My library

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Chapter 1

Hi, welcome to myLibrary!

This is C library with some common tasks and data structures. I know the name is not the best but I have no imagination for names.
Check here for the documentation and here to download latest build (for x86-64 only, but you can compile from source in order to support other architectures).

1.1 Table of contents

1.2 Introduction and examples

This library contains some useful data structures which are not supported by default in C and some frequently used functions and algorithms.
As this library is written in C, almost every function needs you to specify as a function argument which type of data you are using it on through type and formatting specifiers. The convention used is the same used in standard C for `printf` and `scanf`.
In order to make writing code a bit more lighter the library includes also some macros that automatically detect the type of arguments passed so you don't have to explicitly use format and type specifiers. However, these macros are supported on C11 and newer compilers only and using them in some development environments can cause warnings or error reportings even though they are used correctly. See `macros.h` in the docs for more. In order to be as inclusive as possibile, since this macros are not supported by every C compilers, in the following examples they are not used.
The approach used by this library to handle errors with pointers is that every error is fatal: for example, when a pointer passed to a function is null and it should not be null, or some needed memory could not be allocated, the program prints where the error occurred and exits.

1.2.1 ArrayLists

ArrayLists are dynamically growing and shrinking lists of data, which can be of `char`, `int`, `float`, `double` or pointer type. You can create an ArrayList from a C array or you can create a new empty ArrayList. You can append items at its end, insert items, change its items, get its items, sort it (only ascending order is currently supported), print it, merge it with another ArrayList and much more. See `arrayList.h` in the docs for all the details.
The difference with LinkedLists is in the implementation and hence in the time needed for accessing its item. For example, an ArrayList has constant time for accessing items, while a LinkedList takes linear time. If you are intrested in these topics I suggest you to search more information on the Internet, as LinkedList and ArrayList are very standard data structures and on the web you can find a lot of information.
Here are some examples of ArrayList usage:

```
#include "myLibrary.h"
int main() {
    // Create an empty ArrayList of int type
    ArrayList list1 = newAL("%i");
    // Print list1
    printAL("%i\n", list1);
    // Output:
    // Empty
    // Append two items to list1
    appendToAL(list1, 3);
    appendToAL(list1, 4);
    // Now list1 contains: 3, 4
    // Insert an item to list1 at index 1
    insertToAL(list1, 1, -1);
    // Now list1 contains: 3, -1, 4
    // Change value of item at index 1 in list1
    setALItem(list1, 1, -2);
    // Now list1 contains: 3, -2, 4
    // Remove item at index 1 from list1
    removeFromAL(list1, 1);
    // Now list1 contains: 3, 4
    int extracted;
    // Get item at index 1 from list1 and save it into extracted
    getFromAL(list1, 1, &extracted);
    // list1 still contains: 3, 4; extracted is now 4
    int myArray[] = {23, 4, 65, -5, 12};
    // Create an ArrayList of ints from the static array myArray which contains 5 elements
    ArrayList list2 = chooseNewALFromArray("%i", myArray, 5);
    // Now list2 contains: 23, 4, 65, -5, 12
    printAL("% i", list1);
    // Output:
    //  23 4 65 -5 12
    // Sort list2 using a quicksort algorithm
    quickSortAL(list2);
    // Now list2 contains: -5, 4, 12, 23, 65
    // Reverse an ArrayList
    reverseAL(list2);
    // Now list2 contains: 65, 23, 12, 4, -5
    // Get the index of 12 in list2
    int index = linearSearchAL(list2, 12);
    // index is now 2
    // Check if list1 and list2 have equal contents
    byte areEqual = areALEqual(list1, list2);
    // areListsEqual is now FALSE (See
       [constants.h](https://catomaior.github.io/myLibrary/constants_8h.html) docs for its numeric value)
    // Merge list1 and list2
    mergeAL(list1, list2);
    // list2 still contains: 65, 23, 12, 4, -5; list1 now contains 3, 4, 65, 23, 12, 4, -5
    // Get list1 length
    unsigned int list1Length = getALLength(list1);
    // list1Length is now 7
    // Delete list1 and list2
    deleteAL(list1);
    deleteAL(list2);
    // Memory used by list1 and list2 is now freed. In order to avoid memory leaks is always good practice
       to delete ArrayLists before they go out of their scope
    return 0;
}
```

1.2.2 LinkedLists

LinkedLists are a quite standard implementation of linked lists, dynamically growing and shrinking lists of data, which can be of `char`, `int`, `float`, `double` or pointer type. You can create a LinkedList from a C array or you can create a new empty LinkedList. You can append items at its end, insert items, change its items, get its items,

print it, merge it with another LinkedList and much more. See `linkedList.h` in the docs for all the details.
The difference with ArrayLists is in the implementation and hence in the time needed for accessing its item. For example, a LinkedList has constant time for accessing items, while a LinkedList takes linear time. If you are intrested in these topics I suggest you to search more information on the Internet, as ArrayLists and LinkedLists are very standard data structures and on the web you can find a lot of information. As for now, LinkedLists and ArrayLists have more or less the same functionalities except sorting and reversing, which are currently supported only on ArrayLists.
Here are some examples of LinkedList usage:

```
#include "myLibrary.h"
int main() {
    // Create an empty LinkedList of int type
    LinkedList list1 = newLL("%i");
    // Print list1
    printLL("%i\n", list1);
    // Output:
    // Empty
    // Append two items to list1
    appendToLL(list1, 3);
    appendToLL(list1, 4);
    // Now list1 contains: 3, 4
    // Insert an item to list1 at index 1
    insertToLL(list1, 1, -1);
    // Now list1 contains: 3, -1, 4
    // Change value of item at index 1 in list1
    setLLItem(list1, 1, -2);
    // Now list1 contains: 3, -2, 4
    // Remove item at index 1 from list1
    removeFromLL(list1, 1);
    // Now list1 contains: 3, 4
    int extracted;
    // Get item at index 1 from list1 and save it into extracted
    getFromLL(list1, 1, &extracted);
    // list1 still contains: 3, 4; extracted is now 4
    int myArray[] = {23, 4, 65, -5, 12};
    // Create a LinkedList of ints from the static array myArray which contains 5 elements
    LinkedList list2 = chooseNewLLFromArray("%i", myArray, 5);
    // Now list2 contains: 23, 4, 65, -5, 12
    printLL("% i", list1);
    // Output:
    //  23 4 65 -5 12
    // Get the index of 12 in list2
    int index = linearSearchLL(list2, 12);
    // index is now 2
    // Check if list1 and list2 have equal contents
    byte areEqual = areLLEqual(list1, list2);
    // areListsEqual is now FALSE (See
       [constants.h](https://catomaior.github.io/myLibrary/constants_8h.html) docs for its numeric value)
    // Merge list1 and list2
    mergeLL(list1, list2);
    // list2 still contains: 65, 23, 12, 4, -5; list1 now contains 3, 4, 65, 23, 12, 4, -5
    // Get list1 length
    unsigned int list1Length = getLLLength(list1);
    // list1Length is now 7
    // Delete list1 and list2
    deleteLL(list1);
    deleteLL(list2);
    // Memory used by list1 and list2 is now freed. In order to avoid memory leaks is always good practice
       to delete LinkedLists before they go out of their scope
    return 0;
}
```

1.2.3 Stacks

Stacks are a quite standard implementation of LIFO stacks and can contain `char`, `int`, `float`, `double` or pointer data. You can create a Stack from a C array or you can create a new empty Stack. You can print its content, push items to its top, pop items from its top, peek from its top and much more. See `stack.h` in the docs for all the details.
Here are some examples of Stack usage:

```
#include "myLibrary.h"
int main() {
    // Create an empty Stack of int type
    Stack stack1 = newStack("%i");
    // Print stack1
    printStack("%i\n", stack1);
    // Output:
    // Empty
    // Push three items to stack1
```

```
    push(stack1, 3);
    push(stack1, 4);
    push(stack1, -1);
    // Now stack1 contains: -1, 4, 3
    int extracted;
    // Pop the item on top from stack1 and save it into extracted
    pop(stack1, &extracted);
    // Now stack1 contains: 4, 3; extracted is now -1
    // Peek the item on top from stack1 and save it into extracted
    peekStack(stack1, &extracted);
    // stack1 still contains: 4, 3; extracted is now 4
    int myArray[] = {23, 4, 65, -5, 12};
    // Create a Stack of ints from the static array myArray which contains 5 elements
    Stack stack2 = chooseNewStackFromArray("%i", myArray, 5);
    // Now stack2 contains: 12, -5, 65, 4, 23
    printStack("% i", stack1);
    // Output:
    //  12 -5 65 4 23
    // Check if stack1 and stack2 have equal contents
    byte areEqual = areStacksEqual(stack1, stack2);
    // areListsEqual is now FALSE (See
       [constants.h](https://catomaior.github.io/myLibrary/constants_8h.html) docs for its numeric value)
    // Delete an item from the top of stack2 without saving it
    deleteHeadFromStack(stack2);
    // Now stack2 contains: -5, 65, 4, 23
    // Get stack2 length
    unsigned int stack2Length = getStackLength(stack2);
    // stack2Length is now 4
    // Delete stack1 and stack2
    deleteStack(stack1);
    deleteStack(stack2);
    // Memory used by stack1 and stack2 is now freed. In order to avoid memory leaks deleting Stacks before
       they go out of their scope is always good practice
    return 0;
}
```

1.2.4 Queues

Queues are a quite standard implementation of FIFO queues and can contain `char`, `int`, `float`, `double` or pointer data. You can create a Queue from a C array or you can create a new empty Queue. You can print its content, enqueue items to its end, dequeue items from its top, peek from its top and much more. See `queue.h` in the docs for all the details.
Here are some examples of Queue usage:

```
#include "myLibrary.h"
int main() {
    // Create an empty Queue of int type
    Queue queue1 = newQueue("%i");
    // Print queue1
    printQueue("%i\n", queue1);
    // Output:
    // Empty
    // Enqueue three items in queue1
    enqueue(queue1, 3);
    enqueue(queue1, 4);
    enqueue(queue1, -1);
    // Now queue1 contains: 3, 4, -1
    int extracted;
    // Dequeue the item on top from queue1 and save it into extracted
    dequeue(queue1, &extracted);
    // Now queue1 contains: 4, -1; extracted is now 3
    // Peek the item on top from queue1 and save it into extracted
    peekQueue(queue1, &extracted);
    // queue1 still contains: 4, -1 extracted is now 4
    int myArray[] = {23, 4, 65, -5, 12};
    // Create a Queue of ints from the static array myArray which contains 5 elements
    Queue queue2 = chooseNewQueueFromArray("%i", myArray, 5);
    // Now queue2 contains: 23, 4, 65, -5, 12
    printQueue("% i", queue1);
    // Output:
    //  23 4 65 -5 12
    // Check if queue1 and queue2 have equal contents
    byte areEqual = areQueuesEqual(queue1, queue2);
    // areListsEqual is now FALSE (See
       [constants.h](https://catomaior.github.io/myLibrary/constants_8h.html) docs for its numeric value)
    // Delete an item from the top of queue2 without saving it
    deleteHeadFromQueue(queue2);
    // Now queue2 contains: 4, 65, -5, 12
    // Get queue2 length
    unsigned int queue2Length = getQueueLength(queue2);
    // queue2Length is now 4
```

```
    // Delete queue1 and queue2
    deleteQueue(queue1);
    deleteQueue(queue2);
    // Memory used by queue1 and queue2 is now freed. In order to avoid memory leaks deleting Queues before
       they go out of their scope is always good practice
    return 0;
}
```

1.2.5 Array algorithms

This library contains some basic functions that implement some commonly used algorithms for arrays and matrix, such as linear searching or sorting. These functions are massively used inside the library itself, but they can be useful out of that context too.
Since these functions work with standard C static arrays, they always have its size and its type, specified using the `printf` convention, as parameters.
See `arrays.h` in the docs for all the details.
Here are some examples of their usage:

```
#include "myLibrary.h"
int main() {
    int myArray[] = {23, 45, 11, -23, -43, 43};
    // Sort myArray (which contains 6 items) using a bubbleSort algorithm
    chooseBubbleSortArr("%i", myArray, 6);
    // myArray now contains: -43, -23, 11, 23, 43, 45
    // Find the index of an item inside an array
    int index = chooseLinearSearchArr("%i", myArray, 6, 11);
    // index is now 2
    int myMatrix[][6] = {{23, 45, 11, -23, -43, 43},
                         {23, 45, 11, -23, -43, 43}};

    // Print myMatrix
    printMatrix("%4i", myMatrix, 2, 6);
    // Output is:
    //  23  45  11 -23 -43  43
    //  23  45  11 -23 -43  43
}
```

1.2.6 Strings

This library contains some basic functions for working with strings, such as getting a string of arbitrary size and saving it in memory, checking if it ends with a given substring, changing its last characters and getting a copy of it.
See `strings.h` in the docs for all the details.
Here are some examples of their usage:

```
#include "myLibrary.h"
int main() {
    // Get a string from command line and save it in myString (See
       [types.h](https://catomaior.github.io/myLibrary/types_8h.html) for details about string type)
    string myString = getString();
    // Assuming the user Typed "Test" and pressed enter, myString now is: "Test"
    // Check if myString ends with "st"
    int endsWithST = endsWith(myString, "st");
    // endsWithST is now TRUE (See [constants.h](https://catomaior.github.io/myLibrary/constants_8h.html)
       docs for its numeric value)
    // Create a new string with different last character from myString
    string newString = changeLastCharacter(myString, "T");
    // newString is now: "TesT"
    // Create a copy of newString
    string otherString = copyOf(newString);
    // newString is now: "TesT"
}
```

1.2.7 Miscellaneous

This library contains also standard comparing functions for `char`, `int`, `float`, `double` and pointer type and also two functions that try to allocate or reallocate memory. These functions are massively used inside the library itself, but they can be useful out of that context too.

