**Course Name:**

**Principles of Software Design**

**Lab Section:**

**B02**

**Course Code:**

**ENSF 480**

**Assignment Number:**

**Lab 1**

**Submission Date and Time:**

**20/09/2023**

**Completed By:**

**Findlay Brown: 30145677**

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# Exercise A

|  |  |
| --- | --- |
| **Program output and its order** | **Your explanation (why and where is the cause for this output)** |
| **constructor with int argument is called.** | it is called at line 12 in exAmain. The statement, Mystring c = 3 is interpreted by the compiler as a call to the constructor Mystring::Mystring(int n). |
| **default constructor is called.**  **default constructor is called.** | Both default constructors are called at line 18 in exAmain. The statement Mystring x[2] creates a 2 element array “x” and then calls the default constructor for each element in x. |
| **constructor with char\* argument is called.** | Called at line 22 in exAmain. The statement, Mystring \*z = new Mystring("4"); is interpreted by the compiler as a call to the constructor Mystring::Mystring(const char \*s). |
| **copy constructor is called.**  **copy constructor is called.** | Called at line 24 in exAmain. The copy constructor is called since objects are being copied into the append function as arguments. |
| **destructor is called.**  **destructor is called.** | Called at line 24 in exAmain. The destructor is called since the arguments for the append function are going out of scope when the function finishes and as such the destructor is automatically called on. |
| **copy constructor is called.** | Called at line 26 in exAmain. The statement, Mystring mars = x[0]; is interpreted by the compiler as a call to the copy constructor Mystring::Mystring(const Mystring &source). |
| **assignment operator called.** | Called at line 28 in exAmain. The statement, x[1] = x[0]; is interpreted by the compiler as a call to the assignment constructor Mystring &Mystring::operator=(const Mystring &S). |
| **constructor with char\* argument is called.**  **constructor with char\* argument is called.** | First call is on line 30 and the second on line 32 in exAmain. The statements, Mystring jupiter("White"); and ar[0] = new Mystring("Yellow"); are interpreted by the compiler as a call to the constructor Mystring::Mystring(const char \*s). |
| **destructor is called.**  **destructor is called.**  **destructor is called.**  **destructor is called.**  **destructor is called.** | The first 4 destructors are called on line 34 after the closing bracket in exAmain and the last is called on line 37 in exAmain. The first 4 destructors are automatically called once the Mystring objects x[0], x[1], mars, and jupiter go out of scope. The last destructor on line 37 is called using the delete operator on ar[0]. |
| **constructor with char\* argument is called.** | Called on line 39 in exAmain. The statement, Mystring d = "Green"; is interpreted by the compiler as a call to the constructor Mystring::Mystring(const char \*s). |
| **Program terminated successfully.** | Printed out on line 41 in exAmain. This is directly printed to the terminal since cout prints to the terminal. |
| **destructor is called.**  **destructor is called** | Called at line 43 in exAmain. The program is finished as such that any object that wasn’t deleted in the program has its destructor automatically called. |

# Exercise B

Part 1:

**A diagram of a computer

Description automatically generated**

Part 2

A screenshot of a computer program

Description automatically generated

## Missing Functions

## Find

*void* DictionaryList::find(const Key &*keyA*)

{

  Node \*current = headM;

  while (current->nextM != 0 && current->keyM != *keyA*)

  {

    current = current->nextM;

  }

  if (current->keyM == *keyA*)

  {

    this->cursorM = current;

    return;

  }

  else

  {

    this->cursorM = 0;

  }

}

Destroy

*void* DictionaryList::destroy()

{

  this->cursorM = this->headM;

  this->sizeM = 0;

  while (this->cursorM != 0)

  {

    this->cursorM = this->headM->nextM;

    delete this->headM;

    this->headM = this->cursorM;

  }

}

Copy

*void* DictionaryList::copy(const DictionaryList &*source*)

{

  this->sizeM = *source*.sizeM;

  this->headM = new Node(*source*.headM->keyM, *source*.headM->datumM, nullptr);

  Node \*tempSrcNode = *source*.headM;

