

SALE!

x

GeeksforGeeks Courses Upto 25% Off Enroll Now!

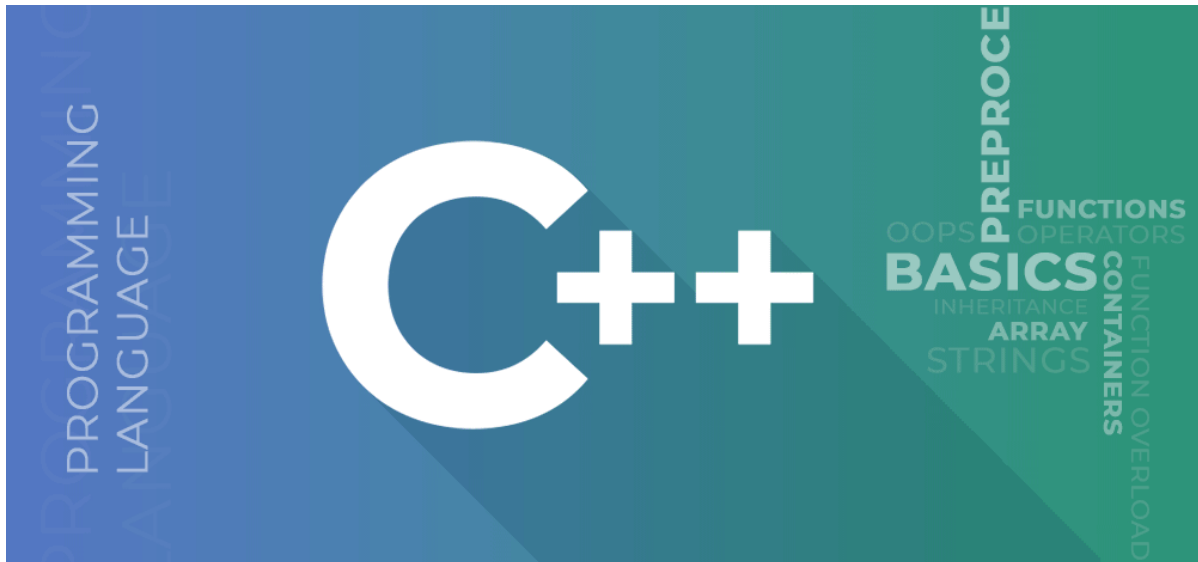
[Save 25% on Courses](#) [DSA](#) [Data Structures](#) [Algorithms](#) [Interview Preparation](#) [Data Science](#) [T](#)

# C++ Programming Language

Last Updated : 05 Mar, 2023

[Read](#)[Discuss\(250+\)](#)[Courses](#)[Practice](#)[Video](#)

C++ is a general-purpose programming language and is widely used nowadays for competitive programming. It has imperative, object-oriented and generic programming features. C++ runs on lots of platforms like Windows, Linux, Unix, Mac etc.



## C++ Recent Articles!

### C++ Interview Questions

### C++ Programs

Basics, C vs C++, C++ vs Java, Input and Output, Operators, Arrays and Strings, Functions, References and Pointers, Dynamic memory allocation, Object Oriented Programming(OOP), Constructor and Destructor, Function Overloading, Operator Overloading, Virtual Functions, Exception Handling, Namespaces, Standard Template Library (STL), Inheritance, C++ Library, C++ Advanced, C++ in Competitive Programming, Puzzles, Interview Questions, Multiple Choice Questions

### Basics

1. [Setting up C++ Development Environment](#)
2. [Writing first C++ program\(Practice\)](#)

### Standard Template Library (STL)

#### Algorithms

1. [Introduction to STL](#)
2. [Sorting](#)