See `utility.h` in the docs for all the details.
Here are some examples of their usage:

```
#include "myLibrary.h"
int main() {
    int a = 0, b = 1;
    // Compare a and b as integer values
    byte compare = chooseCmp("%i", &a, &b);
    // compare is now SMALLER (See [constants.h](https://catomaior.github.io/myLibrary/constants_8h.html)
       docs for its numeric value)
    // Get a pointer to a dynamically allocated buffer of 1 byte
    void *ptr = saferMalloc(1);
    // ptr is now a pointer to a 1 byte buffer. If memory cannot be allocated the program prints the
       following and exits:
    // An errorr occured in function saferMalloc:
    // Could not allocate memory
    // Exiting
    // Resize an already allocated buffer
    ptr = saferRealloc(ptr, 2);
    // ptr is now a pointer to a 2 byte buffer. If memory cannot be reallocated the program prints the
       following and exits:
    // An errorr occured in function saferRealloc:
    // Could not reallocate memory
    // Exiting
}
```

1.3 How to import

1.3.1 On Linux

Download the build for Linux, unzip it and place it somewhere. Consider the following code:

```
#include "myLibrary.h"
int main() {
    byte myMatrix[][2] = {{42, 24}, {-24, 42}};
    printMatrix("%3hi", myMatrix, 2, 2);
    return 0;
}
```

Assuming it is saved in a file named `myFile.c` and you want to compile it using `gcc`, the correct command for compilation is:

```
gcc path/to/myFile.c -o path/to/myFileExecutable -I path/to/folder/with/myLibrary \
    path/to/folder/with/myLibrary/build/myLibrary_Linux.lib
```

Where:

- `path/to/myFile.c` is the relative or absolute path to myFile.c
- `path/to/myFileExecutable` is the relative or absolute path for the compiler output
- `path/to/folder/with/myLibrary` is the relative or absolute path of extracted myLibrary folder
- `path/to/folder/with/myLibrary/build/myLibrary_Linux.lib` is the path to the binary file of the library

1.3.2 On Visual Studio for Windows

Download the build for Windows, unzip it and place it somewhere. Steps to import:

- Open the solution where you want to use myLibrary
- Ensure the source file where you want to import myLibrary has `.c` extension. If its extension is `.cpp`, change it to `.c`
- Go to "Project" > "myProject Properties"

- In "Configuration" choose "All Configurations"
- In "Platform" choose "x64"
- Go to "Configuration Properties" > "C/C++" > "General". In "Additional Include Directories" add the path of the myLibrary folder you extracted before
- Go to "Configuration Properties" > "Linker" > "General". In "Additional Library Directories" add the path of the "build" folder inside the myLibrary folder you extracted before
- Go to "Configuration Properties" > "Linker" > "Input". In "Additional Dependencies" add `myLibrary_Windows.lib;legacy_stdio_definitions.lib;legacy_stdio_wide_specifiers.lib;`
- Click on "Ok" at the bottom of the window
- Near to "Local Windows Debugger" choose "x64". Now you are ready to `#include "myLibrary.h"` and compile and run your code

1.4 How to compile from source

Compilation from source is currently supported only on Linux. The only dependencies are `gcc` and `make`. Run:

```
git clone https://github.com/CatoMaior/myLibrary.git
cd myLibrary
make lib
```

The compiled binaries are `myLibrary_Linux.lib` and `myLibrary_Windows.lib` in the `build` folder. If you want a pdf version of the docs too run:

```
make docs
```

The pdf is now in the `docs` folder

Chapter 2

Data Structure Index

2.1 Data Structures

Here are the data structures with brief descriptions:

Chapter 3

File Index

3.1 File List

Here is a list of all files with brief descriptions:

Chapter 4

Data Structure Documentation

4.1 ArrayList Struct Reference

ArrayList type

`#include <types.h>`

Data Fields

- spec_t type

  The type of the elements contained by the ArrayList. Refer to spec_t.
- void * body

  Void pointer to the first element of the ArrayList.
- unsigned int size

  The number of elements contained by the ArrayList.

4.1.1 Detailed Description

ArrayList type

Note

All the parameters in this structure must be intended as read-only. Manually modifying them can cause unknown and unwanted behavior

4.1.2 Field Documentation

4.1.2.1 body

`void* ArrayList::body`

Void pointer to the first element of the ArrayList.

4.1.2.2 size

```
unsigned int ArrayList::size
```

The number of elements contained by the ArrayList.

4.1.2.3 type

```
spec_t ArrayList::type
```

The type of the elements contained by the ArrayList. Refer to spec_t.

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

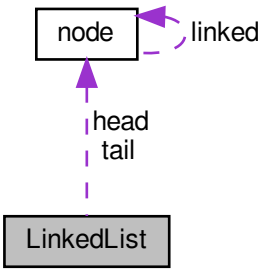
- types.h

4.2 LinkedList Struct Reference

LinkedList type

```
#include <types.h>
```

Collaboration diagram for LinkedList:



Data Fields

- spec_t type
  The type of the elements contained by the LinkedList. Refer to spec_t.
- Node head
  Head of the LinkedList.
- Node tail
  Tail of the LinkedList.
- unsigned int size
  The number of elements contained by the LinkedList.

4.2.1 Detailed Description

LinkedList type

Note

All the parameters in this structure must be intended as read-only. Manually modifying them can cause unknown and unwanted behavior

4.2.2 Field Documentation

4.2.2.1 head

```
Node LinkedList::head
```

Head of the LinkedList.

4.2.2.2 size

```
unsigned int LinkedList::size
```

The number of elements contained by the LinkedList.

4.2.2.3 tail

```
Node LinkedList::tail
```

Tail of the LinkedList.

4.2.2.4 type

```
spec_t LinkedList::type
```

The type of the elements contained by the LinkedList. Refer to spec_t.

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

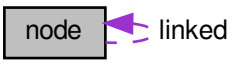
- types.h

4.3 node Struct Reference

Node type

`#include <types.h>`

Collaboration diagram for node:



Data Fields

- void * data

  Pointer to the value contained.
- struct node * linked

  The Node this Node is linked to.

4.3.1 Detailed Description

Node type

Base component of every linked data type

Note

All the parameters in this structure must be intended as read-only. Manually modifying them can cause unknown and unwanted behavior

4.3.2 Field Documentation

4.3.2.1 data

`void* node::data`

Pointer to the value contained.

4.3.2.2 linked

```
struct node* node::linked
```

The Node this Node is linked to.

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

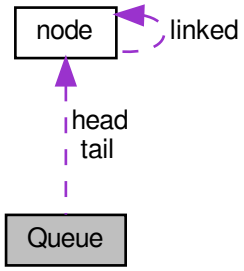
- types.h

4.4 Queue Struct Reference

Queue type

```
#include <types.h>
```

Collaboration diagram for Queue:



Data Fields

- spec_t type
  The type of the elements contained by the Queue. Refer to spec_t.
- Node head
  Head of the Queue.
- Node tail
  Tail of the Queue.
- unsigned int size
  The number of elements contained by the Queue.

4.4.1 Detailed Description

Queue type

Note

All the parameters in this structure must be intended as read-only. Manually modifying them can cause unknown and unwanted behavior

4.4.2 Field Documentation

4.4.2.1 head

```
Node Queue::head
```

Head of the Queue.

4.4.2.2 size

```
unsigned int Queue::size
```

The number of elements contained by the Queue.

4.4.2.3 tail

```
Node Queue::tail
```

Tail of the Queue.

4.4.2.4 type

```
spec_t Queue::type
```

The type of the elements contained by the Queue. Refer to spec_t.

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

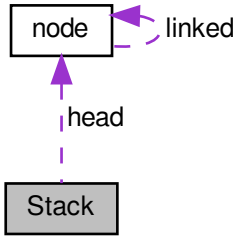
- types.h

4.5 Stack Struct Reference

Stack type

`#include <types.h>`

Collaboration diagram for Stack:



Data Fields

- spec_t type

  The type of the elements contained by the Stack. Refer to spec_t.
- Node head

  Head of the Stack.

4.5.1 Detailed Description

Stack type

Note

All the parameters in this structure must be intended as read-only. Manually modifying them can cause unknown and unwanted behavior

4.5.2 Field Documentation

4.5.2.1 head

`Node Stack::head`

Head of the Stack.

4.5.2.2 type

```
spec_t Stack::type
```

The type of the elements contained by the Stack. Refer to spec_t.

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

- types.h

Chapter 5

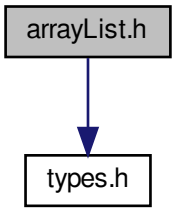
File Documentation

5.1 arrayList.h File Reference

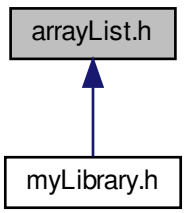
Functions for working with ArrayList type.

```
#include "types.h"
```

Include dependency graph for arrayList.h:



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



Functions

- ArrayList newAL (const spec_t spec)

  Allocate a new ArrayList of specified type.
- ArrayList newALFromAL (const ArrayList list)

  Get a copy of an ArrayList.
- void appendToAL (ArrayList list,...)

  Insert an item at the end of an ArrayList.
- void insertToAL (ArrayList list, unsigned int index,...)

  Insert an item at a specified position of an ArrayList.
- void setALItem (ArrayList list, unsigned int index,...)

  Set value of an item of an ArrayList.
- void mergeAL (ArrayList list1, const ArrayList list2)

  Merge two ArrayList.
- void sliceAL (ArrayList list, unsigned int begin, unsigned int end)

  Slice an ArrayList.
- void printAL (const spec_t spec, const ArrayList list)

  Print contents from an ArrayList.
- void removeFromAL (ArrayList list, unsigned int index)

  Remove an item from an ArrayList.
- void getFromAL (const ArrayList list, unsigned int index, void ∗dest)

  Get an item from an ArrayList.
- void deleteAL (ArrayList list,...)

  Delete an ArrayList.
- byte areALEqual (const ArrayList list1, const ArrayList list2,...)

  Compare two ArrayList.
- void reverseAL (ArrayList list)

  Reverse an ArrayList.
- void bubbleSortAL (ArrayList list,...)

  Bubble sort for ArrayList.
- void quickSortAL (ArrayList list,...)

  Quicksort for ArrayList.
- byte isInAL (ArrayList list,...)

  Detect if an item is inside an ArrayList.
- int linearSearchAL (ArrayList list,...)

  Linear search for ArrayList.
- ArrayList chooseNewALFromArray (const spec_t spec, const void ∗list, unsigned int size)

  Create an ArrayList from a static array.
- ArrayList newALFromCharArray (const char list[ ], unsigned int size)

  Create ArrayList from a list of chars.
- ArrayList newALFromByteArray (const char list[ ], unsigned int size)

  Create ArrayList from a list of bytes.
- ArrayList newALFromIntArray (const int list[ ], unsigned int size)

  Create ArrayList from a list of ints.
- ArrayList newALFromFloatArray (const float list[ ], unsigned int size)

  Create ArrayList from a list of floats.
- ArrayList newALFromDoubleArray (const double list[ ], unsigned int size)

  Create ArrayList from an list of doubles.
- ArrayList newALFromPtrArray (const void ∗list, unsigned int size)

  Create ArrayList from an list of pointers.
- unsigned int getALLength (const ArrayList list)

  Get the size of an ArrayList.
- byte isALEmpty (ArrayList list)

  Check if ArrayList is empty.

5.1.1 Detailed Description

Functions for working with ArrayList type.

Author

Pietro Firpo (pietro.firpo@pm.me)

5.1.2 Function Documentation

5.1.2.1 appendToAL()

```
void appendToAL (
            ArrayList list,
             ...  )
```

Insert an item at the end of an ArrayList.

Parameters

list	The ArrayList you want to append an item to
...	The item you want to append to `list`

Note

Even though appending more than one item for single call does not throw a compiler nor runtime error, only appending one item is supported. Other items are ignored and are not appended to `list`. If you don't specify any item to be appended, still no errors occur but the content of your ArrayList can be messed up

5.1.2.2 areALEqual()

```
byte areALEqual (
            const ArrayList list1,
            const ArrayList list2,
             ...  )
```

Compare two ArrayList.

Parameters

list1	The first ArrayList you want to compare
list2	The second ArrayList you want to compare
...	The comparison function needed to compare items inside given lists. This parameter is necessary only for pointer ArrayList type and is ignored otherwise. Must be a function that takes two pointers as argument and returns a positive int if the item pointed by the first argument is greater than the item pointed by the second argument, a negative int if the item pointed by the first argument is is smaller than the item pointed by second, a zero int if the item pointed by first and second arguments are equal

Note

If comparing two pointer ArrayList type and the comparing function is not given a compiler nor runtime error is given, but the result of the comparison is unpredictable

Returns

The result of the comparison

Return values

TRUE	`list1` and `list2` have equal type, equal length and equal contents
FALSE	`list1` and `list2` do not have equal type, equal length or equal contents

5.1.2.3 bubbleSortAL()

```
void bubbleSortAL (
            ArrayList list,
             ...  )
```

Bubble sort for ArrayList.

Parameters

list	The ArrayList you want to bubble sort
...	The comparison function needed to compare items inside given lists. This parameter is necessary only for pointer ArrayList type and is ignored otherwise. Must be a function that takes two pointers as argument and returns a positive int if the item pointed by the first argument is greater than the item pointed by the second argument, a negative int if the item pointed by the first argument is is smaller than the item pointed by second, a zero int if the item pointed by first and second arguments are equal

Note

If sorting an ArrayList type and the comparing function is not passed a compiler error is not given, but the ArrayList will be messed up

5.1.2.4 chooseNewALFromArray()

```
ArrayList chooseNewALFromArray (
            const spec_t spec,
            const void * list,
            unsigned int size )
```

Create an ArrayList from a static array.

Parameters

spec	The type specifier of the array passed. Refer to spec_t
list	The list you want to create the ArrayList from
size	The number of items in `list`

Note

When creating an ArrayList from a pointer array the pointers are inserted into the ArrayList, not what they point to

Returns

An ArrayList containing the items in `list` in the same order

5.1.2.5 deleteAL()

```
void deleteAL (
              ArrayList list,
               ...  )
```

Delete an ArrayList.

Parameters

list	The ArrayList you want to delete
...	The function used to free memory pointed by every pointer of the ArrayList. Must be a function that takes a pointer as argument. Necessary only for pointer ArrayList type, ignored otherwise. When deleting a pointer ArrayList type if no free function is passed no compiler errors are thrown but you may cause severe memory leaks

5.1.2.6 getALLength()

```
unsigned int getALLength (
              const ArrayList list )
```

Get the size of an ArrayList.

Parameters

list	The ArrayList you want to evaluate

Returns

The number of items in `list`

5.1.2.7 getFromAL()

```
void getFromAL (
            const ArrayList list,
            unsigned int index,
            void * dest )
```

Get an item from an ArrayList.

Parameters

list	The ArrayList you want to get an item from
index	The index of the item you want to get
dest	The address of the variable you want to store the item in

5.1.2.8 insertToAL()

```
void insertToAL (
            ArrayList list,
            unsigned int index,
             ...  )
```

Insert an item at a specified position of an ArrayList.

