

My Project

Generated by Doxygen 1.8.13

Contents

1	Class Index	1
1.1	Class List	1
2	File Index	3
2.1	File List	3
3	Class Documentation	5
3.1	bst< K, V, CO >::_iterator< oK, oV > Class Template Reference	5
3.1.1	Detailed Description	6
3.1.2	Constructor & Destructor Documentation	6
3.1.2.1	_iterator() [1/2]	7
3.1.2.2	_iterator() [2/2]	7
3.1.3	Member Function Documentation	7
3.1.3.1	operator!=(()) [1/2]	7
3.1.3.2	operator!=(()) [2/2]	8
3.1.3.3	operator*() [1/2]	8
3.1.3.4	operator*() [2/2]	8
3.1.3.5	operator++() [1/4]	8
3.1.3.6	operator++() [2/4]	9
3.1.3.7	operator++() [3/4]	9
3.1.3.8	operator++() [4/4]	9
3.1.3.9	operator->() [1/2]	9
3.1.3.10	operator->() [2/2]	10
3.1.3.11	operator==(()) [1/2]	10

3.1.3.12	<code>operator==()</code> [2/2]	10
3.1.4	Friends And Related Function Documentation	10
3.1.4.1	<code>operator<<</code>	10
3.2	<code>bst< K, V, CO ></code> Class Template Reference	11
3.2.1	Detailed Description	13
3.2.2	Member Typedef Documentation	13
3.2.2.1	<code>iterator</code>	13
3.2.3	Constructor & Destructor Documentation	13
3.2.3.1	<code>bst()</code> [1/4]	13
3.2.3.2	<code>bst()</code> [2/4]	14
3.2.3.3	<code>bst()</code> [3/4]	14
3.2.3.4	<code>bst()</code> [4/4]	14
3.2.4	Member Function Documentation	15
3.2.4.1	<code>begin()</code> [1/2]	15
3.2.4.2	<code>begin()</code> [2/2]	15
3.2.4.3	<code>cbegin()</code>	15
3.2.4.4	<code>cend()</code>	16
3.2.4.5	<code>emplace()</code>	16
3.2.4.6	<code>end()</code> [1/2]	16
3.2.4.7	<code>end()</code> [2/2]	17
3.2.4.8	<code>erase()</code>	17
3.2.4.9	<code>erase_node()</code>	17
3.2.4.10	<code>find()</code> [1/2]	17
3.2.4.11	<code>find()</code> [2/2]	18
3.2.4.12	<code>insert()</code> [1/2]	18
3.2.4.13	<code>insert()</code> [2/2]	19
3.2.4.14	<code>max_depth()</code>	19
3.2.4.15	<code>node_depth()</code>	19
3.2.4.16	<code>operator=()</code> [1/2]	20
3.2.4.17	<code>operator=()</code> [2/2]	20

3.2.4.18	operator[]() [1/2]	20
3.2.4.19	operator[]() [2/2]	21
3.2.5	Friends And Related Function Documentation	21
3.2.5.1	get_root	21
3.2.5.2	operator<<	21
3.3	bst< K, V, CO >::node Struct Reference	22
3.3.1	Detailed Description	23
3.3.2	Constructor & Destructor Documentation	23
3.3.2.1	node() [1/5]	23
3.3.2.2	node() [2/5]	24
3.3.2.3	node() [3/5]	24
3.3.2.4	node() [4/5]	24
3.3.2.5	node() [5/5]	24
3.3.3	Member Function Documentation	25
3.3.3.1	depth()	25
3.3.3.2	findLowest() [1/2]	25
3.3.3.3	findLowest() [2/2]	25
3.3.3.4	findUpper() [1/2]	26
3.3.3.5	findUpper() [2/2]	26
3.3.3.6	rightmost()	26
4	File Documentation	27
4.1	Trash/iterators.h File Reference	27
4.1.1	Detailed Description	27
4.2	Trash/node.h File Reference	27
4.2.1	Detailed Description	28
Index		29

Chapter 1

Class Index

1.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

bst< K, V, CO >::_iterator< oK, oV >	
Implements the iterator for the bst	5
bst< K, V, CO >	
Implementation of the type: binary search tree	11
bst< K, V, CO >::node	
Definition of the node struct	22

