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Very typical C++ interview questions

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These are simple interview questions that people get 95% correct.

Explain abstraction.

- Simplified view of an object in user's language is called abstraction.
- It is the simplest, well-defined interface to an object in OO and C++ that provides all the expected features and services to the user in a safe and predictable manner.
- It provides all the information that the user requires.
- Good domain knowledge is important for effective abstraction.
- It separates specifications from implementation & keeps the code simpler and more stable.

What is the real purpose of class – to export data?

No, the real purpose of a class is not to export data. Rather, it is to provide services. Class provides a way to abstract behaviour rather than just encapsulating the bits.

What things would you remember while making an interface?

- A class's interface should be sensible enough. It should behave the way user expects it to.
- It should be designed from the outside in.

Explain the benefits of proper inheritance.

The biggest benefits of proper inheritance are :

1. Substitutability
2. Extensibility.

1. Substitutability :

The objects of a properly derived class can be easily and safely substituted for an object of its base class.

2. Extensibility :

The properly derived class can be freely and safely used in place of its base class even if the properly derived class is created a lot later than defining the user code. Extending the functionalities of a system is much easier when you add a properly derived class containing enhanced functionalities.

Does improper inheritance have a potential to wreck a project?

- Many projects meet a dead end because of bad inheritance. So, it certainly has the potential to wreck a project.
- Small projects still have a scope to avoid the complete consequence of bad inheritance if the developers communicate and co-ordinate with an easy system design. This kind of a luxury is not possible in big projects, which means that the code breaks in a way difficult and at times impossible way to fix it.

How should runtime errors be handled in C++?

- The runtime errors in C++ can be handled using exceptions.
- This exception handling mechanism in C++ is developed to handle the errors in software made up of independently developed components operating in one process and under synchronous control.
- According to C++, any routine that does not fulfil its promise throws an exception. The caller who knows the way to handle these exceptions can catch it.

When should a function throw an exception?

- A function should throw an exception when it is not able to fulfil its promise.
- As soon as the function detects a problem that prevents it from fulfilling its promise, it should throw an exception.
- If the function is able to handle the problem, recover itself and deliver the promise, then the exception should not be thrown.
- If an event happens very frequently then exception handling is not the best way to deal with it. It requires proper fixation.

Where are setjmp and longjmp used in C++?

- Setjmp and longjmp should not be used in C++.
- Longjmp jumps out of the function without unwinding the stack. This means that the local objects generated are not destructed properly.
- The better option is to use try/catch/throw instead. They properly destruct the local objects.

Are there any special rules about inlining?

Yes, there are a few rules about inlining :

1. Any source files that used the inline function must contain the function's definition.
2. An inline function must be defined everywhere. The easier way to deal with this is to define the function once in the class header file and include the definition as required. The harder way is to redefine the function everywhere and learn the one-definition rule.
3. Main() can not be inline.

Explain One-Definition Rule (ODR).

- According to one-definition rule, C++ constructs must be identically defined in every compilation unit they are used in.
- As per ODR, two definitions contained in different source files are called to be identically defined if they token-for-token identical. The tokens should have same meaning in both source files.
- Identically defined doesn't mean character-by-character equivalence. Two definitions can have different whitespace or comments and yet be identical.

What are the advantages of using friend classes?

- Friend classes are useful when a class wants to hide features from users which are needed only by another, tightly coupled class.
- Implementation details can be kept safe by providing friend status to a tightly cohesive class.

What is the use of default constructor?

- It is a constructor that does not accept any parameters.
- If there is no user-defined constructor for a class, the compiler declares a default parameterless constructor called default constructor.
- It is an inline public member of its class.
- When the compiler uses this constructor to create an object – the constructor will have no constructor initializer and a null body.

Differentiate between class and structure.

- The members of structures are public while those of a class are private.
- Classes provide data hiding while structures don't.
- Class bind both data as well as member functions while structures contain only data.

Explain container class.