Parameters

list	The ArrayList you want to insert an item into
index	The position you want to insert an item at
...	The item you want to insert into `list`

Note

Even though inserting more than one item for single call does not throw a compiler nor runtime error, only inserting one item is supported. Other items are ignored and are not inserted into `list`. If you don't specify any item to be inserted, still no errors occur but the content of your ArrayList can be messed up

5.1.2.9 isALEmpty()

```
byte isALEmpty (
            ArrayList list )
```

Check if ArrayList is empty.

Parameters

list	The ArrayList to be checked

Return values

TRUE	`list` is empty
FALSE	`list` is not empty

5.1.2.10 isInAL()

```
byte isInAL (
             ArrayList list,
              ...  )
```

Detect if an item is inside an ArrayList.

Parameters

list	The ArrayList you want search in
...	The item you want to search. If searaching in a pointer ArrayList type, after the item you want so search, you must provide the comparison function needed to compare the item you want to search and the items in the ArrayList. Must be a function that takes two pointers as argument and returns a zero int only if the item pointed by first and second arguments are equal

Note

Even though searching more than one item for single call does not throw a compiler nor runtime error, only searching one item is supported. Other items are ignored. If you don't specify any item to be searched, still no errors occur but the return value of the function can be unpredictable. If searching in a pointer ArrayList type and the comparing function is not passed a compiler error is not given either, but the return value of the function can be unpredictable

Return values

TRUE	Given item is contained in `list`
FALSE	Given item is not contained in `list`

5.1.2.11 linearSearchAL()

```
int linearSearchAL (
             ArrayList list,
              ...  )
```

Linear search for ArrayList.

Parameters

list	The ArrayList to be inspected
...	The key to be searched. If searaching in a pointer ArrayList type, after the item you want so search, you must provide the comparison function needed to compare the item you want to search and the items in the ArrayList. Must be a function that takes two pointers as argument and returns a zero int only if the item pointed by first and second arguments are equal

Note

Even though passing more than one key does not throw a compiler nor runtime error, only searching one key is supported. Other items are ignored. If you don't specify any item to be searched, still no errors occur but the return value of the function can be unpredictable. If searching in a pointer ArrayList type and the comparing function is not passed a compiler or runtime error is not given either, but the return value of the function can be unpredictable

Returns

The index of the first occurence of the key in the list or the return code of the function

Return values

KEY_NOT_FOUND	The key was not found

5.1.2.12 mergeAL()

```
void mergeAL (
            ArrayList list1,
            const ArrayList list2 )
```

Merge two ArrayList.

Parameters

list1	The first ArrayList to be merged, where the merged ArrayList is saved
list2	The second ArrayList to be merged

5.1.2.13 newAL()

```
ArrayList newAL (
            const spec_t spec )
```

Allocate a new ArrayList of specified type.

Parameters

spec	Type specifier of the ArrayList you want to create

Returns

An empty ArrayList

5.1.2.14 newALFromAL()

```
ArrayList newALFromAL (
            const ArrayList list )
```

Get a copy of an ArrayList.

Parameters

list	The ArrayList you want to copy

Note

When creating an ArrayList from a pointer ArrayList type the pointers in `list` are inserted into the ArrayList, not what they point to

Returns

A copy of `list`

5.1.2.15 newALFromByteArray()

```
ArrayList newALFromByteArray (
            const char list[],
            unsigned int size )
```

Create ArrayList from a list of bytes.

Alias for newALFromCharArray(). Used to create ArrayList from byte list. Refer to newALFromCharArray()

5.1.2.16 newALFromCharArray()

```
ArrayList newALFromCharArray (
            const char list[],
            unsigned int size )
```

Create ArrayList from a list of chars.

Equivalent to `chooseNewALFromArray("%c", list, size)`. Refer to chooseNewALFromArray()

5.1.2.17 newALFromDoubleArray()

```
ArrayList newALFromDoubleArray (
            const double list[],
            unsigned int size )
```

Create ArrayList from an list of doubles.

Equivalent to `chooseNewALFromArray("%lf", list, size)`. Refer to chooseNewALFromArray()

5.1.2.18 newALFromFloatArray()

```
ArrayList newALFromFloatArray (
            const float list[],
            unsigned int size )
```

Create ArrayList from a list of floats.

Equivalent to `chooseNewALFromArray("%f", list, size)`. Refer to chooseNewALFromArray()

5.1.2.19 newALFromIntArray()

```
ArrayList newALFromIntArray (
            const int list[],
            unsigned int size )
```

Create ArrayList from a list of ints.

Equivalent to `chooseNewALFromArray("%i", list, size)`. Refer to chooseNewALFromArray()

5.1.2.20 newALFromPtrArray()

```
ArrayList newALFromPtrArray (
            const void * list,
            unsigned int size )
```

Create ArrayList from an list of pointers.

Equivalent to `chooseNewALFromArray("%p", list, size)`. Refer to chooseNewALFromArray()

5.1.2.21 printAL()

```
void printAL (
            const spec_t spec,
            const ArrayList list )
```

Print contents from an ArrayList.

Parameters

spec	The type and format specifier you want to use to print the single item of the ArrayList. Use the `printf()` conventions
list	The ArrayList you want to print

5.1.2.22 quickSortAL()

```
void quickSortAL (
            ArrayList list,
             ...  )
```

Quicksort for ArrayList.

Parameters

list	The ArrayList you want to quicksort
...	The comparison function needed to compare items inside given lists. This parameter is necessary only for pointer ArrayList type and is ignored otherwise. Must be a function that takes two pointers as argument and returns a positive int if the item pointed by the first argument is greater than the item pointed by the second argument, a negative int if the item pointed by the first argument is is smaller than the item pointed by second, a zero int if the item pointed by first and second arguments are equal

Note

If sorting a pointer ArrayList type and the comparing function is not passed a compiler error is not given, but the ArrayList will be messed up

5.1.2.23 removeFromAL()

```
void removeFromAL (
            ArrayList list,
            unsigned int index )
```

Remove an item from an ArrayList.

Parameters

list	The ArrayList you want to delete an item from
index	The index of the item you want to delete

5.1.2.24 reverseAL()

```
void reverseAL (
            ArrayList list )
```

Reverse an ArrayList.

Parameters

list	The ArrayList you want to reverse

5.1.2.25 setALItem()

```
void setALItem (
            ArrayList list,
            unsigned int index,
             ...  )
```

Set value of an item of an ArrayList.

Parameters

list	The ArrayList you want to edit
index	The index of the item you want to change
...	The item you want to set the index-th item of `list` to

Note

Even though changing more than one item for single call does not throw a compiler nor runtime error, only setting one item is supported. Other items are ignored. If you don't specify any item to be inserted, still no errors occur but the content of your ArrayList can be messed up

5.1.2.26 sliceAL()

```
void sliceAL (
            ArrayList list,
            unsigned int begin,
            unsigned int end )
```

Slice an ArrayList.

Parameters

list	The ArrayList you want to slice, where the sliced ArrayList is saved
begin	The index of the beginning of the slice
end	The index of the end of the slice

5.2 arrayList.h

Go to the documentation of this file.

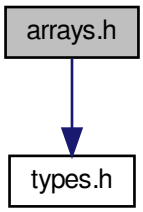
```
1
7 #ifndef SEEN_ARRAYLIST
8 #define SEEN_ARRAYLIST
9
10 #include "types.h"
11
12 // TYPE INDEPENDENT FUNCTIONS
18 ArrayList newAL(const spec_t spec);
19
26 ArrayList newALFromAL(const ArrayList list);
27
34 void appendToAL(ArrayList list, ...);
35
43 void insertToAL(ArrayList list, unsigned int index, ...);
44
52 void setALItem(ArrayList list, unsigned int index, ...);
53
59 void mergeAL(ArrayList list1, const ArrayList list2);
60
67 void sliceAL(ArrayList list, unsigned int begin, unsigned int end);
68
74 void printAL(const spec_t spec, const ArrayList list);
75
81 void removeFromAL(ArrayList list, unsigned int index);
82
89 void getFromAL(const ArrayList list, unsigned int index, void *dest);
90
96 void deleteAL(ArrayList list, ...);
97
108 byte areALEqual(const ArrayList list1, const ArrayList list2, ...);
109
114 void reverseAL(ArrayList list);
115
122 void bubbleSortAL(ArrayList list, ...);
123
130 void quickSortAL(ArrayList list, ...);
131
140 byte isInAL(ArrayList list, ...);
141
150 int linearSearchAL(ArrayList list, ...);
151
160 ArrayList chooseNewALFromArray(const spec_t spec, const void *list, unsigned int size);
161
162 // TYPE DEPENDENT FUNCTIONS
167 ArrayList newALFromCharArray(const char list[], unsigned int size);
168
173 ArrayList newALFromByteArray(const char list[], unsigned int size);
174
179 ArrayList newALFromIntArray(const int list[], unsigned int size);
180
185 ArrayList newALFromFloatArray(const float list[], unsigned int size);
186
191 ArrayList newALFromDoubleArray(const double list[], unsigned int size);
192
197 ArrayList newALFromPtrArray(const void *list, unsigned int size);
198
204 unsigned int getALLength(const ArrayList list);
205
212 byte isALEmpty(ArrayList list);
213
214 #endif
```

5.3 arrays.h File Reference

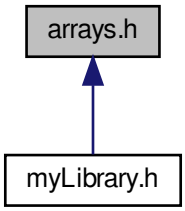
Common tasks with arrays: sorting, searching, printing etc.

```
#include "types.h"
```

Include dependency graph for arrays.h:



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



Functions

- void chooseBubbleSortArr (const spec_t spec, void ∗arr, unsigned int size,...)

  Bubble sort for arrays.
- void chooseQuickSortArr (const spec_t spec, void ∗arr, int size,...)

  Quick sort for arrays.
- int chooseLinearSearchArr (const spec_t spec, const void ∗arr, int size,...)

  Linear search for arrays.
- void printMatrix (const spec_t spec, const void ∗matrix, const unsigned int nRows, const unsigned int n↩ Columns)

  Print a matrix of specified size with specified formatting.
- void charBubbleSortArr (char ∗arr, unsigned int size)

  Bubblesort for arrays of chars.
- void intBubbleSortArr (int ∗arr, unsigned int size)

  Bubblesort for arrays of ints.
- void floatBubbleSortArr (float ∗arr, unsigned int size)

  Bubblesort for arrays of floats.
- void doubleBubbleSortArr (double ∗arr, unsigned int size)

Bubblesort for arrays of doubles.

- void ptrBubbleSortArr (void **arr, unsigned int size, int(*cmpFunc)(const void *a, const void *b))

  Bubblesort for arrays of pointers.
- void charQuickSortArr (char *arr, int size)

  Quicksort for arrays of chars.
- void intQuickSortArr (int *arr, int size)

  Quicksort for arrays of ints.
- void floatQuickSortArr (float *arr, int size)

  Quicksort for arrays of floats.
- void doubleQuickSortArr (double *arr, int size)

  Quicksort for arrays of doubles.
- void ptrQuickSortArr (void *arr, int size, int(*cmpFunc)(const void *a, const void *b))

  Quicksort for arrays of pointers.
- int charLinearSearchArr (const char *arr, int size, char key)

  Linear search for arrays of chars.
- int intLinearSearchArr (const char *arr, int size, int key)

  Linear search for arrays of integers.
- int floatLinearSearchArr (const char *arr, int size, float key)

  Linear search for arrays of floats.
- int doubleLinearSearchArr (const char *arr, int size, double key)

  Linear search for arrays of doubles.
- int ptrLinearSearchArr (const void *arr, int size, void *key, int(*cmpFunc)(const void *a, const void *b))

  Linear search for arrays of pointers.

5.3.1 Detailed Description

Common tasks with arrays: sorting, searching, printing etc.

Author

Pietro Firpo (pietro.firpo@pm.me)

5.3.2 Function Documentation

5.3.2.1 charBubbleSortArr()

```
void charBubbleSortArr (
            char * arr,
            unsigned int size )
```

Bubblesort for arrays of chars.

Equivalent to `chooseBubbleSortArr("%c", arr, size)`. Refer to chooseBubbleSortArr()

5.3.2.2 charLinearSearchArr()

```
int charLinearSearchArr (
            const char * arr,
            int size,
            char key )
```

Linear search for arrays of chars.

Equivalent to `chooseLinearSearchArr("%c", arr, size, key)`. Refer to chooseQuickSortArr()

5.3.2.3 charQuickSortArr()

```
void charQuickSortArr (
            char * arr,
            int size )
```

Quicksort for arrays of chars.

Equivalent to `chooseQuickSortArr("%c", arr, size)`. Refer to chooseQuickSortArr()

5.3.2.4 chooseBubbleSortArr()

```
void chooseBubbleSortArr (
            const spec_t spec,
            void * arr,
            unsigned int size,
             ...  )
```

Bubble sort for arrays.

Parameters

spec	Type specifier of the array to be sorted. Refer to spec_t for supported types
arr	Pointer to the first element of the array to be sorted
size	Number of elements of the array to be sorted
...	The comparison function needed to compare items inside given lists. This parameter is necessary only for pointer ArrayList type and is ignored otherwise. Must be a function that takes two pointers as argument and returns a positive int if the item pointed by the first argument is greater than the item pointed by the second argument, a negative int if the item pointed by the first argument is is smaller than the item pointed by second, a zero int if the item pointed by first and second arguments are equal

5.3.2.5 chooseLinearSearchArr()

```
int chooseLinearSearchArr (
            const spec_t spec,
            const void * arr,
```

```
            int size,
             ...  )
```

Linear search for arrays.

Parameters

spec	Type specifier of the array to be sorted. Refer to spec_t for supported types
arr	Pointer to the first element of the array to be inspected
size	Number of elements of the array to be inspected
...	The key to be searched. If searaching in a pointer array, after the item you want so search, you must provide the comparison function needed to compare the item you want to search and the items in the array. Must be a function that takes two pointers as argument and returns a zero int only if the item pointed by first and second arguments are equal

Note

Even though passing more than one key does not throw a compiler nor runtime error, only searching one key is supported. Other items are ignored. If you don't specify any item to be searched, still no errors occur but the return value of the function can be unpredictable. If searching in a pointer array and the comparing function is not passed a compiler or runtime error is not given either, but the return value of the function can be unpredictable

Returns

The index of the first occurence of the key in the array or the return code of the function

Return values

KEY_NOT_FOUND	The key was not found

5.3.2.6 chooseQuickSortArr()

```
void chooseQuickSortArr (
            const spec_t spec,
            void * arr,
            int size,
             ...  )
```

Quick sort for arrays.

