Circular Linked List

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Chapter 1

Class Index

1.1 Class List

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

Chapter 2

File Index

2.1 File List

Here is a list of all files with brief descriptions:

Chapter 3

Class Documentation

3.1 CircularLinkedList< T > Class Template Reference

A circular singly linked list container.

`#include <circular_list.h>`

Classes

- class const_iterator

  Constant forward iterator for CircularLinkedList.
- class iterator

  Forward iterator for CircularLinkedList.

Public Member Functions

- CircularLinkedList ()

  Default constructor. Creates an empty CircularLinkedList.
- ~CircularLinkedList ()

  Destructor. Clears the list and releases memory.
- iterator begin ()

  Returns an iterator to the first element.
- iterator end ()

  Returns an iterator to one past the last element.
- const_iterator begin () const

  Returns a const_iterator to the first element.
- const_iterator end () const

  Returns a const_iterator to one past the last element.
- const_iterator cbegin () const

  Returns a const_iterator to the first element.
- const_iterator cend () const

  Returns a const_iterator to one past the last element.
- void push_front (const T &value)

  Inserts a new element at the front of the list.

- void pop_front ()

  Removes the first element of the list.
- T & front ()

  Accesses the first element.
- const T & front () const

  Accesses the first element (const version).
- bool empty () const

  Checks whether the list is empty.
- size_t size () const

  Returns the number of elements in the list.
- iterator insert_after (const iterator pos, const T &value)

  Inserts a new element after the given position.
- iterator erase_after (const iterator pos)

  Erases the element following the given position.
- void clear ()

  Clears the list, deleting all elements.
- CircularLinkedList (const CircularLinkedList &other)

  Copy constructor. Creates a deep copy of another CircularLinkedList.
- CircularLinkedList & operator= (const CircularLinkedList &other)

  Copy assignment operator. Replaces the contents with a copy of another list.
- bool operator== (const CircularLinkedList &other) const

  Equality comparison operator. Checks if two circular lists contain the same elements in the same order, accounting for circular rotation.
- bool operator!= (const CircularLinkedList &other) const

  Inequality comparison operator.

Friends

- class iterator

  Forward declaration of iterator classes as friends.
- class const_iterator

3.1.1 Detailed Description

template<typename T>
class CircularLinkedList< T >

A circular singly linked list container.

This class implements a circular singly linked list similar in interface to std::forward_list. The list elements are linked in a circle, where the last element points back to the head.

Template Parameters

T	Type of elements stored in the list.

3.1.2 Constructor & Destructor Documentation

3.1.2.1 CircularLinkedList() [1/2]

```
template<typename T >
CircularLinkedList< T >::CircularLinkedList ( )  [inline]
```

Default constructor. Creates an empty CircularLinkedList.

3.1.2.2 ~CircularLinkedList()

```
template<typename T >
CircularLinkedList< T >::~CircularLinkedList ( )  [inline]
```

Destructor. Clears the list and releases memory.

3.1.2.3 CircularLinkedList() [2/2]

```
template<typename T >
CircularLinkedList< T >::CircularLinkedList (
            const CircularLinkedList< T > & other )  [inline]
```

Copy constructor. Creates a deep copy of another CircularLinkedList.

Parameters

other	The list to copy from.

3.1.3 Member Function Documentation

3.1.3.1 begin() [1/2]

```
template<typename T >
iterator CircularLinkedList< T >::begin ( )  [inline]
```

Returns an iterator to the first element.

Returns

iterator pointing to the head element.

3.1.3.2 begin() [2/2]

```
template<typename T >
const_iterator CircularLinkedList< T >::begin ( ) const  [inline]
```

Returns a const_iterator to the first element.

Returns

const_iterator pointing to the head element.

3.1.3.3 cbegin()

```
template<typename T >
const_iterator CircularLinkedList< T >::cbegin ( ) const  [inline]
```

Returns a const_iterator to the first element.

Returns

const_iterator pointing to the head element.

3.1.3.4 cend()

```
template<typename T >
const_iterator CircularLinkedList< T >::cend ( ) const  [inline]
```

Returns a const_iterator to one past the last element.

Returns

const_iterator representing the end of the list.

3.1.3.5 clear()

```
template<typename T >
void CircularLinkedList< T >::clear ( )  [inline]
```

Clears the list, deleting all elements.