  Node \*tempNode = this->headM;

  while (tempSrcNode->nextM != 0)

  {

    tempSrcNode = tempSrcNode->nextM;

    tempNode->nextM = new Node(tempSrcNode->keyM, tempSrcNode->datumM, nullptr);

    tempNode = tempNode->nextM;

  }

  tempNode->nextM = nullptr;

  if (*source*.cursorM == nullptr)

  {

    this->cursorM = nullptr;

  }

  else

  {

    this->find(*source*.cursorM->keyM);

  }

}

Full code

## exBmain.cpp

/\*

 \* File Name: exBmain.cpp

 \* Assignment: Lab 1 Exercise B

 \* Lab Section: B02

 \* Completed by: Findlay Brown, David Rodriguez

 \* Submission Date: Sept 20, 2023

 \*/

#include <assert.h>

#include <iostream>

#include "dictionaryList.h"

using *namespace* std;

DictionaryList dictionary\_tests();

*void* test\_copying();

*void* print(DictionaryList &*dl*);

*void* test\_finding(DictionaryList &*dl*);

*void* test\_operator\_overloading(DictionaryList &*dl*);

*int* main()

{

    DictionaryList dl = dictionary\_tests();

    test\_copying();

    // Uncomment the call to test\_copying when DictionaryList::copy is properly defined

    test\_finding(dl);

    // test\_operator\_overloading(dl);

    return 0;

}

DictionaryList dictionary\_tests()

{

    DictionaryList dl;

    assert(dl.size() == 0);

    cout << "\nPrinting list just after its creation ...\n";

    print(dl);

    // Insert using new keys.

    dl.insert(8001, "Dilbert");

    dl.insert(8002, "Alice");

    dl.insert(8003, "Wally");

    assert(dl.size() == 3);

    cout << "\nPrinting list after inserting 3 new keys ...\n";

    print(dl);

    dl.remove(8002);

    dl.remove(8001);

    dl.insert(8004, "PointyHair");

    assert(dl.size() == 2);

    cout << "\nPrinting list after removing two keys and inserting PointyHair ...\n";

    print(dl);

    // Insert using existing key.

    dl.insert(8003, "Sam");

    assert(dl.size() == 2);

    cout << "\nPrinting list after changing data for one of the keys ...\n";

    print(dl);

    dl.insert(8001, "Allen");

    dl.insert(8002, "Peter");

    assert(dl.size() == 4);

    cout << "\nPrinting list after inserting 2 more keys ...\n";

    print(dl);

    cout << "\*\*\*----Finished dictionary tests---------------------------\*\*\*\n\n";

    return dl;

}

*void* test\_copying()

{

    DictionaryList one;

    // Copy an empty list.

    DictionaryList two;

    assert(two.size() == 0);

    // Copy a list with three entries and a valid cursor.

    one.insert(319, "Randomness");

    one.insert(315, "Shocks");

    one.insert(335, "ParseErrors");

    one.go\_to\_first();

    one.step\_fwd();

    DictionaryList three(one);

    assert(three.cursor\_datum().isEqual("Randomness"));

    one.remove(335);

    cout << "Printing list--keys should be 315, 319\n";

    print(one);

    cout << "Printing list--keys should be 315, 319, 335\n";

    print(three);

    // Assignment operator check.

    one = two = three = three;

    one.remove(319);

    two.remove(315);

    cout << "Printing list--keys should be 315, 335\n";

    print(one);

    cout << "Printing list--keys should be 319, 335\n";

    print(two);

    cout << "Printing list--keys should be 315, 319, 335\n";

    print(three);

    cout << "\*\*\*----Finished tests of copying----------------------\*\*\*\n\n";

}

*void* print(DictionaryList &*dl*)

{

    if (*dl*.size() == 0)

        cout << "  List is EMPTY.\n";

    for (*dl*.go\_to\_first(); *dl*.cursor\_ok(); *dl*.step\_fwd())

    {

        cout << "  " << *dl*.cursor\_key();

        cout << "  " << *dl*.cursor\_datum().c\_str() << '\n';

    }

}

*void* test\_finding(DictionaryList &*dl*)