Parameters

spec	Type specifier of the array to be sorted. Refer to spec_t for supported types
arr	Pointer to the first element of the array to be sorted
size	Number of elements of the array to be sorted
...	The comparison function needed to compare items inside given lists. This parameter is necessary only for pointer ArrayList type and is ignored otherwise. Must be a function that takes two pointers as argument and returns a positive int if the item pointed by the first argument is greater than the item pointed by the second argument, a negative int if the item pointed by the first argument is is smaller than the item pointed by second, a zero int if the item pointed by first and second arguments are equal

5.3.2.7 doubleBubbleSortArr()

```
void doubleBubbleSortArr (
            double * arr,
            unsigned int size )
```

Bubblesort for arrays of doubles.

Equivalent to `chooseBubbleSortArr("%lf", arr, size)`. Refer to chooseBubbleSortArr()

5.3.2.8 doubleLinearSearchArr()

```
int doubleLinearSearchArr (
            const char * arr,
            int size,
            double key )
```

Linear search for arrays of doubles.

Equivalent to `chooseLinearSearchArr("%lf", arr, size, key)`. Refer to chooseLinearSearchArr()

5.3.2.9 doubleQuickSortArr()

```
void doubleQuickSortArr (
            double * arr,
            int size )
```

Quicksort for arrays of doubles.

Equivalent to `chooseQuickSortArr("%lf", arr, size)`. Refer to chooseQuickSortArr()

5.3.2.10 floatBubbleSortArr()

```
void floatBubbleSortArr (
            float * arr,
            unsigned int size )
```

Bubblesort for arrays of floats.

Equivalent to `chooseBubbleSortArr("%f", arr, size)`. Refer to chooseBubbleSortArr()

5.3.2.11 floatLinearSearchArr()

```
int floatLinearSearchArr (
            const char * arr,
            int size,
            float key )
```

Linear search for arrays of floats.

Equivalent to `chooseLinearSearchArr("%f", arr, size, key)`. Refer to chooseLinearSearchArr()

5.3.2.12 floatQuickSortArr()

```
void floatQuickSortArr (
            float * arr,
            int size )
```

Quicksort for arrays of floats.

Equivalent to `chooseQuickSortArr("%f", arr, size)`. Refer to chooseQuickSortArr()

5.3.2.13 intBubbleSortArr()

```
void intBubbleSortArr (
            int * arr,
            unsigned int size )
```

Bubblesort for arrays of ints.

Equivalent to `chooseBubbleSortArr("%i", arr, size)`. Refer to chooseBubbleSortArr()

5.3.2.14 intLinearSearchArr()

```
int intLinearSearchArr (
            const char * arr,
            int size,
            int key )
```

Linear search for arrays of integers.

Equivalent to `chooseLinearSearchArr("%i", arr, size, key)`. Refer to chooseLinearSearchArr()

5.3.2.15 intQuickSortArr()

```
void intQuickSortArr (
            int * arr,
            int size )
```

Quicksort for arrays of ints.

Equivalent to `chooseQuickSortArr("%i", arr, size)`. Refer to chooseQuickSortArr()

5.3.2.16 printMatrix()

```
void printMatrix (
            const spec_t spec,
            const void * matrix,
            const unsigned int nRows,
            const unsigned int nColumns )
```

Print a matrix of specified size with specified formatting.

Parameters

spec	Type and format specifier used to print a cell. The printf() identifier and formatting convention is supported. See spec_t for details. Additional supported specifiers: `"%hi"` (numerical output for char)

Note

The format specifier must end with the letter of the type specifier. For example, `"%5.3lf"` is supported, `"%5.3lf\n"` or `"%5.3lfTest"` is not supported and nothing is printed

Parameters

matrix	Pointer to the first element of the matrix
nRows	Number of rows of the matrix
nColumns	Number of rows of the matrix

5.3.2.17 ptrBubbleSortArr()

```
void ptrBubbleSortArr (
            void ** arr,
            unsigned int size,
            int(*)(const void *a, const void *b) cmpFunc )
```

Bubblesort for arrays of pointers.

Parameters

arr	The array to be sorted
size	The number of items contained in arr
cmpFunc	The comparison function needed to compare items inside given lists. Must be a function that takes two pointers as argument and returns a positive int if the item pointed by the first argument is greater than the item pointed by the second argument, a negative int if the item pointed by the first argument is is smaller than the item pointed by second, a zero int if the item pointed by first and second arguments are equal

5.3.2.18 ptrLinearSearchArr()

```
int ptrLinearSearchArr (
            const void * arr,
            int size,
            void * key,
            int(*)(const void *a, const void *b) cmpFunc )
```

Linear search for arrays of pointers.

Parameters

arr	Pointer to the first element of the array to be inspected
size	Number of elements of the array to be inspected
key	The key to be searched
cmpFunc	The comparison function to be used. Must be a function that returns a positive int if first argument is greater than the second, a negative byte if first argument is smaller than the second, a zero byte if first and second arguments are equal

Returns

The index of the first occurence of the key in the array or the return code of the function

Return values

KEY_NOT_FOUND	The key was not found

5.3.2.19 ptrQuickSortArr()

```
void ptrQuickSortArr (
            void * arr,
            int size,
            int(*)(const void *a, const void *b) cmpFunc )
```

Quicksort for arrays of pointers.

Parameters

arr	The array to be sorted
size	The number of items contained in arr
cmpFunc	The comparison function to be used. Must be a function that returns a positive int if first argument is greater than the second, a negative byte if first argument is smaller than the second, a zero byte if first and second arguments are equal

5.4 arrays.h

Go to the documentation of this file.

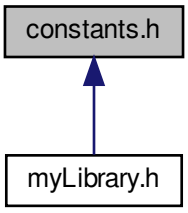
```
1
7 #ifndef SEEN_ARRAYS
8 #define SEEN_ARRAYS
9
10 #include "types.h"
11
12 // Do the pointer version for ArrayLists, LinkedLists, Stacks, Queues
13
21 void chooseBubbleSortArr(const spec_t spec, void *arr, unsigned int size, ...);
22
30 void chooseQuickSortArr(const spec_t spec, void *arr, int size, ...);
31
42 int chooseLinearSearchArr(const spec_t spec, const void *arr, int size, ...);
```

```
43
52 void printMatrix(const spec_t spec, const void *matrix, const unsigned int nRows, const unsigned int
       nColumns);
53
58 void charBubbleSortArr(char *arr, unsigned int size);
59
64 void intBubbleSortArr(int *arr, unsigned int size);
65
70 void floatBubbleSortArr(float *arr, unsigned int size);
71
76 void doubleBubbleSortArr(double *arr, unsigned int size);
77
84 void ptrBubbleSortArr(void **arr, unsigned int size, int (*cmpFunc)(const void *a, const void *b));
85
90 void charQuickSortArr(char *arr, int size);
91
96 void intQuickSortArr(int *arr, int size);
97
102 void floatQuickSortArr(float *arr, int size);
103
108 void doubleQuickSortArr(double *arr, int size);
109
116 void ptrQuickSortArr(void *arr, int size, int (*cmpFunc)(const void *a, const void *b));
117
122 int charLinearSearchArr(const char *arr, int size, char key);
123
128 int intLinearSearchArr(const char *arr, int size, int key);
129
134 int floatLinearSearchArr(const char *arr, int size, float key);
135
140 int doubleLinearSearchArr(const char *arr, int size, double key);
141
151 int ptrLinearSearchArr(const void *arr, int size, void *key, int (*cmpFunc)(const void *a, const void
       *b));
152
153 #endif
```

5.5 constants.h File Reference

Definition of symbolic constants used by the library.

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



Macros

- #define GREATER 1

  Returned by typeCmp() functions when first argument is grater than the second.
- #define EQUAL 0

  Returned by typeCmp() functions when first argument is equal to the second.
- #define SMALLER -1

Returned by typeCmp() functions when first argument is smaller than the second.

- #define TRUE 0xFF

  Bool value definition.

- #define FALSE 0

  Bool value definition.

- #define KEY_NOT_FOUND -1

  Returned by search functions of the library when key was not found.

5.5.1 Detailed Description

Definition of symbolic constants used by the library.

Author

Pietro Firpo (pietro.firpo@pm.me)

5.5.2 Macro Definition Documentation

5.5.2.1 EQUAL

```
#define EQUAL 0
```

Returned by *type*Cmp() functions when first argument is equal to the second.

5.5.2.2 FALSE

```
#define FALSE 0
```

Bool value definition.

5.5.2.3 GREATER

```
#define GREATER 1
```

Returned by *type*Cmp() functions when first argument is grater than the second.

5.5.2.4 KEY_NOT_FOUND

```
#define KEY_NOT_FOUND -1
```

Returned by search functions of the library when key was not found.

5.5.2.5 SMALLER

```
#define SMALLER -1
```

Returned by *type*Cmp() functions when first argument is smaller than the second.

5.5.2.6 TRUE

```
#define TRUE 0xFF
```

Bool value definition.

5.6 constants.h

Go to the documentation of this file.

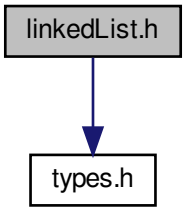
```
1
7 #ifndef SEEN_CONSTANTS
8 #define SEEN_CONSTANTS
9
13 #define GREATER 1
14
18 #define EQUAL 0
19
23 #define SMALLER -1
24
28 #define TRUE 0xFF
29
33 #define FALSE 0
34
38 #define KEY_NOT_FOUND -1
39
40 #endif
```

5.7 linkedList.h File Reference

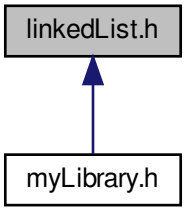
Functions for working with LinkedList type.

```
#include "types.h"
```

Include dependency graph for linkedList.h:



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



Functions

- LinkedList newLL (const spec_t spec)

  Allocate a new LinkedList of specified type.
- LinkedList chooseNewLLFromArray (const spec_t spec, const void ∗arr, unsigned int size)

  Create a LinkedList from an array.
- void printLL (const spec_t spec, const LinkedList list)

  Print contents from a LinkedList.
- void appendToLL (LinkedList list,...)

  Insert an item at the end of a LinkedList.
- void appendToLLFromPtr (LinkedList list, const void ∗element)

  Insert an item at the end of a LinkedList.
- void insertToLL (LinkedList list, unsigned int index,...)

  Insert an element at a specified position of a LinkedList.

- void deleteLL (LinkedList list)

  Delete a LinkedList.
- void getFromLL (LinkedList list, unsigned int index, void *dest)

  Get an item from a LinkedList.
- void setLLItem (LinkedList list, unsigned int index,...)

  Set value of an element of a LinkedList.
- void removeFromLL (LinkedList list, unsigned int index)

  Remove an item from a LinkedList.
- void mergeLL (LinkedList list1, const LinkedList list2)

  Merge two LinkedList.
- LinkedList newLLFromLL (const LinkedList list)

  Get a copy of a LinkedList.
- void sliceLL (LinkedList list, unsigned int begin, unsigned int end)

  Slice a LinkedList.
- int linearSearchLL (LinkedList list,...)

  Linear search for LinkedList.
- void * linearSearchLLPtr (LinkedList list,...)

  Linear search for LinkedList.
- byte areLLEqual (const LinkedList list1, const LinkedList list2)

  Compare two LinkedList.
- byte isInLL (LinkedList list,...)

  Detect if an element is inside a LinkedList.
- unsigned int getLLLength (const LinkedList list)

  Get the size of a LinkedList.
- LinkedList newLLFromCharArray (const char arr[ ], unsigned int size)

  Create a LinkedList from a array of chars.
- LinkedList newLLFromIntArray (const int arr[ ], unsigned int size)

  Create a LinkedList from a array of ints.
- LinkedList newLLFromFloatArray (const float arr[ ], unsigned int size)

  Create a LinkedList from a array of floats.
- LinkedList newLLFromDoubleArray (const double arr[ ], unsigned int size)

  Create a LinkedList from an array of doubles.
- LinkedList newLLFromPtrArray (const void *arr, unsigned int size)

  Create a LinkedList from an array of pointers.
- byte isLLEmpty (LinkedList list)

  Check if LinkedList is empty.

5.7.1 Detailed Description

Functions for working with LinkedList type.

Author

Pietro Firpo (pietro.firpo@pm.me)

5.7.2 Function Documentation

5.7.2.1 appendToLL()

```
void appendToLL (
            LinkedList list,
             ...  )
```

Insert an item at the end of a LinkedList.

Parameters

list	The LinkedList you want to append an item to
...	The item you want to append to `list`

Note

Even though appending more than one item for single call does not throw a compiler nor runtime error, only appending one item is supported. Other items are ignored and are not appended to `list`. If you don't specify any item to be appended, still no errors occur but the content of your LinkedList can be messed up

5.7.2.2 appendToLLFromPtr()

```
void appendToLLFromPtr (
            LinkedList list,
            const void * element )
```

Insert an item at the end of a LinkedList.

Parameters

list	The LinkedList you want to append an item to
element	Pointer to the item you want to append to `list`

5.7.2.3 areLLEqual()

```
byte areLLEqual (
            const LinkedList list1,
            const LinkedList list2 )
```

Compare two LinkedList.

Parameters

list1	The first LinkedList you want to compare
list2	The second LinkedList you want to compare

Returns

The result of the comparison

Return values

TRUE	`list1` and `list2` have equal type, equal length and equal contents
FALSE	`list1` and `list2` do not have equal type, equal length or equal contents

5.7.2.4 chooseNewLLFromArray()

```
LinkedList chooseNewLLFromArray (
            const spec_t spec,
            const void * arr,
            unsigned int size )
```

Create a LinkedList from an array.

Parameters

spec	The type specifier of the array passed. Refer to spec_t for supported types
arr	The array you want to create the LinkedList from
size	The number of items of `list`

Returns

A LinkedList containing the elements in `list` in the same order

5.7.2.5 deleteLL()

```
void deleteLL (
            LinkedList list )
```

Delete a LinkedList.

Parameters

list	The LinkedList you want to delete

5.7.2.6 getFromLL()

```
void getFromLL (
            LinkedList list,
```

```
            unsigned int index,
            void * dest )
```

Get an item from a LinkedList.

Parameters

list	The LinkedList you want to get an item from
index	The index of the item you want to get
dest	The address of the variable you want to store the item in

5.7.2.7 getLLLength()

```
unsigned int getLLLength (
            const LinkedList list )
```

Get the size of a LinkedList.