3.1.3.6 empty()

```
template<typename T >
bool CircularLinkedList< T >::empty ( ) const  [inline]
```

Checks whether the list is empty.

Returns

True if the list contains no elements.

3.1.3.7 end() [1/2]

```
template<typename T >
iterator CircularLinkedList< T >::end ( )  [inline]
```

Returns an iterator to one past the last element.

Returns

iterator representing the end of the list.

3.1.3.8 end() [2/2]

```
template<typename T >
const_iterator CircularLinkedList< T >::end ( ) const  [inline]
```

Returns a const_iterator to one past the last element.

Returns

const_iterator representing the end of the list.

3.1.3.9 erase_after()

```
template<typename T >
iterator CircularLinkedList< T >::erase_after (
            const iterator pos )  [inline]
```

Erases the element following the given position.

Parameters

pos	Iterator pointing to the element before the one to erase.

Returns

Iterator pointing to the element following the erased element.

Exceptions

std::invalid_argument	if pos is invalid or nothing to erase.

3.1.3.10 front() [1/2]

```
template<typename T >
T& CircularLinkedList< T >::front ( )  [inline]
```

Accesses the first element.

Returns

Reference to the first element's value.

Exceptions

std::out_of_range	if the list is empty.

3.1.3.11 front() [2/2]

```
template<typename T >
const T& CircularLinkedList< T >::front ( ) const  [inline]
```

Accesses the first element (const version).

Returns

Const reference to the first element's value.

Exceptions

std::out_of_range	if the list is empty.

3.1.3.12 insert_after()

```
template<typename T >
iterator CircularLinkedList< T >::insert_after (
            const iterator pos,
            const T & value )  [inline]
```

Inserts a new element after the given position.

Parameters

pos	Iterator pointing to the element after which to insert.
value	Value to insert.

Returns

Iterator pointing to the newly inserted element.

Exceptions

std::invalid_argument	if pos is invalid or end iterator.

3.1.3.13 operator"!=()

```
template<typename T >
bool CircularLinkedList< T >::operator!= (
            const CircularLinkedList< T > & other ) const  [inline]
```

Inequality comparison operator.

Parameters

other	The list to compare with.

Returns

True if lists are not equal.

3.1.3.14 operator=()

```
template<typename T >
CircularLinkedList& CircularLinkedList< T >::operator= (
            const CircularLinkedList< T > & other )  [inline]
```

Copy assignment operator. Replaces the contents with a copy of another list.

Parameters

other	The list to copy from.

Returns

Reference to this list.

3.1.3.15 operator==()

```
template<typename T >
bool CircularLinkedList< T >::operator== (
            const CircularLinkedList< T > & other ) const  [inline]
```

Equality comparison operator. Checks if two circular lists contain the same elements in the same order, accounting for circular rotation.

Parameters

other	The list to compare with.

Returns

True if lists are equal.

3.1.3.16 pop_front()

```
template<typename T >
void CircularLinkedList< T >::pop_front ( )  [inline]
```

Removes the first element of the list.

Exceptions

std::out_of_range	if the list is empty.

3.1.3.17 push_front()

```
template<typename T >
void CircularLinkedList< T >::push_front (
            const T & value )  [inline]
```

Inserts a new element at the front of the list.

Parameters

value	Value to insert.

3.1.3.18 size()

```
template<typename T >
size_t CircularLinkedList< T >::size ( ) const  [inline]
```

Returns the number of elements in the list.

Returns

Size of the list.

3.1.4 Friends And Related Function Documentation

3.1.4.1 const_iterator

```
template<typename T >
friend class const_iterator  [friend]
```

3.1.4.2 iterator

```
template<typename T >
friend class iterator  [friend]
```

Forward declaration of iterator classes as friends.

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

- circular_list.h

3.2 CircularLinkedList< T >::const_iterator Class Reference

Constant forward iterator for CircularLinkedList.

```
#include <circular_list.h>
```

Public Types

- using iterator_category = std::forward_iterator_tag
- using difference_type = std::ptrdiff_t
- using value_type = const T
- using pointer = const T ∗
- using reference = const T &

Public Member Functions

- const_iterator (const Element ∗elem, const Element ∗head, bool end)

  Constructs a const_iterator.
- ∼const_iterator ()=default
- const_iterator (const const_iterator &)=default
- const_iterator & operator= (const const_iterator &)=default
- const T & operator∗ () const

  Dereference operator.
- const T ∗ operator-> () const

  Member access operator.
- const_iterator & operator++ ()

  Pre-increment operator. Advances the iterator to the next element.
- const_iterator operator++ (int)

  Post-increment operator. Advances the iterator but returns the previous state.
- bool operator== (const const_iterator &other) const

  Equality comparison.
- bool operator!= (const const_iterator &other) const

  Inequality comparison.