- Class to hold objects in memory or external storage. It acts as a generic holder.
- It has a predefined behaviour and a known interface.
- It is used to hide the topology used for maintaining the list of objects in memory.
- The container class can be of two types:
 - 1. Heterogeneous container :** Here the container class contains a group of mixed objects
 - 2. Homogeneous container :** Here the container contains all the same objects.

What is namespace?

- Namespaces are used to group entities like classes, objects and functions under a name.

Explain explicit container.

- These are constructors that cannot take part in an implicit conversion.
- These are conversion constructors declared with explicit keyword.
- Explicit container is reserved explicitly for construction. It is not used by the compiler to implement an implied conversion of types.

Explain class invariant.

- It is a condition that ensures correct working of a class and defines all the valid states for an object.
- When an object is created class invariants must hold.
- It is necessary for them to be preserved under all operations of the class.
- All class invariants are both preconditions as well as post-conditions for all operations or member functions of the class.

Differentiate between late binding and early binding. What are the advantages of early binding?

- Late binding refers to function calls that are not resolved until run time while early binding refers to the events that occur at compile time.
- Late binding occurs through virtual functions while early binding takes place when all the information needed to call a function is known at the time of compiling.
- Early binding increases the efficiency. Some of the examples of early binding are normal function calls, overloaded function calls, and overloaded operators etc.

Explain public, protected, private in C++?

These are three access specifiers in C++.

1. **Public** : Here the data members and functions are accessible outside the class.
2. **Protected** : Data members and functions are available to derived classes only.
3. **Private** : Data members and functions are not accessible outside the class.

Explain Copy Constructor.

It is a constructor which initializes its object member variable with another object of the same class. If you don't implement a copy constructor in your class, the compiler automatically does it.

When do you call copy constructors?

Copy constructors are called in these situations :

1. When compiler generates a temporary object.
2. When a function returns an object of that class by value .
3. When the object of that class is passed by value as an argument to a function .
4. When you construct an object based on another object of the same class.

Name the implicit member functions of a class.

1. default constructor
2. copy constructor
3. assignment operator
4. default destructor
5. address operator

Explain storage qualifiers in C++.

1. **Const** : This variable means that if the memory is initialised once, it should not be altered by a program.
2. **Volatile** : This variable means that the value in the memory location can be altered even though nothing in the program code modifies the contents.
3. **Mutable** : This variable means that a particular member of a structure or class can be altered even if a particular structure variable, class or class member function is constant.

Explain dangling pointer.

- When the address of an object is used after its lifetime is over, dangling pointer comes into existence.
- Some examples of such situations are : Returning the addresses of the automatic variables from

a function or using the address of the memory block after it is freed.

In what situations do you have to use initialization list rather than assignment in constructors?

- When you want to use non-static const data members and reference data members you should use initialization list to initialize them.

When does a class need a virtual destructor?

- If your class has at least one virtual function, you should have a virtual destructor. This allows you to delete a dynamic object through a pointer to a base class object. In absence of this, the wrong destructor will be invoked during deletion of the dynamic object.

What is the type of “this” pointer? When does it get created?

- It is a constant pointer type. It gets created when a non-static member function of a class is called.

How would you differentiate between a pre and post increment operators while overloading?

- Mentioning the keyword `int` as the second parameter in the post increment form of the `operator++()` helps distinguish between the two forms.

What is a pdb file?

- A program database (PDB) file contains debugging and project state information that allows incremental linking of a Debug configuration of the program. This file is created when you compile a C/C++ program with `/ZI` or `/Zi` or a Visual Basic/C#/JScript .NET program with `/debug`.

You run a shell on UNIX system. How would you tell which shell are you running?

- To check this you can simply do the `Echo $RANDOM`.

- The results will be :

1. Undefined variable if you are from the C-Shell,
2. A return prompts if you are from the Bourne shell,
3. A 5 digit random number if you are from the Korn shell. You could also do a `ps -l` and look for the shell with the highest PID.

What are Stacks? Give an example where they are useful.