Chapter 2

File Index

2.1 File List

Here is a list of all documented files with brief descriptions:

include/ bst.h	??
include/ methods.h	??
Trash/ iterators.h	
Header containing the implementation of the bst iterator_class	27
Trash/ node.h	
Header containing the implementation of the binary search tree	27

Chapter 3

Class Documentation

3.1 `bst< K, V, CO >::_iterator< oK, oV >` Class Template Reference

Implements the iterator for the bst.

```
#include <iterators.h>
```

Public Types

- using **value_type** = std::pair< oK, oV >
- using **reference** = value_type &
- using **pointer** = value_type *
- using **difference_type** = std::ptrdiff_t
- using **iterator_category** = std::forward_iterator_tag
- using **value_type** = std::pair< oK, oV >
- using **reference** = value_type &
- using **pointer** = value_type *
- using **difference_type** = std::ptrdiff_t
- using **iterator_category** = std::forward_iterator_tag

Public Member Functions

- `_iterator` ()=default
Default constructor of iterator class.
- `_iterator (node *p)`
Custom constructor of iterator class.
- `~_iterator` ()=default
Default destructor of iterator class.
- `_iterator & operator++ ()`
Pre-increment.
- `_iterator operator++ (int)`
Post-increment.
- bool `operator==` (const `_iterator` &other_it) const
Equality operator.
- bool `operator!=` (const `_iterator` &other_it) const

- Inequality operator.*
- reference `operator*` ()
- Dereference operator.*
- pointer `operator->` ()
- Arrow operator.*
- `_iterator` ()=default
- Default constructor of the class `_iterator`.*
- `_iterator` (node *p)
- Custom constructor of the class `_iterator`.*
- `_iterator` (const `_iterator` &other_it)
- `~_iterator` ()=default
- Default destructor of the class `_iterator`.*
- `_iterator` & `operator++` ()
- Overload of the pre-increment operator ++.*
- `_iterator` `operator++` (int)
- Overload of the post-increment operator ++.*
- bool `operator==` (const `_iterator` &other_it) const
- Overload of the operator ==.*
- bool `operator!=` (const `_iterator` &other_it) const
- Overload of the operator !=.*
- reference `operator*` ()
- Overload of the arrow operator ->*
- pointer `operator->` ()
- Overload of the dereference operator *.*

Friends

- class **bst**
- std::ostream & `operator<<` (std::ostream &os, const `_iterator` &it)
- Overload of the put-to operator, which lets the user print the node pointed to by the iterator.*
- std::ostream & **operator<<** (std::ostream &os, const `_iterator` &it)

3.1.1 Detailed Description

```
template<class K, class V, class CO = std::less<K>>
template<class oK, class oV>
class bst< K, V, CO >:: _iterator< oK, oV >
```

Implements the iterator for the bst.

Template Parameters

<i>oK</i>	type of the key
<i>oV</i>	type of the value

3.1.2 Constructor & Destructor Documentation

3.1.2.1 _iterator() [1/2]

```
template<class K, class V, class CO = std::less<K>>
template<class oK , class oV >
bst< K, V, CO >::_iterator< oK, oV >::_iterator (
    node * p ) [inline], [explicit]
```

Custom constructor of iterator class.

Parameters

<i>p</i>	pointer to a node
----------	-------------------

3.1.2.2 _iterator() [2/2]

```
template<class K, class V, class CO = std::less<K>>
template<class oK , class oV >
bst< K, V, CO >::_iterator< oK, oV >::_iterator (
    node * p ) [inline], [explicit]
```

Custom constructor of the class [_iterator](#).

Parameters

<i>p</i>	Raw pointer to node
----------	---------------------

Creates an iterator pointing to the given node

3.1.3 Member Function Documentation

3.1.3.1 operator!=() [1/2]

```
template<class K, class V, class CO = std::less<K>>
template<class oK , class oV >
bool bst< K, V, CO >::_iterator< oK, oV >::operator!= (
    const _iterator< oK, oV > & other_it ) const [inline]
```

Overload of the operator !=.

Parameters

<i>other_it</i>	Iterator to be compared to
-----------------	----------------------------

Returns

bool False if the iterators point to the same node, True otherwise

3.1.3.2 operator!=() [2/2]

```
template<class K, class V, class CO = std::less<K>>
template<class oK , class oV >
bool bst< K, V, CO >::_iterator< oK, oV >::operator!= (
    const _iterator< oK, oV > & other_it ) const [inline]
```

Inequality operator.

