Competitive Programming Notebook

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Contents

1 Snippets

2 Template

3 Macros

4 Container Classes and Initialization

1. **Vector:**

   (a) Class:

   ```
   template < class T,
   class Alloc = allocator<T>> class vector;
   
   ```

   (b) Initialization:

   i. `vector<int> v`: Declares a vector of integers.

   ii. `vector<int> v(n)`: Declares a vector of integers of size n.

   iii. `vector<int> v(n, x)`: Declares a vector of integers of size n, with all elements initialized to x.

   iv. `vector<int> v = {1, 2, 3, 4}`: Declares a vector of integers with the elements 1, 2, 3 and 4.

   v. `vector<int> v {1, 2, 3, 4}`: Declares a vector of integers with the elements 1, 2, 3 and 4.

2. **Set:**

   (a) Class:

   ```
   template < class T,
   class Compare = less<T>, \\ View Interesting Classes Chapter
     for more information
   class Alloc = allocator<T>> class set;
   
   ```

   (b) Initialization:

   i. `set<int> s`: Declares a set of integers.

   ii. `set<int> s {1, 2, 3, 4}`: Declares a set of integers with the elements 1, 2, 3 and 4.

   iii. `set<int> s = {1, 2, 3, 4}`: Declares a set of integers with the elements 1, 2, 3 and 4.

5 Functions

Containers Functions

1. **Vector:**

2. **Set:**

   (a) `insert(x)`: Insert element x in the set. ej:

   ```
   set<int> s;
   s.insert(5);
   // New value of s = {5}
   ```

   Note: Complexity of O($log_2 n$).

   (b) `erase(x)`: Erase element x from the set. ej:

   ```
   set<int> s ({5, 6, 7});
   s.erase(5);
   // New value of s = {6, 7}
   ```

   Note: Complexity of O($log_2 n$).

   (c) `find(x)`: Find element x in the set. ej:

   ```
   set<int> s;
   s.find(5);
   // Will return s.end() if x is not in the set
   ```

   Note: Complexity of O($log_2 n$).

   (d) `lower_bound(x)`: Find the first element that is not less than x. ej:

   ```
   set<int> s ({5, 6, 7});
   s.lower_bound(6);
   // Will return an iterator to the element 6
   ```

   Note: Complexity of O($log_2 n$). **Note:** Uses Binary Search under the hood.

   (e) `upper_bound(x)`: Find the first element that is greater than x. ej:

   ```
   set<int> s ({5, 6, 7});
   s.upper_bound(6);
   // Will return an iterator to the element 7
   ```

   Note: Complexity of O($log_2 n$). **Note:** Uses Binary Search under the hood.

6 Greedy

7 Two Pointers

8 Search

Binary Search

Ternary Search

9 Sorting

10 Array and Range Sums

11 Dynamic Programming

12 Number Theory

13 Graph Theory