C++ Programming

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Dynamic Memory Allocation

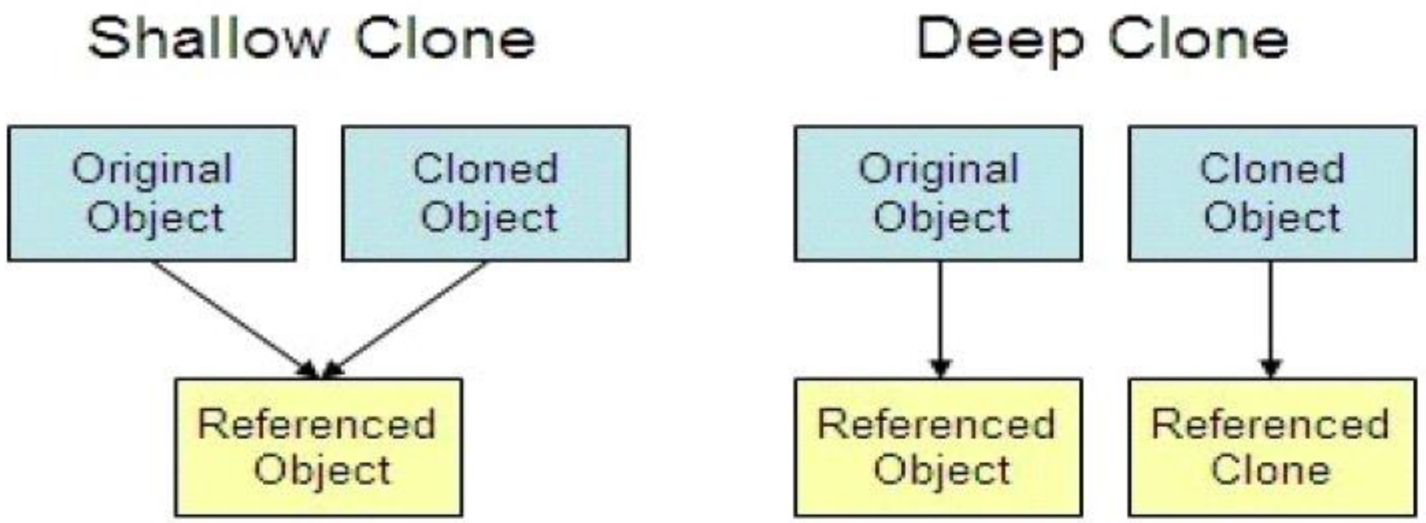
- If we want to allocate memory dynamically then we should use new operator and to deallocate that memory we should use delete operator.
- If pointer contains, address of deallocated memory then such pointer is called dangling pointer.
- When we allocate space in memory, and if we loose pointer to reach to that memory then such wastage of memory is called memory leakage.

- Example :

```
int main()
{
    int *ptr = new int;          //int *ptr = ( int* )::operator new( sizeof( int ) * 1 );
    *ptr = 125;      //Dereferencing
    cout<<"Value  :              "<<*ptr<<endl; //Dereferencing
    delete ptr;                  //::operator delete( ptr );
    ptr = NULL;
    return 0;
```

Object Copying

- In object-oriented programming, “object copying” is a process of creating a copy of an existing object.
- The resulting object is called an object copy or simply copy of the original object.
- Methods of copying:
  - Shallow copy
  - Deep copy



Types of Copy

- **Shallow Copy**
  - The process of copying state of object into another object.
  - It is also called as bit-wise copy/ bit-by bit copy.
  - When we assign one object to another object at that time copying all the contents from source object to destination object as it is. Such type of copy is called as shallow copy.
  - Compiler by default create a shallow copy. Default copy constructor always create shallow copy.
- **Deep Copy**
  - Deep copy is the process of copying state of the object by modifying some state.
  - It is also called as member-wise copy.
    - When class contains at least one data member of pointer type,
    - when class contains user defined destructor
    - And when we assign one object to another object at that time instead of copy base address allocate a new memory for each and every object and then copy contain from memory of source object into memory of destination object. Such type of copy is called as deep copy.

Shallow Copy

- Process of copying state of object into another object as it is, is called shallow copy.
- It is also called as bit-wise copy / bit by bit copy.
- Following are the cases when shallow copy taken place:
    1. If we pass variable / object as a argument to the function by value.
    2. If we return object from function by value.
    3. If we initialize object: Complex c2=c1
    4. If we assign the object , c2=c1;
    5. If we catch object by value.
- Examples of shallow copy

Example 1: (Initialization)

```
int num1=50;
int num2=num1;
```

Example 2: (Assignment)

```
Complex c1(40,50);
c2=c1;
```

Deep Copy

- It is also called as member-wise copy. By modifying some state, if we create copy of the object then it is called deep copy.
    - Conditions to create deep copy
        - Class must contain at least one pointer type data member.

```
class Array
    {               private:
                    int size;
                    int *arr;
                    public:
                    Array( int size )
                    {                                   this->size = size;
                              this->arr = new int[ this->size ];
                    }
    };
```

- Steps to create deep copy
    - 1. Copy the required size from source object into destination object.

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.
- Unintialized static and global variable get space on BSS segment.
- Intialized 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 Methods or Static Member Functions

- Except main function, we can declare global function as well as member function static.
- To access non static members of the class, we should declare member function non static and to access
- static members of the class we should declare member function static.
- Member function of a class which is designed to call on object is called instance method. In short non static member function is also called as instance method.
- To access instance method either we should use object, pointer or reference to object.
- static member function is also called as class level method.
- To access class level method we should use classname and ::(scope resolution) operator.

Exception Handling

- If we give wrong input to the application then it generates runtime error/exception.
- Exception is an object, which is used to send notification to the end user of the system if any exceptional situation occurs in the program.
- To handle exception then we should use 3 keywords:
- 1**. try**
  - try is keyword in C++.
  - If we want to inspect exception then we should put statements inside try block/handler.
  - Try block may have multiple catch block but it must have at least one catch block.
- **2. catch**
  - If we want to handle exception then we should use catch block/handler.
  - Single try block may have multiple catch block.
  - Catch block can handle exception thrown from try block only.
  - A catch block, which can handle any type of exception is called generic catch block / catch-all handler.
  - For each type of exception, we can write specific catch block or we can write single catch block which can handle all types of exception. A catch block which can handle all type of exception is called generic catch block.
- **3. throw**
  - throw is keyword in C++.
  - If we want to generate exception explicitly then we should use throw keyword.
  - "throw statement" is a jump statement.
  - To generate new exception, we should use throw keyword. Throw statement is jump statement.

Note : For thrown exception, if we do not provide matching catch block then C++ runtime gives call to the std::terminate() function which implicitly gives call to the std::abort() function.

Thank You