{

    // Pretend that a user is trying to look up names.

    cout << "\nLet's look up some names ...\n";

*dl*.find(8001);

    if (*dl*.cursor\_ok())

        cout << "  name for 8001 is: " << *dl*.cursor\_datum().c\_str() << ".\n";

    else

        cout << "  Sorry, I couldn't find 8001 in the list. \n";

*dl*.find(8000);

    if (*dl*.cursor\_ok())

        cout << "  name for 8000 is: " << *dl*.cursor\_datum().c\_str() << ".\n";

    else

        cout << "  Sorry, I couldn't find 8000 in the list. \n";

*dl*.find(8002);

    if (*dl*.cursor\_ok())

        cout << "  name for 8002 is: " << *dl*.cursor\_datum().c\_str() << ".\n";

    else

        cout << "  Sorry, I couldn't find 8002 in the list. \n";

*dl*.find(8004);

    if (*dl*.cursor\_ok())

        cout << "  name for 8004 is: " << *dl*.cursor\_datum().c\_str() << ".\n";

    else

        cout << "  Sorry, I couldn't find 8004 in the list. \n";

    cout << "\*\*\*----Finished tests of finding -------------------------\*\*\*\n\n";

}

#if 0

*void* test\_operator\_overloading(DictionaryList& *dl*)

{

    DictionaryList dl2 = dl;

    dl.go\_to\_first();

    dl.step\_fwd();

    dl2.go\_to\_first();

    cout << "\nTestig a few comparison and insertion operators." << endl;

    // Needs to overload >= and << (insertion operator) in class Mystring

    if(dl.cursor\_datum() >= (dl2.cursor\_datum()))

       cout << endl << dl.cursor\_datum() << " is greater than or equal " << dl2.cursor\_datum();

    else

       cout << endl << dl2.cursor\_datum() << " is greater than " << dl.cursor\_datum();

    // Needs to overload <= for Mystring

    if(dl.cursor\_datum() <= (dl2.cursor\_datum()))

        cout << dl.cursor\_datum() << " is less than or equal" << dl2.cursor\_datum();

    else

        cout << endl << dl2.cursor\_datum() << " is less than " << dl.cursor\_datum();

    if(dl.cursor\_datum() != (dl2.cursor\_datum()))

        cout << endl << dl.cursor\_datum() << " is not equal to " << dl2.cursor\_datum();

    else

        cout << endl << dl2.cursor\_datum() << " is equal to " << dl.cursor\_datum();

    if(dl.cursor\_datum() > (dl2.cursor\_datum()))

        cout << endl << dl.cursor\_datum() << " is greater than " << dl2.cursor\_datum();

    else

        cout << endl << dl.cursor\_datum() << " is not greater than " << dl2.cursor\_datum();

    if(dl.cursor\_datum() < (dl2.cursor\_datum()))

        cout << endl << dl.cursor\_datum() << " is less than " << dl2.cursor\_datum();

    else

        cout << endl << dl.cursor\_datum() << " is not less than " << dl2.cursor\_datum();

    if(dl.cursor\_datum() == (dl2.cursor\_datum()))

        cout << endl << dl.cursor\_datum() << " is equal to " << dl2.cursor\_datum();

    else

        cout << endl << dl.cursor\_datum() << " is not equal to " << dl2.cursor\_datum();

   cout << endl << "\nUsing square bracket [] to access elements of Mystring objects. ";

*char* c = dl.cursor\_datum()[1];

    cout << endl << "The socond element of "  << dl.cursor\_datum() << " is: " << c;

    dl.cursor\_datum()[1] = 'o';

    c = dl.cursor\_datum()[1];

    cout << endl << "The socond element of "  << dl.cursor\_datum() << " is: " << c;

    cout << endl << "\nUsing << to display key/datum pairs in a Dictionary list: \n";

    /\* The following line is expected to display the content of the linked list

     \* dl2 -- key/datum pairs. It should display:

     \*   8001  Allen

     \*   8002  Peter

     \*   8003  Sam

     \*   8004  PointyHair

     \*/

    cout << dl2;

    cout << endl << "\nUsing [] to display the datum only: \n";