Parameters

list	The LinkedList you want to evaluate

Returns

The number of elements in `list`

5.7.2.8 insertToLL()

```
void insertToLL (
            LinkedList list,
            unsigned int index,
             ...  )
```

Insert an element at a specified position of a LinkedList.

Parameters

list	The LinkedList you want to insert an element into
index	The position you want to insert an element at
...	The item you want to insert into `list`

Note

Even though inserting more than one item for single call does not throw a compiler nor runtime error, only inserting one item is supported. Other items are ignored and are not inserted into `list`. If you don't specify any item to be inserted, still no errors occur but the content of your LinkedList can be messed up

5.7.2.9 isInLL()

```
byte isInLL (
             LinkedList list,
              ...  )
```

Detect if an element is inside a LinkedList.

Parameters

list	The LinkedList you want search in
...	The element you want to search

Note

Even though checking more than one item for single call does not throw a compiler nor runtime error, only checking one item is supported. Other items are ignored. If you don't specify any item to be checked, still no errors occur but the return value of the function can be unpredictable

Return values

TRUE	Given element is contained in `list`
FALSE	Given element is not contained in `list`

5.7.2.10 isLLEmpty()

```
byte isLLEmpty (
             LinkedList list )
```

Check if LinkedList is empty.

Parameters

list	The LinkedList to be checked

Return values

TRUE	`list` is empty
FALSE	`list` is not empty

5.7.2.11 linearSearchLL()

```
int linearSearchLL (
            LinkedList list,
             ...  )
```

Linear search for LinkedList.

Parameters

list	The LinkedList to be inspected
...	The key to be searched

Note

This function does not support float and double LinkedList types

Even though passing more than one key does not throw a compiler nor runtime error, only searching one item is supported. Other items are ignored. If you don't specify any item to be searched, still no errors occur but the return value of the function can be unpredictable

Returns

The index of the first occurence of the key in the list or the return code of the function

Return values

KEY_NOT_FOUND	The key was not found

5.7.2.12 linearSearchLLPtr()

```
void * linearSearchLLPtr (
            LinkedList list,
             ...  )
```

Linear search for LinkedList.

Parameters

list	The LinkedList to be inspected
...	The key to be searched

Note

This function does not support float and double LinkedList types

Even though passing more than one key does not throw a compiler nor runtime error, only searching one item is supported. Other items are ignored. If you don't specify any item to be searched, still no errors occur but the return value of the function can be unpredictable

Returns

A void pointer of the first occurence of the key in the list or the return code of the function

Return values

NULL	The key was not found

5.7.2.13 mergeLL()

```
void mergeLL (
            LinkedList list1,
            const LinkedList list2 )
```

Merge two LinkedList.

Parameters

list1	The first LinkedList to be merged, where the merged LinkedList is saved
list2	The second LinkedList to be merged

5.7.2.14 newLL()

```
LinkedList newLL (
            const spec_t spec )
```

Allocate a new LinkedList of specified type.

Parameters

spec	Type specifier of the LinkedList you want to create. Refer to spec_t for supported types

Returns

An empty LinkedList

5.7.2.15 newLLFromCharArray()

```
LinkedList newLLFromCharArray (
            const char arr[],
            unsigned int size )
```

Create a LinkedList from a array of chars.

Equivalent to `chooseNewLLFromArray("%c", arr, size)`. Refer to chooseNewLLFromArray()

5.7.2.16 newLLFromDoubleArray()

```
LinkedList newLLFromDoubleArray (
            const double arr[],
            unsigned int size )
```

Create a LinkedList from an array of doubles.

Equivalent to `chooseNewLLFromArray("%lf", arr, size)`. Refer to chooseNewLLFromArray()

5.7.2.17 newLLFromFloatArray()

```
LinkedList newLLFromFloatArray (
            const float arr[],
            unsigned int size )
```

Create a LinkedList from a array of floats.

Equivalent to `chooseNewLLFromArray("%f", arr, size)`. Refer to chooseNewLLFromArray()

5.7.2.18 newLLFromIntArray()

```
LinkedList newLLFromIntArray (
            const int arr[],
            unsigned int size )
```

Create a LinkedList from a array of ints.

Equivalent to `chooseNewLLFromArray("%i", arr, size)`. Refer to chooseNewLLFromArray()

5.7.2.19 newLLFromLL()

```
LinkedList newLLFromLL (
            const LinkedList list )
```

Get a copy of a LinkedList.

Parameters

list	The LinkedList you want to copy

Returns

A copy of `list`

5.7.2.20 newLLFromPtrArray()

```
LinkedList newLLFromPtrArray (
            const void * arr,
            unsigned int size )
```

Create a LinkedList from an array of pointers.

Equivalent to `chooseNewLLFromArray("%p", arr, size)`. Refer to chooseNewLLFromArray()

5.7.2.21 printLL()

```
void printLL (
            const spec_t spec,
            const LinkedList list )
```

Print contents from a LinkedList.

Parameters

spec	The type and format specifier you want to use to print the single element of the LinkedList. Use the `printf()` conventions
list	The LinkedList you want to print

5.7.2.22 removeFromLL()

```
void removeFromLL (
            LinkedList list,
            unsigned int index )
```

Remove an item from a LinkedList.

Parameters

list	The LinkedList you want to delete an item from
index	The index of the item you want to delete

5.7.2.23 setLLItem()

```
void setLLItem (
            LinkedList list,
            unsigned int index,
             ... )
```

Set value of an element of a LinkedList.

Parameters

list	The LinkedList you want to edit
index	The index of the element you want to change
...	The item you want to set the index-th element of `list` to

Note

Even though changing more than one item for single call does not throw a compiler nor runtime error, only setting one item is supported. Other items are ignored. If you don't specify any item to be inserted, still no errors occur but the content of your LinkedList can be messed up

5.7.2.24 sliceLL()

```
void sliceLL (
              LinkedList list,
              unsigned int begin,
              unsigned int end )
```

Slice a LinkedList.

Parameters

list	The LinkedList you want to slice, where the sliced LinkedList is saved
begin	The index of the beginning of the slice
end	The index of the end of the slice

5.8 linkedList.h

Go to the documentation of this file.

```
1
7 #ifndef SEEN_LINKEDLIST
8 #define SEEN_LINKEDLIST
9
10 #include "types.h"
11
17 LinkedList newLL(const spec_t spec);
18
26 LinkedList chooseNewLLFromArray(const spec_t spec, const void *arr, unsigned int size);
27
33 void printLL(const spec_t spec, const LinkedList list);
34
41 void appendToLL(LinkedList list, ...);
42
48 void appendToLLFromPtr(LinkedList list, const void *element);
49
57 void insertToLL(LinkedList list, unsigned int index, ...);
58
63 void deleteLL(LinkedList list);
64
71 void getFromLL(LinkedList list, unsigned int index, void *dest);
72
80 void setLLItem(LinkedList list, unsigned int index, ...);
81
87 void removeFromLL(LinkedList list, unsigned int index);
88
```

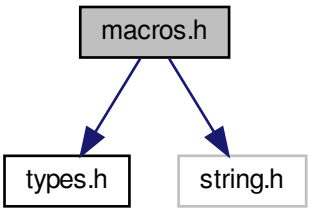
```
94 void mergeLL(LinkedList list1, const LinkedList list2);
95
101 LinkedList newLLFromLL(const LinkedList list);
102
109 void sliceLL(LinkedList list, unsigned int begin, unsigned int end);
110
120 int linearSearchLL(LinkedList list, ...);
121
131 void *linearSearchLLPtr(LinkedList list, ...);
132
141 byte areLLEqual(const LinkedList list1, const LinkedList list2);
142
151 byte isInLL(LinkedList list, ...);
152
158 unsigned int getLLLength(const LinkedList list);
159
164 LinkedList newLLFromCharArray(const char arr[], unsigned int size);
165
170 LinkedList newLLFromIntArray(const int arr[], unsigned int size);
171
176 LinkedList newLLFromFloatArray(const float arr[], unsigned int size);
177
182 LinkedList newLLFromDoubleArray(const double arr[], unsigned int size);
183
188 LinkedList newLLFromPtrArray(const void *arr, unsigned int size);
189
196 byte isLLEmpty(LinkedList list);
197
198 // TODO Sorting algorithms, currently available only for ArrayList
199
200 #endif
```

5.9 macros.h File Reference

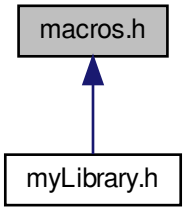
Macros for emulated overloading.

```
#include "types.h"
#include <string.h>
```

Include dependency graph for macros.h:



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



Macros

- #define cmpVal(a, b)

  Compare two values.
- #define bubbleSortArr(arr, size)

  BubbleSort for arrays.
- #define quickSortArr(arr, size, ...)

  Quicksort for arrays.
- #define newALFromArray(arr, size)

  Create an ArrayList from a static array.
- #define newLLFromArray(arr, size)

  Create a LinkedList from a static array.
- #define newStackFromArray(arr, size)

  Create a Stack from a static array.
- #define newQueueFromArray(arr, size)

  Create a Queue from a static array.
- #define newStackFromArray(arr, size)

  Create a Stack from a static array.
- #define print(spec, collection)

  Print contents from an ArrayList, LinkedList, Stack or Queue.
- #define areEqual(collection1, collection2)

  Compare two ArrayList, LinkedList, Stack or Queue.
- #define append(list, item)

  Insert an item at the end of an ArrayList or LinkedList.
- #define insert(list, index, item)

  Insert an element at a specified position of an ArrayList or LinkedList.
- #define set(list, index, newItem)

  Set value of an element of an ArrayList or LinkedList.
- #define merge(list1, list2)

  Merge two ArrayList or LinkedList.
- #define slice(list, begin, end)

  Slice an ArrayList or LinkedList.
- #define removeItem(list, index)

  Remove an item from an ArrayList or LinkedList.
- #define getItem(list, index, dest)

Get an item from an ArrayList or LinkedList.

- #define delete(collection)

  Delete an ArrayList, LinkedList, Stack or Queue.

- #define isIn(collection, item)

  Detect if an item is inside an ArrayList, LinkedList, Stack or Queue.

- #define getLength(collection)

  Get the number of elements in an ArrayList, LinkedList, Stack, Queue or string.

- #define linearSearch(list, key)

  Linear search for an ArrayList or LinkedList.

- #define deleteHead(collection)

  Delete current Stack or Queue head.

- #define isEmpty(collection)

  Check if an ArrayList, LinkedList, Stack or Queue is empty.

- #define peek(collection, dest)

  Get the item at the head of a Stack or Queue without popping/dequeueing it.

5.9.1 Detailed Description

Macros for emulated overloading.

Author

Pietro Firpo (pietro.firpo@pm.me)

Note

Many of these macros work on C11 or newer compilers only. If they are not supported by your compiler you have to use the function the macro expands to in your case. For example, if you want to bubblesort an array of floats and the macro bubbleSort() is not supported by your compiler, you have to call floatBubbleSortArr() or chooseBubbleSortArr(). Moreover, these macros don't work with pointer arrays, ArrayList, LinkedList, Stack or Queue type

In some development environments, for example Vscode, calls to these macros can be reported as errors even if they are correct. If you use Vscode you have to set `"C_Cpp.default.cStandard": "c17"` in your `settings.json` file in order to avoid these error reportings

5.9.2 Macro Definition Documentation

5.9.2.1 append

```
#define append(
              list,
              item )
```

Value:

```
_Generic(list, ArrayList          \
: appendToAL, LinkedList \
: appendToLL)(list, item)
```

Insert an item at the end of an ArrayList or LinkedList.

Parameters

list	The list you want to append an item to
item	The item you want to append to `list`

5.9.2.2 areEqual

```
#define areEqual(
              collection1,
              collection2 )
```

Value:

```
_Generic(collection1, ArrayList         \
: areALEqual, LinkedList \
: areLLEqual, Stack      \
: areStacksEqual, Queue  \
: areQueuesEqual)(collection1, collection2)
```

Compare two ArrayList, LinkedList, Stack or Queue.

Parameters

collection1	The first ArrayList, LinkedList, Stack or Queue you want to compare
collection2	The second ArrayList, LinkedList, Stack or Queue you want to compare

Note

Passing two different types (for example, an ArrayList and a Stack) does not throw errors but does not work and the result can be unpredictable

5.9.2.3 bubbleSortArr

```
#define bubbleSortArr(
              arr,
              size )
```

Value:

```
_Generic(arr, char *                \
: charBubbleSortArr, int *     \
: intBubbleSortArr, float *    \
: floatBubbleSortArr, double * \
: doubleBubbleSortArr, void ** \
: ptrBubbleSortArr)(arr, size)
```

BubbleSort for arrays.

Returns

The return code of the function called

Parameters

arr	Pointer to the array to be sorted
size	Number of elements in the array to be sorted

5.9.2.4 cmpVal

```
#define cmpVal(
              a,
              b )
```

Value:

```
_Generic((a, b), char *       \
: charCmp, int *     \
: intCmp, float *    \
: floatCmp, double * \
: doubleCmp, void ** \
: ptrCmp)(a, b)
```

Compare two values.

Parameters

a	Pointer to the first value to be compared
b	Pointer to the second value to be compared

Returns

The return code of the function called

Return values

GREATER	First element is grater than the second
EQUAL	First element is equal to the second
SMALLER	First element is smaller than the second

5.9.2.5 delete

```
#define delete(
              collection )
```

Value:

```
_Generic(collection, ArrayList         \
: deleteAL, LinkedList \
: deleteLL, Stack      \
: deleteStack, Queue   \
: deleteQueue)(collection)
```

Delete an ArrayList, LinkedList, Stack or Queue.

Parameters

collection	The ArrayList, LinkedList, Stack or Queue you want to delete

5.9.2.6 deleteHead

```
#define deleteHead(
              collection )
```

Value:

```
_Generic(list, Stack                  \
: deleteHeadFromStack, Queue \
: deleteHeadFromQueue)(collection)
```

Delete current Stack or Queue head.

Parameters

collection	The Stack or Queue you want to delete the head from

5.9.2.7 getItem

```
#define getItem(
              list,
              index,
              dest )
```

Value:

```
_Generic(list, ArrayList         \
: getFromAL, LinkedList \
: getFromLL)(list, index, dest)
```

Get an item from an ArrayList or LinkedList.