Overloading of inequality operator

3.1.3.3 operator*() [1/2]

```
template<class K, class V, class CO = std::less<K>>
template<class oK , class oV >
reference bst< K, V, CO >::_iterator< oK, oV >::operator* ( ) [inline]
```

Overload of the arrow operator ->

Returns

Pointer to the current node the iterator is pointing to

3.1.3.4 operator*() [2/2]

```
template<class K, class V, class CO = std::less<K>>
template<class oK , class oV >
reference bst< K, V, CO >::_iterator< oK, oV >::operator* ( ) [inline]
```

Dereference operator.

Overloading of dereference operator

3.1.3.5 operator++() [1/4]

```
template<class K, class V, class CO = std::less<K>>
template<class oK , class oV >
_iterator& bst< K, V, CO >::_iterator< oK, oV >::operator++ ( ) [inline]
```

Overload of the pre-increment operator ++.

Returns

[_iterator&](#) pointing to the next node

Used to traverse the tree from the leftmost to the rightmost node in ascending key order

3.1.3.6 operator++() [2/4]

```
template<class K, class V, class CO = std::less<K>>
template<class oK , class oV >
_iterator bst< K, V, CO >::_iterator< oK, oV >::operator++ (
    int ) [inline]
```

Overload of the post-increment operator ++.

Returns

[_iterator](#)& before advancing to the next node

Used to traverse the tree from the leftmost to the rightmost node in ascending key order

3.1.3.7 operator++() [3/4]

```
template<class K, class V, class CO = std::less<K>>
template<class oK , class oV >
_iterator& bst< K, V, CO >::_iterator< oK, oV >::operator++ ( ) [inline]
```

Pre-increment.

Overloading of pre-increment operator

3.1.3.8 operator++() [4/4]

```
template<class K, class V, class CO = std::less<K>>
template<class oK , class oV >
_iterator bst< K, V, CO >::_iterator< oK, oV >::operator++ (
    int ) [inline]
```

Post-increment.

Overloading of post-increment operator

3.1.3.9 operator->() [1/2]

```
template<class K, class V, class CO = std::less<K>>
template<class oK , class oV >
pointer bst< K, V, CO >::_iterator< oK, oV >::operator-> ( ) [inline]
```

Overload of the dereference operator *.

Returns

Reference to the data of the node the iterator is pointing to

3.1.3.10 operator->() [2/2]

```
template<class K, class V, class CO = std::less<K>>
template<class oK , class oV >
pointer bst< K, V, CO >::_iterator< oK, oV >::operator-> ( ) [inline]
```

Arrow operator.

Overloading of arrow operator

3.1.3.11 operator==() [1/2]

```
template<class K, class V, class CO = std::less<K>>
template<class oK , class oV >
bool bst< K, V, CO >::_iterator< oK, oV >::operator== (
    const _iterator< oK, oV > & other_it ) const [inline]
```

Overload of the operator ==.

Parameters

<i>other_it</i>	Iterator to be compared to
-----------------	----------------------------

Returns

bool True if the iterators point to the same node, False otherwise

3.1.3.12 operator==() [2/2]

```
template<class K, class V, class CO = std::less<K>>
template<class oK , class oV >
bool bst< K, V, CO >::_iterator< oK, oV >::operator== (
    const _iterator< oK, oV > & other_it ) const [inline]
```

Equality operator.

Overloading of equality operator

3.1.4 Friends And Related Function Documentation**3.1.4.1 operator<<**

```
template<class K, class V, class CO = std::less<K>>
template<class oK , class oV >
std::ostream& operator<< (
    std::ostream & os,
    const _iterator< oK, oV > & it ) [friend]
```

Overload of the put-to operator, which lets the user print the node pointed to by the iterator.

Parameters

<i>os</i>	Stream where to print the content of the node pointed to by the iterator
<i>it</i>	iterator pointing to the node of interest

Returns

`os` Stream where the content has been sent

The documentation for this class was generated from the following files:

- `include/bst.h`
- `Trash/iterators.h`

3.2 `bst< K, V, CO >` Class Template Reference

Implementation of the type: binary search tree.

```
#include <bst.h>
```

Classes

- class `_iterator`
Implements the iterator for the bst.
- struct `node`
Definition of the node struct.