    /\* The following line is expected to display the content of the linked list

     \* dl2 -- datum. It should display:

     \*   Allen

     \*   Peter

     \*   Sam

     \*   PointyHair

     \*/

    for(*int* i =0; i < dl2.size(); i++)

        cout << dl2[i] << endl;

    cout << endl << "\nUsing [] to display sequence of charaters in a datum: \n";

    /\* The following line is expected to display the characters in the first node

     \* of the dictionary. It should display:

     \*   A

     \*   l

     \*   l

     \*   e

     \*   n

     \*/

    cout << dl2[0][0] << endl;

    cout << dl2[0][1] << endl;

    cout << dl2[0][2] << endl;

    cout << dl2[0][3] << endl;

    cout << dl2[0][4] << endl;

    cout << "\n\n\*\*\*----Finished tests for overloading operators ----------\*\*\*\n\n";

}

#endif

## dictionaryList.cpp

/\*

 \* File Name: dictionaryList.cpp

 \* Assignment: Lab 1 Exercise B

 \* Lab Section: B02

 \* Completed by: Findlay Brown, David Rodriguez

 \* Submission Date: Sept 20, 2023

 \*/

#include <assert.h>

#include <iostream>

#include <stdlib.h>

#include "dictionaryList.h"

#include "mystring\_B.h"

using *namespace* std;

Node::Node(const Key &*keyA*, const Datum &*datumA*, Node \**nextA*)

    : keyM(*keyA*), datumM(*datumA*), nextM(*nextA*)

{

}

DictionaryList::DictionaryList()

    : sizeM(0), headM(0), cursorM(0)

{

}

DictionaryList::DictionaryList(const DictionaryList &*source*)

{

  copy(*source*);

}

DictionaryList &DictionaryList::operator=(const DictionaryList &*rhs*)

{

  if (this != &*rhs*)

  {

    destroy();

    copy(*rhs*);

  }

  return \*this;

}

DictionaryList::~DictionaryList()

{

  destroy();

}

*int* DictionaryList::size() const

{

  return sizeM;

}

*int* DictionaryList::cursor\_ok() const

{

  return cursorM != 0;

}

const Key &DictionaryList::cursor\_key() const

{

  assert(cursor\_ok());

  return cursorM->keyM;

}

const Datum &DictionaryList::cursor\_datum() const

{

  assert(cursor\_ok());

  return cursorM->datumM;

}

*void* DictionaryList::insert(const *int* &*keyA*, const Mystring &*datumA*)

{

  // Add new node at head?

  if (headM == 0 || *keyA* < headM->keyM)

  {

    headM = new Node(*keyA*, *datumA*, headM);

    sizeM++;

  }

  // Overwrite datum at head?

  else if (*keyA* == headM->keyM)

    headM->datumM = *datumA*;

  // Have to search ...

  else

  {

    // POINT ONE

    // if key is found in list, just overwrite data;

    for (Node \*p = headM; p != 0; p = p->nextM)

    {

      if (*keyA* == p->keyM)

      {

        p->datumM = *datumA*;

        return;

      }

    }

    // OK, find place to insert new node ...

    Node \*p = headM->nextM;

    Node \*prev = headM;

    while (p != 0 && *keyA* > p->keyM)

    {

      prev = p;

      p = p->nextM;

    }

    prev->nextM = new Node(*keyA*, *datumA*, p);

    sizeM++;

  }

  cursorM = NULL;

}

*void* DictionaryList::remove(const *int* &*keyA*)

{

  if (headM == 0 || *keyA* < headM->keyM)

    return;

  Node \*doomed\_node = 0;

  if (*keyA* == headM->keyM)

  {

    doomed\_node = headM;

    headM = headM->nextM;

    // POINT TWO

  }

  else

  {

    Node \*before = headM;

    Node \*maybe\_doomed = headM->nextM;

    while (maybe\_doomed != 0 && *keyA* > maybe\_doomed->keyM)

    {

      before = maybe\_doomed;

      maybe\_doomed = maybe\_doomed->nextM;

