Lab 01 Report **Completed by: Dominic Choi 30109955**

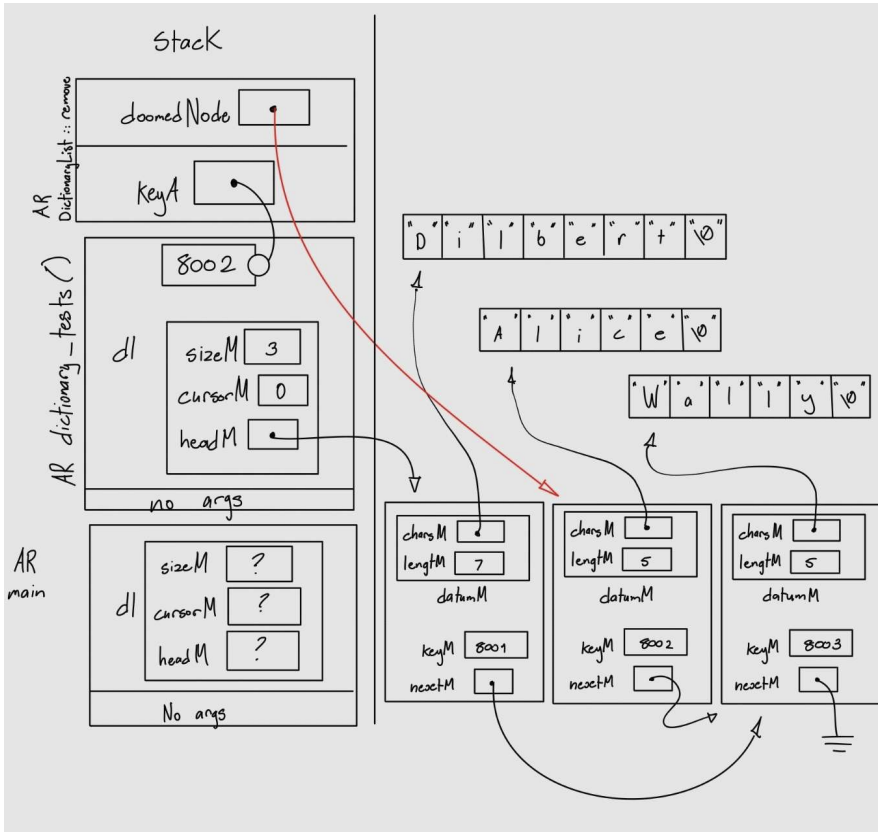
Nathan Ante 30157706

Exercise A:

Program output	Why and Where
constructor with int argument is called.	Called at line 12 in exAmain Mystring c = 3 is interpreted by the compiler as a call to Mystring::Mystring(int n).
default constructor is called. **default constructor is called.**	Called at line 18 in exAmain. Mystring x[2] creates an array of 2 Mystrings is interpreted by the compiler as a call to Mystring::Mystring().
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 Mystring::Mystring(const char *s)
copy constructor is called. **copy constructor is called.**	It is called at Line 24 in exAmain x[0].append(*z).append(x[1]); is interpreted by the compiler as 2 calls to Mystring& Mystring::append(const Mystring other) Which each calls Mystring::Mystring(const Mystring& source)
destructor is called. **destructor is called.**	At the same place as above, Called after append is terminated As when append ends, it calls Mystring::~Mystring() once each time append was run
copy constructor is called.	At line 26 in exAmain The statement Mystring mars = x[0]; is interpreted as a call to the constructor Mystring::Mystring(const Mystring& source)
assignment operator called.	At Line 28 in exAmain The statement x[1] = x[0]; is interpreted as a call to the assignment operator Mystring& Mystring::operator =(const Mystring& S)
constructor with char* argument is called. **constructor with char* argument is called.**	It is called at line 30 and 32 in exAmain The statements Mystring jupiter("White"); ar[0] = new Mystring ("Yellow"); is interpreted as a call to the constructor Mysrting::Mystring(const char *s)

destructor is called. **destructor is called.** **destructor is called.** **destructor is called.** **destructor is called.**	Block of code ends, so x(2 elements), mars, and Jupiter are freed Then line 37 in exAmain deletes ar[0] These are interpreted as Mystring::~Mystring()
constructor with char* argument is called.	Line 39 in exAmain Mystring d = "Green"; is interpreted as a call to Mystring::Mystring(const char *s)
Program terminated successfully.	Line 41 in exAmain output this to the console
destructor is called. **destructor is called**	Function main ends and calls the destructors, so d and c are destroyed by Mystring::~Mystring()