Public Types

- using `iterator` = `_iterator< K, V >`
bst iterator is defined in the header iterator.h
- using `const_iterator` = `_iterator< const K, const V >`

Public Member Functions

- `bst()`=default
Default constructor of bst class.
- `bst(const pair_type &pair)`
Custom constructor of bst class.
- `bst(key_type &&_key, value_type &&_value)`
Custom constructor of bst class.
- `~bst()`=default
Default destructor of bst class.
- `bst(const bst &to_copy)`
Copy constructor of bst class.
- `bst &operator= (const bst &to_copy)`

- Copy assignment of bst class.*

 - **bst** (**bst** &&move_from)

Move constructor of bst class.

 - **bst** & **operator=** (**bst** &&move_from)

Move assignment of bst class.

 - std::pair< **iterator**, bool > **insert** (const pair_type &x)

Inserts a new element in the tree.

 - std::pair< **iterator**, bool > **insert** (pair_type &&x)

Inserts a new element in the tree.

 - template<class... Types>
std::pair< **iterator**, bool > **emplace** (Types &&... args)

Inserts a new element in the tree constructed in-place.

 - void **clear** ()

Clears the content of the tree without any memory leak.

 - **iterator** **begin** () noexcept

Points to the "smallest" node.

 - **const_iterator** **begin** () const noexcept

Points to the "smallest" node.

 - **const_iterator** **cbegin** () const noexcept

Points to the "smallest" node.

 - **iterator** **end** () noexcept

Points to one past the "biggest" node.

 - **const_iterator** **end** () const noexcept

Points to one past the "biggest" node.

 - **const_iterator** **cend** () const noexcept

Points to one past the "biggest" node.

 - **iterator** **find** (const key_type &x)

Finds a node in the bst given a key.

 - **const_iterator** **find** (const key_type &x) const

Finds a node in the bst given a key.

 - reference **operator[]** (const key_type &x)

Overload of the [] operator, which lets the user find a value given the key.

 - reference **operator[]** (key_type &&x)

Overload of the [] operator, which lets the user find a value given the key.

 - void **balance** ()

Balances the bst, i.e. re-structures the tree in order to minimize its depth.

 - void **erase_node** (**node** *N)

Erase a node from the tree.

 - void **erase** (const key_type &key)

Erase a node with a given key from the tree.

 - unsigned int **node_depth** (const key_type &k)

Makes depth of the node available for the user.

 - unsigned int **max_depth** ()

Returns maximum depth of the binary search tree.

 - void **print_2D** ()

Prints tree structure.

 - template<class... Types>
std::pair< typename **bst**< K, V, CO >::iterator, bool > **emplace** (Types &&... args)

Public Attributes

- CO `comp`
Comparison operator.

Friends

- `std::ostream & operator<< (std::ostream &os, const bst &x)`
Overload of the put-to operator, which lets the user print the tree in ascending order of the keys.
- `auto get_root (const bst &x)`
Returns the key and value of the root of the given bst.

3.2.1 Detailed Description

```
template<class K, class V, class CO = std::less<K>>
class bst< K, V, CO >
```

Implementation of the type: binary search tree.

Template Parameters

<i>K</i>	Key type
<i>V</i>	Value type
<i>CO</i>	Comparison operator typer (default is <code>std::less<K></code>)

3.2.2 Member Typedef Documentation

3.2.2.1 iterator

```
template<class K, class V, class CO = std::less<K>>
using bst< K, V, CO >::iterator = _iterator<K,V>
```

bst iterator is defined in the header iterator.h

Template class holding the bst iterator type

3.2.3 Constructor & Destructor Documentation

3.2.3.1 bst() [1/4]

```
template<class K, class V, class CO = std::less<K>>
bst< K, V, CO >::bst (
    const pair_type & pair ) [inline], [explicit]
```

Custom constructor of bst class.

Parameters

<i>pair</i>	contains the key and value of the first node with which to build the tree (root)
-------------	--

3.2.3.2 bst() [2/4]

```
template<class K, class V, class CO = std::less<K>>
bst< K, V, CO >::bst (
    key_type && _key,
    value_type && _value ) [inline]
```

Custom constructor of bst class.