    }

    if (maybe\_doomed != 0 && maybe\_doomed->keyM == *keyA*)

    {

      doomed\_node = maybe\_doomed;

      before->nextM = maybe\_doomed->nextM;

    }

  }

  if (doomed\_node == cursorM)

    cursorM = 0;

  delete doomed\_node; // Does nothing if doomed\_node == 0.

  sizeM--;

}

*void* DictionaryList::go\_to\_first()

{

  cursorM = headM;

}

*void* DictionaryList::step\_fwd()

{

  assert(cursor\_ok());

  cursorM = cursorM->nextM;

}

*void* DictionaryList::make\_empty()

{

  destroy();

  sizeM = 0;

  cursorM = 0;

}

// The following function are supposed to be completed by the stuents, as part

// of the exercise B part II. the given fucntion are in fact place-holders for

// find, destroy and copy, in order to allow successful linking when you're

// testing insert and remove. Replace them with the definitions that work.

*void* DictionaryList::find(const Key &*keyA*)

{

  Node \*current = headM;

  while (current->nextM != 0 && current->keyM != *keyA*)

  {

    current = current->nextM;

  }

  if (current->keyM == *keyA*)

  {

    this->cursorM = current;

    return;

  }

  else

  {

    this->cursorM = 0;

  }

}

*void* DictionaryList::destroy()

{

  this->cursorM = this->headM;

  this->sizeM = 0;

  while (this->cursorM != 0)

  {

    this->cursorM = this->headM->nextM;

    delete this->headM;

    this->headM = this->cursorM;

  }

}

*void* DictionaryList::copy(const DictionaryList &*source*)

{

  this->sizeM = *source*.sizeM;

  this->headM = new Node(*source*.headM->keyM, *source*.headM->datumM, NULL);

  Node \*tempSrcNode = *source*.headM;

  Node \*tempNode = this->headM;

  while (tempSrcNode->nextM != 0)

  {

    tempSrcNode = tempSrcNode->nextM;

    tempNode->nextM = new Node(tempSrcNode->keyM, tempSrcNode->datumM, NULL);

    tempNode = tempNode->nextM;

  }

  tempNode->nextM = nullptr;

  if (*source*.cursorM == nullptr)

  {

    this->cursorM = nullptr;

  }

  else

  {

    this->find(*source*.cursorM->keyM);

  }

}

## dictionaryList.h

/\*

 \* File Name: dictionaryList.h

 \* Assignment: Lab 1 Exercise B

 \* Lab Section: B02

 \* Completed by: Findlay Brown, David Rodriguez

 \* Submission Date: Sept 20, 2023

 \*/

#ifndef DICTIONARY\_H

#define DICTIONARY\_H

#include <iostream>

using *namespace* std;

// class DictionaryList: GENERAL CONCEPTS

//

//    key/datum pairs are ordered.  The first pair is the pair with

//    the lowest key, the second pair is the pair with the second

//    lowest key, and so on.  This implies that you must be able to

//    compare two keys with the < operator.

//

//    Each DictionaryList object has a "cursor" that is either attached

//    to a particular key/datum pair or is in an "off-list" state, not

//    attached to any key/datum pair.  If a DictionaryList is empty, the

//    cursor is automatically in the "off-list" state.

#include "mystring\_B.h"

// Edit these typedefs to change the key or datum types, if necessary.

typedef *int* Key;

typedef Mystring Datum;

// THE NODE TYPE

//    In this exercise the node type is a class, that has a ctor.

//    Data members of Node are private, and class DictionaryList

//    is declared as a friend. For details on the friend keyword refer to your

//    lecture notes.

*class* Node

{

  friend *class* DictionaryList;

*private:*

  Key keyM;

  Datum datumM;

  Node \*nextM;

  // This ctor should be convenient in insert and copy operations.

  Node(const Key &*keyA*, const Datum &*datumA*, Node \**nextA*);

};

*class* DictionaryList

{

*public:*

  DictionaryList();

  DictionaryList(const DictionaryList &*source*);

  DictionaryList &operator=(const DictionaryList &*rhs*);

  ~DictionaryList();

*int* size() const;

  // PROMISES: Returns number of keys in the table.