3. void main or main()
4. C++ Data Types(Practice)
5. Basic Input/Output
6. Response on exceeding valid range of data types
7. C++ Preprocessors
8. Operators in C++(Practice)
9. Loops (Practice)
10. Decision Making in C++(Practice)
11. Execute both if and else simultaneously
12. How to compile 32-bit program on 64-bit gcc in C and C++
13. Switch statement in C++(Practice)
14. Functions in C++(Practice)
15. Arrays in C/C++(Practice)
16. Strings in C++(Practice)
17. Pointers in C++(Practice)
18. References in C++
19. Introduction to OOP in C++

### C vs C++

1. C program that won't compile in C++
2. Undefined Behaviour in C and C++
3. Name Mangling and extern "C" in C++
4. void \* in C vs C++
5. Program that produces different results in C and C++
6. Type difference of character literals in C vs C++
7. Difference between Structures in C and C++

### C++ vs Java

1. Inheritance in C++ vs Java
2. static keyword in C++ vs Java
3. default virtual behavior in C++ vs Java
4. Exception Handling in C++ vs Java
5. Foreach in C++ vs Java
6. Templates in C++ vs Generics in Java
7. Floating Point Operations & Associativity in C, C++ and Java
8. Similarities between Java and C++

### Input and output

### 3. Searching

#### Containers:

1. Pair (Practice)
2. Vector (Practice)
  - Ways to copy a vector in C++
  - Sorting 2D Vector in C++ | Set 3 (By number of columns), (Sort in descending order by first and second)
  - Sorting 2D Vector in C++ | Set 2 (In descending order by row and column)
  - 2D vector in C++ with user defined size
  - Vector::clear() and vector::erase() in C++ STL
  - Passing vector to a function in C++
  - Vector::push\_back() and vector::pop\_back() in C++ STL
  - Vector::empty() and vector::size() in C++ STL
  - vector::front() and vector::back() in C++ STL
  - Initialize a vector; Different ways
  - Sorting 2D Vector in C++ | Set 1 (By row and column), (Sort by first and second)
  - Computing index using pointers returned by STL functions in C++
3. List
  - List in C++ | Set 2 (Some Useful Functions)
  - Forward List in C++ | Set 1 (Introduction and Important Functions)
  - Forward List in C++ | Set 2 (Manipulating Functions)
  - list::remove() and list::remove\_if() in C++ STL
  - Forward\_list::front() and forward\_list::empty() in C++ STL
  - Forward\_list::remove() and forward\_list::remove\_if() in C++ STL
  - forward\_list::unique() in C++ STL
  - forward\_list::reverse() in C++ STL
  - forward\_list::max\_size() in C++ STL
  - forward\_list::before\_begin() in C++ STL

1. I/O Redirection in C++
2. Clearing The Input Buffer
3. Basic Input/Output(Practice)
4. cout << endl vs cout << "\n" in C++
5. Problem with scanf() when there is fgets()/gets()/scanf() after it
6. How to use getline() in C++ when there are blank lines in input?
7. scanf() and fscanf() in C – Simple Yet Powerful
8. Using return value of cin to take unknown number of inputs in C++
9. How to change the output of printf() in main() ?
10. Implementation of a Falling Matrix
11. What does buffer flush means in C++ ?
12. kbhit in C language
13. Code to generate the map of India

## Operators

1. Operators in C++
2. Unary operators in C/C++
3. Conditionally assign a value without using conditional and arithmetic operators
4. Execution of printf with ++ operators
5. Set a variable without using Arithmetic, Relational or Conditional Operator
6. Scope Resolution Operator vs this pointer
7. Pre-increment (or pre-decrement)
8. new and delete operator in C++
9. CHAR\_BIT in C
10. Casting operators | Set 1 (const\_cast)

## Arrays and Strings

1. Arrays in C/C++
2. Array of Strings
3. Multidimensional arrays in C/C++
4. Raw string literal
5. Counts of distinct consecutive sub-string of length two
6. Converting string to number and vice-versa
7. Find size of array in C/C++ without using sizeof