Parameters

<i>_key</i>	contains the key of the first node with which to build the tree (root)
<i>_value</i>	contains the value of the first node with which to build the tree (root)

3.2.3.3 bst() [3/4]

```
template<class K, class V, class CO = std::less<K>>
bst< K, V, CO >::bst (
    const bst< K, V, CO > & to_copy ) [inline]
```

Copy constructor of bst class.

Parameters

<i>to_copy</i>	bst object to be copied
----------------	-------------------------

3.2.3.4 bst() [4/4]

```
template<class K, class V, class CO = std::less<K>>
bst< K, V, CO >::bst (
    bst< K, V, CO > && move_from ) [inline]
```

Move constructor of bst class.

Parameters

<i>move_from</i>	bst object to be moved
------------------	------------------------

Creates a bst by moving the content of the input bst

3.2.4 Member Function Documentation

3.2.4.1 begin() [1/2]

```
template<class K , class V , class CO >
bst< K, V, CO >::iterator bst< K, V, CO >::begin ( ) [noexcept]
```

Points to the "smallest" node.

Returns

iterator an iterator pointing to the leftmost node, i.e. the one with the smallest key

3.2.4.2 begin() [2/2]

```
template<class K , class V , class CO >
bst< K, V, CO >::const_iterator bst< K, V, CO >::begin ( ) const [noexcept]
```

Points to the "smallest" node.

Returns

const_iterator a const_iterator pointing to the leftmost node i.e. the one with the smallest key

3.2.4.3 cbegin()

```
template<class K , class V , class CO >
bst< K, V, CO >::const_iterator bst< K, V, CO >::cbegin ( ) const [noexcept]
```

Points to the "smallest" node.

Returns

const_iterator a const_iterator pointing to the leftmost node, i.e. the one with the smallest key

3.2.4.4 cend()

```
template<class K , class V , class CO >
bst< K, V, CO >::const_iterator bst< K, V, CO >::cend ( ) const [noexcept]
```

Points to one past the "biggest" node.

Returns

const_iterator a const_iterator pointing to one past the last node, i.e. the node past the one with the larger key

3.2.4.5 emplace()

```
template<class K, class V, class CO = std::less<K>>
template<class... Types>
std::pair<iterator,bool> bst< K, V, CO >::emplace (
    Types &&... args )
```

Inserts a new element in the tree constructed in-place.

Template Parameters

<i>Types</i>	types of the parameters passed to build a new element
--------------	---

Parameters

<i>args</i>	parameters passed to build a new element
-------------	--

Returns

std::pair<iterator,bool> the function returns a pair of: an iterator pointing to the inserted node; a bool which is true if a new node has been allocated, false if the node is already in the tree

3.2.4.6 end() [1/2]

```
template<class K , class V , class CO >
bst< K, V, CO >::iterator bst< K, V, CO >::end ( ) [noexcept]
```

Points to one past the "biggest" node.

Returns

iterator an iterator pointing to one past the last node, i.e. the node past the one with the larger key

3.2.4.7 end() [2/2]

```
template<class K , class V , class CO >
bst< K, V, CO >::const_iterator bst< K, V, CO >::end ( ) const [noexcept]
```

Points to one past the "biggest" node.

Returns

const_iterator a const_iterator pointing to one past the last node, i.e. the node past the one with the larger key

3.2.4.8 erase()

```
template<class K , class V , class CO >
void bst< K, V, CO >::erase (
    const key_type & key )
```

Erase a node with a given key from the tree.

Parameters

<i>key</i>	Key of the none to be erased
------------	------------------------------

3.2.4.9 erase_node()

```
template<class K , class V , class CO >
void bst< K, V, CO >::erase_node (
    bst< K, V, CO >::node * N )
```

Erase a node from the tree.

Parameters

<i>N</i>	pointer to a node of the tree
----------	-------------------------------

3.2.4.10 find() [1/2]

```
template<class K , class V , class CO >
bst< K, V, CO >::iterator bst< K, V, CO >::find (
    const key_type & x )
```

Finds a node in the bst given a key.

Parameters

x	Key to be found
---	-----------------

Returns

iterator pointing to the node with that key if the key exists, otherwise it returns an iterator pointing to "nullptr"

3.2.4.11 find() [2/2]

```
template<class K , class V , class CO >
bst< K, V, CO >::const_iterator bst< K, V, CO >::find (
    const key_type & x ) const
```

Finds a node in the bst given a key.

