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STL

1. Sequential Containers

Container	Structure	Complexity	Usage	Properties
vector	Dynamic Array	O(1) for access, insert at end , O(n) for insert , erase in the middle	Best for frequent random access, appending at the end	Supports push_back, resize, capacity, contiguous memory
deque	Double-ended queue (array of arrays)	O(1) for access, O(1) for insert/erase at both ends, O(n) in middle	Fast insert/delete at both ends, slower than vector for random access	No contiguous memory, supports push_front & push_back
list	Doubly linked list	O(n) for access, O(1) for insert/erase anywhere	Efficient insert/erase in the middle, poor cache locality	No random access, supports bidirectional iteration
forward_list	Singly linked list	O(n) for access, O(1) for insert/erase (only with iterators)	Lightweight list, best when only forward traversal is needed	No reverse traversal, lower memory overhead than list
array	Static Array	O(1) for access	When a fixed-size array is required	Similar to vector but with fixed size

2. Associative Containers

Container	Underlying Structure	Complexity	Usage	Properties
set	Red-Black Tree	O(log n) for insert, erase, find	Unique sorted elements, fast search	No duplicates, ordered traversal
multiset	Red-Black Tree	O(log n) for insert, erase, find	Allow duplicate sorted elements	Stores multiple occurrences of values
map	Red-Black Tree	O(log n) for insert, erase, find	Key-value pairs sorted by key	Ordered, unique keys
multimap	Red-Black Tree	O(log n) for insert, erase, find	Multiple values for the same key	Ordered, duplicate keys allowed

3. Unordered Containers (Hash-based)

Container	Underlying Structure	Complexity	Usage	Properties
unordered_set	Hash Table	O(1) avg, O(n) worst for insert, erase, find	Fast search and insert, order not required	No duplicates, hashed storage
unordered_multiset	Hash Table	O(1) avg, O(n) worst for insert, erase, find	Allow duplicate values	Unordered storage
unordered_map	Hash Table	O(1) avg, O(n) worst for insert, erase, find	Key-value pairs with fast lookup	No duplicate keys, unordered
unordered_multimap	Hash Table	O(1) avg, O(n) worst for insert, erase, find	Multiple values per key	Unordered, duplicate keys allowed

4. Container Adapters

Container	Underlying Structure	Complexity	Usage	Properties
stack	deque (default), vector or list	O(1) for push/pop	LIFO (Last In, First Out)	Restricted operations (push, pop, top)
queue	deque (default)	O(1) for push/pop	FIFO (First In, First Out)	Restricted operations (push, pop, front, back)
priority_queue	Binary Heap (Heap Sort)	O(log n) for push/pop	Fast access to largest/smallest element	Heap-based