Friends

- class CircularLinkedList

3.2.1 Detailed Description

template<typename T>
class CircularLinkedList< T >::const_iterator

Constant forward iterator for CircularLinkedList.

Provides read-only access to list elements.

3.2.2 Member Typedef Documentation

3.2.2.1 difference_type

```
template<typename T >
using CircularLinkedList< T >::const_iterator::difference_type = std::ptrdiff_t
```

3.2.2.2 iterator_category

```
template<typename T >
using CircularLinkedList< T >::const_iterator::iterator_category = std::forward_iterator_tag
```

3.2.2.3 pointer

```
template<typename T >
using CircularLinkedList< T >::const_iterator::pointer = const T*
```

3.2.2.4 reference

```
template<typename T >
using CircularLinkedList< T >::const_iterator::reference = const T&
```

3.2.2.5 value_type

```
template<typename T >
using CircularLinkedList< T >::const_iterator::value_type = const T
```

3.2.3 Constructor & Destructor Documentation

3.2.3.1 const_iterator() [1/2]

```
template<typename T >
CircularLinkedList< T >::const_iterator::const_iterator (
            const Element * elem,
            const Element * head,
            bool end )  [inline]
```

Constructs a const_iterator.

Parameters

elem	Pointer to current element.
head	Pointer to the head element of the list.
end	Flag indicating if this is the end iterator.

3.2.3.2 ~const_iterator()

```
template<typename T >
CircularLinkedList< T >::const_iterator::~const_iterator ( )  [default]
```

3.2.3.3 const_iterator() [2/2]

```
template<typename T >
CircularLinkedList< T >::const_iterator::const_iterator (
            const const_iterator &  )  [default]
```

3.2.4 Member Function Documentation

3.2.4.1 operator"!=()

```
template<typename T >
bool CircularLinkedList< T >::const_iterator::operator!= (
            const const_iterator & other ) const  [inline]
```

Inequality comparison.

Parameters

other	Iterator to compare with.

Returns

True if iterators differ.

3.2.4.2 operator*()

```
template<typename T >
const T& CircularLinkedList< T >::const_iterator::operator* ( ) const  [inline]
```

Dereference operator.

Returns

Const reference to the value of the current element.

Exceptions

std::out_of_range	if iterator is invalid or at end.

3.2.4.3 operator++() [1/2]

```
template<typename T >
const_iterator& CircularLinkedList< T >::const_iterator::operator++ ( )  [inline]
```

Pre-increment operator. Advances the iterator to the next element.

Returns

Reference to the incremented iterator.

Exceptions

std::out_of_range	if iterator is invalid or at end.

3.2.4.4 operator++() [2/2]

```
template<typename T >
const_iterator CircularLinkedList< T >::const_iterator::operator++ (
            int  )  [inline]
```

Post-increment operator. Advances the iterator but returns the previous state.

Returns

Iterator before increment.

Exceptions

std::out_of_range	if iterator is invalid or at end.

3.2.4.5 operator->()

```
template<typename T >
const T* CircularLinkedList< T >::const_iterator::operator-> ( ) const  [inline]
```

Member access operator.

Returns

Const pointer to the value of the current element.

Exceptions

std::out_of_range	if iterator is invalid or at end.

3.2.4.6 operator=()

```
template<typename T >
const_iterator& CircularLinkedList< T >::const_iterator::operator= (
            const const_iterator &  )  [default]
```

3.2.4.7 operator==()

```
template<typename T >
bool CircularLinkedList< T >::const_iterator::operator== (
            const const_iterator & other ) const  [inline]
```

Equality comparison.

Parameters

other	Iterator to compare with.

Returns

True if both iterators point to the same element and end state.

