C++ Programming

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What we are going to cover in this module?

- 1 : Introduction to C++
- 2 : Function features
- 3 : class and object
- 4 : namespaces, new-delete
- 5 : References , deep-shallow copy
- 6 : Object oriented concept
- 7 : composition
- 8 : Inheritance
- 9 : virtual function
- 10: static, const, friend
- 11: template and Exception
- 12: Design pattern

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.

Characteristics of Language

1. It has own syntax
2. It has its own rule(semantics)
3. It contain tokens:
   - Identifier
   - Keyword
   - Constant/literal
   - Operator
   - Separator / punctuators
4. It contains built in features.
5. We use language to develop application(CUI, GUI, Library)

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, C++, Java, C#, Python, Go
   - "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 ISO

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.

Helloworld program in CPP

- 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.

What’s new

1: In cpp extension of file is → .cpp

2: Compiler name is → g++

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 Definition**

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

- **Function Call**

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

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

- Function overloading in C++ is a feature that allows you to define **multiple functions** with the **same name**

  but with different **parameter lists** (different number or types of parameters).
- The C++ compiler determines which specific function to call based on the arguments provided during the function call.
- Function overloading is possible due to name mangling done by the C++ compiler
- Mangled name => is a unique name generated by compiler for each function to differentiate it from other functions with the same name.
- Name mangling process => process of creating mangled name is known as name mangling process
- Return type is not considered for function overloading.

We can achieve Function overloading by passing parameter which are

- Differ in number of input arguments
- Differ in data type of input arguments
- Differ at least in the sequence of the input arguments

- Example :
  - int sum(int a, int b) { return a+b; }
  - float sum(float a, float b) { return a+b; }
  - int sum(int a, int b, int c) { return a+b+c;};

Thank You