Sort Methods

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Chapter 1

Sorting algorithms for sequences

1.0.1 Description

Through this program developed in c++17 we can study the different types of sorting algorithms that exist and their complexity. The following algorithms are used:

- Insertion
- Mergesort
- Shellsort
- Heapsort
- Radixsort

1.0.2 Usage

To compile the program, the make command is used in the main directory and the executable of the program is located in the /bin/main directory.

1.0.3 Author

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Chapter 2

Hierarchical Index

2.1 Class Hierarchy

This inheritance list is sorted roughly, but not completely, alphabetically:

Chapter 3

Class Index

3.1 Class List

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

Chapter 4

File Index

4.1 File List

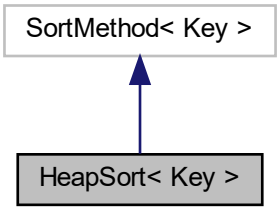
Here is a list of all documented files with brief descriptions:

Chapter 5

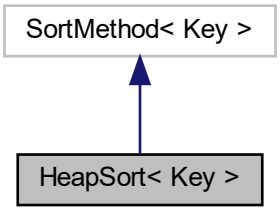
Class Documentation

5.1 HeapSort< Key > Class Template Reference

Inheritance diagram for HeapSort< Key >:



Collaboration diagram for HeapSort< Key >:



Public Member Functions

- HeapSort (std::vector< Key >, unsigned, bool=false)

  Construct a new Heap Sort< Key>:: Heap Sort object.
- void Sort () override

  Sort the sequence using the HeapSort algorithm.

Additional Inherited Members

5.1.1 Constructor & Destructor Documentation

5.1.1.1 HeapSort()

```
template<class Key >
HeapSort< Key >::HeapSort (
            std::vector< Key > seq,
            unsigned size,
            bool trace = false )
```

Construct a new Heap Sort< Key>:: Heap Sort object.

Template Parameters

Key	

Parameters

seq	
size	
trace	

5.1.2 Member Function Documentation

5.1.2.1 Sort()

```
template<class Key >
void HeapSort< Key >::Sort  [override], [virtual]
```

Sort the sequence using the HeapSort algorithm.

Template Parameters

Key	

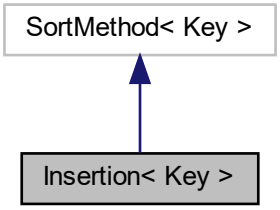
Implements SortMethod< Key >.

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

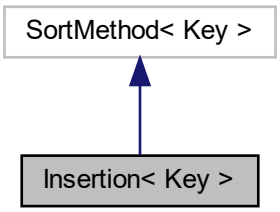
- include/HeapSort.h

5.2 Insertion< Key > Class Template Reference

Inheritance diagram for Insertion< Key >:



Collaboration diagram for Insertion< Key >:



Public Member Functions

- Insertion (std::vector< Key >, unsigned, bool=false)

  Construct a new Insertion< Key>:: Insertion object.
- void Sort () override

  Sort the sequence using the Insertion algorithm.

Additional Inherited Members

5.2.1 Constructor & Destructor Documentation

5.2.1.1 Insertion()

```
template<class Key >
Insertion< Key >::Insertion (
            std::vector< Key > seq,
            unsigned size,
            bool trace = false )
```

Construct a new Insertion< Key>:: Insertion object.

Template Parameters

Key	

Parameters

seq	
size	
trace	

5.2.2 Member Function Documentation

5.2.2.1 Sort()

```
template<class Key >
void Insertion< Key >::Sort  [override], [virtual]
```

Sort the sequence using the Insertion algorithm.

Template Parameters

Key	

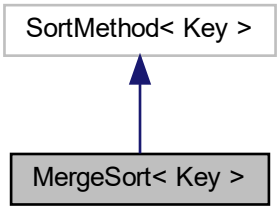
Implements SortMethod< Key >.

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

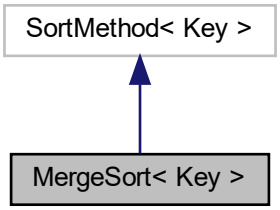
- include/Insertion.h

5.3 MergeSort< Key > Class Template Reference

Inheritance diagram for MergeSort< Key >:



Collaboration diagram for MergeSort< Key >:



Public Member Functions

- MergeSort (std::vector< Key >, unsigned, bool=false)

  Construct a new Merge Sort< Key>:: Merge Sort object.
- void Sort () override

  Sort the sequence using the MergeSort algorithm.