A Stack is a linear structure in which insertions and deletions are always made at one end i.e the top - this is termed as Last in First out (LIFO). Stacks are useful when we need to check some syntax errors like missing parentheses.

Differentiate between an external iterator and an internal iterator? What is the advantage of an external iterator.

An external iterator is implemented as a separate class that can be "attach" to the object that has items to step through while an internal iterator is implemented with member functions of the class that has items to step through. With an external iterator many different iterators can be active simultaneously on the same object - this is its basic advantage.

Do you think the following code is fine? If not, what is the problem?

```
T *p = 0;  
delete p;
```

- No, the code has a problem. The program will crash in an attempt to delete a null pointer.

In a function declaration, what does extern mean?

- Here, the extern tells the compiler about the existence of a variable or a function, even though the compiler hasn't yet seen it in the file currently being compiled. This variable or function may be defined in another file or further down in the current file.

You want to link a C++ program to C functions. How would you do it?

This can be done by using the extern "C" linkage specification around the C function declarations.

Explain STL.

STL stands for Standard Template Library. It is a library of container templates approved by the ANSI committee for inclusion in the standard C++ specification.

What are the different types of STL containers?

Following are the 3 types of STL containers :

1. Adaptive containers : For e.g. queue, stack

2. Associative containers : For e.g. set, map
3. Sequence containers : For e.g. vector, deque

Explain Stack unwinding.

Stack unwinding is a process during exception handling when the destructor is called for all local objects between the place where the exception was thrown and where it is caught.

How would you find out if a linked-list is a cycle or not?

We can find out if the linked-list is not a cycle by using two pointers. One of them goes 2 nodes every time while the second one goes at 1 node each time. If there is a cycle, the one that goes 2 nodes each time will meet the one that goes slower. If this happens, you can say that the linked-list is a cycle else not.

How does code-bloating occur in C++?

- Improper use of Inline functions and templates may lead to code bloating.
- Multiple Inheritance may also lead to code bloating.

Differentiate between realloc() and free().

- **Free()** : A block of memory previously allocated by the malloc subroutine is freed by free subroutine. Undefined results come out if the Pointer parameter is not a valid pointer. If the Pointer parameter is a null value, no action will take place.
- **Realloc()** : This subroutine changes the size of the block of memory pointed to by the Pointer parameter to the number of bytes specified by the Size parameter and returns a new pointer to the block. The pointer specified by the Pointer parameter must be created with the malloc, calloc or realloc subroutines and should not be deallocated with the free or realloc subroutines. Undefined results show up if the Pointer parameter is not a valid pointer.

Explain Function overloading and Operator overloading.

a. Function overloading :

- The capability of C++ to define several functions of the same name with different sets of parameters is called function overloading. While calling an overloaded function, the C++ compiler selects the proper function by examining the number, types and order of the arguments.
- Function overloading is commonly used to create several functions of the same name that perform similar tasks but on different data types.

b. Operator overloading :

- When the existing C++ operators are redefined to work on objects of user-defined classes, it is called operator overloading.
- Overloaded operators form a pleasant facade which improves the understandability and reduces maintenance costs without adding anything fundamental to the language.

Explain following storage classes in C++.

a. Auto :

- This is the default storage class.
- Variables in this class are automatically created and initialized when they are defined.
- These variable are then destroyed at the end of the block containing their definition. They are not visible outside that block.

b. Register :

- This is a type of auto variable.
- It gives a suggestion to the compiler to use a CPU register for performance.

c. Static :

- A variable that is known only in the function that contains its definition.
- It is never destroyed and retains its value between calls to that function.

d. Extern :

- This is a static variable.
- Its definition and placement is determined when all object and library modules are combined (linked) to form the executable code file.
- It can be visible outside the file where it is defined.

Explain "const" reference arguments in function?

- It protects you against programming errors that can alter data.
- It allows function to process both const and non-const actual arguments.
- A function without const in the prototype can only accept non constant arguments.
- Using a const reference allows the function to generate and use a temporary variable appropriately.

