world problems.
- @1960 ← simula is first oop language designed by Ole-Johan Dahl and Kristen Nygaard. Problem with simula is that performance wise it is very slow.
- @1972 ← C is developed by Dennis Ritchie at AT&T bell laboratories.
- @1979 ← Bjarne Stroustrup develop "C with Classes"
- @1983 ← C++ (rename 'C with classes') with added features. New features were added, including virtual functions, operator overloading ,references
- @1998 ← C++ is standardized by the ANSI
(American National Standards Institute)



OOPS(Object Oriented Programming Language)

- It is a programming methodology to organize complex program in to simple program in terms of classes and object such methodology is called oops.
- It is a programming methodology to organized complex program into simple program by using concept of abstraction , encapsulation , polymorphism and inheritance.
- Languages which support abstraction , encapsulation polymorphism and inheritance are called oop language.



Main Function

- main should be entry point function of C/C++
- Calling/invoking main function is responsibility of operating system.
- Hence it is also called as Callback function.

[In cpp extension of file is -> .cpp
compiler name is -> g++]

Helloworld.cpp



Functions / User Defined Functions

- It is a set of instructions written to gather as a block to complete specific functionality.
- Function can be reused.
- It is a subprogram written to reduce complexity of source code
- Function may or may not return value.
- Function may or may not take argument
- Function can return only one value at time

- **Writing function helps to**
 - improve readability of source code
 - helps to reuse code
 - reduces complexity

- **Types of Functions**
 - Library Functions
 - User Defined Functions



User Defined Functions

A function is a group of statements that together perform a task.

- **Function declaration / Prototype / Function Signature**

<return type> <functionName> ([<arg type>...]);

- **Function Call**

<location> = < functionName >(<arg value/address>);

- **Function Definition**

```
<return type> < functionName > ([<arg type> <identifier>...])  
    {  
        //function body  
    }
```



Inline Function

- C++ provides a keyword *inline* that makes the function as inline function.
- Inline functions get replaced by compiler at its call statement. It ensures faster execution of function.
- Inline is a request made to compiler.
- If a function is inline, the compiler places a copy of the code of that function at each point where the function is called at compile time.

When to use Inline function?

- We can use the inline function when performance is needed.



Default Arguments

- In C++, functions may have arguments with the default values. Passing these arguments while calling a function is optional.
- A default argument is a default value provided for a function parameter/argument.
- If the user does not supply an explicit argument for a parameter with a default argument, the default value will be used.
- If such argument is not passed, then its default value is considered. Otherwise arguments are treated as normal arguments.
- Default arguments should be given in right to left order.

```
Int sum (int a, int b, int c=0, int d=0) {  
    return a + b + c + d;  
}
```

The above function may be called as

- Res=sum(10,20);
- Res=sum(10,20,40);
- Res=sum(10,30,40,50);



Function Overloading

- Functions with same name and different signature are called as overloaded functions.
- Return type is not considered for function overloading.
- Function call is resolved according to types of arguments passed.
- Function overloading is possible due to name mangling done by the C++ compiler (Name mangling process , mangled name)
- Differ in number of input arguments
- Differ in data type of input arguments
- Differ at least in the sequence of the input arguments

Example :

```
void print ( int n1) { ----- }  
void print (char a) { ----- }  
void print (int a, int b) { ----- }  
void print (char a, int b) { ----- }  
void print (int i, char c) { ----- }
```



Data Types in C++

- It describes 3 things about variable / object
 1. Memory : How much memory is required to store the data.
 2. Nature : Which type of data memory can store
 3. Operation : Which operations are allowed to perform on data stored inside memory.
- Fundamental Data Types (int,char,float,double)
- Derived Data Types (Array, Function, Pointer, Union ,Structure)

Two more additional data types that c++ supports are

1. **bool** :- it can take *true* or *false* value. It takes one byte in memory.
2. **wchar_t** :- it can store 16 bit character. It takes 2 bytes in memory.



Bool and wchar_t

- **e.g: bool val=true;**
- **wchar_t**: Wide Character. This should be avoided because its size is implementation defined and not reliable.
- Char can take 256 values which corresponds to entries in the ASCII
- Wide char can take on 65536 values which corresponds to UNICODE values
- The type for character is char, the type for wide character is wchar_t.
- This data type occupies 2 or 4 bytes depending on the compiler being used.
- Mostly the wchar_t datatype is used when international languages like Japanese are used.
- L is the prefix for wide character literals and wide-character string literals which tells the compiler that that the char or string is of type wide-char.
- w is prefixed in operations like scanning (**wcin**) or printing (**wcout**) while operating wide-char type.



Structure

- Structure is a collection of similar or dissimilar data. It is used to bind logically related data into a single unit.
- This data can be modified by any function to which the structure is passed.
- Thus there is no security provided for the data within a structure.
- This concept is modified by C++ to bind data as well as functions.

Access Specifier

- By default all members in structure are accessible everywhere in the program by dot(.) or arrow(→) operators.
- But such access can be restricted by applying access specifiers.
 - private: Accessible only within the struct
 - public: Accessible within & outside struct



Struct in CPP

```
struct Time
{
    int hr;
    int min;
    int sec;
    void printTime() {--}
    void acceptTime() {--}
    void incrementTimeByOneSec() {--}
}
```



Data member - also called field, property, attribute

struct Time

{

int hr;

int min;

int sec;

Member function-methods ,
operations, behaviour,
message

void printTime() {--}

void acceptTime() {--}

void incrTime() {--}

}

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 out side function(like main()). Generally member functions should declared as public.



Difference - Structure in C & C++

struct in c	struct in c ++
we can include only variables into the structure.	we can include the variables as well as the functions in structure.
We need to pass a structure variable by value or by address to the functions.	We don't pass the structure variable to the functions to accept it / display it. The functions inside the struct are called with the variable and DOT operator.
By default all the variables of structure are accessible outside the structure. (using structure variable name)	By default all the members are accessible outside the structure, but we can restrict their access by applying the keywords private /public/ protected.
struct Time t1;	struct Time t1;
AcceptTime(struct Time &t1);	t1.AcceptTime(); //function call



Time class in CPP

Class is collection of logically related data member and member function.

Difference between class and struct in cpp

- all the members of class is by default private and all the members of structure in cpp is by default public.



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 behaviour.
- 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.



Object

- Object is an instance of class.
- Entity that has physical existence, can store data.
- 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**
 - **State of object (Data members)**
 - Value stored inside object is called state of the object.
 - Value of data member represent state of the object.
 - **Behaviour of object (Member function)**
 - Set of operation that we perform on object is called behaviour of an object.
 - Member function of class represent behaviour of the object.
 - **Identity of object (Unique address)**
 - Value of any data member, which is used to identify object uniquely is called its identity.
 - State of object may be same But its address can be **Unique** 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.





Like a class



Objects of same class
having same
properties and
behaviour



Empty Class :-

A class which do not have any Data member or member function is called as the Empty class.

- We can create an object of a empty class.
- Size of an object of a empty class is 1 byte.



Thank You

