

Programming in C/C++

Exercises set four: containers

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Exercise 22, Containers solving complex tasks

We are asked to order all words obtain by the standard input and print them in the screen.

Code listings

Listing 1: main.cc

```
1  #include <iostream>
2  #include <vector>
3  #include <string>
4  #include <algorithm>
5
6  int main()
7  {
8      std::vector<std::string> vec;
9      std::string stringTemp;
10
11     while (std::cin >> stringTemp)
12         vec.push_back(stringTemp);
13
14     sort(vec.begin(), vec.end());
15
16     for (std::size_t ind = 0; ind < vec.size(); ++ind)
17         std::cout << ind << ".\t" << vec[ind]
```

```

18         << std::endl;
19     }

```

Exercise 23, vectors and shrinking

So we experimented with slicing off extra capacity with vectors and a class with a vector as a data member.

Output

```

1 size: 10 capacity: 16
2 size: 11 capacity: 16
3 size: 11 capacity: 11
4
5 size: 11 capacity: 16
6 size: 12 capacity: 16
7 size: 12 capacity: 12

```

Code listings

Listing 2: main.ih

```

1 #include "main.h"
2
3 using namespace std;

```

Listing 3: main.h

```

1 #ifndef MAIN_H_
2 #define MAIN_H_
3
4 #include <iostream>
5 #include "uwl/uniquewordlist.h"
6
7 void reader(std::istream &stream,
8     std::vector<std::string> &wordList);
9 void printer(std::ostream &stream,
10     std::vector<std::string> const &wordList);
11 void printer(std::ostream &stream,
12     UniqueWordList const &wordList);
13
14 #endif

```

Listing 4: main.cc

```
1 #include "main.ih"
2 #include "uwl/uniquewordlist.h"
3
4 int main(int argc, char **argv)
5 {
6     vector<string> wordList;
7     reader(cin, wordList);
8     printer(cout, wordList);
9
10    wordList.push_back("test");
11    printer(cout, wordList);
12
13    wordList = vector<string>(wordList);
14    printer(cout, wordList);
15
16    UniqueWordList uwl;
17    for (auto it = wordList.begin();
18         it != wordList.end(); ++it)
19    {
20        uwl.addWord(*it);
21    }
22    cout << '\n';
23
24    printer(cout, uwl);
25
26    uwl.addWord("west");
27    printer(cout, uwl);
28
29    uwl = uwl;
30    printer(cout, uwl);
31 }
```

Listing 5: printer1.cc

```
1 #include "main.ih"
2
3 void printer(ostream &stream,
4             vector<string> const &wordList)
5 {
```

```

6     stream << "size: " << wordList.size()
7         << " capacity: " << wordList.capacity() << '\n';
8 }

```

Listing 6: printer2.cc

```

1 #include "main.ih"
2
3 void printer(ostream &stream,
4     UniqueWordList const &wordList)
5 {
6     stream << "size: " << wordList.size()
7         << " capacity: " << wordList.capacity() << '\n';
8 }

```

Listing 7: reader.cc

```

1 #include "main.ih"
2
3 #include <algorithm>
4
5 void reader(istream &stream, vector<string> &wordList)
6 {
7     string word;
8     while (stream >> word)
9     {
10         if (find(wordList.begin(), wordList.end(), word)
11             == wordList.end())
12
13             wordList.push_back(word);
14     }
15 }

```

UniqueWordList

Listing 8: uniquewordlist.ih

```

1 #include "uniquewordlist.h"
2
3 using namespace std;

```

Listing 9: uniquewordlist.h

```

1 #ifndef UNIQUEWORDLIST_H_

```

```

2  #define UNIQUEWORDLIST_H_
3
4  #include <vector>
5  #include <string>
6
7  class UniqueWordList
8  {
9      std::vector<std::string> d_list;
10
11  public:
12      UniqueWordList() = default;
13      UniqueWordList(
14          UniqueWordList const &uwl) = default;
15
16      UniqueWordList &operator=(
17          UniqueWordList const &uwl);
18
19      void swap(UniqueWordList &uwl);
20
21      void addWord(std::string word);
22
23      std::size_t size();
24      std::size_t capacity();
25
26      std::size_t size() const;
27      std::size_t capacity() const;
28 };
29
30 #endif

```

Listing 10: addword.cc

```

1  #include "uniquewordlist.ih"
2
3  #include <algorithm>
4
5  void UniqueWordList::addWord(string word)
6  {
7      if (find(d_list.begin(), d_list.end(), word)
8          == d_list.end())
9

```

```
10     d_list.push_back(word);
11 }
```

Listing 11: capacity.cc

```
1 #include "uniquewordlist.ih"
2
3 size_t UniqueWordList::capacity()
4 {
5     return d_list.capacity();
6 }
```

Listing 12: capacityconst.cc

```
1 #include "uniquewordlist.ih"
2
3 size_t UniqueWordList::capacity() const
4 {
5     return d_list.capacity();
6 }
```

Listing 13: operator=.cc

```
1 #include "uniquewordlist.ih"
2
3 UniqueWordList &UniqueWordList::operator=(
4     UniqueWordList const &uwl)
5 {
6     UniqueWordList copy(uwl);
7     swap(copy);
8     return *this;
9 }
```

Listing 14: size.cc

```
1 #include "uniquewordlist.ih"
2
3 size_t UniqueWordList::size()
4 {
5     return d_list.size();
6 }
```

Listing 15: sizeconst.cc

```
1 #include "uniquewordlist.ih"
2
3 size_t UniqueWordList::size() const
4 {
5     return d_list.size();
6 }
```

Listing 16: swap.cc

```
1 #include "uniquewordlist.ih"
2
3 #include <cstring>
4
5 void UniqueWordList::swap(UniqueWordList &uwl)
6 {
7     char bytes[sizeof(UniqueWordList)];
8     memcpy(bytes, this, sizeof(UniqueWordList));
9     memcpy(this, &uwl, sizeof(UniqueWordList));
10    memcpy(&uwl, bytes, sizeof(UniqueWordList));
11 }
```

Exercise 24, Containers solving complex tasks

Now, we are asked to count the number of repetitions of each word, this is a continuation from exercise 22.