Why do you use the namespace feature?

- Multiple providers of libraries might use common global identifiers causing a name collision when an application tries to link with two or more such libraries.
- The namespace feature surrounds a library's external declaration with a unique namespace that eliminates the potential for those collisions.
- It identifies and assigns a name to a declarative region.
- The identifier in a namespace declaration must be unique in the declarative region in which it is used.
- The identifier is the name of the namespace and is used to reference its members.

Explain Overriding.

- Overriding a method means that replacing a method functionality in child class. To imply overriding functionality we need parent and child classes. In the child class you define the same method signature as one defined in the parent class.
- To override a method, a subclass of the class that originally declared the method must declare a method with the same name, return type (or a subclass of that return type), and same parameter list.
- Method overriding must have same : method name, data type, argument list.

How are virtual functions implemented in C++?

- Virtual functions are implemented using a table of function pointers. It is called the vtable.
- There exists one entry in the table per virtual function in the class.
- The table is created by the constructor of the class.
- When a derived class is constructed, its base class is constructed first. This creates the vtable.
- The derived class may override some of the base classes virtual functions. Such entries in the vtable are overwritten by the derived class constructor. For this reason, the virtual functions should not be called from a constructor.

What happens when you make call “delete this;”?

The two pit-falls exist here,

1. If it executes in a member function for an extern, static, or automatic object, the program will probably crash as soon as the delete statement gets executed.
2. When an object finishes like this, the using program might not know about this end. As far as the instantiating program is concerned, the object remains in scope and continues to exist even though the object is finished. Subsequent dereferencing of the pointer can lead to disaster.

Differentiate between a copy constructor and an overloaded

assignment operator.

- A copy constructor constructs a new object by using the content of the argument object while an overloaded assignment operator assigns the contents of an existing object to another existing object of the same class.
- Copy Constructor invoke in cases, such as:
 - i. Creation and initialization of an object simultaneously.
 - ii. When an object is passed to a function by value.
 - iii. When an object is returned from a function by value.

Explain Stack & Heap Objects.

The memory a program uses is divided into four areas :

1. The code area :

This is where the compiled program sits in memory.

2. The global area :

The place where global variables are stored.

3. The heap :

The place where dynamically allocated variables are allocated from.

4. The stack :

The place where parameters and local variables are allocated from.

Explain deep copy and a shallow copy.

a. Deep copy :

It involves using the contents of one object to create another instance of the same class. Here, the two objects may contain the same information but the target object will have its own buffers and resources. The destruction of either object will not affect the remaining objects.

b. Shallow copy :

It involves copying the contents of one object into another instance of the same class. This creates a mirror image. The two objects share the same externally contained contents of the other object to be unpredictable. This happens because of the straight copying of references and pointers.

Explain virtual class and friend class.

Virtual Base Class :

- It is used in context of multiple inheritance in C++.
- If you want to derive two classes from a class, and further derive one class from the two classes

in the second level, you need to declare the uppermost base class as 'virtual' in the inherited classes.

- This prevents multiple copies of the uppermost base class data members when an object of the class at the third level of hierarchy is created.

b.) Friend class:

- When a class declares another class as its friend, it is giving complete access to all its data and methods including private and protected data and methods to the friend class member methods.
- Friendship is not necessarily bi-directional. If A declares B as its friend it does not imply that A can access private data of B. It only means that B can access all data of A.

Explain the scope of resolution operator.

- A scope resolution operator (::) is used to define the member functions of a class outside the class.
- Mostly, a scope resolution operator is required when a data member is redefined by a derived class or an overridden method of the derived class wants to call the base class version of the same method.

List the advantages of inheritance.

- Inheritance permits code reusability.
- Reusability saves time in program development.
- It encourages the reuse of proven and debugged high-quality software which reduces the problems after a system becomes functional.

Differentiate between declaration and definition.

- The declaration informs the compiler that at some later point we plan to present the definition of this declaration.