Exercise B:
AR Diagram:



Code:

```
// dictionaryList.cpp
// ENSF 480 - Lab 1 - Exercise B
// Completed by: Nathan Ante & Dominic Choi

#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)
{
  if (headM == 0)
      return;

  // Set current node as headM, go through each node and check if keyA ==
current->keyM
  // If keyA == current->keyM, then set cursorM as current
  // If no matching key, set cursorM as 0 and return
  Node* current = headM;
  while(current != NULL) {
    if (current->keyM ==  keyA) {
      cursorM = current;
      return;
    }
    current = current->nextM;
  }

  // Key is not within list
  cursorM = 0;
  return;

}
```

```
void DictionaryList::destroy()
{
  if (this->headM == NULL || this->headM->nextM == NULL) {
    headM = 0;
    return;
  }

  while(this->headM->nextM != NULL) {
    Node* currentLast = this->headM;
    while (currentLast->nextM->nextM != NULL)
    {
      currentLast = currentLast->nextM;
    }
    currentLast->nextM = NULL;
  }
  headM = 0;
}


void DictionaryList::copy(const DictionaryList& source)
{
  this->sizeM = 0;
  this->cursorM = 0;
  this->headM = 0;

  if (source.headM == 0) {
    return;
  }

  this->headM = new Node(source.headM->keyM, source.headM->datumM,
this->headM);
  this->sizeM++;

  Node* current = this->headM;
  Node* currentSource = source.headM->nextM;
  while(currentSource != NULL) {
    current->nextM = new Node(currentSource->keyM, currentSource->datumM,
```

```
NULL);
    current = current->nextM;
    currentSource = currentSource->nextM;
    this->sizeM++;
  }

  this->cursorM = source.cursorM;
  return;
}
```

```
// dictionaryList.h
// ENSF 480 - Lab 1 - Exercise B
#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
```

```
// exBmain.cpp
// ENSF 480 - Lab 2 - Exercise A
#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
```

```
/*  mystring_B.cpp
 *
 *
 */
// ENSF 480 - Lab 2 - Exercise A
#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);
    }
}
```

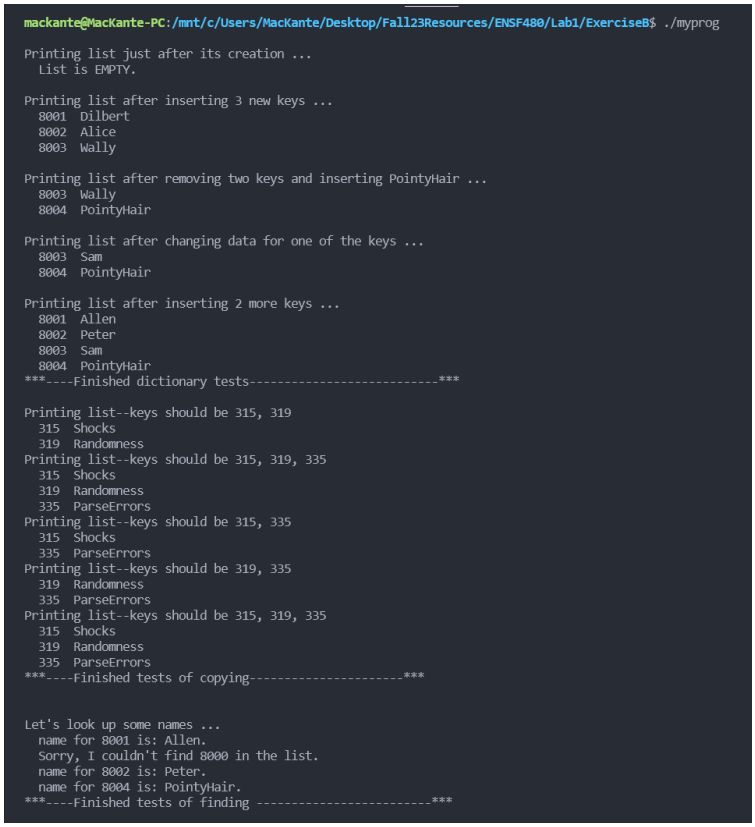
```
/* File: mystring_B.h
 *
 *
 */
// ENSF 480 - Lab 2 - Exercise A
#include <iostream>
#include <string>
using namespace std;

#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
```

