C++ : Map Tutorial Part 1: Usage Detail with examples

Varun January 31, 2015 C++, std::map 6 Comments

In this article we see how & why to use std::map in c++.

std::map Introduction

std::map is an associative container that store elements in key-value pair.

Benefits of using std::map :

- It stores only unique keys and that too in sorted order based on its assigned sorting criteria.
- As keys are in sorted order therefore searching element in map through key is very fast i.e. it takes logarithmic time.
- In std::map there will be only one value attached with the every key.
- std::map can be used as associative arrays.
- It might be implemented using balanced binary trees.

Lets see an example,

```
1 #include <iostream>
2 #include <map>
3 #include <string>
```


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```
#include <iterator>

int main()
{
    std::map<std::string, int> mapOfWords;
    // Inserting data in std::map
    mapOfWords.insert(std::make_pair("earth", 1));
    mapOfWords.insert(std::make_pair("moon", 2));
    mapOfWords["sun"] = 3;
    // Will replace the value of already added key i.e. earth
    mapOfWords["earth"] = 4;
    // Iterate through all elements in std::map
    std::map<std::string, int>::iterator it = mapOfWords.begin()
    while(it != mapOfWords.end())
    {
        std::cout<<it->first<<" :: "<<it->second<<std::endl;
        it++;
    }
    // Check if insertion is successful or not
    if(mapOfWords.insert(std::make_pair("earth", 1)).second == f
    {
        std::cout<<"Element with key 'earth' not inserted becaus
    }
    // Searching element in std::map by key.
    if(mapOfWords.find("sun") != mapOfWords.end())
        std::cout<<"word 'sun' found"<<std::endl;
    if(mapOfWords.find("mars") == mapOfWords.end())
        std::cout<<"word 'mars' not found"<<std::endl;
    return 0;
}
```

Output:

earth :: 4
moon :: 2
sun :: 3
Element with key 'earth' not inserted because already existed
word 'sun' found
word 'mars' not found

Creating std::map objects

Creating a std::map of words i.e.

Key = Word (std::string)
Value = Word's frequency count (int)

```
std::map<std::string, int> mapOfWords;
```

As no external sorting criteria for key(std::string) is specified in above std::map, therefore it will use default key sorting criteria i.e operator < and all elements will be arranged inside std::map in alphabetical sorted order of keys.

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Inserting data in std::map :

Inserting data using insert member function,

```
mapOfWords.insert(std::make_pair("earth", 1));
mapOfWords.insert(std::make_pair("moon", 2));
```

We can also insert data in std::map using operator [] i.e.

```
mapOfWords["sun"] = 3;
```

Different between operator [] and insert function:

If specified key already existed in map then operator [] will silently change its value where as insert will not replace already added key instead it returns the information i.e. if element is added or not. e.g.

```
mapOfWords["earth"] = 4; // Will replace the value of already ad
```

Where as for insert member function,

```
mapOfWords.insert(std::make_pair("earth", 1)).second
```

will return false.

Iterating through all std::map elements:

```
std::map<std::string, int>::iterator it = mapOfWords.begin();
while(it != mapOfWords.end())
{
std::cout<<it->first<<" :: "<<it->second<<std::endl;
it++;
}
```

Each entry in std::map<std::string, int> is std::pair<std::string, int>
therefore through iterator,
key can be accessed by it->first and value by it->second .

Searching element in std::map by key

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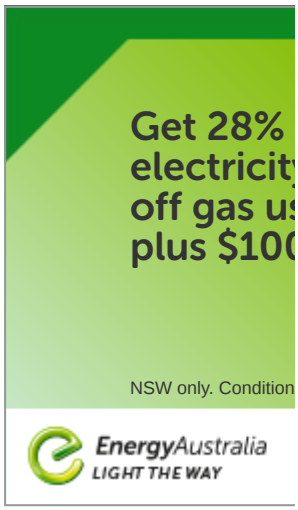

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Search

Search … Search

find member function of std::map can be used to search element in std::map by key. If specified key is not present then it returns the std::map::end else an iterator to the searched element.

```
iterator find (const key_type& k);

//e.g.

if(mapOfWords.find("sun") != mapOfWords.end())
std::cout<<"word 'sun' found"<<std::endl;
if(mapOfWords.find("mars") == mapOfWords.end())
std::cout<<"word 'mars' not found"<<std::endl;
```

Searching element in std::map by Value

To search element in std::map by value we need to iterate through all of the elements and check for the passed value and return i.e.

```
#include <iostream>
#include <map>
#include <string>
#include <iterator>

std::map<std::string, int>::iterator serachByValue(std::map<std:
{
    // Iterate through all elements in std::map and search for t
    std::map<std::string, int>::iterator it = mapOfWords.begin()
    while(it != mapOfWords.end())
    {
        if(it->second == val)
        return it;
        it++;
    }
}
int main()
{
    std::map<std::string, int> mapOfWords;
    // Inserting data in std::map
    mapOfWords.insert(std::make_pair("earth", 1));
    mapOfWords.insert(std::make_pair("moon", 2));
    mapOfWords["sun"] = 3;

    std::map<std::string, int>::iterator it = serachByValue(mapO
    if(it != mapOfWords.end())
        std::cout<<it->first<<" :: "<<it->second<<std::endl;

return 0;
}
```

Output:

sun :: 3

Deleting data from std::map

std::map's erase member function is used to delete the element in std::map i.e.