Parameters

x	Key to be found
---	-----------------

Returns

const_iterator pointing to the node with that key if the key exists, otherwise it returns a const_iterator pointing to "nullptr"

3.2.4.12 insert() [1/2]

```
template<class K , class V , class CO >
std::pair< typename bst< K, V, CO >::iterator, bool > bst< K, V, CO >::insert (
    const pair_type & x )
```

Inserts a new element in the tree.

Parameters

x	pair to be inserted of type std::pair<key, value>
---	---

Returns

std::pair<iterator,bool> The function returns a pair of: an iterator pointing to the inserted node, a bool which is true if a new node has been allocated, false if the key is already present in the tree

3.2.4.13 insert() [2/2]

```
template<class K , class V , class CO >
std::pair< typename bst< K, V, CO >::iterator, bool > bst< K, V, CO >::insert (
    pair_type && x )
```

Inserts a new element in the tree.

Parameters

<i>x</i>	pair to be inserted of type std::pair<key, value>
----------	---

Returns

std::pair<iterator,bool> The function returns a pair of: an iterator pointing to the inserted node; a bool which is true if a new node has been allocated, false if the key is already present in the tree

3.2.4.14 max_depth()

```
template<class K , class V , class CO >
unsigned int bst< K, V, CO >::max_depth ( )
```

Returns maximum depth of the binary search tree.

Returns

unsigned int storing the depth of the deepest node of the tree

3.2.4.15 node_depth()

```
template<class K , class V , class CO >
unsigned int bst< K, V, CO >::node_depth (
    const key_type & k )
```

Makes depth of the node available for the user.

Parameters

<i>k</i>	key value associated with the node whose depth is requested
----------	---

Returns

unsigned int storing the depth of the node identified by the key

3.2.4.16 operator=() [1/2]

```
template<class K , class V , class CO >
bst< K, V, CO > & bst< K, V, CO >::operator= (
    const bst< K, V, CO > & to_copy )
```

Copy assignment of bst class.

Parameters

<i>to_copy</i>	bst object to be copied
----------------	-------------------------

Returns

bst& reference to copied binary search tree

3.2.4.17 operator=() [2/2]

```
template<class K , class V , class CO >
bst< K, V, CO > & bst< K, V, CO >::operator= (
    bst< K, V, CO > && move_from )
```

Move assignment of bst class.

Parameters

<i>move_from</i>	bst object to be moved
------------------	------------------------

Returns

bst& reference to moved binary search tree

3.2.4.18 operator[]() [1/2]

```
template<class K , class V , class CO >
bst< K, V, CO >::reference bst< K, V, CO >::operator[] (
    const key_type & x )
```

Overload of the [] operator, which lets the user find a value given the key.

Parameters

<i>x</i>	Key to be found
----------	-----------------

Returns

value_type& If the key exists returns a reference to the associated value. Otherwise it adds a new node containing the input key and the default value and returns a reference to the value

3.2.4.19 operator[]() [2/2]

```
template<class K , class V , class CO >
bst< K, V, CO >::reference bst< K, V, CO >::operator[] (
    key_type && x )
```

Overload of the [] operator, which lets the user find a value given the key.

Parameters

x	Key to be found
---	-----------------

Returns

value_type& If the key exists returns a reference to the associated value. Otherwise it adds a new node containing the input key and the default value and returns a reference to the value

3.2.5 Friends And Related Function Documentation**3.2.5.1 get_root**

```
template<class K, class V, class CO = std::less<K>>
auto get_root (
    const bst< K, V, CO > & x ) [friend]
```

Returns the key and value of the root of the given bst.

Parameters

x	bst to return the info
---	------------------------

Returns

std::pair<key_type, value_type> pair containing the key and the value of the root node

3.2.5.2 operator<<

```
template<class K, class V, class CO = std::less<K>>
std::ostream& operator<< (
```

```
std::ostream & os,
const bst< K, V, CO > & x ) [friend]
```

Overload of the put-to operator, which lets the user print the tree in ascending order of the keys.