3.2.5 Friends And Related Function Documentation

3.2.5.1 CircularLinkedList

```
template<typename T >
friend class CircularLinkedList  [friend]
```

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

- circular_list.h

3.3 CircularLinkedList< T >::iterator Class Reference

Forward iterator for CircularLinkedList.

```
#include <circular_list.h>
```

Public Types

- using iterator_category = std::forward_iterator_tag
- using difference_type = std::ptrdiff_t
- using value_type = T
- using pointer = T *
- using reference = T &

Public Member Functions

- iterator (Element *elem, Element *head, bool end)

  Constructs an iterator.
- ~iterator ()=default
- iterator (const iterator &)=default
- iterator & operator= (const iterator &)=default
- T & operator* () const

  Dereference operator.
- T * operator-> () const

  Member access operator.
- iterator & operator++ ()

  Pre-increment operator. Advances the iterator to the next element.
- iterator operator++ (int)

  Post-increment operator. Advances the iterator but returns the previous state.
- bool operator== (const iterator &other) const

  Equality comparison.
- bool operator!= (const iterator &other) const

  Inequality comparison.

Friends

- class CircularLinkedList

3.3.1 Detailed Description

template<typename T>
class CircularLinkedList< T >::iterator

Forward iterator for CircularLinkedList.

Supports traversal of the list from head to end (one past last element).

3.3.2 Member Typedef Documentation

3.3.2.1 difference_type

```
template<typename T >
using CircularLinkedList< T >::iterator::difference_type = std::ptrdiff_t
```

3.3.2.2 iterator_category

```
template<typename T >
using CircularLinkedList< T >::iterator::iterator_category = std::forward_iterator_tag
```

3.3.2.3 pointer

```
template<typename T >
using CircularLinkedList< T >::iterator::pointer = T*
```

3.3.2.4 reference

```
template<typename T >
using CircularLinkedList< T >::iterator::reference = T&
```

3.3.2.5 value_type

```
template<typename T >
using CircularLinkedList< T >::iterator::value_type = T
```

3.3.3 Constructor & Destructor Documentation

3.3.3.1 iterator() [1/2]

```
template<typename T >
CircularLinkedList< T >::iterator::iterator (
            Element * elem,
            Element * head,
            bool end )  [inline]
```

Constructs an iterator.

Parameters

elem	Pointer to current element.
head	Pointer to the head element of the list.
end	Flag indicating if this is the end iterator.

3.3.3.2 ~iterator()

```
template<typename T >
CircularLinkedList< T >::iterator::~iterator ( )  [default]
```

3.3.3.3 iterator() [2/2]

```
template<typename T >
CircularLinkedList< T >::iterator::iterator (
            const iterator &  )  [default]
```

3.3.4 Member Function Documentation

3.3.4.1 operator"!=()

```
template<typename T >
bool CircularLinkedList< T >::iterator::operator!= (
            const iterator & other ) const  [inline]
```

Inequality comparison.

Parameters

other	Iterator to compare with.

Returns

True if iterators differ.

3.3.4.2 operator*()

```
template<typename T >
T& CircularLinkedList< T >::iterator::operator* ( ) const  [inline]
```

Dereference operator.

Returns

Reference to the value of the current element.

Exceptions

std::out_of_range	if iterator is invalid or at end.

3.3.4.3 operator++() [1/2]

```
template<typename T >
iterator& CircularLinkedList< T >::iterator::operator++ ( )  [inline]
```

Pre-increment operator. Advances the iterator to the next element.

Returns

Reference to the incremented iterator.

Exceptions

std::out_of_range	if iterator is invalid or at end.

3.3.4.4 operator++() [2/2]

```
template<typename T >
```

```
iterator CircularLinkedList< T >::iterator::operator++ (
            int  )  [inline]
```

Post-increment operator. Advances the iterator but returns the previous state.

Returns

Iterator before increment.

Exceptions

std::out_of_range	if iterator is invalid or at end.

3.3.4.5 operator->()

```
template<typename T >
T* CircularLinkedList< T >::iterator::operator-> ( ) const  [inline]
```

Member access operator.

Returns

Pointer to the value of the current element.

Exceptions

std::out_of_range	if iterator is invalid or at end.

3.3.4.6 operator=()

```
template<typename T >
iterator& CircularLinkedList< T >::iterator::operator= (
            const iterator &  )  [default]
```

3.3.4.7 operator==()

```
template<typename T >
bool CircularLinkedList< T >::iterator::operator== (
            const iterator & other ) const  [inline]
```

Equality comparison.