- forward\_list::cbefore\_begin() in C++ STL
- forward\_list::unique() in C++ STL
- forward\_list::before\_begin() in C++ STL
- forward\_list::cbefore\_begin() in C++ STL
- forward\_list::reverse() in C++ STL
- forward\_list::max\_size() in C++ STL
- forward\_list::splice\_after() in C++ STL
- list::empty() and list::size() in C++ STL
- list::front() and list::back() in C++ STL
- list::pop\_front() and list::pop\_back() in C++ STL
- list::push\_front() and list::push\_back() in C++ STL
- list push\_front() function in C++ STL
- list pop\_back() function in C++ STL
- list pop\_front() function in C++ STL
- list reverse function in C++ STL
- list resize() function in C++ STL
- list size() function in C++ STL
- list max\_size() function in C++ STL

4. Dequeue
5. Deque::empty() and deque::size() in C++ STL
6. Deque::pop\_front() and deque::pop\_back() in C++ STL
7. Deque::clear() and deque::erase() in C++ STL
8. Queue (Practice)
9. Queue::front() and queue::back() in C++ STL
- 10.
11. Queue::push() and queue::pop() in C++ STL
12. queue::empty() and queue::size() in C++ STL
13. **Priority Queue**
14. Stack (Practice)
15. Stack::push() and stack::pop() in C++ STL
16. Forward\_list :: push\_front() and forward\_list :: pop\_front() in C++ STL
17. Stack::top() in C++ STL
18. Stack::empty() and stack::size() in C++ STL
19. **Set** (Practice)
  - Count number of unique Triangles using STL | Set 1 (Using set)
  - std::istream\_iterator and std::ostream\_iterator in C++ STL
20. Std::next\_permutation and prev\_permutation in C++

8. How to quickly reverse a string in C++?
9. Tokenizing a string in C++
10. Getline() function and character array
11. Convert string to char array in C++
12. C++ string class and its applications , Set 2
13. How to create a dynamic 2D array inside a class in C++ ?
14. Lexicographically next permutation
15. Print size of array parameter
16. Split a string in C/C++, Python and Java
17. Stringstream in C++ and its applications
18. Strchr() function in C/C++
19. Isspace() in C/C++ and its application to count whitespace characters
20. Char\* vs std::string vs char[] in C++
21. Std::lexicographical\_compare() in C++ STL
22. Std::string::at in C++
23. Std::substr() in C/C++
24. std::stol() and std::stoll() functions in C++
25. Extract all integers from string in C++
26. Strchr() function in C++ and its applications
27. Strcat() vs strncat() in C++
28. Strncat() function in C/C++
29. Strpbrk() in C
30. strcoll() in C/C++
31. Why strcpy and strncpy are not safe to use?
21. Std::stoul and std::stoull in C++
22. Shuffle vs random\_shuffle in C++
23. Difference between set, multiset, unordered\_set, unordered\_multiset
24. Check if a key is present in a C++ map or unordered\_map
25. Std::stable\_partition in C++
26. Valarray slice selector
27. Std::memchr in C++
28. Std::strncmp() in C++
29. Stable\_sort() in C++ STL
30. Std::memcmp() in C++
31. Std::memset in C++
32. Std::bucket\_count and std::bucket\_size in unordered\_map in C++
33. Map of pairs in STL
34. Range-based for loop in C++
35. Std::includes() in C++ STL
36. Std::set\_symmetric\_difference in C++
37. Std::sort\_heap in C++
38. Map vs unordered\_map in C++
39. Round() in C++
40. Modulus of two float or double numbers
41. **Multiset**
42. Map (Practice)
43. Heap using STL C++

### Functions

1. Functions in C++
2. Default Arguments
3. C function argument and return values
4. Inline Functions
5. Return from void functions
6. Returning multiple values from a function using Tuple and Pair
7. Function Call Puzzle
8. Functors
9. Ciel and floor functions in C++
10. Const member functions
11. atol(), atoll() and atof() functions in C/C++
12. swap() in C++
13. wmemmove() function in c++
14. wcscat() function in C++
15. wcscmp() function in C++ with Examples

