

PA04

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Contents

1	Hierarchical Index	1
1.1	Class Hierarchy	1
2	Class Index	3
2.1	Class List	3
3	File Index	5
3.1	File List	5
4	Class Documentation	7
4.1	BubbleSorter Class Reference	7
4.1.1	Detailed Description	8
4.1.2	Constructor & Destructor Documentation	8
4.1.2.1	BubbleSorter()	8
4.1.3	Member Function Documentation	8
4.1.3.1	sortInPlace(int *arr, int len)	8
4.2	CountingSorter Class Reference	9
4.2.1	Detailed Description	9
4.2.2	Constructor & Destructor Documentation	10
4.2.2.1	CountingSorter()	10
4.2.3	Member Function Documentation	10
4.2.3.1	sortInPlace(int *arr, int len)	10
4.3	MergeSorter Class Reference	10
4.3.1	Detailed Description	11
4.3.2	Constructor & Destructor Documentation	11

4.3.2.1	MergeSorter()	11
4.3.3	Member Function Documentation	11
4.3.3.1	mergeParts(int *part1, int len1, int *part2, int len2, int *dest)	11
4.3.3.2	sortInPlace(int *arr, int len)	12
4.3.3.3	sortRecursive(int *arr, int len)	12
4.4	Sorter Class Reference	12
4.4.1	Detailed Description	13
4.4.2	Constructor & Destructor Documentation	13
4.4.2.1	Sorter()	13
4.4.3	Member Function Documentation	13
4.4.3.1	getName()	13
4.4.3.2	getStats()	14
4.4.3.3	resetStats()	14
4.4.3.4	sortInPlace(int *arr, int len)=0	14
4.4.4	Member Data Documentation	14
4.4.4.1	name	14
4.4.4.2	sortsRun	14
4.4.4.3	totCPUTime	14
4.4.4.4	totNumComparisons	14
4.4.4.5	totNumSwaps	14
4.5	SortStats Struct Reference	15
4.5.1	Detailed Description	15
4.5.2	Member Data Documentation	15
4.5.2.1	avgCPUTime	15
4.5.2.2	avgNumComparisons	15
4.5.2.3	avgNumSwaps	15

5	File Documentation	17
5.1	BubbleSorter.cpp File Reference	17
5.1.1	Detailed Description	17
5.2	BubbleSorter.h File Reference	18
5.2.1	Detailed Description	18
5.3	CountingSorter.cpp File Reference	19
5.3.1	Detailed Description	19
5.4	CountingSorter.h File Reference	19
5.4.1	Detailed Description	20
5.5	MergeSorter.cpp File Reference	21
5.5.1	Detailed Description	21
5.6	MergeSorter.h File Reference	21
5.6.1	Detailed Description	22
5.7	PA04.cpp File Reference	23
5.7.1	Detailed Description	24
5.7.2	Function Documentation	24
5.7.2.1	fillArrayRandomly(int *arr, int numInts)	24
5.7.2.2	fillRandset(int **&set, int nval)	24
5.7.2.3	freeOneRandset(int **&set)	25
5.7.2.4	freeRandsets()	25
5.7.2.5	generateRandsets()	25
5.7.2.6	main()	25
5.7.2.7	testArray(Sorter *sorter, int *arr, int len, std::stringstream &sortOut, bool writeOut=false)	25
5.7.2.8	testOneSorter(Sorter *sorter, std::stringstream &sortOut, std::stringstream &statOut)	26
5.7.2.9	testRandset(Sorter *sorter, int **set, int len, std::stringstream &sortOut, std::stringstream &statOut)	26
5.7.2.10	testSorters(std::stringstream &sortOut, std::stringstream &statOut)	26
5.7.3	Variable Documentation	26
5.7.3.1	randset_100k	26
5.7.3.2	randset_10k	26
5.7.3.3	randset_1k	26
5.8	Sorter.cpp File Reference	26
5.8.1	Detailed Description	27
5.9	Sorter.h File Reference	27
5.9.1	Detailed Description	28
	Index	29

Chapter 1

Hierarchical Index

1.1 Class Hierarchy

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

Sorter	12
BubbleSorter	7
CountingSorter	9
MergeSorter	10
SortStats	15

Chapter 2

Class Index

2.1 Class List

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

BubbleSorter		
BubbleSorter class	. . . . .	7
CountingSorter		
CountingSorter class	. . . . .	9
MergeSorter		
MergeSorter class	. . . . .	10
Sorter		
Base class for Sorter classes, which sort int data	. . . . .	12
SortStats		
Contains sorting statistics	. . . . .	15