Parameters

other	Iterator to compare with.

Returns

True if both iterators point to the same element and end state.

3.3.5 Friends And Related Function Documentation

3.3.5.1 CircularLinkedList

```
template<typename T >
friend class CircularLinkedList  [friend]
```

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

- circular_list.h

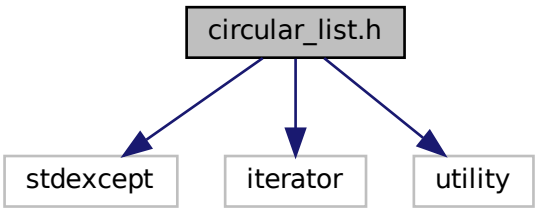
Chapter 4

File Documentation

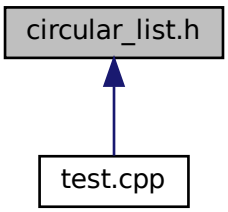
4.1 circular_list.h File Reference

```
#include <stdexcept>
#include <iterator>
#include <utility>
```

Include dependency graph for circular_list.h:



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



Classes

- class CircularLinkedList< T >

  A circular singly linked list container.
- class CircularLinkedList< T >::iterator

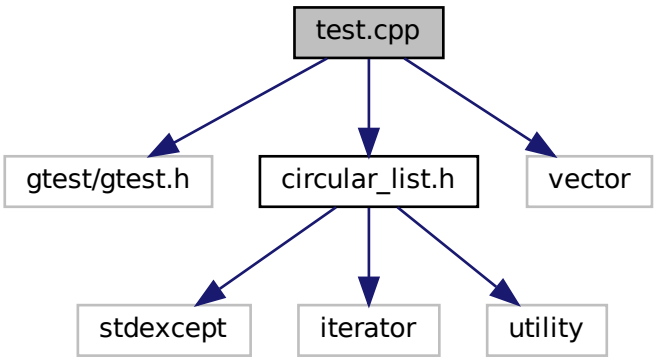
  Forward iterator for CircularLinkedList.
- class CircularLinkedList< T >::const_iterator

  Constant forward iterator for CircularLinkedList.

4.2 test.cpp File Reference

```
#include <gtest/gtest.h>
#include "circular_list.h"
#include <vector>
```

Include dependency graph for test.cpp:



Functions

- TEST (CircularLinkedListTest, DefaultConstructor)
- TEST (CircularLinkedListTest, PushFront)
- TEST (CircularLinkedListTest, PopFront)
- TEST (CircularLinkedListTest, Iterator)
- TEST (CircularLinkedListTest, ConstIterator)
- TEST (CircularLinkedListTest, InsertAfter)
- TEST (CircularLinkedListTest, EraseAfter)
- TEST (CircularLinkedListTest, Clear)
- TEST (CircularLinkedListTest, CopyConstructor)
- TEST (CircularLinkedListTest, Equality)
- int main (int argc, char **argv)

4.2.1 Function Documentation

4.2.1.1 main()

```
int main (
            int argc,
            char ** argv )
```

4.2.1.2 TEST() [1/10]

```
TEST (
            CircularLinkedListTest ,
            Clear  )
```

4.2.1.3 TEST() [2/10]

```
TEST (
            CircularLinkedListTest ,
            ConstIterator  )
```

4.2.1.4 TEST() [3/10]

```
TEST (
            CircularLinkedListTest ,
            CopyConstructor  )
```

4.2.1.5 TEST() [4/10]

```
TEST (
            CircularLinkedListTest ,
            DefaultConstructor  )
```

4.2.1.6 TEST() [5/10]

```
TEST (
            CircularLinkedListTest ,
            Equality  )
```

4.2.1.7 TEST() [6/10]

```
TEST (
            CircularLinkedListTest ,
            EraseAfter  )
```

4.2.1.8 TEST() [7/10]

```
TEST (
            CircularLinkedListTest ,
            InsertAfter  )
```

4.2.1.9 TEST() [8/10]

```
TEST (
            CircularLinkedListTest ,
            Iterator  )
```

4.2.1.10 TEST() [9/10]

```
TEST (
            CircularLinkedListTest ,
            PopFront  )
```

4.2.1.11 TEST() [10/10]

```
TEST (
            CircularLinkedListTest ,
            PushFront  )
```

Index