*int* cursor\_ok() const;

  // PROMISES:

  //   Returns 1 if the cursor is attached to a key/datum pair,

  //   and 0 if the cursor is in the off-list state.

  const Key &cursor\_key() const;

  // REQUIRES: cursor\_ok()

  // PROMISES: Returns key of key/datum pair to which cursor is attached.

  const Datum &cursor\_datum() const;

  // REQUIRES: cursor\_ok()

  // PROMISES: Returns datum of key/datum pair to which cursor is attached.

*void* insert(const Key &*keyA*, const Datum &*datumA*);

  // PROMISES:

  //   If keyA matches a key in the table, the datum for that

  //   key is set equal to datumA.

  //   If keyA does not match an existing key, keyA and datumM are

  //   used to create a new key/datum pair in the table.

  //   In either case, the cursor goes to the off-list state.

*void* remove(const Key &*keyA*);

  // PROMISES:

  //   If keyA matches a key in the table, the corresponding

  //   key/datum pair is removed from the table.

  //   If keyA does not match an existing key, the table is unchanged.

  //   In either case, the cursor goes to the off-list state.

*void* find(const Key &*keyA*);

  // PROMISES:

  //   If keyA matches a key in the table, the cursor is attached

  //   to the corresponding key/datum pair.

  //   If keyA does not match an existing key, the cursor is put in

  //   the off-list state.

*void* go\_to\_first();

  // PROMISES: If size() > 0, cursor is moved to the first key/datum pair

  //   in the table.

*void* step\_fwd();

  // REQUIRES: cursor\_ok()

  // PROMISES:

  //   If cursor is at the last key/datum pair in the list, cursor

  //   goes to the off-list state.

  //   Otherwise the cursor moves forward from one pair to the next.

*void* make\_empty();

  // PROMISES: size() == 0.

*private:*

*int* sizeM;

  Node \*headM;

  Node \*cursorM;

*void* destroy();

  // Deallocate all nodes, set headM to zero.

*void* copy(const DictionaryList &*source*);

  // Establishes \*this as a copy of source.  Cursor of \*this will

  // point to the twin of whatever the source's cursor points to.

};

#endif

## Mystring\_B.cpp

/\*

 \* File Name: mystring\_B.cpp

 \* Assignment: Lab 1 Exercise B

 \* Lab Section: B02

 \* Completed by: Findlay Brown, David Rodriguez

 \* Submission Date: Sept 20, 2023

 \*/

#include "mystring\_B.h"

#include <string.h>

#include <iostream>

using *namespace* std;

Mystring::Mystring()

{

  charsM = new *char*[1];

  // make sure memory is allocated.

  memory\_check(charsM);

  charsM[0] = '\0';

  lengthM = 0;

}

Mystring::Mystring(const *char* \**s*)

    : lengthM(strlen(*s*))

{

  charsM = new *char*[lengthM + 1];

  // make sure memory is allocated.

  memory\_check(charsM);

  strcpy(charsM, *s*);

}

Mystring::Mystring(*int* *n*)

    : lengthM(0), charsM(new *char*[*n*])

{

  // make sure memory is allocated.

  memory\_check(charsM);

  charsM[0] = '\0';

}

Mystring::Mystring(const Mystring &*source*) : lengthM(*source*.lengthM), charsM(new *char*[*source*.lengthM + 1])

{

  memory\_check(charsM);

  strcpy(charsM, *source*.charsM);

}

Mystring::~Mystring()

{

  delete[] charsM;

}

*int* Mystring::length() const

{

  return lengthM;

}

*char* Mystring::get\_char(*int* *pos*) const

{

  if (*pos* < 0 && *pos* >= length())

  {

    cerr << "\nERROR: get\_char: the position is out of boundary.";

  }

  return charsM[*pos*];

}

const *char* \*Mystring::c\_str() const

{

  return charsM;

}

*void* Mystring::set\_char(*int* *pos*, *char* *c*)

{

  if (*pos* < 0 && *pos* >= length())

  {

    cerr << "\nset\_char: the position is out of boundary."