### Multimap

- Multimap in C++ Standard Template Library (STL)
- multimap::find() in C++ STL
- multimap::erase() in C++ STL
- map::emplace() in C++ STL
- multimap::emplace\_hint() in C++ STL
- multimap::emplace() in C++ STL
- multimap::count() in C++ STL
- multimap::find() in C++ STL
- multimap::erase() in C++ STL
- multimap::begin() and multimap::end() in C++ STL
- multimap::cbegin() and multimap::cend() in C++ STL
- map::cbegin() and map::cend() function in C++ STL

16. wcsncpy() function in C++ with Examples
17. wcslen() function in C++ with Examples
18. difftime() function in C++
19. asctime() function in C++
20. localtime() function in C++
21. scalbn() function in C++
22. isunordered() function in C++
23. isnormal() in C++
24. isinf() function in C++
25. quick\_exit() function in C++ with Examples
26. ctime() Function in C/C++
27. clock() function in C/C++
28. nearbyint() function in C++
29. quick\_exit() function in C++ with Examples
30. wcscmp() function in C++ with Examples
31. wcsncpy() function in C++ with Examples
32. wcslen() function in C++ with Examples

### Pointers and References

1. Pointers in C and C++
2. What is Array Decay in C++? How can it be prevented?
3. Opaque Pointer
4. References
5. Can references refer to invalid location?
6. Pass arguments by reference or pointer
7. Smart Pointers
8. 'this' pointer
9. Type of 'this' pointer
10. "delete this"
11. auto\_ptr, unique\_ptr, shared\_ptr and weak\_ptr
12. Dangling, Void, Null and Wild Pointers
13. Passing by pointer Vs Passing by Reference
14. NaN in C++ - What is it and how to check for it?
15. nullptr
16. Pointers vs References in C++

### Dynamic memory allocation

1. new and delete operator in C++
2. malloc() vs new
3. delete() and free()
4. Std::get\_temporary\_buffer in C++

- multimap::cbegin() and multimap::crend() in C++ STL
- multimap size() function in C++ STL
- multimap lower\_bound() function in C++ STL
- multimap swap() function in C++ STL
- multimap upper\_bound() function in C++ STL
- multimap maxsize() in C++ STL
- multimap insert() in C++ STL
- multimap equal\_range() in C++ STL

### C++-Math

- sinh() function in C++ STL
- cosh() function in C++ STL
- tanh() function in C++ STL
- acos() function in C++ STL
- asinh() function in C++ STL
- acosh() function in C++ STL
- atanh() function in C++ STL

### More:

1. sort() in C++ STL
2. Strand sort
3. Type Inference in C++ (auto and decltype)
4. transform() in C++ STL
5. Variadic function templates in C++
6. Template Specialization
7. Implementing iterator pattern of a singly linked list
8. Binary Search functions in C++ STL
9. Descending order in Map and Multimap of C++ STL
10. Insertion and Deletion in STL Set C++
11. set::key\_comp() in C++ STL
12. set value\_comp() function in C++ STL
13. unordered\_set get\_allocator() in C++ STL with Examples

### Inheritance

- What all is inherited from parent class in C++?
- Virtual Functions and Runtime Polymorphism in C++
- Multiple Inheritance in C++

## Object Oriented Programming(OOP)

1. Object oriented design
2. Introduction to OOP in C++
3. Classes and Objects
4. Access Modifiers
5. Inheritance
6. Polymorphism
7. Encapsulation
8. Data Abstraction
9. Structure vs class
10. Can a C++ class have an object of self type?
11. Why is the size of an empty class not zero?
12. Static data members in C++
13. Some interesting facts about static member functions
14. Friend class and function
15. Local Class
16. Nested Classes
17. Simulating final class

## Constructor and Destructor

1. Constructors
2. Copy Constructor
3. Destructors
4. Does compiler create default constructor when we write our own?
5. When should we write our own copy constructor?
6. When is copy constructor called?
7. Initialization of data members
8. Use of explicit keyword
9. When do we use Initializer List in?
10. Default Constructors
11. Private Destructor
12. Playing with Destructors
13. Copy elision
14. C++ default constructor | Built-in types
15. When does compiler create a default constructor and copy constructor?
16. Why copy constructor argument should be const in C++?
17. Advanced C++ | Virtual Constructor
18. Advanced C++ | Virtual Copy Constructor