Output:



```
mackante@MacKante-PC:/mnt/c/Users/MacKante/Desktop/Fall23Resources/ENSF480/Lab1/ExerciseB$ ./myprog

Printing list just after its creation ...
  List is EMPTY.

Printing list after inserting 3 new keys ...
  8001  Dilbert
  8002  Alice
  8003  Wally

Printing list after removing two keys and inserting PointyHair ...
  8003  Wally
  8004  PointyHair

Printing list after changing data for one of the keys ...
  8003  Sam
  8004  PointyHair

Printing list after inserting 2 more keys ...
  8001  Allen
  8002  Peter
  8003  Sam
  8004  PointyHair
***----Finished dictionary tests---------------------------***

Printing list--keys should be 315, 319
  315  Shocks
  319  Randomness
Printing list--keys should be 315, 319, 335
  315  Shocks
  319  Randomness
  335  ParseErrors
Printing list--keys should be 315, 335
  315  Shocks
  335  ParseErrors
Printing list--keys should be 319, 335
  319  Randomness
  335  ParseErrors
Printing list--keys should be 315, 319, 335
  315  Shocks
  319  Randomness
  335  ParseErrors
***----Finished tests of copying---------------------***


Let's look up some names ...
  name for 8001 is: Allen.
  Sorry, I couldn't find 8000 in the list.
  name for 8002 is: Peter.
  name for 8004 is: PointyHair.
***----Finished tests of finding -------------------------***
```

Exercise C:

```
/*
* File Name: exC.cpp
* Assignment: Lab 1 Exercise C
* Completed by: Dominic Choi 30109955, Nathan Ante 30157706
* Submission Date: Sept 20, 2023
*/

#include <string>
#include <vector>
using namespace std;
```

```
class Employee {
    private:
        string name;
        string address;
        string dateOfBirth;

    public:
        Employee(const string& name, const string& address, const string&
dateOfBirth):
            name(name), address(address), dateOfBirth(dateOfBirth){}
};

class Customer {
    private:
        string name;
        string address;
        string phone;

    public:
        Customer(const string& name, const string& address, const string&
phone):
            name(name), address(address), phone(phone){}
};

class Company {
    private:
        string companyName;
        string companyAddress;
        string dateEstablished;
        vector<Employee> employees;
        vector<string> employeeState;
        vector<Customer> customers;

    public:
        Company(const string& name, const string& address, const string&
dateEstablished):
            companyName(name), companyAddress(address),
dateEstablished(dateEstablished){}
```

```
        void addEmployee(const string& name, const string& address, const
string& dateOfBirth){
            employees.emplace_back(name, address, dateOfBirth);
        }

        void addCustomer(const string& name, const string& address, const
string& phone){
            customers.emplace_back(name, address, phone);
        }
};
```

Exercise D:

Output:

```
PROBLEMS  OUTPUT  DEBUG CONSOLE  PORTS  COMMENTS  TERMINAL

mackante@MacKante-PC:/mnt/c/Users/MacKante/Desktop/Fall23Resources/ENSF480/Lab1/ExerciseD$ g++ -Wall -o myprog human_program.cpp human.cpp point.cpp
mackante@MacKante-PC:/mnt/c/Users/MacKante/Desktop/Fall23Resources/ENSF480/Lab1/ExerciseD$ ./myprog
Human Name: Ken Lai
Human Location: 2000, 3000.

mackante@MacKante-PC:/mnt/c/Users/MacKante/Desktop/Fall23Resources/ENSF480/Lab1/ExerciseD$
```