Code listings

Listing 17: main.cc

```
1 #include <iostream>
2 #include <vector>
3 #include <string>
4 #include <algorithm>
5
6 int main()
7 {
8     std::vector<std::string> vec;
9     std::string stringTemp;
10 }
```

```

11     while (std::cin >> stringTemp)
12         vec.push_back(stringTemp);
13
14     sort(vec.begin(), vec.end());
15
16     for (std::size_t ind = 0; ind < vec.size(); ++ind)
17         std::cout << ind << ".\t" << vec[ind]
18             << std::endl;
19
20     std::cout << std::endl;
21     //End algorithm from exercise 22
22     for (std::size_t position = 0, posCompare
23         = position; position <= vec.size();
24         ++position)
25     {
26         if (vec[posCompare] != vec[position])
27         {
28             std::size_t times = position -
29                 posCompare - 1;
30             std::cout << "The element "
31                 << vec[posCompare] << " is repited "
32                 << times << " times" << std::endl;
33             posCompare = position;
34         }
35     }
36
37
38 }

```

Exercise 25, unique keys

We made a snippet of code to count the number of unique keys in an `unordered_multimap`. Never again.

Code listings

Listing 18: main.cc

```

1 #include "main.ih"
2 #include "uwl/uniquewordlist.h"
3

```



```

4 int main(int argc, char **argv)
5 {
6     vector<string> wordList;
7     reader(cin, wordList);
8     printer(cout, wordList);
9
10    wordList.push_back("test");
11    printer(cout, wordList);
12
13    wordList = vector<string>(wordList);
14    printer(cout, wordList);
15
16    UniqueWordList uwl;
17    for (auto it = wordList.begin();
18         it != wordList.end(); ++it)
19    {
20        uwl.addWord(*it);
21    }
22    cout << '\n';
23
24    printer(cout, uwl);
25
26    uwl.addWord("west");
27    printer(cout, uwl);
28
29    uwl = uwl;
30    printer(cout, uwl);
31 }

```

Exercise 26, signal handling

We made the class interface for the Signal class and made a TestHandler class that inherits from the class SignalHandler.

Code listings

Listing 19: signal.h

```

1 #include "signal.h"
2 #include <iostream>
3 #include <signal.h>

```

```

4
5 using namespace std;

```

Listing 20: signal.h

```

1 #ifndef SIGNAL_H
2 #define SIGNAL_H
3
4 #include <map>
5
6 class Signal
7 {
8     // map to store pair of signal with
9     // set of signalhandlers
10    map<size_t,
11        set<SignalHandler>> d_signalHandlerMap;
12    static Signal *s_instance = NULL;
13
14    public:
15        Signal(Signal const &other) = delete;
16        static Signal &instance();
17
18    private:
19        Signal();
20        ~Signal();
21        // calls the signalhandlers for the
22        // given signal it is linked to all
23        // required signals using sigaction
24        void (*processSignal)(size_t signum);
25        void add(size_t signum,
26            SignalHandler &object);
27        void remove(size_t signum,
28            SignalHandler &object);
29        void ignore(size_t signum);
30        void reset(size_t signum);
31 };
32
33 #endif

```

Listing 21: signalhandler.ih

```

1 #include "signalhandler.h"

```

```

2  #include <iostream>
3
4  using namespace std;

```

Listing 22: signalhandler.h

```

1  #ifndef SIGNALHANDLER_H
2  #define SIGNALHANDLER_H
3
4  class SignalHandler
5  {
6      friend class Signal;
7
8      public:
9          virtual ~SignalHandler();
10     private:
11         virtual void signalHandler(size_t signum) = 0;
12 };
13
14 #endif

```

Listing 23: testhandler.h

```

1  #ifndef TESTHANDLER_H
2  #define TESTHANDLER_H
3
4  class TestHandler: public SignalHandler
5  {
6      friend class Signal;
7
8      public:
9          TestHandler();
10         virtual ~TestHandler() override;
11     private:
12         virtual void signalHandler(
13             size_t signum) override;
14 };
15
16 #endif

```

Listing 24: testhandler.cc

```

1  #include "signalhandler.ih"

```

```

2
3 TestHandler::TestHandler()
4 {
5     Signal.instance().add(SIGINT, *this);
6 }

```

Listing 25: destructor testhandler.cc

```

1 #include "signalhandler.ih"
2
3 virtual void TestHandler::~~TestHandler()
4 {
5     Signal.instance().remove(SIGINT);
6 }

```

Exercise 27, implementing singleton functionality

We have implemented the member function that belong to the singleton property of the class `Signal`.

Code listings

Listing 26: instance.cc

```

1 #include "signal.ih"
2
3 static Signal &Signal::instance();
4 {
5     if (s_instance == NULL)
6         s_instance = new Signal;
7
8     return *Signal;
9 }

```

Listing 27: destructor of signal

```

1 #include "signal.ih"
2
3 Signal::~~Signal()
4 {
5     delete s_instance;
6 }

```