Chapter 3

File Index

3.1 File List

Here is a list of all files with brief descriptions:

BubbleSorter.cpp	Implementation file for the BubbleSorter class	17
BubbleSorter.h	Declaration file for the BubbleSorter class	18
CountingSorter.cpp	Implementation file for the CountingSorter class	19
CountingSorter.h	Declaration file for the CountingSorter class	19
MergeSorter.cpp	Implementation file for the MergeSorter class	21
MergeSorter.h	Declaration file for the MergeSorter class	21
PA04.cpp	Main file for CS302/PA04	23
Sorter.cpp	Implementation file for basic sorting structures	26
Sorter.h	Declaration file for basic sorting structures	27

Chapter 4

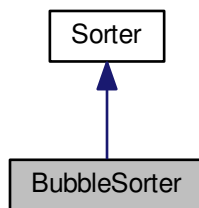
Class Documentation

4.1 BubbleSorter Class Reference

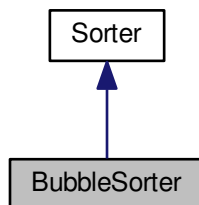
[BubbleSorter](#) class.

```
#include <BubbleSorter.h>
```

Inheritance diagram for BubbleSorter:



Collaboration diagram for BubbleSorter:



Public Member Functions

- [BubbleSorter](#) ()
- void [sortInPlace](#) (int *arr, int len)

Additional Inherited Members

4.1.1 Detailed Description

[BubbleSorter](#) class.

4.1.2 Constructor & Destructor Documentation

4.1.2.1 [BubbleSorter::BubbleSorter](#) ()

Default constructor for Sorters.

Constructs with name: "Bubble Sorter"

4.1.3 Member Function Documentation

4.1.3.1 void [BubbleSorter::sortInPlace](#) (int * *arr*, int *len*) [virtual]

Sorts an array in place.

Uses the bubble sort algorithm.

Implements [Sorter](#).

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

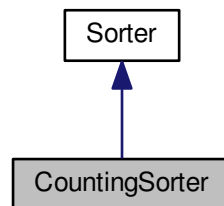
- [BubbleSorter.h](#)
- [BubbleSorter.cpp](#)

4.2 CountingSorter Class Reference

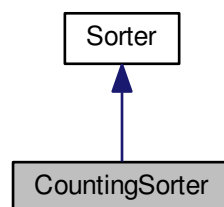
[CountingSorter](#) class.

```
#include <CountingSorter.h>
```

Inheritance diagram for CountingSorter:



Collaboration diagram for CountingSorter:



Public Member Functions

- [CountingSorter](#) ()
- void [sortInPlace](#) (int *arr, int len)

Additional Inherited Members

4.2.1 Detailed Description

[CountingSorter](#) class.

4.2.2 Constructor & Destructor Documentation

4.2.2.1 CountingSorter::CountingSorter ()

4.2.3 Member Function Documentation

4.2.3.1 void CountingSorter::sortInPlace (int * *arr*, int *len*) [virtual]

Sorts an array in place.

Uses the counting sort algorithm.

Implements [Sorter](#).

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

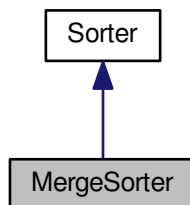
- [CountingSorter.h](#)
- [CountingSorter.cpp](#)

4.3 MergeSorter Class Reference

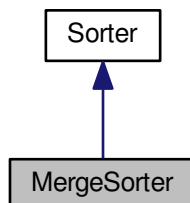
[MergeSorter](#) class.

```
#include <MergeSorter.h>
```

Inheritance diagram for MergeSorter:



Collaboration diagram for MergeSorter:



Public Member Functions

- [MergeSorter](#) ()
- void [sortInPlace](#) (int *arr, int len)

Private Member Functions

- void [mergeParts](#) (int *part1, int len1, int *part2, int len2, int *dest)
Merge two arrays in the right way.
- void [sortRecursive](#) (int *arr, int len)
The recursive layer for merge sort.

Additional Inherited Members

4.3.1 Detailed Description

[MergeSorter](#) class.