- What happens when more restrictive access is given to a derived class method in C++?
- Object Slicing in C++
- Hiding of all overloaded methods in base class
- Inheritance and friendship
- Simulating final class

## C++ Library

1. <random> file – generators and distributions
2. Array type manipulation
3. C++ programming and STL facts
4. Sqrt, sqrtl and sqrtf in C++
5. std::stof, std::stod, std::stold in C++
6. C program to demonstrate fork() and pipe()
7. Complex numbers in C++ | Set 1 Set 2
8. Inbuilt library functions for user Input
9. Rename function in C/C++
10. Chrono
11. valarray class
12. Floating Point Manipulation (fmod(), remainder(), remquo() ... in cmath)(Practice)
13. Character Classification: ctype
14. Snprintf() in C library
15. Boost::split in C++ library
16. Modulus of two float or double numbers
17. Is\_trivial function in C++
18. Array sum in C++ STL
19. Div() function in C++
20. Exit() vs \_Exit() in C and C++
21. Std::none\_of in C++
22. Isprint() in C++
23. Isctrl() in C++ and its application to find control characters
24. Std::partition\_point in C++
25. Iterator Invalidation in C++
26. Fsetround() and fegetround() in C++ and their application
27. Rint(), rintf(), rintl() in C++
28. Hypot(), hypotf(), hypotl() in C++
29. Std::gslice | Valarray generalized slice selector
30. std::setbase, std::setw, std::setfill in C++
31. Strxfrm() in C/C++



19. When are static objects destroyed?

20. Is it possible to call constructor and destructor explicitly?

### Function Overloading

1. Function Overloading
2. Functions that can't be overloaded
3. Function overloading and const keyword
4. Function overloading and return type
5. Does overloading work with Inheritance?
6. Can main() be overloaded
7. Function Overloading and float

### Operator Overloading

1. Operator Overloading
2. Copy constructor vs assignment operator
3. When should we write our own assignment operator?
4. Operators that cannot be overloaded
5. Conversion Operators
6. Is assignment operator inherited?
7. Default Assignment Operator and References
8. Overloading stream insertion (<<) and extraction (>>) operators
9. Overloading array index operator []

### Virtual Functions

1. Virtual Functions and Runtime Polymorphism
2. Default arguments and virtual function
3. Virtual functions in derived classes
4. Can static functions be virtual?
5. Virtual Destructor
6. Virtual Constructor
7. Virtual Copy Constructor
8. RTTI (Run-time type information)
9. Can virtual functions be private?
10. Inline virtual function
11. Pure Virtual Functions and Abstract Classes
12. Pure virtual destructor

### Exception Handling

1. Exception Handling Basics
2. Stack Unwinding

32. Set position with seekg() in C++ language file handling

33. Strstr() in C/C++

34. Difftime() C library function

35. Socket Programming

36. Precision of floating point numbers in C++ (floor(), ceil(), trunc(), round() and setprecision())

37. <bit/stdc++.h> header file

38. std::string class in C++

39. Merge operations using STL in C++ (merge, includes, set\_union, set\_intersection, set\_difference, ..)

40. std::partition in C++ STL

41. Ratio Manipulations in C++ | Set 1 (Arithmetic) , Set 2 (Comparison)

42. numeric header in C++ STL | Set 1 (accumulate() and partial\_sum()), Set 2 (adjacent\_difference(), inner\_product() and iota())

