

```

=== 演習1 解答例 =====
--- compile-and-run.txt ---
$ g++ -std=c++17 ex07-1.cpp
$ ./a.out
1, 2, 3, 4, 5
3, 5, 4, 6, 8
7, 4, 2, 1, 9
2, 6, 8

--- ex07-1.cpp ---
// print template function
#include <iostream>
#include <vector>
#include <deque>
#include <list>
#include <set>

template<typename T>
void print(const T& x)
{
    for (auto it = x.begin(); it != x.end(); ++it) {
        if (it != x.begin()) std::cout <<" ";
        std::cout << *it;
    }
    std::cout <<"\n";
}

int main()
{
    std::vector a {1,2,3,4,5};
    std::deque b {3,5,4,6,8};
    std::list c {7,4,2,1,9};
    std::set d {6,2,8,6,2};
    print(a); // 1, 2, 3, 4, 5
    print(b); // 3, 5, 4, 6, 8
    print(c); // 7, 4, 2, 1, 9
    print(d); // 2, 6, 8
}

```

```

=== 演習2 解答例 =====
--- compile-and-run.txt ---
$ g++ -std=c++17 ex07-2.cpp
$ ./a.out
9
3, 5, 2, 8, 10, 9, 6, 4
6
3, 5, 2, 8, 9, 7, 6, 4

--- ex07print.hpp ---
#include <iostream>
template<typename T>
void print(const T& x)
{
    for (auto it = x.begin(); it != x.end(); ++it) {
        if (it != x.begin()) std::cout << ", ";
        std::cout << *it;
    }
    std::cout << "\n";
}

--- ex07-2.cpp ---
#include <algorithm>
#include <vector>
#include <list>
#include "ex07print.hpp"

template<typename T>
void find_and_insert(T& c, int f, int in)
{
    auto it { std::find(c.begin(), c.end(), f) };
    if (it != c.end()) {
        std::cout << *it << "\n";
        c.insert(it, in);
    }
}

int main()
{
    std::list x {3,5,2,8,9,6,4};
    find_and_insert(x, 9, 10); // 9
    print(x); // 3, 5, 2, 8, 10, 9, 6, 4

    std::vector y {3,5,2,8,9,6,4};
    find_and_insert(y, 6, 7); // 6
    print(y); // 3, 5, 2, 8, 9, 7, 6, 4
}

```

=== 演習3 解答例 =====

--- compile-and-run.txt ---

\$ g++ -std=c++17 ex07-3.cpp

\$./a.out

5, 10, 3, 5, 10, 8, 5, 10, 5, 10, 4

--- ex07print.hpp ---

#include <iostream>

template<typename T>

void print(const T& x)

{

for (auto it = x.begin(); it != x.end(); ++it) {

if (it != x.begin()) std::cout << ", ";

std::cout << *it;

}

std::cout << "\n";

}

--- ex07-3.cpp ---

// insert

#include <vector>

#include "ex07print.hpp"

int main()

{

std::vector x {10,3,10,8,10,10,4};

// すべての10の前に5を挿入

for (auto it = x.begin(); it != x.end(); ++it) {

if (*it == 10) {

it = x.insert(it, 5); // 5のイテレータ

++ it; // 10のイテレータ

}

}

print(x);

// 5, 10, 3, 5, 10, 8, 5, 10, 5, 10, 4

}

=== 演習4 解答例 =====

--- compile-and-run.txt ---

\$ g++ -std=c++17 ex07-4.cpp

\$./a.out

5, 8, 6

--- ex07print.hpp ---

#include <iostream>

template<typename T>

void print(const T& x)

```
{
    for (auto it = x.begin(); it != x.end(); ++it) {
        if (it != x.begin()) std::cout << ", ";
        std::cout << *it;
    }
    std::cout << "\n";
}
```

}

--- ex07-4.cpp ---

// erase

#include <vector> // ex07-4.cpp

#include "ex07print.hpp"

int main()

```
{
    std::vector x {3,5,3,8,3,6,3};
    // すべての3を削除
    auto it { x.begin() };
    while (it != x.end()) {
        if (*it == 3)
            it = x.erase(it);
        else
            ++it;
    }
}
```

print(x); // 5, 8, 6

}

=== 演習5 解答例 =====

--- compile-and-run.txt ---

\$ g++ -std=c++17 ex07-5.cpp

\$./a.out

[xn,10][xn,5][xn,36][xn,24]

--- ex07-5.cpp ---

#include <iostream> // ex07-5.cpp

#include <map>

```
int main() {
    std::multimap<std::string,int> x
    { {"xn",10}, {"ya",5}, {"xn", 5}, {"zn",3},
      {"xn",36}, {"sa",5}, {"xn",24}, {"tn",3}};

    auto r { x.equal_range("xn") };
    for (auto it = r.first; it != r.second; ++it) {
        auto [k,v] {*it};
        std::cout << "[" << k << ", " << v << "]" << " ";
    }
    std::cout << "\n";
}
```

=== 演習6 解答例 =====

--- compile-and-run.txt ---

\$ g++ -std=c++17 ex07-6.cpp

\$./a.out

[d,24][e,10][f,36]

--- ex07-6.cpp ---

#include <iostream> // ex07-6.cpp

#include <map>

```
int main() {
    std::map<std::string,int> x
    { {"e",10}, {"a",5}, {"i", 5}, {"h",3},
      {"f",36}, {"b",5}, {"d",24}, {"g",3}};

    auto l {x.lower_bound("c")}; // "c"はない
    auto u {x.upper_bound("f")};
    for (auto it = l; it != u; ++it) {
        auto [k,v] {*it};
        std::cout <<"["<< k <<","<< v <<"]";
    }
    std::cout <<"\n"; // [d,24][e,10][f,36]
}
```

=== 演習7 解答例 =====

--- compile-and-run.txt ---

\$ g++ -std=c++17 ex07-7.cpp

\$./a.out

0:1 2:3 4:5 6:7 8:9

--- ex07-7.cpp ---

// advance/deference

#include <iostream>

#include <iterator>

#include <list>

int main()

{

std::list x {1,2,3,4,5,6,7,8,9,10};

for (auto it {x.begin()};

it !=x.end(); std::advance(it, 2)) {

std::cout << std::distance(x.begin(), it)

<< ":" << *it << " ";

}

std::cout << "\n"; // 0:1 2:3 4:5 6:7 8:9

}

=== 演習8 解答例 =====

--- compile-and-run.txt ---

\$ g++ -std=c++17 ex07-8.cpp

\$ echo 1 2 3 4 5 | ./a.out

2, 4, 6, 8, 10,

--- ex07-8.cpp ---

// stream iterator

#include <iostream> // ex07-8.cpp

#include <iterator>

int main()

{

std::istream_iterator<int> in{std::cin};

std::istream_iterator<int> eos;

std::ostream_iterator<int> out{std::cout, ", "};

for (; in != eos; ++in)

(out++) = 2(*in);

}