Parameters

list	The list you want to get an item from
index	The index of the item you want to get
dest	The address of the variable you want to store the item in

5.9.2.8 getLength

```
#define getLength(
              collection )
```

Value:

```
_Generic(collection, ArrayList          \
: getALLength, LinkedList \
: getLLLength, Stack      \
: getStackLength, Queue   \
: getQueueLength, string  \
: strlen)(collection)
```

Get the number of elements in an ArrayList, LinkedList, Stack, Queue or string.

Parameters

collection	The ArrayList, LinkedList, Stack, Queue or string you want to evaluate

Returns

The number of elements in `collection`

5.9.2.9 insert

```
#define insert(
              list,
              index,
              item )
```

Value:

```
_Generic(list, ArrayList          \
: insertToAL, LinkedList \
: insertToLL)(list, index, item)
```

Insert an element at a specified position of an ArrayList or LinkedList.

Parameters

list	The list you want to insert an element into
index	The position you want to insert an item at
item	The item you want to insert into `list`

5.9.2.10 isEmpty

```
#define isEmpty(
              collection )
```

Value:

```
_Generic(collection, ArrayList        \
: isALEmpty, LinkedList \
: isLLEmpty, Stack      \
: isStackEmpty, Queue   \
: isQueueEmpty)(collection, item)
```

Check if an ArrayList, LinkedList, Stack or Queue is empty.

Parameters

collection	The ArrayList, LinkedList, Stack or Queue to be checked

Return values

TRUE	`collection` is empty
FALSE	`collection` is not empty

5.9.2.11 isIn

```
#define isIn(
              collection,
              item )
```

Value:

```
                                _Generic(collection, ArrayList      \
                                : isInAL, LinkedList \
                                : isInLL, Stack      \
                                : isInStack, Queue   \
                                : isInQueue)(collection, item)
```

Detect if an item is inside an ArrayList, LinkedList, Stack or Queue.

Parameters

collection	The ArrayList, LinkedList, Stack or Queue you want search in
item	The item you want to search

Note

Passing float or double ArrayList, LinkedList, Stack or Queue is not supported

Return values

TRUE	Given item is contained in `collection`
FALSE	Given item is not contained in `collection`

5.9.2.12 linearSearch

```
#define linearSearch(
              list,
              key )
```

Value:

```
                                    _Generic(list, ArrayList            \
```

```
                                    : linearSearchAL, LinkedList \
                                    : linearSearchLL)(list, key)
```

Linear search for an ArrayList or LinkedList.

Parameters

list	The ArrayList or LinkedList to be inspected
key	The key to be searched

Note

This function does not support float and double LinkedList or ArrayList types

Returns

The index of the first occurence of the key in the list or the return code of the function called

Return values

KEY_NOT_FOUND	The key was not found

5.9.2.13 merge

```
#define merge(
              list1,
              list2 )
```

Value:

```
_Generic(list1, ArrayList      \
: mergeAL, LinkedList \
: mergeLL)(list1, list2)
```

Merge two ArrayList or LinkedList.

Parameters

list1	The first list to be merged, where the merged list is saved
list2	The second list to be merged

Note

Passing an ArrayList and a LinkedList does not throw errors but does not work and `list1` is messed up

5.9.2.14 newALFromArray

```
#define newALFromArray(
              arr,
              size )
```

Value:

```
_Generic(arr, char *                    \
: newALFromCharArray, int *     \
: newALFromIntArray, float *    \
: newALFromFloatArray, double * \
: newALFromDoubleArray, void ** \
: newALFromPtrArray)(arr, size)
```

Create an ArrayList from a static array.

Parameters

arr	The array you want to create an ArrayList from
size	The size of `arr`

Returns

An ArrayList containing all the elements of `arr`

5.9.2.15 newLLFromArray

```
#define newLLFromArray(
              arr,
              size )
```

Value:

```
_Generic(arr, char *                    \
: newLLFromCharArray, int *     \
: newLLFromIntArray, float *    \
: newLLFromFloatArray, double * \
: newLLFromDoubleArray, void ** \
: newLLFromPtrArray)(arr, size)
```

Create a LinkedList from a static array.

Parameters

arr	The array you want to create a LinkedList from
size	The size of `arr`

Returns

A LinkedList containing all the elements of `arr` in the same order

5.9.2.16 newQueueFromArray

```
#define newQueueFromArray(
              arr,
              size )
```

Value:

```
_Generic(arr, char *                        \
: newQueueFromCharArray, int *      \
: newQueueFromIntArray, float *     \
: newQueueFromFloatArray, double * \
: newQueueFromDoubleArray, void ** \
: newQueueFromPtrArray)(arr, size)
```

Create a Queue from a static array.

Parameters

arr	The array you want to create a Queue from
size	The size of `arr`

Returns

A Queue containing all the elements of `arr` with the first element of `arr` as head

5.9.2.17 newStackFromArray [1/2]

```
#define newStackFromArray(
              arr,
              size )
```

Value:

```
_Generic(arr, char *                        \
: newStackFromCharArray, int *      \
: newStackFromIntArray, float *     \
: newStackFromFloatArray, double * \
: newStackFromDoubleArray, void ** \
: newStackFromPtrArray)(arr, size)
```

Create a Stack from a static array.

Parameters

arr	The array you want to create a Stack from
size	The size of `arr`

Returns

A Stack containing all the elements of `arr` with the last element of `arr` as head

Parameters

arr	The array you want to create a Stack from
size	The size of `arr`

Returns

A Stack containing all the elements of `arr` with the first element of `arr` as head

5.9.2.18 newStackFromArray [2/2]

```
#define newStackFromArray(
              arr,
              size )
```

Value:

```
_Generic(arr, char *                          \
: newStackFromCharArray, int *      \
: newStackFromIntArray, float *     \
: newStackFromFloatArray, double * \
: newStackFromDoubleArray, void ** \
: newStackFromPtrArray)(arr, size)
```

Create a Stack from a static array.

Parameters

arr	The array you want to create a Stack from
size	The size of `arr`

Returns

A Stack containing all the elements of `arr` with the last element of `arr` as head

Parameters

arr	The array you want to create a Stack from
size	The size of `arr`

Returns

A Stack containing all the elements of `arr` with the first element of `arr` as head

5.9.2.19 peek

```
#define peek(
              collection,
              dest )
```

Value:

```
_Generic(list, Stack                  \
: peekStack, Queue \
: peekQueue)(collection)
```

Get the item at the head of a Stack or Queue without popping/dequeueing it.

Parameters

collection	The Stack or Queue you want to get the item from
dest	The address of the variable you want to store the item in

5.9.2.20 print

```
#define print(
              spec,
              collection )
```

Value:

```
_Generic(collection, ArrayList       \
: printAL, LinkedList \
: printLL, Stack      \
: printStack, Queue   \
: printQueue)(spec, collection)
```

Print contents from an ArrayList, LinkedList, Stack or Queue.

Parameters

spec	The type and format specifier you want to use to print the single element. Use the `printf()` conventions
collection	The ArrayList, LinkedList, Stack or Queue you want to print

5.9.2.21 quickSortArr

```
#define quickSortArr(
              arr,
              size,
              ...  )
```

Value:

```
_Generic(arr, char *                \
: charQuickSortArr, int *     \
: intQuickSortArr, float *    \
: floatQuickSortArr, double * \
: doubleQuickSortArr, void ** \
: ptrQuickSortArr)(arr, size, ...)
```

Quicksort for arrays.

Returns

The return code of the function called

Parameters

arr	Pointer to the array to be sorted
size	Number of elements in the array to be sorted

5.9.2.22 removeItem

```
#define removeItem(
              list,
              index )
```

Value:

```
_Generic(list, ArrayList           \
: removeFromAL, LinkedList \
: removeFromLL)(list, index)
```

Remove an item from an ArrayList or LinkedList.

Parameters

list	The list you want to delete an item from
index	The index of the item you want to delete

5.9.2.23 set

```
#define set(
              list,
              index,
              newItem )
```

Value:

```
_Generic(list, ArrayList         \
: setALItem, LinkedList \
: setLLItem)(list, index, newItem)
```

Set value of an element of an ArrayList or LinkedList.

Parameters

list	The list you want to edit
index	The index of the item you want to change
newItem	The item you want to set the index-th element of `list` to

5.9.2.24 slice

```
#define slice(
              list,
              begin,
              end )
```

Value:

```
_Generic(list, ArrayList       \
: sliceAL, LinkedList \
: sliceLL)(list, begin, end)
```

Slice an ArrayList or LinkedList.

Parameters

list	The list you want to slice, where the sliced list is saved
begin	The index of the beginning of the slice
end	The index of the end of the slice

5.10 macros.h

Go to the documentation of this file.

```
1
9 #ifndef SEEN_MACROS
10 #define SEEN_MACROS
11
12 #include "types.h"
13 #include <string.h>
14
24 #define cmpVal(a, b) _Generic((a, b), char *       \
25                               : charCmp, int *     \
26                               : intCmp, float *    \
27                               : floatCmp, double * \
28                               : doubleCmp, void ** \
29                               : ptrCmp)(a, b)
30
37 #define bubbleSortArr(arr, size) _Generic(arr, char *                \
38                                           : charBubbleSortArr, int *     \
39                                           : intBubbleSortArr, float *    \
40                                           : floatBubbleSortArr, double * \
41                                           : doubleBubbleSortArr, void ** \
42                                           : ptrBubbleSortArr)(arr, size)
43
50 #define quickSortArr(arr, size, ...) _Generic(arr, char *                \
51                                         : charQuickSortArr, int *     \
52                                         : intQuickSortArr, float *    \
53                                         : floatQuickSortArr, double * \
54                                         : doubleQuickSortArr, void ** \
55                                         : ptrQuickSortArr)(arr, size, ...)
56
63 #define newALFromArray(arr, size) _Generic(arr, char *                    \
64                                           : newALFromCharArray, int *     \
65                                           : newALFromIntArray, float *    \
66                                           : newALFromFloatArray, double * \
67                                           : newALFromDoubleArray, void ** \
68                                           : newALFromPtrArray)(arr, size)
69
76 #define newLLFromArray(arr, size) _Generic(arr, char *                    \
77                                           : newLLFromCharArray, int *     \
78                                           : newLLFromIntArray, float *    \
79                                           : newLLFromFloatArray, double * \
80                                           : newLLFromDoubleArray, void ** \
81                                           : newLLFromPtrArray)(arr, size)
82
89 #define newStackFromArray(arr, size) _Generic(arr, char *                        \
90                                             : newStackFromCharArray, int *     \
91                                             : newStackFromIntArray, float *    \
92                                             : newStackFromFloatArray, double * \
93                                             : newStackFromDoubleArray, void ** \
94                                             : newStackFromPtrArray)(arr, size)
95
102 #define newQueueFromArray(arr, size) _Generic(arr, char *                        \
103                                             : newQueueFromCharArray, int *     \
104                                             : newQueueFromIntArray, float *    \
105                                             : newQueueFromFloatArray, double * \
106                                             : newQueueFromDoubleArray, void ** \
107                                             : newQueueFromPtrArray)(arr, size)
108
115 #define newStackFromArray(arr, size) _Generic(arr, char *                        \
116                                             : newStackFromCharArray, int *     \
117                                             : newStackFromIntArray, float *    \
```

```
118                                         : newStackFromFloatArray, double * \
119                                         : newStackFromDoubleArray, void ** \
120                                         : newStackFromPtrArray)(arr, size)
121
127 #define print(spec, collection) _Generic(collection, ArrayList       \
128                                     : printAL, LinkedList \
129                                     : printLL, Stack      \
130                                     : printStack, Queue   \
131                                     : printQueue)(spec, collection)
132
139 #define areEqual(collection1, collection2) _Generic(collection1, ArrayList         \
140                                       : areALEqual, LinkedList \
141                                       : areLLEqual, Stack      \
142                                       : areStacksEqual, Queue  \
143                                       : areQueuesEqual)(collection1, collection2)
144
150 #define append(list, item) _Generic(list, ArrayList          \
151                                    : appendToAL, LinkedList \
152                                    : appendToLL)(list, item)
153
160 #define insert(list, index, item) _Generic(list, ArrayList          \
161                                           : insertToAL, LinkedList \
162                                           : insertToLL)(list, index, item)
163
170 #define set(list, index, newItem) _Generic(list, ArrayList         \
171                                           : setALItem, LinkedList \
172                                           : setLLItem)(list, index, newItem)
173
180 #define merge(list1, list2) _Generic(list1, ArrayList      \
181                                     : mergeAL, LinkedList \
182                                     : mergeLL)(list1, list2)
183
190 #define slice(list, begin, end) _Generic(list, ArrayList       \
191                                         : sliceAL, LinkedList \
192                                         : sliceLL)(list, begin, end)
193
199 #define removeItem(list, index) _Generic(list, ArrayList            \
200                                         : removeFromAL, LinkedList \
201                                         : removeFromLL)(list, index)
202
209 #define getItem(list, index, dest) _Generic(list, ArrayList         \
210                                           : getFromAL, LinkedList \
211                                           : getFromLL)(list, index, dest)
212
217 #define delete(collection) _Generic(collection, ArrayList         \
218                                    : deleteAL, LinkedList \
219                                    : deleteLL, Stack      \
220                                    : deleteStack, Queue   \
221                                    : deleteQueue)(collection)
222
231 #define isIn(collection, item) _Generic(collection, ArrayList      \
232                                       : isInAL, LinkedList \
233                                       : isInLL, Stack      \
234                                       : isInStack, Queue   \
235                                       : isInQueue)(collection, item)
236
242 #define getLength(collection) _Generic(collection, ArrayList           \
243                                      : getALLength, LinkedList \
244                                      : getLLLength, Stack      \
245                                      : getStackLength, Queue   \
246                                      : getQueueLength, string  \
247                                      : strlen)(collection)
248
257 #define linearSearch(list, key) _Generic(list, ArrayList              \
258                                         : linearSearchAL, LinkedList \
259                                         : linearSearchLL)(list, key)
260
265 #define deleteHead(collection) _Generic(list, Stack                  \
266                                       : deleteHeadFromStack, Queue \
267                                       : deleteHeadFromQueue)(collection)
268
275 #define isEmpty(collection) _Generic(collection, ArrayList         \
276                                    : isALEmpty, LinkedList \
277                                    : isLLEmpty, Stack      \
278                                    : isStackEmpty, Queue   \
279                                    : isQueueEmpty)(collection, item)
280
286 #define peek(collection, dest) _Generic(list, Stack                   \
287                                         : peekStack, Queue \
288                                         : peekQueue)(collection)
289 #endif
```

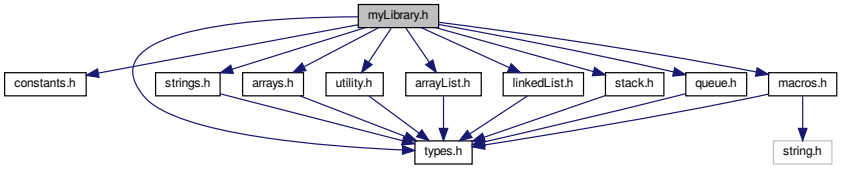
5.11 mainPage.md File Reference

5.12 myLibrary.h File Reference

Includes all other headers. Useful for rapid import.

```
#include "constants.h"
#include "macros.h"
#include "types.h"
#include "strings.h"
#include "arrays.h"
#include "utility.h"
#include "arrayList.h"
#include "linkedList.h"
#include "stack.h"
#include "queue.h"
```

Include dependency graph for myLibrary.h:



5.12.1 Detailed Description

Includes all other headers. Useful for rapid import.