Parameters

<i>os</i>	Stream where to print the content of the tree
<i>x</i>	bst to be printed

Returns

os Stream where the content has been sent

The documentation for this class was generated from the following files:

- include/bst.h
- include/methods.h

3.3 bst< K, V, CO >::node Struct Reference

Definition of the node struct.

```
#include <node.h>
```

Public Member Functions

- **node** ()=default
Default constructor of node struct.
- **node** (const pair_type &n)
Custom constructor of node struct.
- **node** (const pair_type &n, **node** *new_parent)
Custom destructor of node struct.
- **~node** () noexcept=default
Default destructor of node struct.
- **node** * **findLowest** () noexcept
Finds the "smaller" element of the bst object that has the current node as root.
- **node** * **findUpper** ()
Finds the first right ancestor of the current node.
- unsigned int **depth** (unsigned int &&Depth=1)
Compute the depth of the current node in the tree.
- **node** ()=default
Default constructor for the class node.
- **node** (pair_type &n)
Custom constructor for the class node.
- **node** (const pair_type &n, **node** *new_parent)
Custom constructor for the class node.
- **~node** () noexcept=default

Default destructor of the class node.

- `node` (const std::unique_ptr< `node` > ©_from)

DA COMMENTARE.

- `node * findLowest` () noexcept

Finds the node with the lowest key in the tree.

- `node * findUpper` ()

DA COMMENTARE.

- `node * rightmost` ()

DA COMMENTARE.

Public Attributes

- `pair_type data`
pair of a key and a value, stored in the element of the bst object
- `std::unique_ptr< node > left`
Unique pointer to the left child of the current element.
- `std::unique_ptr< node > right`
Unique pointer to the right child of the current element.
- `node * parent`
Pointer to the parent node of the current element.

3.3.1 Detailed Description

```
template<class K, class V, class CO = std::less<K>>
struct bst< K, V, CO >::node
```

Definition of the node struct.

3.3.2 Constructor & Destructor Documentation

3.3.2.1 node() [1/5]

```
template<class K, class V, class CO = std::less<K>>
bst< K, V, CO >::node::node (
    const pair_type & n ) [inline], [explicit]
```

Custom constructor of node struct.

Parameters

<code>n</code>	pair of a key and a value to store in the element node
----------------	--

3.3.2.2 node() [2/5]

```
template<class K, class V, class CO = std::less<K>>
bst< K, V, CO >::node::node (
    const pair_type & n,
    node * new_parent ) [inline]
```

Custom destructor of node struct.

Parameters

<i>n</i>	pair of a key and a value to store in the element node
<i>new_parent</i>	pointer to a node, which will become the parent of the new element node

3.3.2.3 node() [3/5]

```
template<class K, class V, class CO = std::less<K>>
bst< K, V, CO >::node::node (
    pair_type & n ) [inline], [explicit]
```

Custom constructor for the class node.

Parameters

<i>n</i>	Data to be inserted in the node
----------	---------------------------------

Initializes a node with its data

3.3.2.4 node() [4/5]

```
template<class K, class V, class CO = std::less<K>>
bst< K, V, CO >::node::node (
    const pair_type & n,
    node * new_parent ) [inline]
```

Custom constructor for the class node.

Parameters

<i>n</i>	Data to be inserted in the node
<i>new_parent</i>	Parent of the node

Initializes a node with data and parent node

3.3.2.5 node() [5/5]

```
template<class K, class V, class CO = std::less<K>>
```

```
bst< K, V, CO >::node::node (
    const std::unique_ptr< node > & copy_from ) [inline], [explicit]
```

DA COMMENTARE.

Parameters

<i>copy_from</i>	
------------------	--

3.3.3 Member Function Documentation

3.3.3.1 depth()

```
template<class K, class V, class CO = std::less<K>>
unsigned int bst< K, V, CO >::node::depth (
    unsigned int && Depth = 1 ) [inline]
```

Compute the depth of the current node in the tree.

Returns

Depth unsigned int storing the depth of the current node in the tree

3.3.3.2 findLowest() [1/2]

```
template<class K, class V, class CO = std::less<K>>
node* bst< K, V, CO >::node::findLowest ( ) [inline], [noexcept]
```

Finds the node with the lowest key in the tree.

Returns

Raw pointer to the node with the smallest key

3.3.3.3 findLowest() [2/2]

```
template<class K, class V, class CO = std::less<K>>
node* bst< K, V, CO >::node::findLowest ( ) [inline], [noexcept]
```

Finds the "smaller" element of the bst object that has the current node as root.