Additional Inherited Members

5.3.1 Constructor & Destructor Documentation

5.3.1.1 MergeSort()

```
template<class Key >
MergeSort< Key >::MergeSort (
            std::vector< Key > seq,
            unsigned size,
            bool trace = false )
```

Construct a new Merge Sort< Key>:: Merge Sort object.

Template Parameters

Key	

Parameters

seq	
size	
trace	

5.3.2 Member Function Documentation

5.3.2.1 Sort()

```
template<class Key >
void MergeSort< Key >::Sort  [override], [virtual]
```

Sort the sequence using the MergeSort algorithm.

Template Parameters

Key	

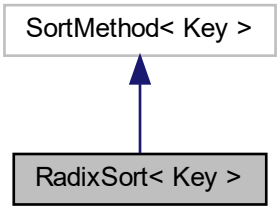
Implements SortMethod< Key >.

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

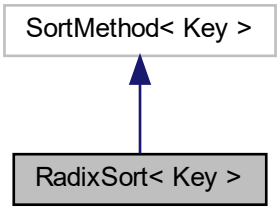
- include/MergeSort.h

5.4 RadixSort< Key > Class Template Reference

Inheritance diagram for RadixSort< Key >:



Collaboration diagram for RadixSort< Key >:



Public Member Functions

- RadixSort (std::vector< Key >, unsigned, bool=false)

  Construct a new Radix Sort< Key>:: Radix Sort object.
- void Sort () override

  Sort the sequence using the RadixSort algorithm.

Additional Inherited Members

5.4.1 Constructor & Destructor Documentation

5.4.1.1 RadixSort()

```
template<class Key >
RadixSort< Key >::RadixSort (
            std::vector< Key > seq,
            unsigned size,
            bool trace = false )
```

Construct a new Radix Sort< Key>:: Radix Sort object.

Template Parameters

Key	

Parameters

seq	
size	
trace	

5.4.2 Member Function Documentation

5.4.2.1 Sort()

```
template<class Key >
void RadixSort< Key >::Sort  [override], [virtual]
```

Sort the sequence using the RadixSort algorithm.

Template Parameters

Key	

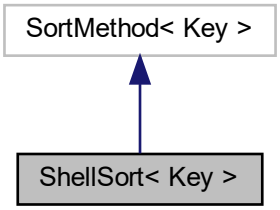
Implements SortMethod< Key >.

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

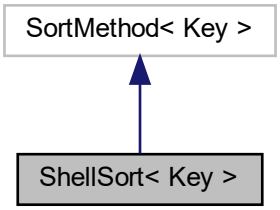
- include/RadixSort.h

5.5 ShellSort< Key > Class Template Reference

Inheritance diagram for ShellSort< Key >:



Collaboration diagram for ShellSort< Key >:



Public Member Functions

- ShellSort (std::vector< Key >, unsigned, bool=false)

  Construct a new Shell Sort< Key>:: Shell Sort object.
- void Sort () override

  Sort the sequence using the ShellSort algorithm.

Additional Inherited Members

5.5.1 Constructor & Destructor Documentation

5.5.1.1 ShellSort()

```
template<class Key >
ShellSort< Key >::ShellSort (
            std::vector< Key > seq,
            unsigned size,
            bool trace = false )
```

Construct a new Shell Sort< Key>:: Shell Sort object.

Template Parameters

Key	

Parameters

seq	
size	
trace	

5.5.2 Member Function Documentation

5.5.2.1 Sort()

```
template<class Key >
void ShellSort< Key >::Sort  [override], [virtual]
```

Sort the sequence using the ShellSort algorithm.

Template Parameters

Key	

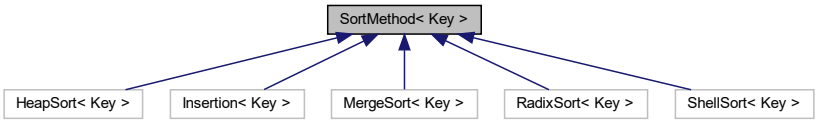
Implements SortMethod< Key >.