Author

Pietro Firpo (pietro.firpo@pm.me)

5.13 myLibrary.h

Go to the documentation of this file.

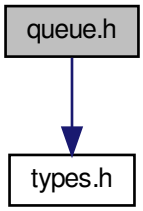
```
1
7 #include "constants.h"
8
9 #include "macros.h"
10
11 #include "types.h"
12
13 #include "strings.h"
14
15 #include "arrays.h"
16
17 #include "utility.h"
18
19 #include "arrayList.h"
20
21 #include "linkedList.h"
22
23 #include "stack.h"
24
25 #include "queue.h"
```

5.14 queue.h File Reference

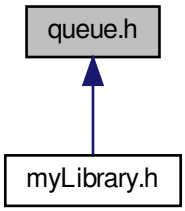
Functions for working with Queue type.

```
#include "types.h"
```

Include dependency graph for queue.h:



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



Functions

- Queue newQueue (const spec_t spec)

  Allocate a new Queue of specified type.
- void enqueue (Queue queue,...)

  Enqueue an item into a Queue.
- void dequeue (Queue queue, void ∗dest)

  Dequeue an item from a Queue.
- void printQueue (const spec_t spec, const Queue queue)

  Print contents from a Queue.
- unsigned int getQueueLength (const Queue queue)

  Get the size of a Queue.
- void deleteHeadFromQueue (Queue queue)

  Delete current Queue head.

- void peekQueue (const Queue queue, void *dest)

  Get the item in the head of a Queue without dequeueing it.
- void deleteQueue (Queue queue)

  Delete a Queue.
- byte isInQueue (Queue queue,...)

  Detect if an item is inside a Queue.
- Queue chooseNewQueueFromArray (const spec_t spec, const void *arr, unsigned int size)

  Create a Queue from an array.
- void enqueueFromPtr (Queue queue, const void *element)

  Enqueue an item into a Queue.
- byte isQueueEmpty (Stack stack)

  Check if Queue is empty.
- Queue newQueueFromCharArray (const char arr[ ], unsigned int size)

  Create a Queue from an array of chars.
- Queue newQueueFromIntArray (const int arr[ ], unsigned int size)

  Create a Queue from an array of integers.
- Queue newQueueFromFloatArray (const float arr[ ], unsigned int size)

  Create a Queue from an array of floats.
- Queue newQueueFromDoubleArray (const double arr[ ], unsigned int size)

  Create a Queue from an array of doubles.
- Queue newQueueFromPtrArray (const void *arr, unsigned int size)

  Create a Queue from an array of pointers.
- byte areQueuesEqual (const Queue queue1, const Queue queue2)

  Compare two Queue.

5.14.1 Detailed Description

Functions for working with Queue type.

Author

Pietro Firpo (pietro.firpo@pm.me)

5.14.2 Function Documentation

5.14.2.1 areQueuesEqual()

```
byte areQueuesEqual (
            const Queue queue1,
            const Queue queue2 )
```

Compare two Queue.

Parameters

queue1	The first Queue you want to compare
queue2	The second Queue you want to compare

Returns

The result of the comparison

Return values

TRUE	`Queue1` and `Queue2` have equal type and equal contents
FALSE	`Queue1` and `Queue2` do not have equal type or equal contents

5.14.2.2 chooseNewQueueFromArray()

```
Queue chooseNewQueueFromArray (
            const spec_t spec,
            const void * arr,
            unsigned int size )
```

Create a Queue from an array.

Parameters

spec	The type specifier of the array passed. Refer to spec_t for supported types
arr	The array you want to create a Queue from
size	The number of items in `arr`

Returns

A Queue containing the elements in `arr`, having the first element of `arr` as head

5.14.2.3 deleteHeadFromQueue()

```
void deleteHeadFromQueue (
            Queue queue )
```

Delete current Queue head.

Parameters

queue	The Queue you want to delete the head from

5.14.2.4 deleteQueue()

```
void deleteQueue (
            Queue queue )
```

Delete a Queue.

Parameters

queue	The Queue you want to delete

5.14.2.5 dequeue()

```
void dequeue (
             Queue queue,
             void * dest )
```

Dequeue an item from a Queue.

Parameters

queue	The Queue you want to dequeue from
dest	The address of the variable you want to store the dequeued item in

5.14.2.6 enqueue()

```
void enqueue (
             Queue queue,
              ...  )
```

Enqueue an item into a Queue.

Parameters

queue	The Queue you want to enqueue an item into
...	The item you want to enqueue into `queue`

Note

Even though enqueueing more than one item for single call does not throw a compiler nor runtime error, only enqueueing one item is supported. Other items are ignored and are not enqueued into `queue`. If you don't specify any item to be enqueued, still no errors occur but the content of your Queue can be messed up

5.14.2.7 enqueueFromPtr()

```
void enqueueFromPtr (
             Queue queue,
             const void * element )
```

Enqueue an item into a Queue.

Parameters

queue	The Queue you want to enqueue an item into
element	Pointer to the item you want to enqueue into `queue`

5.14.2.8 getQueueLength()

```
unsigned int getQueueLength (
             const Queue queue )
```

Get the size of a Queue.

Parameters

queue	The Queue you want to evaluate

Returns

The number of elements in `queue`

5.14.2.9 isInQueue()

```
byte isInQueue (
             Queue queue,
              ...  )
```

Detect if an item is inside a Queue.

Parameters

queue	The Queue you want search in
...	The element you want to search

Note

This function does not support float and double Queue types

Even though specifying more than one item for single call does not throw a compiler nor runtime error, only searching one item is supported. Other items are ignored. If you don't specify any item to be searched, still no errors occur but the return value of the function can be unpredictable

Return values

TRUE	Given element is contained in `queue`
FALSE	Given element is not contained in `queue`

5.14.2.10 isQueueEmpty()

```
byte isQueueEmpty (
            Stack stack )
```

Check if Queue is empty.

Parameters

stack	The Queue to be checked

Return values

TRUE	`queue` is empty
FALSE	`queue` is not empty

5.14.2.11 newQueue()

```
Queue newQueue (
            const spec_t spec )
```

Allocate a new Queue of specified type.

Parameters

spec	Type specifier of the Queue you want to create. Refer to spec_t for supported types

Returns

An empty Queue

5.14.2.12 newQueueFromCharArray()

```
Queue newQueueFromCharArray (
            const char arr[],
            unsigned int size )
```

Create a Queue from an array of chars.

Equivalent to `chooseNewQueueFromArray("%c", arr, size)`. Refer to chooseNewQueueFromArray()

5.14.2.13 newQueueFromDoubleArray()

```
Queue newQueueFromDoubleArray (
            const double arr[],
            unsigned int size )
```

Create a Queue from an array of doubles.

Equivalent to `chooseNewQueueFromArray("%lf", arr, size)`. Refer to chooseNewQueueFromArray()

5.14.2.14 newQueueFromFloatArray()

```
Queue newQueueFromFloatArray (
            const float arr[],
            unsigned int size )
```

Create a Queue from an array of floats.

Equivalent to `chooseNewQueueFromArray("%f", arr, size)`. Refer to chooseNewQueueFromArray()

5.14.2.15 newQueueFromIntArray()

```
Queue newQueueFromIntArray (
            const int arr[],
            unsigned int size )
```

Create a Queue from an array of integers.

Equivalent to `chooseNewQueueFromArray("%i", arr, size)`. Refer to chooseNewQueueFromArray()

5.14.2.16 newQueueFromPtrArray()

```
Queue newQueueFromPtrArray (
            const void * arr,
            unsigned int size )
```

Create a Queue from an array of pointers.

Equivalent to `chooseNewQueueFromArray("%p", arr, size)`. Refer to chooseNewQueueFromArray()

5.14.2.17 peekQueue()

```
void peekQueue (
            const Queue queue,
            void * dest )
```

Get the item in the head of a Queue without dequeueing it.

Parameters

queue	The Queue you want to get the item in the head from
dest	The address of the variable you want to store the item in

5.14.2.18 printQueue()

```
void printQueue (
            const spec_t spec,
            const Queue queue )
```

Print contents from a Queue.

Parameters

spec	The type and format specifier you want to use to print the single element of the Queue. Use the `printf()` conventions
queue	The Queue you want to print

5.15 queue.h

Go to the documentation of this file.

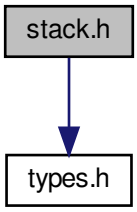
```
1
7 #ifndef SEEN_QUEUE
8 #define SEEN_QUEUE
9
10 #include "types.h"
11
17 Queue newQueue(const spec_t spec);
18
25 void enqueue(Queue queue, ...);
26
32 void dequeue(Queue queue, void *dest);
33
39 void printQueue(const spec_t spec, const Queue queue);
40
46 unsigned int getQueueLength(const Queue queue);
47
52 void deleteHeadFromQueue(Queue queue);
53
59 void peekQueue(const Queue queue, void *dest);
60
65 void deleteQueue(Queue queue);
66
76 byte isInQueue(Queue queue, ...);
77
85 Queue chooseNewQueueFromArray(const spec_t spec, const void *arr, unsigned int size);
86
92 void enqueueFromPtr(Queue queue, const void *element);
93
100 byte isQueueEmpty(Stack stack);
101
106 Queue newQueueFromCharArray(const char arr[], unsigned int size);
107
112 Queue newQueueFromIntArray(const int arr[], unsigned int size);
113
118 Queue newQueueFromFloatArray(const float arr[], unsigned int size);
119
124 Queue newQueueFromDoubleArray(const double arr[], unsigned int size);
125
130 Queue newQueueFromPtrArray(const void *arr, unsigned int size);
131
```

```
140 byte areQueuesEqual(const Queue queue1, const Queue queue2);
141
142 #endif
```

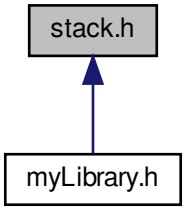
5.16 stack.h File Reference

Functions for working with Stack type.

`#include "types.h"`
Include dependency graph for stack.h:



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



Functions

- Stack newStack (const spec_t spec)

  Allocate a new Stack of specified type.
- void push (Stack stack,...)

  Push an item into a Stack.
- void printStack (const spec_t spec, const Stack stack)

  Print contents from a Stack.
- void pop (Stack stack, void ∗dest)

  Pop an item from a Stack.

- void deleteHeadFromStack (Stack stack)

  Delete current Stack head.
- byte isStackEmpty (Stack stack)

  Check if Stack is empty.
- void deleteStack (Stack stack)

  Delete a Stack.
- void peekStack (Stack stack, void *dest)

  Get the item at the head of a Stack without popping it.
- byte isInStack (Stack stack,...)

  Detect if an item is inside a Stack.
- Stack chooseNewStackFromArray (const spec_t spec, const void *arr, unsigned int size)

  Create a Stack from an array.
- void pushFromPtr (Stack stack, const void *element)

  Push an item into a Stack.
- unsigned int getStackLength (const Stack stack)

  Get the size of a Stack.
- Stack newStackFromCharArray (const char arr[ ], unsigned int size)

  Create a Stack from an array of chars.
- Stack newStackFromIntArray (const int arr[ ], unsigned int size)

  Create a Stack from an array of integers.
- Stack newStackFromFloatArray (const float arr[ ], unsigned int size)

  Create a Stack from an array of floats.
- Stack newStackFromDoubleArray (const double arr[ ], unsigned int size)

  Create a Stack from an array of doubles.
- Stack newStackFromPtrArray (const void *arr, unsigned int size)

  Create a Stack from an array of pointers.
- byte areStacksEqual (const Stack stack1, const Stack stack2)

  Compare two Stack.

5.16.1 Detailed Description

Functions for working with Stack type.

Author

Pietro Firpo (pietro.firpo@pm.me)

5.16.2 Function Documentation

5.16.2.1 areStacksEqual()

```
byte areStacksEqual (
            const Stack stack1,
            const Stack stack2 )
```

Compare two Stack.

Parameters

stack1	The first Stack you want to compare
stack2	The second Stack you want to compare

Returns

The result of the comparison

Return values

TRUE	`stack1` and `stack2` have equal type and equal contents
FALSE	`stack1` and `stack2` do not have equal type or equal contents

5.16.2.2 chooseNewStackFromArray()

```
Stack chooseNewStackFromArray (
            const spec_t spec,
            const void * arr,
            unsigned int size )
```

Create a Stack from an array.

Parameters

spec	The type specifier of the array passed. Refer to spec_t for supported types
arr	The array you want to create the Stack from
size	The number of items in `arr`

Returns

A Stack containing the elements in `arr`, having the last element of `arr` as head

5.16.2.3 deleteHeadFromStack()

```
void deleteHeadFromStack (
            Stack stack )
```

Delete current Stack head.

Parameters

stack	The Stack you want to delete the head from

5.16.2.4 deleteStack()

```
void deleteStack (
            Stack stack )
```

Delete a Stack.

Parameters

stack	The Stack you want to delete

5.16.2.5 getStackLength()

```
unsigned int getStackLength (
            const Stack stack )
```

Get the size of a Stack.

Parameters

stack	The Stack you want to evaluate

Returns

The number of elements in `stack`

5.16.2.6 isInStack()

```
byte isInStack (
            Stack stack,
             ...  )
```

Detect if an item is inside a Stack.