         << " Nothing was changed.";

    return;

  }

  if (*c* != '\0')

  {

    cerr << "\nset\_char: char c is empty."

         << " Nothing was changed.";

    return;

  }

  charsM[*pos*] = *c*;

}

Mystring &Mystring::operator=(const Mystring &*S*)

{

  if (this == &*S*)

    return \*this;

  delete[] charsM;

  lengthM = (*int*)strlen(*S*.charsM);

  charsM = new *char*[lengthM + 1];

  memory\_check(charsM);

  strcpy(charsM, *S*.charsM);

  return \*this;

}

Mystring &Mystring::append(const Mystring &*other*)

{

*char* \*tmp = new *char*[lengthM + *other*.lengthM + 1];

  memory\_check(tmp);

  lengthM += *other*.lengthM;

  strcpy(tmp, charsM);

  strcat(tmp, *other*.charsM);

  delete[] charsM;

  charsM = tmp;

  return \*this;

}

*void* Mystring::set\_str(*char* \**s*)

{

  delete[] charsM;

  lengthM = (*int*)strlen(*s*);

  charsM = new *char*[lengthM + 1];

  memory\_check(charsM);

  strcpy(charsM, *s*);

}

*int* Mystring::isNotEqual(const Mystring &*s*) const

{

  return (strcmp(charsM, *s*.charsM) != 0);

}

*int* Mystring::isEqual(const Mystring &*s*) const

{

  return (strcmp(charsM, *s*.charsM) == 0);

}

*int* Mystring::isGreaterThan(const Mystring &*s*) const

{

  return (strcmp(charsM, *s*.charsM) > 0);

}

*int* Mystring::isLessThan(const Mystring &*s*) const

{

  return (strcmp(charsM, *s*.charsM) < 0);

}

*void* Mystring::memory\_check(*char* \**s*)

{

  if (*s* == 0)

  {

    cerr << "Memory not available.";

    exit(1);

  }

}

## mystring\_B.h

/\*

 \* File Name: mystring\_B.h

 \* Assignment: Lab 1 Exercise B

 \* Lab Section: B02

 \* Completed by: Findlay Brown, David Rodriguez

 \* Submission Date: Sept 20, 2023

 \*/

#include <iostream>

#include <string>

using *namespace* std;

#ifndef MYSTRING\_H

#define MYSTRING\_H

*class* Mystring

{

*public:*

  Mystring();

  // PROMISES: Empty string object is created.

  Mystring(*int* *n*);

  // PROMISES: Creates an empty string with a total capacity of n.

  //           In other words, dynamically allocates n elements for

  //           charsM,sets the lengthM to zero, and fills the first

  //           element of charsM with '\0'.

  Mystring(const *char* \**s*);

  // REQUIRES: s points to first char of a built-in string.

  // REQUIRES: Mystring object is created by copying chars from s.

  ~Mystring(); // destructor

  Mystring(const Mystring &*source*); // copy constructor

  Mystring &operator=(const Mystring &*rhs*); // assignment operator

  // REQUIRES: rhs is reference to a Mystring as a source

  // PROMISES: to make this-object (object that this is pointing to, as  a copy

  //           of rhs.

*int* length() const;

  // PROMISES: Return value is number of chars in charsM.

*char* get\_char(*int* *pos*) const;

  // REQUIRES: pos >= 0 && pos < length()

  // PROMISES:

  // Return value is char at position pos.

  // (The first char in the charsM is at position 0.)

  const *char* \*c\_str() const;

  // PROMISES:

  //   Return value points to first char in built-in string

  //   containing the chars of the string object.

*void* set\_char(*int* *pos*, *char* *c*);

  // REQUIRES: pos >= 0 && pos < length(), c != '\0'

  // PROMISES: Character at position pos is set equal to c.

  Mystring &append(const Mystring &*other*);

  // PROMISES: extends the size of charsM to allow concatenate other.charsM to

  //           to the end of charsM. For example if charsM points to "ABC", and

  //          other.charsM points to XYZ, extends charsM to "ABCXYZ".