What do you mean by a template?

- Templates enable creation of generic functions that admit any data type as parameters and return value without having to overload the function with all the possible data types unless they fulfill the functionality of a macro.
- Its prototype can be one of the following :

template function_declaration; template function_declaration;

- The only difference between both prototypes is the use of keyword class or typename. It's use is indistinct since both expressions have exactly the same meaning and behave exactly the same way.

Explain RTTI.

- RTTI - Runtime type identification
- It lets you find the dynamic type of an object when you have only a pointer or a reference to the base type.
- RTTI is the official way in standard C++ to discover the type of an object and to convert the type of a pointer or reference.

Difference between a copy constructor and an assignment operator.

- A copy constructor is used to declare and initialize an object from another object.
- **For Example :** integer l2(l1);
- An assignment operator doesnot invoke the copy constructor. It simply assigns the values of an object to another, member by member.

Difference between struct and class in terms of Access Modifier.

Classes and structures are syntactically similar. In C++, the role of the structure was expanded, making it an alternative way to specify a class. In C, the structures include data members, in C++ they are expanded to have function members as well. This makes structures in C++ and classes to be virtually same. The only difference between a C++ struct and a class is that, by default all the struct members are public while by default class members are private.

What are virtual functions?

Polymorphism is also achieved in C++ using virtual functions. If a function with same name exists in base as well as parent class, then the pointer to the base class would call the functions associated only with the base class. However, if the function is made virtual and the base pointer is initialized with the address of the derived class, then the function in the child class would be called.

What is a stack? How it can be implemented?

A Stack is a linear data structure which is a collection of homogenous elements but where insertion and deletion operations take place at one end only, called TOP of the stack. Stack is also

known as LIFO (Last In First Out) structure as the element which is inserted in the last will be the first element to come out from the stack.

It can be implemented by using a linear array say `S []` containing `stksize` locations along with an integer variable `TOP` storing the index of the top most element in the stack.

How a modifier is similar to mutator?

A modifier is also known as mutator where the change in the member function value will change the value of a data member that is associated with the function. It modifies the state of an object that is why mutator as it mutates or makes duplicate copies of itself to be used so that by one function many things can be changed at a time.

What are the various operations performed on stack?

Various operations which can be performed on stack are as follows :

creatempty() : It creates an empty stack by initializing `TOP` to `-1`.

isempty() : It determines whether stack is empty or not. It returns value `1` if stack is empty otherwise return `0`.

Push() : Adding a new element at the top of the stack is called Push.

Pop() : Removing an element from the top of the stack is called Pop.

How a new element can be added or pushed in a stack?

Pushing an element into stack :

Whenever an element is to be pushed into stack, `TOP` is increased by `1` and then the element is inserted in the linear array denoted by `S[]` at the location with index `TOP` i.e. at `S[TOP]`. During `push()` operation, a stage may come when `TOP` points to the last location in array `S[]` i.e. it becomes equal to `stksize-1`, then no more element can be pushed into stack and we say that Stack Overflow.

Algo Push(`S`, `Top`, `Item`)

Step 1 : If (`Top == stksize-1`)

then (i) Write "Stack Overflow "

(ii) Exit

step 2 : `top = top + 1`

step 3 : `S[top] = Item`

step 4 : Exit

Explain Queue. How it can be implemented?

- A queue is a linear data structure which is a collection of homogeneous elements where insertion and deletion occurs at different ends.
- The end where insertion takes place is called REAR and the end where deletion takes place is called FRONT.
- Queue is also known as FIFO (FIRST IN FIRST OUT) because the element which is inserted first last will be the first element to come out from the queue.
- Queue can be implemented by :
 1. Array Implementation of Stack
 2. Linked List Implementation of Stack

What are the four partitions in which C++ compiler divides the RAM?

1. Stack Area :

This part of memory is used to store formal parameters, local variables, return addresses of function call etc.

2. Program Code Area :

This part of memory is used to store the object code of the program.