4.3.2 Constructor & Destructor Documentation

4.3.2.1 MergeSorter::MergeSorter ()

Default constructor for Sorters.

Constructs with name: "Merge Sorter"

4.3.3 Member Function Documentation

4.3.3.1 void MergeSorter::mergeParts (int * *part1*, int *len1*, int * *part2*, int *len2*, int * *dest*) [private]

Merge two arrays in the right way.

Parameters

<i>part1</i>	The first part to merge.
<i>len1</i>	The length of the first part.
<i>part2</i>	The second part to merge.
<i>len2</i>	The length of the second part.
<i>dest</i>	The merge destination.

Precondition

The length of dest \geq len1+len2

4.3.3.2 void MergeSorter::sortInPlace (int * *arr*, int *len*) [virtual]

Sorts an array in place.

Uses the merge sort algorithm.

Implements [Sorter](#).

4.3.3.3 void MergeSorter::sortRecursive (int * *arr*, int *len*) [private]

The recursive layer for merge sort.

Parameters

<i>arr</i>	The array to sort.
<i>len</i>	The length of the array to sort

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

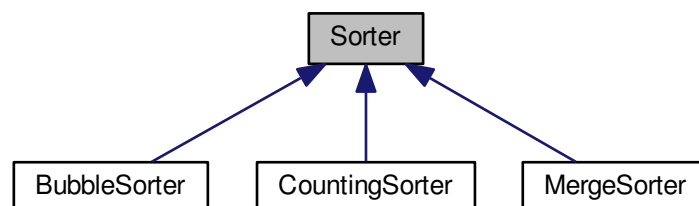
- [MergeSorter.h](#)
- [MergeSorter.cpp](#)

4.4 Sorter Class Reference

Base class for [Sorter](#) classes, which sort int data.

```
#include <Sorter.h>
```

Inheritance diagram for Sorter:



Public Member Functions

- [Sorter](#) ()
Default constructor for Sorters.
- virtual void [sortInPlace](#) (int *arr, int len)=0
Sorts an array in place.
- [SortStats](#) [getStats](#) ()
Returns statistics on all sorts performed.
- void [resetStats](#) ()
Resets the stats.
- std::string [getName](#) ()
Gets the name of this sorter.

Protected Attributes

- int [sortsRun](#)
- long [totCPUTime](#)
- long [totNumComparisons](#)
- long [totNumSwaps](#)
- std::string [name](#)

4.4.1 Detailed Description

Base class for [Sorter](#) classes, which sort int data.

[Sorter](#) classes record various statistics on the sort.

4.4.2 Constructor & Destructor Documentation

4.4.2.1 [Sorter::Sorter](#) ()

Default constructor for Sorters.

Constructs with name: "Base Sorter"

4.4.3 Member Function Documentation

4.4.3.1 [std::string Sorter::getName](#) ()

Gets the name of this sorter.

Returns

The name of this sorter.

4.4.3.2 SortStats Sorter::getStats ()

Returns statistics on all sorts performed.

Returns

A filled [SortStats](#) instance.

4.4.3.3 void Sorter::resetStats ()

Resets the stats.

4.4.3.4 virtual void Sorter::sortInPlace (int * *arr*, int *len*) [pure virtual]

Sorts an array in place.

Parameters

<i>arr</i>	The array to sort.
<i>len</i>	The length of the array to sort.

Precondition

The given array is at least *len* long.

Algorithm is abstracted.

Implemented in [MergeSorter](#), [BubbleSorter](#), and [CountingSorter](#).

4.4.4 Member Data Documentation

4.4.4.1 `std::string Sorter::name` [protected]

4.4.4.2 `int Sorter::sortsRun` [protected]

4.4.4.3 `long Sorter::totCPUTime` [protected]

4.4.4.4 `long Sorter::totNumComparisons` [protected]

4.4.4.5 `long Sorter::totNumSwaps` [protected]

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

- [Sorter.h](#)
- [Sorter.cpp](#)

4.5 SortStats Struct Reference

Contains sorting statistics.

```
#include <Sorter.h>
```

Public Attributes

- float [avgCPUTime](#)
- float [avgNumComparisons](#)
- float [avgNumSwaps](#)

4.5.1 Detailed Description

Contains sorting statistics.