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

- include/ShellSort.h

5.6 SortMethod< Key > Class Template Reference

Inheritance diagram for SortMethod< Key >:



Public Member Functions

- SortMethod ()

  Construct a new Sort Method< Key>:: Sort Method object.
- SortMethod (std::vector< Key > &, unsigned, bool=false)

  Construct a new Sort Method< Key>:: Sort Method object.
- virtual void Sort ()=0

Protected Attributes

- unsigned **size_**
- std::vector< Key > **seq_**
- bool **trace_**

5.6.1 Constructor & Destructor Documentation

5.6.1.1 SortMethod() [1/2]

```
template<class Key >
SortMethod< Key >::SortMethod
```

Construct a new Sort Method< Key>:: Sort Method object.

Template Parameters

Key	

5.6.1.2 SortMethod() [2/2]

```
template<class Key >
SortMethod< Key >::SortMethod (
```

```
std::vector< Key > & seq,
unsigned size,
bool trace = false )
```

Construct a new Sort Method< Key>:: Sort Method object.

Template Parameters

Key	

Parameters

seq	
size	
trace	

5.6.2 Member Function Documentation

5.6.2.1 Sort()

```
template<class Key >
virtual void SortMethod< Key >::Sort ( )  [pure virtual]
```

Implemented in HeapSort< Key >, Insertion< Key >, MergeSort< Key >, RadixSort< Key >, and ShellSort< Key >.

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

- include/SortMethod.h

Chapter 6

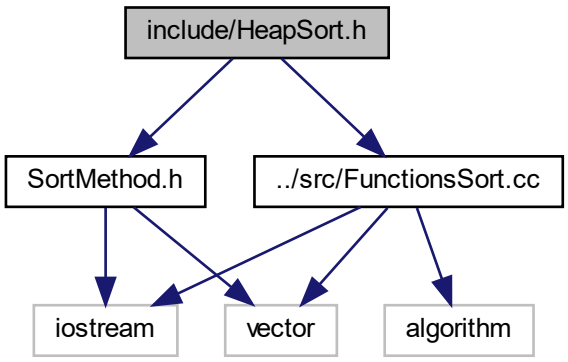
File Documentation

6.1 include/HeapSort.h File Reference

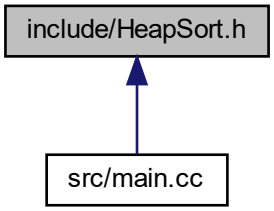
This file contains the HeapSort class.

```
#include "SortMethod.h"
#include "../src/FunctionsSort.cc"
```

Include dependency graph for HeapSort.h:



This graph shows which files directly or indirectly include this file:



Classes

- class HeapSort< Key >

6.1.1 Detailed Description

This file contains the HeapSort class.

Author

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Version

0.1

Date

2023-04-03

Copyright

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6.2 HeapSort.h

Go to the documentation of this file.

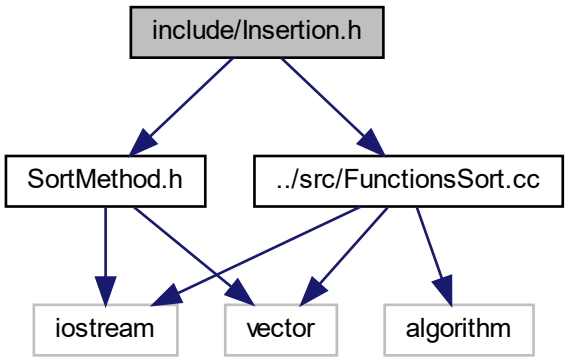
```
1
12 #include "SortMethod.h"
13 #include "../src/FunctionsSort.cc"
14
15
16 template <class Key>
17 class HeapSort : public SortMethod<Key>
18 {
19 public:
20   HeapSort(std::vector<Key>, unsigned, bool = false);
21   void Sort() override;
22 };
23
32 template <class Key>
33 HeapSort<Key>::HeapSort(std::vector<Key> seq, unsigned size, bool trace) : SortMethod<Key>(seq, size,
      trace) {}
34
35
41 template <class Key>
42 void HeapSort<Key>::Sort()
43 {
44   heapSortMethod(this->seq_, this->size_, this->trace_);
45 }
```

6.3 include/Insertion.h File Reference

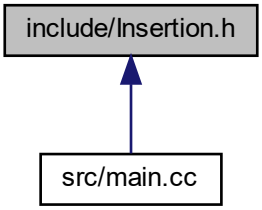
This file contains the Insertion class.

```
#include "SortMethod.h"
#include "../src/FunctionsSort.cc"
```

Include dependency graph for Insertion.h:



This graph shows which files directly or indirectly include this file:



Classes

- class Insertion< Key >

6.3.1 Detailed Description

This file contains the Insertion class.