3. Global Variable Section :

This part of memory is used to store global variables defined in the program.

4. Heap Area or Free Storage Pool :

It consists of unallocated memory locations which are allocated dynamically during program execution using new operator.

Explain static and dynamic memory allocation with an example each.

- When amount of memory to be allocated is known beforehand i.e. at the time of compilation, it is known as Static Memory Allocation. Once the memory is allocated statically, it cannot be deallocated during program run. So it leads to wastage of storage space.

- **Example :** `int A[100];`

- When amount of memory to be allocated is not known beforehand, rather it is determined at the time of program run, it is called Dynamic Memory Allocation. It leads to efficient utilization of storage space.

- **Example :**

```
cout << " Enter number of elements: ";  
cin >> N;  
int *A = new int[N]; // dynamic memory allocation
```

What is function prototyping? What are its advantages?

- Function prototyping is a function declaration statement that tells the compiler about the return type of the function and the number as well as type of arguments required by the function at the time of calling it.

- **Syntax :**

```
return_type function_name( type1 arg1, type 2 arg2, ... );
```

Advantages of function prototype :

- It helps the compiler in determining whether a function is called correctly or not. Each time when a function is called, its calling statement is compared with its prototype. In case of any mismatch, compiler reports an error.

- A function must be defined before calling it. But prototyping allows a function to be called before defining it.

Write a program using Display() function which takes two arguments.

```
cout << A[0] << " ";  
cout << A[1] << " ";  
.....  
cout << A[N-1] << " ";
```

In general : `cout << A[i] << " " ;` where $i = 0$ to $N-1$

```
void Display( float A[ ], int N )  
{  
for ( int i = 0; i<= N-1; i++)  
cout << A[i] << " ";  
cout << endl;  
}
```

Write a program using SHIFT_HALF() function to shift the elements of first half array to second half and vice versa.

```
swap(A[0], A[mid])  
swap(A[1], A[mid+1])  
.....  
swap(A[mid-1], A[N-1])
```


mid = n/2; i = 0, j = mid; swap(A[i], A[j]) where i = 0 to mid-1

```
void SHIFT_HALF( float A[], int n )
{
    int mid= n/2;
    for ( int i = 0, j =mid; i<= mid-1; i++,j++)
    {
        float T = A[i];
        A[i] = A[j];
        A[j] = T;
    }
}
```

What is searching? Explain linear and binary search.

- Finding the location of a given element in a given data structure is called searching.
- There are two types of search :

1. Linear Search :

In this, the element to be searched is compared one by one with each element of given list, starting with first element. The process of comparisons remain continue until the element is not found or list gets exhausted.

2. Binary Search :

It is another technique of searching an element in a given list in minimum possible comparisons. But for applying binary search on a list, there are two pre-conditions :

- i. The elements of list must be arranged either in ascending or descending order.
- ii. The list must be of finite size and should be in form of linear array.

Explain Selection sorting. Also write an example.

- In selection Sorting, one has to perform N-1 iterations or steps to sort a linear array containing N elements.
- In first iteration, we select the first minimum value and interchange it with the element present at first position.
- In Second iteration, we select the Second minimum value and interchange it with the element present at second position and so on.
- **For example :**

```
void SSORT( float A[ ], int n )
{
    for ( int i = 0; i<= N-2; i++)
    {
        int min = i;
        for ( int j = i+1; j<= N-1; j++)
            if ( A[min] > A[j] )
                min = j;
        // end of j loop
        if ( i != min )
        {
            float temp = A[i];
            A[i] = A[min];
            A[min] = temp;
        }
    }
}
```

Explain Bubble sorting.

In Bubble Sorting, we have to perform N-1 steps to sort a linear array.

