

# Maximum N elements

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## C++ 20

### C++ 20 Ranges Implementation

```
1 #include <algorithm> // ranges::partial_sort_copy
2 #include <ranges>    // views::iota, ranges::forward_range, ranges::borrowed_iterator_t
3 #include <vector>    // vector
4
5 /**
6  * @brief   Return a vector of iterators to the n largest elements of the given
7  *          range.
8  *
9  * @tparam R
10 *         The type of range.
11 * @param   range
12 *         The input range to find the largest elements in.
13 * @param   n
14 *         The number of largest elements to return.
15 *
16 * @return  Vector containing iterators to the n largest elements of the range.
17 */
18 template <std::ranges::forward_range R>
19 constexpr std::vector<std::ranges::borrowed_iterator_t<R>>
20 max_n_elements(R &&range, size_t n) {
21     // The iterator type of the input range
22     using iter_t = std::ranges::borrowed_iterator_t<R>;
23     // The range of iterators over the input range
24     auto iterators = std::views::iota(std::ranges::begin(range),
25                                     std::ranges::end(range));
26     // Vector of iterators to the largest n elements
27     std::vector<iter_t> result(n);
28     // Lambda function to compare two iterators: dereference them and compare
29     // their values
30     auto compare = [](iter_t it_a, iter_t it_b) { return *it_a > *it_b; };
31     // Sort the largest n elements of the input range, and store iterators to
32     // these elements to the result vector
33     std::ranges::partial_sort_copy(iterators, result, compare);
34     return result;
35 }
```

### C++ 20 Driver

```
37 #include <iostream>
38
39 int main() {
40     std::vector<int> v = {10, 12, 8, -5, 8, 3, -2, 1, 9, 12};
41     size_t n = 4;
42     auto max_elems = max_n_elements(v, n);
43     std::cout << "Largest elements:" << std::endl;
44     for (auto it : max_elems) {
45         auto idx = it - v.begin();
46         std::cout << "    [" << idx << "]:\t" << *it << std::endl;
47     }
48 }
```

```
Largest elements:
[1]: 12
[9]: 12
[0]: 10
[8]: 9
```

## C++ 11 Algorithms Implementation

```

1  #include <algorithm> // partial_sort_copy
2  #include <iterator>   // forward_iterator_tag
3  #include <vector>     // vector
4
5  /// Range iterator type, to iterate over ranges of iterators
6  template <class Iterator>
7  struct RangeIterator {
8      using value_type = Iterator;
9      using reference = const Iterator &;
10     using pointer = void;
11     using difference_type = ptrdiff_t;
12     using iterator_category = std::forward_iterator_tag;
13
14     value_type it;
15
16     RangeIterator(Iterator it) : it(it) {}
17     reference operator*() const { return it; };
18     RangeIterator &operator++() { return ++it, *this; };
19     RangeIterator operator++(int) { RangeIterator t = *this; ++it; return t; };
20     bool operator!=(RangeIterator other) const { return it != other.it; };
21     bool operator==(RangeIterator other) const { return it == other.it; };
22 };
23
24 /**
25  * @brief   Return a vector of iterators to the n largest elements of the given
26  *          range.
27  *
28  * @tparam  InputIt
29  *          The type of iterator over the input range.
30  * @param   first
31  *          The iterator to the beginning of the input range.
32  * @param   last
33  *          The iterator to the end of the input range.
34  * @param   n
35  *          The number of largest elements to return.
36  *
37  * @return  Vector containing iterators to the n largest elements of the range.
38  */
39 template <class InputIt>
40 constexpr std::vector<InputIt>
41 max_n_elements(InputIt first, InputIt last, size_t n) {
42     // An iterator over the iterators over the input range
43     using iter_iter_t = RangeIterator<InputIt>;
44     // Vector of iterators to the largest n elements
45     std::vector<InputIt> result(n);
46     // Lambda function to compare two iterators: dereference them and compare
47     // their values
48     auto compare = [](InputIt it_a, InputIt it_b) { return *it_a > *it_b; };
49     // Sort the largest n elements of the input range, and store iterators to
50     // these elements to the result vector
51     std::partial_sort_copy(iter_iter_t(first), iter_iter_t(last),
52                           std::begin(result), std::end(result),
53                           compare);
54     return result;
55 }

```

## C++ 11 Driver

```

57 #include <iostream>
58
59 int main() {
60     std::vector<int> v = {10, 12, 8, -5, 8, 3, -2, 1, 9, 12};
61     size_t n = 4;
62     auto max_elems = max_n_elements(v.begin(), v.end(), n);
63     std::cout << "Largest elements:" << std::endl;
64     for (auto it : max_elems) {
65         auto idx = it - v.begin();
66         std::cout << "  [" << idx << "]:\t" << *it << std::endl;
67     }
68 }

```

Largest elements:

```

[1]: 12
[9]: 12
[0]: 10
[8]: 9

```