

Permutation Iterator

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Date: 2004-01-13
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abstract: The permutation iterator adaptor provides a permuted view of a given range. That is, the view includes every element of the given range but in a potentially different order.

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Introduction

The adaptor takes two arguments:

- an iterator to the range V on which the permutation will be applied
- the reindexing scheme that defines how the elements of V will be permuted.

Note that the permutation iterator is not limited to strict permutations of the given range V . The distance between begin and end of the reindexing iterators is allowed to be smaller compared to the size of the range V , in which case the permutation iterator only provides a permutation of a subrange of V . The indexes neither need to be unique. In this same context, it must be noted that the past the end permutation iterator is completely defined by means of the past-the-end iterator to the indices.

Reference

```
template< class ElementIterator
        , class IndexIterator
        , class ValueT          = use_default
        , class CategoryT       = use_default
        , class ReferenceT      = use_default
```

```

        , class DifferenceT = use_default >
class permutation_iterator
{
public:
    permutation_iterator();
    explicit permutation_iterator(ElementIterator x, IndexIterator y);

    template< class OEIter, class OI-
Iter, class V, class C, class R, class D >
    permutation_iterator(
        permutation_iterator<OEIter, OIIter, V, C, R, D> const& r
        , typename enable_if_convertible<OEIter, ElementIterator>::type* = 0
        , typename enable_if_convertible<OIIter, IndexIterator>::type* = 0
    );
    reference operator*() const;
    permutation_iterator& operator++();
    ElementIterator const& base() const;
private:
    ElementIterator m_elt;        // exposition only
    IndexIterator m_order;       // exposition only
};

template <class ElementIterator, class IndexIterator>
permutation_iterator<ElementIterator, IndexIterator>
make_permutation_iterator( ElementIterator e, IndexIterator i);

```

permutation_iterator requirements

`ElementIterator` shall model Random Access Traversal Iterator. `IndexIterator` shall model Readable Iterator. The value type of the `IndexIterator` must be convertible to the difference type of `ElementIterator`.

permutation_iterator models

`permutation_iterator` models the same iterator traversal concepts as `IndexIterator` and the same iterator access concepts as `ElementIterator`.

If `IndexIterator` models Single Pass Iterator and `ElementIterator` models Readable Iterator then `permutation_iterator` models Input Iterator.

If `IndexIterator` models Forward Traversal Iterator and `ElementIterator` models Readable Lvalue Iterator then `permutation_iterator` models Forward Iterator.

If `IndexIterator` models Bidirectional Traversal Iterator and `ElementIterator` models Readable Lvalue Iterator then `permutation_iterator` models Bidirectional Iterator.

If `IndexIterator` models Random Access Traversal Iterator and `ElementIterator` models Readable Lvalue Iterator then `permutation_iterator` models Random Access Iterator.

`permutation_iterator<E1, X, V1, C2, R1, D1>` is interoperable with `permutation_iterator<E2, Y, V2, C2, R2, D2>` if and only if `X` is interoperable with `Y` and `E1` is convertible to `E2`.

permutation_iterator operations

In addition to those operations required by the concepts that `permutation_iterator` models, `permutation_iterator` provides the following operations.

```
permutation_iterator();
```

Effects: Default constructs `m_elt` and `m_order`.

```
explicit permutation_iterator(ElementIterator x, IndexIterator y);
```

Effects: Constructs `m_elt` from `x` and `m_order` from `y`.

```
template< class OEIter, class OIIter, class V, class C, class R, class D >
permutation_iterator(
    permutation_iterator<OEIter, OIIter, V, C, R, D> const& r
    , typename enable_if_convertible<OEIter, ElementIterator>::type* = 0
    , typename enable_if_convertible<OIIter, IndexIterator>::type* = 0
    );
```

Effects: Constructs `m_elt` from `r.m_elt` and `m_order` from `y.m_order`.

```
reference operator*() const;
```

Returns: `*(m_elt + *m_order)`

```
permutation_iterator& operator++();
```

Effects: `++m_order`

Returns: `*this`

```
ElementIterator const& base() const;
```

Returns: `m_order`

```
template <class ElementIterator, class IndexIterator>
permutation_iterator<ElementIterator, IndexIterator>
make_permutation_iterator(ElementIterator e, IndexIterator i);
```

Returns: `permutation_iterator<ElementIterator, IndexIterator>(e, i)`

Example

```
using namespace boost;
int i = 0;

typedef std::vector< int > element_range_type;
typedef std::list< int > index_type;

static const int element_range_size = 10;
static const int index_size = 4;

element_range_type elements( element_range_size );
for(element_range_type::iterator el_it = elements.begin() ; el_it != elements.end() ; ++el_it)
    *el_it = std::distance(elements.begin(), el_it);

index_type indices( index_size );
for(index_type::iterator i_it = indices.begin() ; i_it != indices.end() ; ++i_it )
    *i_it = element_range_size -
index_size + std::distance(indices.begin(), i_it);
```

```

std::reverse( indices.begin(), indices.end() );

typedef permutation_iterator< element_range_type::iterator, in-
dex_type::iterator > permutation_type;
permutation_type begin = make_permutation_iterator( elements.begin(), in-
dices.begin() );
permutation_type it = begin;
permutation_type end = make_permutation_iterator( elements.begin(), in-
dices.end() );

std::cout << "The original range is : ";
std::copy( elements.begin(), ele-
ments.end(), std::ostream_iterator< int >( std::cout, " " ) );
std::cout << "\n";

std::cout << "The reindexing scheme is : ";
std::copy( indices.begin(), in-
dices.end(), std::ostream_iterator< int >( std::cout, " " ) );
std::cout << "\n";

std::cout << "The permuted range is : ";
std::copy( begin, end, std::ostream_iterator< int >( std::cout, " " ) );
std::cout << "\n";

std::cout << "Elements at even indices in the permutation : ";
it = begin;
for(i = 0; i < index_size / 2 ; ++i, it+=2 ) std::cout << *it << " ";
std::cout << "\n";

std::cout << "Permutation backwards : ";
it = begin + (index_size);
assert( it != begin );
for( ; it-- != begin ; ) std::cout << *it << " ";
std::cout << "\n";

std::cout << "Iterate backward with stride 2 : ";
it = begin + (index_size - 1);
for(i = 0 ; i < index_size / 2 ; ++i, it-=2 ) std::cout << *it << " ";
std::cout << "\n";

```

The output is:

```

The original range is : 0 1 2 3 4 5 6 7 8 9
The reindexing scheme is : 9 8 7 6
The permuted range is : 9 8 7 6
Elements at even indices in the permutation : 9 7
Permutation backwards : 6 7 8 9
Iterate backward with stride 2 : 6 8

```

The source code for this example can be found [here](#).