

# libADT

An abstract data type library written in C.

# 1 Lists

Lists are an abstract data type which are used to store a collection of (often) related objects.

They can be ordered or unordered and are an example of a more general ADT called a 'container'. Functions for the list ADT include:

- Constructor - to instantiate a new list.
- Destructor - to remove an instance of a list from memory.
- Add - to add an item to the end of the list.
- Read - to read the value at a given index of the list into a variable.
- Remove - to remove an item in a list at a given index.
- Size - to return the number of items in the list.
- isEmpty - to return true if the list is empty, otherwise false.
- Search - to see if a given value exists within the list.
- Resize - resize the list as long as size is bigger.

## ArrayList

### Constructor(int size)

To instantiate a new ArrayList first define an List pointer.

Then instantiate it with the constructor method *listConst()*.

When calling the constructor pass the size of the ArrayList you want to make.

```
struct List* newList;  
newList = listConst(5); //Creates list of size 5
```

### Destructor(void)

To free a list from memory call the *listDest()* method and pass the list as an argument.

```
struct List* newList;  
newList = listConst();  
  
listDest(newList);
```

### **listAdd(struct List\* list, int entity)**

To add an item to the ArrayList use the *listAdd()* method and pass the list and item as arguments.

```
struct List* newList;  
newList = listConst();  
  
listAdd(newList, 3);  
//ArrayList now reads [3] + 0's for empty initialised indexes.
```

### **listRead(struct List\* list, int index, int\* var)**

To add an item to the ArrayList use the *listRead()* method and pass the list and item as arguments.

```
int var;  
int newList;  
listConst(newList);  
  
listRead(newList, 3, &var);  
  
printf("%d", var); //prints 3
```

### **listRem(struct List\* list, int entity)**

To remove an item from the ArrayList use the *listRem()* method and pass the list and index to remove item.

```
struct List* newList;  
newList = listConst();  
  
listAdd(newList, 3); newList = [3]  
listRem(newList, 1); //Removes 3 from list.
```

Objects will cascade down ArrayLists when removed too.

```
struct List* newList;  
newList = listConst();  
  
listAdd(newList, 5);  
listAdd(newList, 1);  
listAdd(newList, 3);  
  
//List reads [5,1,3] + '0's for empty initialised indexes.  
  
listRem(newList, 1); //Removes '1' from index 1 of list.  
  
//List now reads [5,3] + '0's for empty initialised index.
```

### **listPrint(struct List\* list)**

The *listPrint()* method prints all the values that have been added to the list in square brackets.

```
struct List* newList;  
newList = listConst(5);  
  
listAdd(newList, 3);  
listAdd(newList, 2);  
  
listPrint(newList); //prints [3 2]
```

### **listPrintAll(struct List\* list)**

The *listPrintAll()* method prints the value contained at all indexes. Even ones not yet occupied.

```
struct List* newList;  
newList = listConst(5);  
  
listPrintAll(newList); //prints [0 0 0 0 0]  
  
listAdd(newList, 2);  
  
listPrint(newList); //prints [2]  
listPrintAll(newList); //prints [2 0 0 0 0]
```

### **listSize(struct List\* list)**

To get the number of items currently stored in the ArrayList use the *listSize()* method.

```
struct List* newList;  
newList = listConst();  
  
for(int i=0; i<5; i++)  
{  
    listAdd(newList, i);  
}  
  
printf("%d", listSize(newList)); //prints 5
```

### **listIsEmpty(struct List\* list)**

The *listIsEmpty()* method returns 1 if the ArrayList is empty otherwise 0.

```
struct List* newList;  
newList = listConst();  
  
print("%d", listIsEmpty(newList)); //prints 1  
  
listAdd(newList, 5); //newList = [5]  
  
print("%d", listIsEmpty(newList)); //prints 0
```

### **listResize(struct List\* list, int size)**

Resizes an ArrayList.

If the size chosen is greater than the number of items in the ArrayList, the extra space is initialised with zeroes.

```
struct list* newList;  
newList = listConst(5);  
  
for(int i=0; i<5; i++)  
{  
    listAdd(1,i);  
}  
  
listPrintAll(newList); //prints [0 1 2 3 4]  
  
listResize(10);  
listPrintAll(newList); //prints [0 1 2 3 4 0 0 0 0 0]  
  
listResize(7);  
listPrintAll(newList) //prints [0 1 2 3 4 0 0]  
  
listResize(newList, 1);  
listPrintAll(newList) //prints [0 1 2 3 4] - list isn't truncated.
```

If the size chose is lower than the number of indices occupied, the list will be resized to preserve occupied spaces.

That is to say that the *listResize()* does not truncate ArrayLists.

**listTruncate(struct List\* list, int size)**

The *listTruncate()* method operates in the same manner as the *listResize()* method except it wil truncate a list.

```
struct list* newList;  
    newList = listConst(5);  
  
    for(int i=0; i<5; i++)  
    {  
        listAdd(1,i);  
    }  
  
    listPrintAll(newList); //prints [0 1 2 3 4]  
  
    listResize(10);  
    listPrintAll(newList); //prints [0 1 2 3 4 0 0 0 0 0]  
  
    listResize(7);  
    listPrintAll(newList) //prints [0 1 2 3 4 0 0]  
  
    listTruncate(newList, 1);  
    listPrintAll(newList) //prints [0 ] - list has been truncated.
```

## Single Linked List

### Constructor()

A new SLL struct is instantiated via the *singleListConst()* method.

```
struct SingleList* list = singleListConst();
```

### Destructor()

A SLL is freed from memory using the *singleListDest()* method/

```
struct SingleList* list = singleListConst();  
singleListDest(list); // Frees list from memory
```

### singleListAdd()

To append an item to the end of the SLL.

```
struct SingleList* list = singleListConst();  
singleListAdd(list, 1); //List reads [1]  
singleListAdd(list, 3); //List reads [1,3]
```

### singleListAddFront()

To add an item to the front of the SLL.

```
struct SingleList* list = singleListConst();  
singleListAdd(list, 1); //List reads [1]  
singleListAdd(list, 3); //List reads [1,3]  
singleListAddFront(list, 2) //List reads [2, 1, 3]
```

### singleListRead()

To read an item at a given index into a variable.

```
int i;  
struct SingleList* list = singleListConst();  
  
singleListAdd(list, 3); //List reads [3]  
singleListAddFront(list, 2); //List reads [2, 3]  
  
singleListRead(list, 1, &i); //Value 3 is stored in variable i
```