Parameters

stack	The Stack you want search in
...	The element you want to search

Note

This function does not support float and double Stack types

Even though specifying more than one item for single call does not throw a compiler nor runtime error, only searching one item is supported. Other items are ignored. If you don't specify any item to be searched, still no errors occur but the return value of the function can be unpredictable

Return values

TRUE	Given element is contained in `stack`
FALSE	Given element is not contained in `stack`

5.16.2.7 isStackEmpty()

```
byte isStackEmpty (
             Stack stack )
```

Check if Stack is empty.

Parameters

stack	The Stack to be checked

Return values

TRUE	`stack` is empty
FALSE	`stack` is not empty

5.16.2.8 newStack()

```
Stack newStack (
             const spec_t spec )
```

Allocate a new Stack of specified type.

Parameters

spec	Type specifier of the Stack you want to create. Refer to spec_t for supported types

Returns

An empty Stack

5.16.2.9 newStackFromCharArray()

```
Stack newStackFromCharArray (
            const char arr[],
            unsigned int size )
```

Create a Stack from an array of chars.

Equivalent to `chooseNewStackFromArray("%c", arr, size)`. Refer to chooseNewStackFromArray()

5.16.2.10 newStackFromDoubleArray()

```
Stack newStackFromDoubleArray (
            const double arr[],
            unsigned int size )
```

Create a Stack from an array of doubles.

Equivalent to `chooseNewStackFromArray("%lf", arr, size)`. Refer to chooseNewStackFromArray()

5.16.2.11 newStackFromFloatArray()

```
Stack newStackFromFloatArray (
            const float arr[],
            unsigned int size )
```

Create a Stack from an array of floats.

Equivalent to `chooseNewStackFromArray("%f", arr, size)`. Refer to chooseNewStackFromArray()

5.16.2.12 newStackFromIntArray()

```
Stack newStackFromIntArray (
            const int arr[],
            unsigned int size )
```

Create a Stack from an array of integers.

Equivalent to `chooseNewStackFromArray("%i", arr, size)`. Refer to chooseNewStackFromArray()

5.16.2.13 newStackFromPtrArray()

```
Stack newStackFromPtrArray (
            const void * arr,
            unsigned int size )
```

Create a Stack from an array of pointers.

Equivalent to `chooseNewStackFromArray("%p", arr, size)`. Refer to chooseNewStackFromArray()

5.16.2.14 peekStack()

```
void peekStack (
            Stack stack,
            void * dest )
```

Get the item at the head of a Stack without popping it.

Parameters

stack	The Stack you want to get the item
dest	The address of the variable you want to store the item in

5.16.2.15 pop()

```
void pop (
            Stack stack,
            void * dest )
```

Pop an item from a Stack.

Parameters

stack	The Stack you want to pop an item from
dest	The address of the variable you want to store the popped item in

5.16.2.16 printStack()

```
void printStack (
            const spec_t spec,
            const Stack stack )
```

Print contents from a Stack.

Parameters

spec	The type and format specifier you want to use to print the single element of the Stack. Use the `printf()` conventions
stack	The Stack you want to print

5.16.2.17 push()

```
void push (
            Stack stack,
             ...  )
```

Push an item into a Stack.

Parameters

stack	The Stack you want to push into
...	The item you want to push into `stack`

Note

Even though pushing more than one item for single call does not throw a compiler nor runtime error, only pushing one item is supported. Other items are ignored and are not pushed into `stack`. If you don't specify any item to be pushed, still no errors occur but the content of your Stack can be messed up

5.16.2.18 pushFromPtr()

```
void pushFromPtr (
            Stack stack,
            const void * element )
```

Push an item into a Stack.

Parameters

stack	The Stack you want to push an item into
element	Pointer to the item you want to push into `stack`

5.17 stack.h

Go to the documentation of this file.

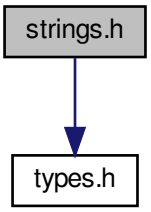
```
1
7 #ifndef SEEN_STACK
8 #define SEEN_STACK
9
10 #include "types.h"
11
17 Stack newStack(const spec_t spec);
18
25 void push(Stack stack, ...);
26
32 void printStack(const spec_t spec, const Stack stack);
33
39 void pop(Stack stack, void *dest);
40
45 void deleteHeadFromStack(Stack stack);
46
53 byte isStackEmpty(Stack stack);
54
59 void deleteStack(Stack stack);
60
66 void peekStack(Stack stack, void *dest);
67
77 byte isInStack(Stack stack, ...);
78
86 Stack chooseNewStackFromArray(const spec_t spec, const void *arr, unsigned int size);
87
93 void pushFromPtr(Stack stack, const void *element);
94
100 unsigned int getStackLength(const Stack stack);
101
106 Stack newStackFromCharArray(const char arr[], unsigned int size);
```

```
107
112 Stack newStackFromIntArray(const int arr[], unsigned int size);
113
118 Stack newStackFromFloatArray(const float arr[], unsigned int size);
119
124 Stack newStackFromDoubleArray(const double arr[], unsigned int size);
125
130 Stack newStackFromPtrArray(const void *arr, unsigned int size);
131
140 byte areStacksEqual(const Stack stack1, const Stack stack2);
141
142 #endif
```

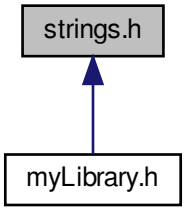
5.18 strings.h File Reference

Common tasks with strings.

`#include "types.h"`
Include dependency graph for strings.h:



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



Functions

- string getString ()

  Reads from terminal a string of arbitrary length.
- byte endsWith (const string str, const string suffix)

Check if a string ends with the specified substring.

- string changeLastCharacter (const string str, char newCharacter)

  Get a tring with different last character.

- string copyOf (const string src)

  Get a copy of the given string.

5.18.1 Detailed Description

Common tasks with strings.

Author

Pietro Firpo (pietro.firpo@pm.me)

5.18.2 Function Documentation

5.18.2.1 changeLastCharacter()

```
string changeLastCharacter (
            const string str,
            char newCharacter )
```

Get a tring with different last character.

Parameters

str	The string you want to change the last character
newCharacter	The character you want to set as last character

Returns

A pointer to a string with the same characters of `str` and newCharacter as last character or the return code of the function

Return values

NULL	Errors occurred during the execution of the function

5.18.2.2 copyOf()

```
string copyOf (
            const string src )
```

Get a copy of the given string.

Parameters

src	The string to be copied

Returns

A pointer to the copy of the given string

5.18.2.3 endsWith()

```
byte endsWith (
            const string str,
            const string suffix )
```

Check if a string ends with the specified substring.

Parameters

str	The string to be inspected
suffix	The string you want to check if `string` ends with

Returns

The return code of the function

Return values

TRUE	`str` ends with `suffix`
FALSE	`str` does not end with `suffix`

5.18.2.4 getString()

```
string getString ( )
```

Reads from terminal a string of arbitrary length.

Returns

A char pointer to the first character of the string or the return code of the function

Return values

NULL	Errors occurred during the execution of the function

5.19 strings.h

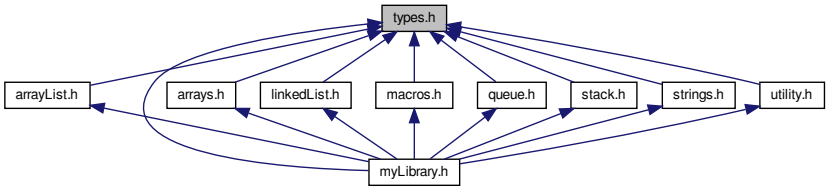
Go to the documentation of this file.

```
1
7 #ifndef SEEN_STRINGS
8 #define SEEN_STRINGS
9
10 #include "types.h"
11
17 string getString();
18
27 byte endsWith(const string str, const string suffix);
28
36 string changeLastCharacter(const string str, char newCharacter);
37
43 string copyOf(const string src);
44
45 #endif
```

5.20 types.h File Reference

Collection of useful types.

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



Data Structures

- struct ArrayList
  ArrayList type
- struct node
  Node type
- struct LinkedList
  LinkedList type
- struct Stack
  Stack type
- struct Queue
  Queue type

Typedefs

- typedef char byte
  Alias for char, just to avoid confusion with 8 bit numbers and ASCII characters.
- typedef char * spec_t
  Used to specify type of argument passed in functions that require a type specifier.
- typedef char * string
  *Alias for char *, used when an array of char is actually used as a string.*
- typedef struct node * Node
  Node type

5.20.1 Detailed Description

Collection of useful types.

Author

Pietro Firpo (pietro.firpo@pm.me)

5.20.2 Typedef Documentation

5.20.2.1 byte

```
typedef char byte
```

Alias for char, just to avoid confusion with 8 bit numbers and ASCII characters.

5.20.2.2 Node

```
typedef struct node * Node
```

Node type

Base component of every linked data type

Note

All the parameters in this structure must be intended as read-only. Manually modifying them can cause unknown and unwanted behavior

5.20.2.3 spec_t

```
typedef char* spec_t
```

Used to specify type of argument passed in functions that require a type specifier.

Supported specifiers: "%c" (char), "%i" (int), "%f" (float), "%lf" (double), "%p" (pointer)

Note

Some functions may not support some identifiers or may support additional identifiers. In those cases refer to that function documentation

5.20.2.4 string

```
typedef char* string
```

Alias for char *, used when an array of char is actually used as a string.

5.21 types.h

Go to the documentation of this file.

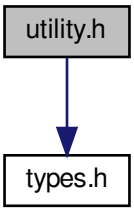
```
1
7 #ifndef SEEN_TYPES
8 #define SEEN_TYPES
9
13 typedef char byte;
14
20 typedef char *spec_t;
21
25 typedef char *string;
26
31 typedef struct {
35     spec_t type;
36
40     void *body;
41
45     unsigned int size;
46 } *ArrayList;
47
53 typedef struct node {
57     void *data;
58
62     struct node *linked;
63 } *Node;
64
69 typedef struct {
73     spec_t type;
74
78     Node head;
79
83     Node tail;
84
88     unsigned int size;
89 } *LinkedList;
90
95 typedef struct {
99     spec_t type;
100
104     Node head;
105 } *Stack;
106
111 typedef struct {
115     spec_t type;
116
120     Node head;
121
125     Node tail;
126
130     unsigned int size;
131 } *Queue;
132
133 #endif
```

5.22 utility.h File Reference

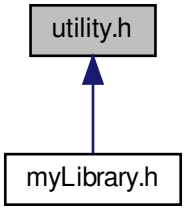
Common tasks such as comparing variables, allocate memory.

```
#include "types.h"
```

Include dependency graph for utility.h:



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



Functions

- int chooseCmp (const spec_t spec, const void *a, const void *b)
  Compare two values.
- int charCmp (const void *a, const void *b)
  Compare two chars.
- int byteCmp (const void *a, const void *b)
  Compare two bytes.
- int intCmp (const void *a, const void *b)
  Compare two ints.
- int floatCmp (const void *a, const void *b)
  Compare two floats.
- int doubleCmp (const void *a, const void *b)
  Compare two doubles.
- int ptrCmp (const void *a, const void *b)
  Compare two pointers.
- void * saferMalloc (unsigned int bytes)
  Return a pointer to a space in memory of specified size.
- void * saferRealloc (void *pointer, unsigned int bytes)
  Reallocate a space in memory.

5.22.1 Detailed Description

Common tasks such as comparing variables, allocate memory.

Author

Pietro Firpo (pietro.firpo@pm.me)

5.22.2 Function Documentation

5.22.2.1 byteCmp()

```
int byteCmp (
            const void * a,
            const void * b )
```

Compare two bytes.

Equivalent to `charCmp(a, b)`. Refer to charCmp().

5.22.2.2 charCmp()

```
int charCmp (
            const void * a,
            const void * b )
```

Compare two chars.

Equivalent to `chooseCmp("%c", a, b)`. Refer to chooseCmp()

5.22.2.3 chooseCmp()

```
int chooseCmp (
            const spec_t spec,
            const void * a,
            const void * b )
```

Compare two values.

Parameters

spec	Type specifier of the values to be compared. Refer to spec_t for supported types.
a	Pointer to the first element to be compared
b	Pointer to the second element to be compared

Returns

Constant for the corresponding comparation result

Return values

GREATER	First element is grater than the second
EQUAL	First element is equal to the second
SMALLER	First element is smaller than the second

5.22.2.4 doubleCmp()

```
int doubleCmp (
            const void * a,
            const void * b )
```

Compare two doubles.

Equivalent to `chooseCmp("%lf", a, b)`. Refer to chooseCmp()

5.22.2.5 floatCmp()

```
int floatCmp (
            const void * a,
            const void * b )
```

Compare two floats.

Equivalent to `chooseCmp("%f", a, b)`. Refer to chooseCmp()

5.22.2.6 intCmp()

```
int intCmp (
            const void * a,
            const void * b )
```

Compare two ints.

Equivalent to `chooseCmp("%i", a, b)`. Refer to chooseCmp()

5.22.2.7 ptrCmp()

```
int ptrCmp (
            const void * a,
            const void * b )
```

Compare two pointers.

Equivalent to `chooseCmp("%p", a, b)`. Refer to chooseCmp()

5.22.2.8 saferMalloc()

```
void * saferMalloc (
            unsigned int bytes )
```

Return a pointer to a space in memory of specified size.

Calls `malloc(bytes)` for a maximum of 10 times until it returns a not null pointer. If in 10 calls does not manage to obtain a not null pointer makes the program terminate

Parameters

bytes	Number of bytes to allocate

Returns

A pointer to the allocated memory

5.22.2.9 saferRealloc()

```
void * saferRealloc (
            void * pointer,
            unsigned int bytes )
```

Reallocate a space in memory.

Calls `realloc(pointer, bytes)` for a maximum of 10 times until it returns a not null pointer. If in 10 calls does not manage to obtain a not null pointer makes the program terminate

Parameters

pointer	Pointer to the memory to be reallocated
bytes	Number of bytes to allocate

Returns

A pointer to the allocated memory

5.23 utility.h

Go to the documentation of this file.

```
1
7 #ifndef SEEN_UTILITY
8 #define SEEN_UTILITY
9
10 #include "types.h"
11
22 int chooseCmp(const spec_t spec, const void *a, const void *b);
23
28 int charCmp(const void *a, const void *b);
29
34 int byteCmp(const void *a, const void *b);
35
40 int intCmp(const void *a, const void *b);
41
46 int floatCmp(const void *a, const void *b);
47
52 int doubleCmp(const void *a, const void *b);
53
58 int ptrCmp(const void *a, const void *b);
59
66 void *saferMalloc(unsigned int bytes);
67
75 void *saferRealloc(void *pointer, unsigned int bytes);
76
77 #endif
```

Index