Author

Fabrizzio Daniell Perilli Martin alu0101138589@ull.edu.es

Version

0.1

Date

2023-04-03

Copyright

6.4 Insertion.h

Go to the documentation of this file.

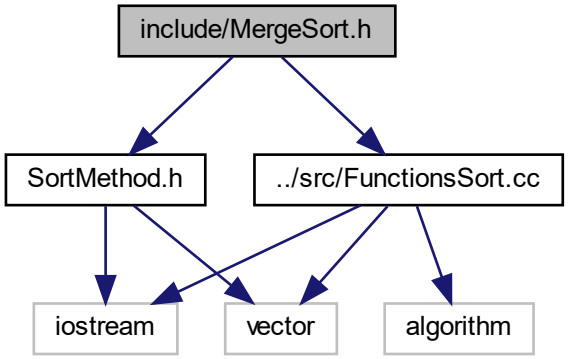
```
1
12 #include "SortMethod.h"
13 #include "../src/FunctionsSort.cc"
14
15
16
17 template <class Key>
18 class Insertion : public SortMethod<Key>
19 {
20 public:
21   Insertion(std::vector<Key>, unsigned, bool = false);
22   void Sort() override;
23 };
24
33 template <class Key>
34 Insertion<Key>::Insertion(std::vector<Key> seq, unsigned size, bool trace) : SortMethod<Key>(seq, size,
       trace) {}
35
36
42 template <class Key>
43 void Insertion<Key>::Sort()
44 {
45   insertionSortMethod(this->seq_, this->size_, this->trace_);
46 }
```

6.5 include/MergeSort.h File Reference

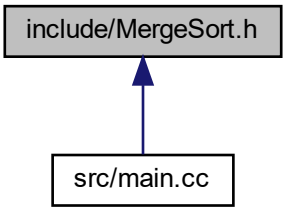
This file contains the MergeSort class.

```
#include "SortMethod.h"
#include "../src/FunctionsSort.cc"
```

Include dependency graph for MergeSort.h:



This graph shows which files directly or indirectly include this file:



Classes

- class MergeSort< Key >

6.5.1 Detailed Description

This file contains the MergeSort class.

Author

Fabrizzio Daniell Perilli Martin alu0101138589@ull.edu.es

Version

0.1

Date

2023-04-03

Copyright

6.6 MergeSort.h

Go to the documentation of this file.

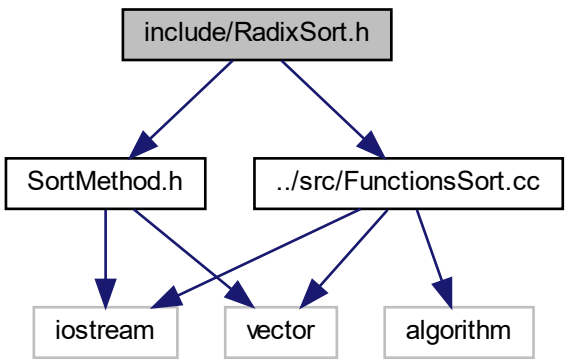
```
1
12 #include "SortMethod.h"
13 #include "../src/FunctionsSort.cc"
14
15 template <class Key>
16 class MergeSort : public SortMethod<Key>
17 {
18 public:
19   MergeSort(std::vector<Key>, unsigned, bool = false);
20   void Sort() override;
21 };
22
23
32 template <class Key>
33 MergeSort<Key>::MergeSort(std::vector<Key> seq, unsigned size, bool trace) : SortMethod<Key>(seq, size,
       trace) {}
34
35
41 template <class Key>
42 void MergeSort<Key>::Sort()
43 {
44   mergeSortMethod(this->seq_, this->size_, this->trace_);
45 }
```

6.7 include/RadixSort.h File Reference

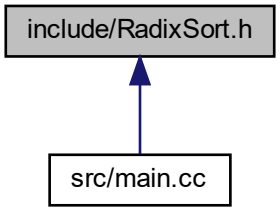
This file contains the RadixSort class.

```
#include "SortMethod.h"
#include "../src/FunctionsSort.cc"
```

Include dependency graph for RadixSort.h:



This graph shows which files directly or indirectly include this file:



Classes

- class RadixSort< Key >

6.7.1 Detailed Description

This file contains the RadixSort class.