4.5.2 Member Data Documentation

4.5.2.1 float SortStats::avgCPUTime

4.5.2.2 float SortStats::avgNumComparisons

4.5.2.3 float SortStats::avgNumSwaps

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

- [Sorter.h](#)

Chapter 5

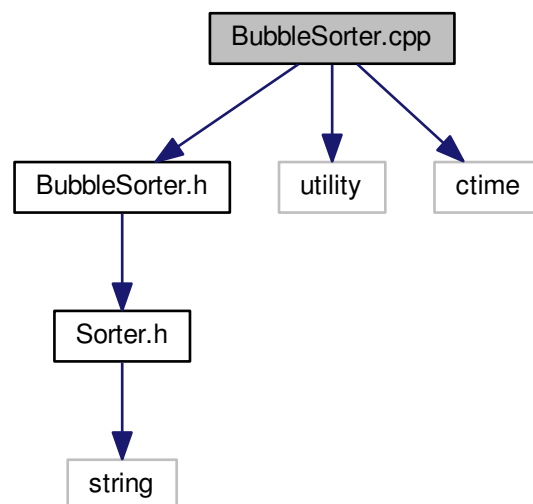
File Documentation

5.1 BubbleSorter.cpp File Reference

Implementation file for the [BubbleSorter](#) class.

```
#include "BubbleSorter.h"  
#include <utility>  
#include <ctime>
```

Include dependency graph for BubbleSorter.cpp:



5.1.1 Detailed Description

Implementation file for the [BubbleSorter](#) class.

Author

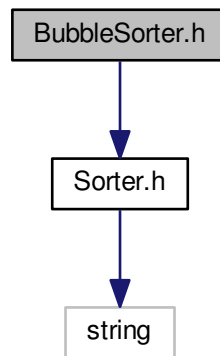
Matthew Bauer

5.2 BubbleSorter.h File Reference

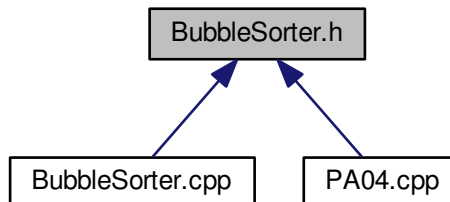
Declaration file for the [BubbleSorter](#) class.

```
#include "Sorter.h"
```

Include dependency graph for BubbleSorter.h:



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



Classes

- class [BubbleSorter](#)
BubbleSorter class.

5.2.1 Detailed Description

Declaration file for the [BubbleSorter](#) class.

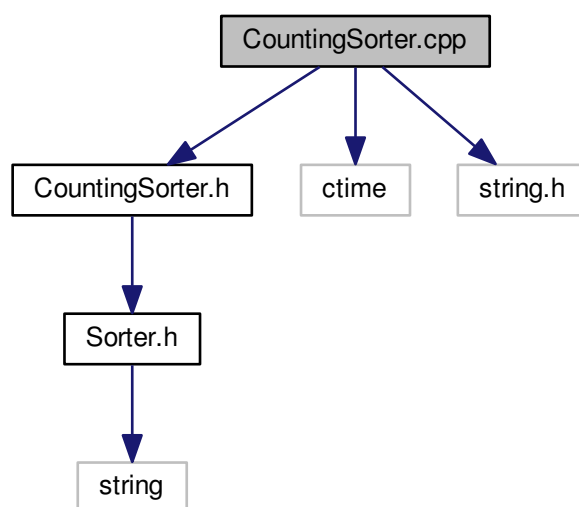
Author

Matthew Bauer

5.3 CountingSorter.cpp File Reference

Implementation file for the [CountingSorter](#) class.

```
#include "CountingSorter.h"  
#include <ctime>  
#include <string.h>  
Include dependency graph for CountingSorter.cpp:
```



5.3.1 Detailed Description

Implementation file for the [CountingSorter](#) class.

Author

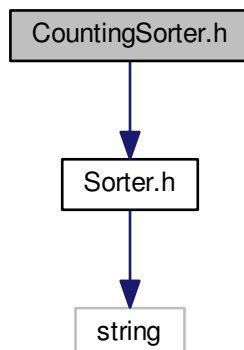
Matthew Bauer

5.4 CountingSorter.h File Reference

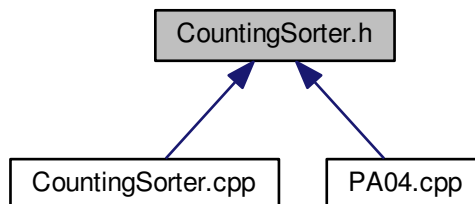
Declaration file for the [CountingSorter](#) class.

```
#include "Sorter.h"
```

Include dependency graph for CountingSorter.h:



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



Classes

- class [CountingSorter](#)
CountingSorter class.