1. In first iteration, we compare A[0] with A[1], A[1] with A[2],.....
A[N-2] with A[N-1] and interchange them if they are not in desired order.
2. In Second iteration, we compare A[0] with A[1], A[1] with A[2],.....
A[N-3] with A[N-2] and interchange them if they are not in desired order.
3. In Third iteration, we compare A[0] with A[1], A[1] with A[2],.....
A[N-4] with A[N-3] and interchange them if they are not in desired order.
4. In last iteration , we compare A[0] with A[1].

What is Insertion sorting?

- In insertion sorting, an array is divided into two parts :

1. Sorted part
2. Unsorted part

- Initially, sorted part contains only one element i.e. A[0] and unsorted part contains remaining N-1 elements i.e. A[1], A[2], ... A[N-1]. We pick elements from unsorted part one by one and insert them in the sorted part. Thus, we have to perform N-1 iterations to sort a linear array.

Write a program using MERGE () function to combine the elements of array X[] and Y[] into array Z[].

- Array X[] contain M elements and array Y[] contains N elements.

```
void MERGE( int x[], int y[], int z[], int m,int n )
{
    int L = 0, R = m+n-1;
    for ( int i = 0; i<= m-1 ; i++)
    {
        if ( x[i] % 2 == 0 )
        {
            c[R] = x[i];
            R--;
        }
        else
        {
            C[L] = x[i];
            L++;
        }
    }
    for ( i = 0; i<= n-1 ; i++)
    {
        if ( y[i] % 2 == 0 )
        {
            c[R] = y[i];
            R--;
        }
        else
        {
            C[L] = y[i];
            L++;
        }
    }
}
```

What are the various situations where a copy constructor is invoked?

Various situations where a copy constructor is invoked are as follows :

- When an object is defined and initializes with the values of another object of the same type, then copy constructor is invoked.
- When an object is passed by value method, then copy constructor is invoked to create the copy of the passed object for the function.
- When a function returns an object, then copy constructor is invoked to create a temporary object to hold the return value in the memory.

What is the need of a destructor? Explain with the help of an example.

- During construction of an object, resources may be allocated for use.
- For example, a constructor may have opened a file and memory area may be allocated to it. These allocated resources must be deallocated before the object is destroyed.
- A destructor performs all clean-up tasks like closing a file, deallocating and releasing memory area etc. automatically.
- **Example :**

```
class X
{
    int i, j;
    public :
    X( int m = 5, int n = 10)
    {
        i = m;
        j = n;
    }
    ~X() // destructor
    {}
    void print()
    {
        cout << i << " " <, j << endl;
    }
};
```

List the special characteristics of constructor.

- A constructor has the same name as that of class.
- It is automatically invoked when an object of the class is declared.

- Constructor obeys the usual access rule. Private & protected constructor can only be accessed by the member function and friend function of the class, Public constructor is available for all the function. Only that function can create the object that has access to the constructor.
- No return type is specified for the constructor.
- These cannot be inherited but a derived class can invoke base class constructor.
- A constructor can also have default arguments.
- A constructor can invoke the member functions.
- The default constructor and copy constructor are provided by the compiler only if these are not defined by the programmer.

Mention the ways in which parameterized can be invoked. Give an example of each.

Parameterized constructor can be invoked in the following ways :

1. Implicit Calling :

By implicit calling, we mean that the constructor's name is not specified in the calling statement.

General Form :

```
class_name object_name( value1, value2, .... );
```

Example :

```
X o1(4,5);
```

2. Explicit Calling :

By explicit calling, we mean that the constructor's name is specified in the calling statement.

General Form :

```
class_name object_name = constructor_name( value1, value2, .... );
```

Example :

```
X o1 = X(4,5);
```

What are the rules for naming an identifier?

- An identifier is the user defined name given to different elements in a program via: - variable name, class name, function name, array name etc.
- Example: M1, M2, M3, Rad. Ht, Vol, A, Calculate
- Identifiers are infinite in numbers.
- An identifier can be named in following ways :

1. An identifier's name must begin with an alphabet or underscore(_).
2. It should not contain special symbol except underscore.
3. It should not be a keyword.

What are the different types of comments allowed in C++?