Author

Fabrizzio Daniell Perilli Martin alu0101138589@ull.edu.es

Version

0.1

Date

2023-04-03

Copyright

Copyright (c) 2023

6.8 RadixSort.h

Go to the documentation of this file.

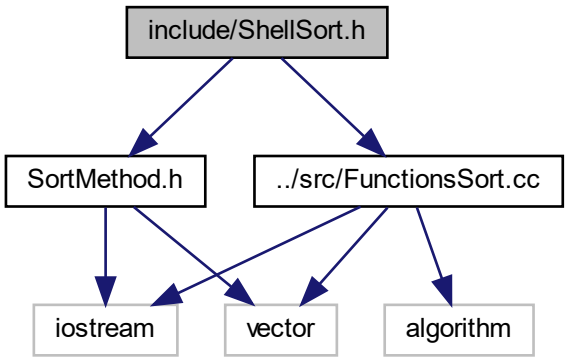
```
1
12 #include "SortMethod.h"
13 #include "../src/FunctionsSort.cc"
14
15 template <class Key>
16 class RadixSort : public SortMethod<Key>
17 {
18 public:
19   RadixSort(std::vector<Key>, unsigned, bool = false);
20   void Sort() override;
21 };
22
23
32 template <class Key>
33 RadixSort<Key>::RadixSort(std::vector<Key> seq, unsigned size, bool trace) : SortMethod<Key>(seq, size,
       trace) {}
34
35
41 template <class Key>
42 void RadixSort<Key>::Sort()
43 {
44   radixSortMethod(this->seq_, this->size_, this->trace_);
45 }
```

6.9 include/ShellSort.h File Reference

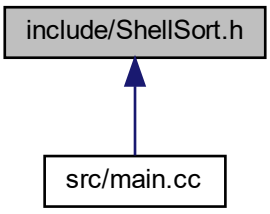
This file contains the ShellSort class.

```
#include "SortMethod.h"
#include "../src/FunctionsSort.cc"
```

Include dependency graph for ShellSort.h:



This graph shows which files directly or indirectly include this file:



Classes

- class ShellSort< Key >

6.9.1 Detailed Description

This file contains the ShellSort class.

Author

Fabrizzio Daniell Perilli Martin alu0101138589@ull.edu.es

Version

0.1

Date

2023-04-03

6.10 ShellSort.h

Go to the documentation of this file.

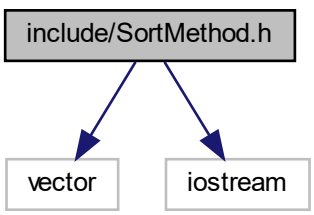
```
1
12 #include "SortMethod.h"
13 #include "../src/FunctionsSort.cc"
14
15 template <class Key>
16 class ShellSort : public SortMethod<Key>
17 {
18 public:
19   ShellSort(std::vector<Key>, unsigned, bool = false);
20   void Sort() override;
21 };
22
31 template <class Key>
32 ShellSort<Key>::ShellSort(std::vector<Key> seq, unsigned size, bool trace) : SortMethod<Key>(seq, size,
       trace) {}
33
34
40 template <class Key>
41 void ShellSort<Key>::Sort()
42 {
43   shellSortMethod(this->seq_, this->size_, this->trace_);
44 }
```

6.11 include/SortMethod.h File Reference

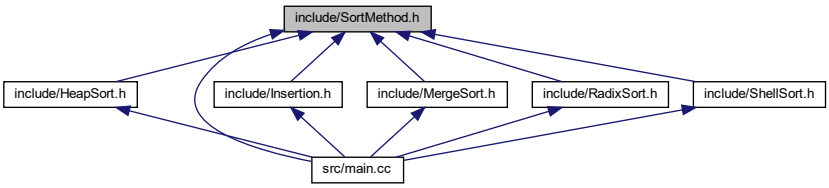
This a abstract class that contains the basic methods for the sorting algorithms.

```
#include <vector>
#include <iostream>
```

Include dependency graph for SortMethod.h:



This graph shows which files directly or indirectly include this file:



Classes

- class SortMethod< Key >

6.11.1 Detailed Description

This a abstract class that contains the basic methods for the sorting algorithms.