5.4.1 Detailed Description

Declaration file for the [CountingSorter](#) class.

Author

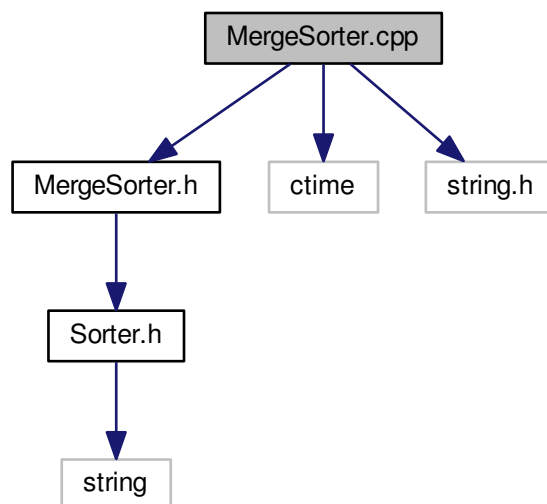
Matthew Bauer

5.5 MergeSorter.cpp File Reference

Implementation file for the [MergeSorter](#) class.

```
#include "MergeSorter.h"  
#include <ctime>  
#include <string.h>
```

Include dependency graph for MergeSorter.cpp:



5.5.1 Detailed Description

Implementation file for the [MergeSorter](#) class.

Author

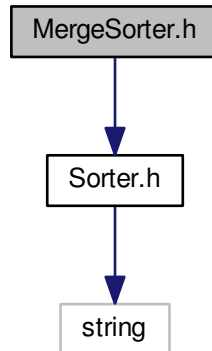
Matthew Bauer

5.6 MergeSorter.h File Reference

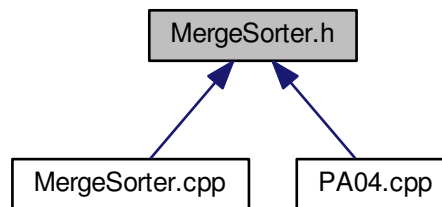
Declaration file for the [MergeSorter](#) class.

```
#include "Sorter.h"
```

Include dependency graph for MergeSorter.h:



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



Classes

- class [MergeSorter](#)
MergeSorter class.

5.6.1 Detailed Description

Declaration file for the [MergeSorter](#) class.

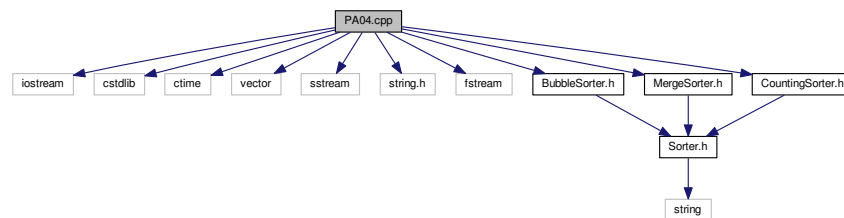
Author

Matthew Bauer

5.7 PA04.cpp File Reference

Main file for CS302/PA04.

```
#include <iostream>
#include <cstdlib>
#include <ctime>
#include <vector>
#include <sstream>
#include <string.h>
#include <fstream>
#include "BubbleSorter.h"
#include "MergeSorter.h"
#include "CountingSorter.h"
Include dependency graph for PA04.cpp:
```



Functions

- void [fillArrayRandomly](#) (int *arr, int numInts)
Fills an array with the given number of random integers with values ranging from 0 to 1000000.
- void [fillRandset](#) (int **&set, int nval)
Fill one randset.
- void [generateRandsets](#) ()
Fill all randsets appropriately.
- void [freeOneRandset](#) (int **&set)
Free one randset.
- void [freeRandsets](#) ()
Free the memory of all randsets.
- void [testArray](#) ([Sorter](#) *sorter, int *arr, int len, std::stringstream &sortOut, bool writeOut=false)
Test an array on a [Sorter](#).
- void [testRandset](#) ([Sorter](#) *sorter, int **set, int len, std::stringstream &sortOut, std::stringstream &statOut)
Test a randset on a [Sorter](#).
- void [testOneSorter](#) ([Sorter](#) *sorter, std::stringstream &sortOut, std::stringstream &statOut)
Test a [Sorter](#) on various data.
- void [testSorters](#) (std::stringstream &sortOut, std::stringstream &statOut)
Tests all Sorters fully.
- int [main](#) ()
Entry point.