  //

*void* set\_str(*char* \**s*);

  // REQUIRES: s is a valid C++ string of characters (a built-in string)

  // PROMISES:copys s into charsM, if the length of s is less than or equal lengthM.

  //          Othrewise, extends the size of the charsM to s.lengthM+1, and copies

  //          s into the charsM.

*int* isGreaterThan(const Mystring &*s*) const;

  // REQUIRES: s refers to an object of class Mystring

  // PROMISES: retruns true if charsM is greater than s.charsM.

*int* isLessThan(const Mystring &*s*) const;

  // REQUIRES: s refers to an object of class Mystring

  // PROMISES: retruns true if charsM is less than s.charsM.

*int* isEqual(const Mystring &*s*) const;

  // REQUIRES: s refers to an object of class Mystring

  // PROMISES: retruns true if charsM equal s.charsM.

*int* isNotEqual(const Mystring &*s*) const;

  // REQUIRES: s refers to an object of class Mystring

  // PROMISES: retruns true if charsM is not equal s.charsM.

*private:*

*int* lengthM;  // the string length - number of characters excluding \0

*char* \*charsM; // a pointer to the beginning of an array of characters, allocated dynamically.

*void* memory\_check(*char* \**s*);

  // PROMISES: if s points to NULL terminates the program.

};

#endif

# Exercise C

## company.h

/\*

 \* File Name: company.h

 \* Assignment: Lab 1 Exercise C

 \* Lab Section: B02

 \* Completed by: Findlay Brown, David Rodriguez

 \* Submission Date: Sept 20, 2023

 \*/

#ifndef COMPANY

#define COMPANY

#include <string>

#include <vector>

#include "employee.h"

#include "customer.h"

#include "address.h"

#include "date.h"

using *namespace* std;

*class* Company

{

*private:*

    string companyName;

    Address companyAddress;

    Date dateEstablished;

    vector<Employee> employees;

    vector<Customer> customers;

    // public: Functions

};

#endif

## employee.h

/\*

 \* File Name: employee.h

 \* Assignment: Lab 1 Exercise C

 \* Lab Section: B02

 \* Completed by: Findlay Brown, David Rodriguez

 \* Submission Date: Sept 20, 2023

 \*/

#ifndef EMPLOYEE

#define EMPLOYEE

#include <string>

#include <vector>

#include "date.h"

#include "address.h"

using *namespace* std;

*class* Employee

{

*private:*

*enum* State

    {

        active = 0,

        suspended,

        retired,

        fired

    };

    string name;

    Address address;

    Date dateOfBirth;

    State employmentStatus;

    // public: Functions

};

#endif

## customer.h

/\*

 \* File Name: customer.h

 \* Assignment: Lab 1 Exercise C

 \* Lab Section: B02

 \* Completed by: Findlay Brown, David Rodriguez

 \* Submission Date: Sept 20, 2023

 \*/

#ifndef CUSTOMER

#define CUSTOMER

#include <string>

#include "address.h"

using *namespace* std;

*class* Customer

{

*private:*

    string name;

    Address address;

    string phoneNumber;

    // public: Functions

};

#endif

## address.h

/\*

 \* File Name: address.h

 \* Assignment: Lab 1 Exercise C

 \* Lab Section: B02

 \* Completed by: Findlay Brown, David Rodriguez

 \* Submission Date: Sept 20, 2023

 \*/

#ifndef ADDRESS

#define ADDRESS

#include <string>

using *namespace* std;

*class* Address

{

*private:*

    string street;

    string postalCode;

    string city;

    string country;

    // public: Functions

};

#endif

## date.h

/\*

 \* File Name: date.h

 \* Assignment: Lab 1 Exercise C

 \* Lab Section: B02

 \* Completed by: Findlay Brown, David Rodriguez

 \* Submission Date: Sept 20, 2023

 \*/

#ifndef DATE

#define DATE

*class* Date

{

*private:*

*int* day;

*int* month;

*int* year;

    // public: Functions

};

#endif

# Exercise D

See zip folder attached to submission.