Author

Fabrizzio Daniell Perilli Martin alu0101138589@ull.edu.es

Version

0.1

Date

2023-04-03

Copyright

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6.12 SortMethod.h

Go to the documentation of this file.

```
1
12 #pragma once
13 #include <vector>
14 #include <iostream>
15
16 template <class Key>
17 class SortMethod
18 {
19 protected:
20   unsigned size_;
21   std::vector<Key> seq_;
22   bool trace_;
23
24 public:
25   SortMethod();
26   SortMethod(std::vector<Key>&, unsigned, bool = false);
```

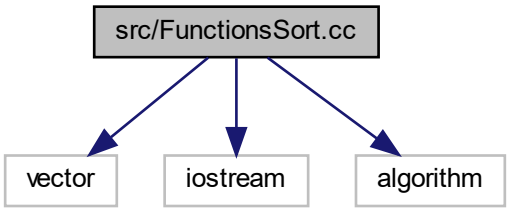
```
27   virtual void Sort() = 0;
28 };
29
30
36 template <class Key>
37 SortMethod<Key>::SortMethod() {}
38
39
48 template <class Key>
49 SortMethod<Key>::SortMethod(std::vector<Key>& seq, unsigned size, bool trace)
50 {
51   seq_ = seq;
52   size_ = size;
53   trace_ = trace;
54 }
```

6.13 src/FunctionsSort.cc File Reference

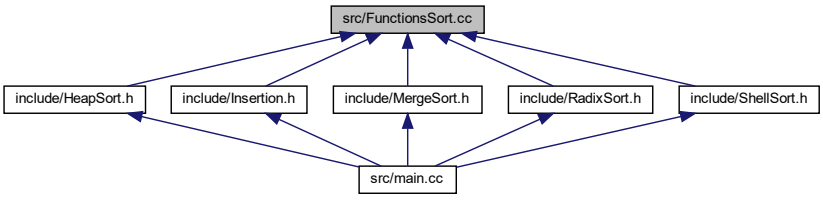
This file contains the functions that are used in method Sort of the derived classes.

```
#include <vector>
#include <iostream>
#include <algorithm>
```

Include dependency graph for FunctionsSort.cc:



This graph shows which files directly or indirectly include this file:



Functions

- template<class Key >
  void divide (std::vector< Key > &seq, int ini, int fin, bool trace, int count)

Divide the sequence in two parts and call the Merge function.

- template<class Key >
  void heapify (std::vector< Key > &seq, int size, int i, bool trace, int count)

  Heapify algorithm.
- template<class Key >
  void deltasort (int delta, std::vector< Key > &seq, int size, bool trace, int count)

  Sort the sequence using the deltasort algorithm for the ShellSort algorithm.
- template<class Key >
  std::ostream & operator<< (std::ostream &os, const std::vector< Key > &seq)

  Overload the operator << to print the sequence.
- template<class Key >
  void insertionSortMethod (std::vector< Key > &seq, unsigned size, bool trace=false)

  Sort the sequence using the Insertion algorithm.
- template<class Key >
  void merge (std::vector< Key > &seq, int ini, int mid, int fin, bool trace, int count)

  Merge the two parts of the sequence.
- template<class Key >
  void mergeSortMethod (std::vector< Key > &seq, unsigned size, bool trace)

  Sort the sequence using the MergeSort algorithm.
- template<class Key >
  void heapSortMethod (std::vector< Key > &seq, unsigned size, bool trace)

  Heapsort algorithm.
- template<class Key >
  void radixSortMethod (std::vector< Key > &seq, unsigned size, bool trace)

  Sort the sequence using the RadixSort algorithm.
- template<class Key >
  void shellSortMethod (std::vector< Key > &seq, int size, bool trace)

  Sort the sequence using the ShellSort algorithm.

6.13.1 Detailed Description

This file contains the functions that are used in method Sort of the derived classes.