Variables

- int ** [randset_1k](#)
- int ** [randset_10k](#)
- int ** [randset_100k](#)

5.7.1 Detailed Description

Main file for CS302/PA04.

Author

Matthew Bauer

5.7.2 Function Documentation

5.7.2.1 void fillArrayRandomly (int * *arr*, int *numInts*)

Fills an array with the given number of random integers with values ranging from 0 to 1000000.

Parameters

<i>array</i>	The array to fill.
<i>numInts</i>	The number of ints to fill it with.

Precondition

The given array must be allocated with more than numInts*4 bytes of space.

Postcondition

The first numInts elements of the array will be filled with random integers.

5.7.2.2 void fillRandset (int **& *set*, int *nval*)

Fill one randset.

Parameters

<i>set</i>	The randset to fill.
<i>nval</i>	The N-value of the randset.

Precondition

The given randset has not been allocated.

5.7.2.3 void freeOneRandset (int **& set)

Free one randset.

Parameters

<i>set</i>	The randset to free.
------------	----------------------

Precondition

The randset is allocated and valid.

Postcondition

The randset pointer will be set to nullptr.

5.7.2.4 void freeRandsets ()

Free the memory of all randsets.

Postcondition

All randset pointers will be set to nullptr.

5.7.2.5 void generateRandsets ()

Fill all randsets appropriately.

5.7.2.6 int main ()

Entry point.

Returns

0 (assumes no failure)

5.7.2.7 void testArray (Sorter * sorter, int * arr, int len, std::stringstream & sortOut, bool writeOut = false)

Test an array on a [Sorter](#).

Parameters

<i>sorter</i>	The Sorter to test the array on.
<i>arr</i>	The array to test.
<i>len</i>	The length of the array to test.
<i>sortOut</i>	The output stream to print sort results to.
<i>writeOut</i>	Whether output should be added to the stream.

5.7.2.8 `void testOneSorter (Sorter * sorter, std::stringstream & sortOut, std::stringstream & statOut)`

Test a [Sorter](#) on various data.

Parameters

<i>sorter</i>	The Sorter to test.
<i>sortOut</i>	The output stream to print sort results to.
<i>statOut</i>	The otuput stream to print stats to.

Precondition

Global randsets have been generated.

5.7.2.9 `void testRandset (Sorter * sorter, int ** set, int len, std::stringstream & sortOut, std::stringstream & statOut)`

Test a randset on a [Sorter](#).

Parameters

<i>sorter</i>	The Sorter to test the randset on.
<i>set</i>	The randset to test.
<i>len</i>	The length of the arrays in the randset to test.
<i>sortOut</i>	The output stream to print sort results to.
<i>statOut</i>	The output stream to print stats to.

5.7.2.10 `void testSorters (std::stringstream & sortOut, std::stringstream & statOut)`

Tests all Sorters fully.

Prints output to files: sorts.txt, stats.txt

5.7.3 Variable Documentation

5.7.3.1 `int ** randset_100k`

5.7.3.2 `int ** randset_10k`

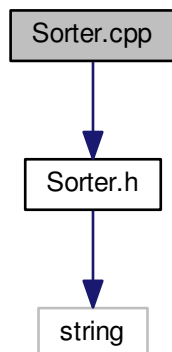
5.7.3.3 `int** randset_1k`

5.8 Sorter.cpp File Reference

Implementation file for basic sorting structures.


```
#include "Sorter.h"
```

Include dependency graph for Sorter.cpp:



5.8.1 Detailed Description

Implementation file for basic sorting structures.