- Comments are the text which is inserted in the source code (program written in C++ language) to make it more readable and understandable.
- There are two types of comments allowed in C++ :

1. Single line comment :

A line of text beginning with symbol double slash (//) up to the end of line is called single line comment. Comments are ignored by compiler during compilation.

2. Multiple line comments :

The text which is enclosed between a pair of symbols (/ * and * /) is called Multiple line comments.

What is the difference between a copy constructor and an overloaded assignment operator?

A **copy constructor is used within the class to copy one object in a new object**. This can be done by using the argument object in it, whereas an overloaded assignment operator **link an existing object to another object** which is existing but in the same class.

How to implement is-A and has-A class relationships?

Is-a is a class relationship which is specialization of another class. It is used to describe the relationship with other classes. This relationship can be seen implemented in inheritance.

For example if an employee class is there with a person then the employee is-A person.

Has-A shows the relationship between classes. In this, class can contain instances of another class. **For example**, employee "has" income, so the employee class is having has-A relationship with the Salary class.

Why use of template is better than a base class?

Templates are used for generic classes that contain objects of other types. It also allows you to manage the objects with their format and behavior intact. Templates are used when more than one class type has to be used and it defines the classes also at the run time. It is used when the type of the class is unknown to the user or manager of the class.

What are the advantages of using a pointer? Define the operators that can be used with a pointer?

Advantages of pointer :

- Through pointer, one can access a memory location directly and manipulate it.
- Pointers support dynamic memory allocation using new & delete operator.
- A pointer makes execution of certain routines faster.
- The operators that can be used with a pointer:

At Address operator (*) :

This operator gives the rvalue of the memory location whose address is stored in its operand.

For example: If P is a pointer that hold the address of variable A, then *P gives the rvalue of the variable A.

ADDRESS operator (&) :

This operator gives the address of its operand.

For Example: &A gives the address of variable A.

Show the application of a dynamic array with the help of an example.

- Dynamic array is an array whose size is defined during the program execution.
- Declare a dynamic array :

```
data_type *array_name = new data_type[size];
```

Example :

```
int N;
cout << " Enter the number of elements: ";
cin >> N;
int *A = new int[N];
# include<iostream.h>
# include<conio.h>
void main()
{
    int N;
    cout << " Enter the number of elements : ";
    cin >> N;
    int *A = new int[N];
    for (int i = 0; i < N; i++)
```

```
{
    cout << "Enter the element no. " << i+1 << " : ";
    cin >> *(A+i);
}
clrscr();
cout << " Given list is as follows: \n\n";
for ( i = 0; i < N; i++)
    cout << A[i] << " ";
getch();
}
```

Define linked lists with the help of an example.

- It is a linear data structure which is collection of homogeneous elements called Nodes where linear relationship is maintained by using Pointers.

- **Example :**

Declare a linked list containing integer values.

struct Node

```
{
    int data;
    Node *link;
};
```

class Linked

```
{
    Node *start;
public:
    Linked()
    {
        start = NULL;
    }
    void Insert();
    void Delete();
    void Display();
    ~Linked()
    {}
};
```


Explain the virtual inheritance in C++.

Virtual inheritance is used when a single base class is inherited with virtual methods. It can be achieved by the virtual keyword in the program. In this the object that belongs to virtual class becomes common to the base class. It is used for multiple inheritance, as it creates multiple sub objects and gives the feature to include two inherit the same class. It removes the problem of ambiguity.

Why is Standard Template Library used?

The Standard template library is used as a container to the templates which have been approved by the ANSI. It includes the standard C++ specification. It helps to construct programming in object oriented manner. It allows the use of pre-defined libraries for generic programming model. It allows faster execution of the programs and allow the user to use functions without even writing them.

What problem does the namespace feature solve?

Namespace are identifiers that provide multiple libraries that use global identifiers. This is used to remove the name collision when a name is linked with two or more libraries. It includes the external declarations of the library with unique namespaces so it eliminates the potential of the collision.