43. Bind function and placeholders

44. Array class

45. Tuples

46. Regex (Regular Expression)

47. Common Subtleties in Vector STLs

48. Understanding constexpr specifier

49. unordered\_multiset and its uses

50. unordered\_multimap and its application

51. Populating a vector in C++ using fill() and fill\_n()

52. Writing OS Independent Code in C/C++

53. C Program to display hostname and IP address

54. Database Connectivity using C/C++

55. C++ bitset and its application

56. unordered\_map in STL and its applications

57. unordered\_set in STL and its applications

58. nextafter() and nexttoward()

### C++ Advanced

1. User Defined Literal
2. Placement new operator
3. Advanced C++ with boost library
4. Copy-and-Swap Idiom

3. Catching base and derived classes as exceptions
4. Catch block and type conversion
5. Exception handling and object destruction

### Namespace

1. Namespace in C++ | Set 1 (Introduction)
2. Set 2 (Extending namespace and Unnamed namespace)
3. Namespace in C++ | Set 3 (Accessing, creating header, nesting and aliasing)
4. Inline namespaces and usage of the "using" directive inside namespaces
5. Can namespaces be nested?

5. Zombie and Orphan Processes
6. Lambda expression
7. C++ | Signal Handling
8. Preventing Object Copy in C++
9. Command line arguments in C++

### C++ in Competitive Programming

1. Writing C/C++ code efficiently in Competitive programming
2. Useful Array algorithms in C++ STL
3. searching in fork()
4. Data Type Ranges and their macros
5. Cin-Cout vs Scanf-Printf
6. getchar\_unlocked() – faster input in C/C++ for Competitive Programming
7. C qsort() vs C++ sort()
8. Middle of three using minimum comparisons
9. Check for integer overflow on multiplication
10. Generating Test Cases (generate() and generate\_n())

### Puzzles

1. Can we call an undeclared function in?
2. Can we access global variable if there is a local variable with same name?
3. Can we use function on left side of an expression in C and C++?
4. Can we access private data members of a class without using a member or a friend function?
5. How to make a C++ class whose objects can only be dynamically allocated?
6. How to print "GeeksforGeeks" with empty main()
7. Print 1 to 100, without loop and recursion
8. C/C++ Tricky Programs
9. Print a number 100 times without using loop, recursion and macro expansion in C++
10. How to restrict dynamic allocation of objects
11. Sum of digits of a number in single statement
12. Write a URL in a C++ program
13. Zoom digits of an integer
14. Composite Design Pattern in C++
15. Assign value without any control statement



16. [Printing pyramid pattern](#)
17. [How to swap two variables in one line in C/C++, Python and Java?](#)
18. [Program to shut down a computer](#)

### Interview Questions

1. [Commonly Asked C++ Interview Questions | Set 1](#)
2. [Commonly Asked OOP Interview Questions | Set 1](#)
3. [C/C++ Programs](#)

### Quick Links:

- [Recent Articles on C++](#)
- [Practice Track on C++](#)
- [C++ Output & Multiple Choice Questions](#)

## Related Articles

1. [Ruby Programming Language](#)  
[<https://www.geeksforgeeks.org/ruby-programming-language/?ref=rp>]

---

2. [Kotlin Programming Language](#)  
[<https://www.geeksforgeeks.org/kotlin-programming-language/?ref=rp>]

---

3. [Perl Programming Language](#)  
[<https://www.geeksforgeeks.org/perl-programming-language/?ref=rp>]

---

4. [Scala Programming Language](#)  
[<https://www.geeksforgeeks.org/scala-programming-language/?ref=rp>]

---

5. [Learning the art of Competitive Programming](#)  
[<https://www.geeksforgeeks.org/learning-art-competitive-programming/?ref=rp>]

---

6. [GATE and Programming Multiple Choice Questions with Solutions](#)  
[<https://www.geeksforgeeks.org/gate-programming-multiple-choice-questions-solutions/?ref=rp>]

---

7. [Quizzes on Programming Languages](#)  
[<https://www.geeksforgeeks.org/quizzes-on-programming-languages-gq/?ref=rp>]

---

8. [Articles on Programming Languages](#)  
[<https://www.geeksforgeeks.org/articles-on-programming-languages-gq/?ref=rp>]

---