Author

Fabrizzio Daniell Perilli Martin

Version

0.1

Date

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6.13.2 Function Documentation

6.13.2.1 deltasort()

```
template<class Key >
void deltasort (
            int delta,
            std::vector< Key > & seq,
            int size,
            bool trace,
            int count )
```

Sort the sequence using the deltasort algorithm for the ShellSort algorithm.

Template Parameters

Key	

Parameters

delta	
seq	
size	
trace	
count	

6.13.2.2 divide()

```
template<class Key >
void divide (
            std::vector< Key > & seq,
            int ini,
            int fin,
            bool trace,
            int count )
```

Divide the sequence in two parts and call the Merge function.

Template Parameters

Key	

Parameters

seq	
ini	

Parameters

fin	
trace	
count	

6.13.2.3 heapify()

```
template<class Key >
void heapify (
            std::vector< Key > & seq,
            int size,
            int i,
            bool trace,
            int count )
```

Heapify algorithm.

Template Parameters

Key	

Parameters

seq	
size	
i	
trace	

6.13.2.4 heapSortMethod()

```
template<class Key >
void heapSortMethod (
            std::vector< Key > & seq,
            unsigned size,
            bool trace )
```

Heapsort algorithm.

Template Parameters

Key	

Parameters

seq	
size	
trace	

6.13.2.5 insertionSortMethod()

```
template<class Key >
void insertionSortMethod (
             std::vector< Key > & seq,
             unsigned size,
             bool trace = false )
```

Sort the sequence using the Insertion algorithm.

Template Parameters

Key	

Parameters

seq	
size	
trace	

6.13.2.6 merge()

```
template<class Key >
void merge (
             std::vector< Key > & seq,
             int ini,
             int mid,
             int fin,
             bool trace,
             int count )
```

Merge the two parts of the sequence.

Template Parameters

Key	

Parameters

seq	
ini	
mid	
fin	
trace	
count	

6.13.2.7 mergeSortMethod()

```
template<class Key >
void mergeSortMethod (
            std::vector< Key > & seq,
            unsigned size,
            bool trace )
```

Sort the sequence using the MergeSort algorithm.

Template Parameters

Key	

Parameters

seq	
size	
trace	

6.13.2.8 operator<<()

```
template<class Key >
std::ostream & operator<< (
            std::ostream & os,
            const std::vector< Key > & seq )
```

Overload the operator << to print the sequence.

Template Parameters

Key	

Parameters

os	

Parameters

seq	

Returns

std::ostream&

6.13.2.9 radixSortMethod()

```
template<class Key >
void radixSortMethod (
             std::vector< Key > & seq,
             unsigned size,
             bool trace )
```

Sort the sequence using the RadixSort algorithm.

Template Parameters

Key	

Parameters

seq	
size	
trace	

6.13.2.10 shellSortMethod()

```
template<class Key >
void shellSortMethod (
             std::vector< Key > & seq,
             int size,
             bool trace )
```

Sort the sequence using the ShellSort algorithm.

Template Parameters

Key	

Parameters

seq	

Parameters

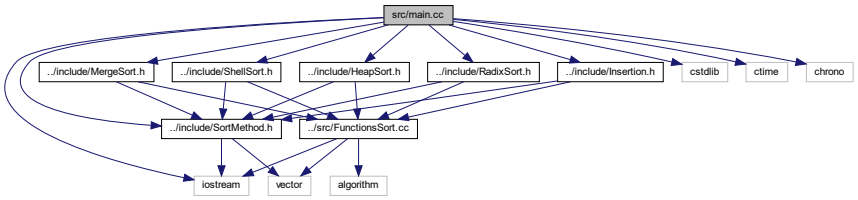
size	
alfa	
trace	

6.14 src/main.cc File Reference

This file contains the main function of the program.

```
#include <iostream>
#include <cstdlib>
#include <ctime>
#include <chrono>
#include "../include/SortMethod.h"
#include "../include/Insertion.h"
#include "../include/MergeSort.h"
#include "../include/ShellSort.h"
#include "../include/HeapSort.h"
#include "../include/RadixSort.h"
```

Include dependency graph for main.cc:



Functions

- int **main** ()

6.14.1 Detailed Description

This file contains the main function of the program.

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