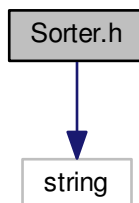
Author

5.9 Sorter.h File Reference

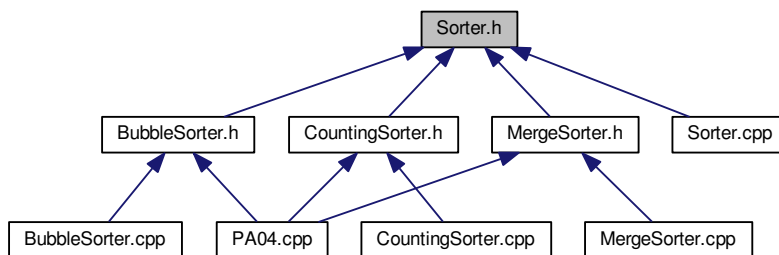
Declaration file for basic sorting structures.

```
#include <string>
```

Include dependency graph for Sorter.h:



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



Classes

- struct [SortStats](#)
Contains sorting statistics.
- class [Sorter](#)
Base class for [Sorter](#) classes, which sort int data.

5.9.1 Detailed Description

Declaration file for basic sorting structures.

Author

Matthew Bauer

Index

- avgCPUTime
 - SortStats, [15](#)
- avgNumComparisons
 - SortStats, [15](#)
- avgNumSwaps
 - SortStats, [15](#)
- BubbleSorter, [7](#)
 - BubbleSorter, [8](#)
 - sortInPlace, [8](#)
- BubbleSorter.cpp, [17](#)
- BubbleSorter.h, [18](#)
- CountingSorter, [9](#)
 - CountingSorter, [10](#)
 - sortInPlace, [10](#)
- CountingSorter.cpp, [19](#)
- CountingSorter.h, [19](#)
- fillArrayRandomly
 - PA04.cpp, [24](#)
- fillRandset
 - PA04.cpp, [24](#)
- freeOneRandset
 - PA04.cpp, [24](#)
- freeRandsets
 - PA04.cpp, [25](#)
- generateRandsets
 - PA04.cpp, [25](#)
- getName
 - Sorter, [13](#)
- getStats
 - Sorter, [13](#)
- main
 - PA04.cpp, [25](#)
- mergeParts
 - MergeSorter, [11](#)
- MergeSorter, [10](#)
 - mergeParts, [11](#)
 - MergeSorter, [11](#)
 - sortInPlace, [11](#)
 - sortRecursive, [12](#)
- MergeSorter.cpp, [21](#)
- MergeSorter.h, [21](#)
- name
 - Sorter, [14](#)
- PA04.cpp, [23](#)
- fillArrayRandomly, [24](#)
- fillRandset, [24](#)
- freeOneRandset, [24](#)
- freeRandsets, [25](#)
- generateRandsets, [25](#)
- main, [25](#)
- randset_100k, [26](#)
- randset_10k, [26](#)
- randset_1k, [26](#)
- testArray, [25](#)
- testOneSorter, [26](#)
- testRandset, [26](#)
- testSorters, [26](#)
- randset_100k
 - PA04.cpp, [26](#)
- randset_10k
 - PA04.cpp, [26](#)
- randset_1k
 - PA04.cpp, [26](#)
- resetStats
 - Sorter, [14](#)
- sortInPlace
 - BubbleSorter, [8](#)
 - CountingSorter, [10](#)
 - MergeSorter, [11](#)
 - Sorter, [14](#)
- sortRecursive
 - MergeSorter, [12](#)
- SortStats, [15](#)
 - avgCPUTime, [15](#)
 - avgNumComparisons, [15](#)
 - avgNumSwaps, [15](#)
- Sorter, [12](#)
 - getName, [13](#)
 - getStats, [13](#)
 - name, [14](#)
 - resetStats, [14](#)
 - sortInPlace, [14](#)
 - Sorter, [13](#)
 - sortsRun, [14](#)
 - totCPUTime, [14](#)
 - totNumComparisons, [14](#)
 - totNumSwaps, [14](#)
- Sorter.cpp, [26](#)
- Sorter.h, [27](#)
- sortsRun
 - Sorter, [14](#)

testArray
 PA04.cpp, [25](#)
testOneSorter
 PA04.cpp, [26](#)
testRandset
 PA04.cpp, [26](#)
testSorters
 PA04.cpp, [26](#)
totCPUTime
 Sorter, [14](#)
totNumComparisons
 Sorter, [14](#)
totNumSwaps
 Sorter, [14](#)