```
void erase (iterator position);
size_type erase (const key_type& k);
void erase (iterator first, iterator last);
```

Code example,

```
#include <iostream>
#include <map>
#include <string>
#include <iterator>
int main()
{
    std::map<std::string, int> mapOfWords;
    mapOfWords.insert(std::make_pair("earth", 1));
    mapOfWords.insert(std::make_pair("moon", 2));
    mapOfWords["sun"] = 3;

    // Erasing By iterator
    std::map<std::string, int>::iterator it = mapOfWords.find("m
    mapOfWords.erase(it);

    // Erasing By Key
    mapOfWords.erase("earth");

    return 0;
}
```

Other Map related articles are,

1.) std::map Usage Detail with examples

2.) std::map and Comparator

3.) std::map & User defined class objects as keys

4.) Set vs Map

5.) How to Iterate over a map in C++

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7.) Iterate a map in reverse order

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C++, std::map, STL

6 Comments Already

Warren - May 3rd, 2016 at 7:20 am

Thanks for the clear demonstration.

Reply

Varun - April 20th, 2018 at 8:32 am

Thanks For appreciating.

Reply

Pat Patterson - April 18th, 2018 at 4:22 am

How do I do something straightforward like get the value associated with at looked-up key and assign it to a variable?

Reply

Varun - April 20th, 2018 at 8:32 am

Method 1 :
If you are sure that key exists in map then directly access using [] operator i.e.

value = mapOfWords[key];

Method 2 :

If you are not sure that key exists in map then,

```
auto it = mapOfWords.find(key);
if(it != mapOfWords.end())
{
value = it->second;
}
```

Reply

Mario - June 22nd, 2018 at 1:59 am

What if the key value type doesn't have a default operator< ?

Reply

Varun - June 24th, 2018 at 12:25 pm

Then you can pass custom comparators. Checkout following articles for complete examples,
std::map and Comparators
std::map and User define objects

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Check if an item exists in List

Check if a list contains all the elements of other list

Create a List and initialize with values

How to Iterate over a List

Insert an element at specific index in List

Sort a list of tuples by 2nd Item

Sort a list of strings

Add an element in list | append() vs extend()

Check if all elements in a List are same

Merge / Join two or more lists

Remove Duplicates from a List

Convert a list to string

Remove element from a list by value or Index

Remove multiple elements from list

Python : Dictionary

Creating Dictionaries in Python

C++11 – Utilities

std::bind

auto specifier

Variadic Templates

C++11 – Unordered Set

1.) unordered_set Basic Example

2.) Initializing an unordered_set

3.) Inserting elements in an unordered_set

4.) Searching an element in unordered_set

5.) unordered_set – Custom Hasher & Comparator

6.) Unordered_set & User defined classes

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- Factory Method Design Pattern

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Allocating 2D Array Dynamically

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2.) Different ways to initialize a vector

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6.) std::vector and Iterator Invalidation

7.) Remove repeated elements from a vector

8.) Fill a vector with random numbers

9.) Hidden cost of std::vector

10.) Adding elements in Vector

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1.) What is std::deque and how deque works internally.

2.) deque vs vector : What to choose ?

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Iterating over Dictionaries in Python

Check if a key exists in Dictionary

Get list of all the keys in Dictionary

Get list of all the Values in a Dictionary

Remove multiple keys in Dictionary while Iterating

Remove a key from Dictionary

Add key/value pairs in Dictionary

Find keys by value in Dictionary

Sort a Dictionary by key or Value

Copy a dictionary | Shallow vs Deep Copy

Python Strings

Access characters in string by index in Python

Iterate over the characters in string

How to Replace characters in a string ?

Java – Hashmap

What is Hashing and Hash Table?

Associating Multiple values with same Key

Remove elements while Iterating

Update the value of an existing key

Get all keys by a value in HashMap

Java – HashSet

What is Hashing and Hash Table?

Create and add elements in a HashSet

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Erase elements while iterating

std::map vs std::unordered_map

C++11 Smart Pointers

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shared_ptr and Custom Deletor

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Create shared_ptr objects carefully

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Part 2: Joining and Detaching Threads

Part 3: Passing Arguments to Threads

Part 4 : Sharing Data & Race Conditions

Part 5 : Fixing Race Conditions using mutex

Part 6 : Need of Event Handling

Part 7: Condition Variables

Part 8: std::future and std::promise

Part 9: std::async Tutorial & Example

Part 10: std::packaged_task<> Tutorial

C++11 Rvalue References

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Function Objects & Functors

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Find all occurrences of a sub string

Case Insensitive string::find

Convert First Letter of each word to Upper Case

Converting a String to Upper & Lower Case

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C++ : How to split a string using String and character as Delimiter?

startsWith() Implementation

endsWith() Implementation

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6.) Remove elements based on External Criterion

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8.) Searching an element in std::list

9.) Different Ways to iterate over a List

10.) Sorting a List & custom Comparator

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2.) Using std::set with user defined classes

3.) std::set and external Sorting criteria | Comparator

4.) Access Element by index in Set

5.) How to insert elements in Set

6.) How to iterate over a Set

7.) Removing an element from Set

8.) Erase elements while Iterating & Generic erase_if()

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1.) std::map Usage Detail with examples

2.) std::map and Comparator

3.) std::map & User defined class objects as keys

4.) Set vs Map

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13.) copy all Values from a Map to vector

STL Multimap

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