Returns

node* pointer to the leftmost node of the bst object that has the current node as root

3.3.3.4 findUpper() [1/2]

```
template<class K, class V, class CO = std::less<K>>
node* bst< K, V, CO >::node::findUpper ( ) [inline]
```

DA COMMENTARE.

Returns

3.3.3.5 findUpper() [2/2]

```
template<class K, class V, class CO = std::less<K>>
node* bst< K, V, CO >::node::findUpper ( ) [inline]
```

Finds the first right ancestor of the current node.

Returns

node* pointer to the first ancestor node which stands on the left of the current node

3.3.3.6 rightmost()

```
template<class K, class V, class CO = std::less<K>>
node* bst< K, V, CO >::node::rightmost ( ) [inline]
```

DA COMMENTARE.

Returns

The documentation for this struct was generated from the following files:

- include/bst.h
- Trash/[node.h](#)

Chapter 4

File Documentation

4.1 Trash/iterators.h File Reference

header containing the implementation of the bst iterator_ class

```
#include <memory>
#include <utility>
#include "bst.h"
```

Classes

- class `bst< K, V, CO >::_iterator< oK, oV >`
Implements the iterator for the bst.

4.1.1 Detailed Description

header containing the implementation of the bst iterator_ class

Authors

Marco Sicklinger, Marco Sciorilli, Lorenzo Cavuoti

4.2 Trash/node.h File Reference

header containing the implementation of the binary search tree

```
#include <memory>
#include <utility>
#include "bst.h"
```

Classes

- struct `bst< K, V, CO >::node`

Definition of the node struct.

4.2.1 Detailed Description

header containing the implementation of the binary search tree

header containing the implementation of the bst node struct

Author

Authors

Marco Sicklinger, Marco Sciorilli, Lorenzo Cavuoti

Index

- `_iterator`
 - `bst::_iterator`, 6, 7
- `begin`
 - `bst`, 15
- `bst`
 - `begin`, 15
 - `bst`, 13, 14
 - `cbegin`, 15
 - `cend`, 15
 - `emplace`, 16
 - `end`, 16
 - `erase`, 17
 - `erase_node`, 17
 - `find`, 17, 18
 - `get_root`, 21
 - `insert`, 18
 - `iterator`, 13
 - `max_depth`, 19
 - `node_depth`, 19
 - `operator<<`, 21
 - `operator=`, 19, 20
 - `operator[]`, 20, 21
- `bst< K, V, CO >`, 11
- `bst< K, V, CO >::_iterator< oK, oV >`, 5
- `bst< K, V, CO >::node`, 22
- `bst::_iterator`
 - `_iterator`, 6, 7
 - `operator!=`, 7, 8
 - `operator<<`, 10
 - `operator*`, 8
 - `operator++`, 8, 9
 - `operator->`, 9
 - `operator==`, 10
- `bst::node`
 - `depth`, 25
 - `findLowest`, 25
 - `findUpper`, 25, 26
 - `node`, 23, 24
 - `rightmost`, 26
- `cbegin`
 - `bst`, 15
- `cend`
 - `bst`, 15
- `depth`
 - `bst::node`, 25
- `emplace`
 - `bst`, 16
- `end`
 - `bst`, 16
- `erase`
 - `bst`, 17
- `erase_node`
 - `bst`, 17
- `find`
 - `bst`, 17, 18
- `findLowest`
 - `bst::node`, 25
- `findUpper`
 - `bst::node`, 25, 26
- `get_root`
 - `bst`, 21
- `insert`
 - `bst`, 18
- `iterator`
 - `bst`, 13
- `max_depth`
 - `bst`, 19
- `node`
 - `bst::node`, 23, 24
- `node_depth`
 - `bst`, 19
- `operator!=`
 - `bst::_iterator`, 7, 8
- `operator<<`
 - `bst`, 21
 - `bst::_iterator`, 10
- `operator*`
 - `bst::_iterator`, 8
- `operator++`
 - `bst::_iterator`, 8, 9
- `operator->`
 - `bst::_iterator`, 9
- `operator=`
 - `bst`, 19, 20
- `operator==`
 - `bst::_iterator`, 10
- `operator[]`
 - `bst`, 20, 21
- `rightmost`
 - `bst::node`, 26

Trash/iterators.h, [27](#)

Trash/node.h, [27](#)