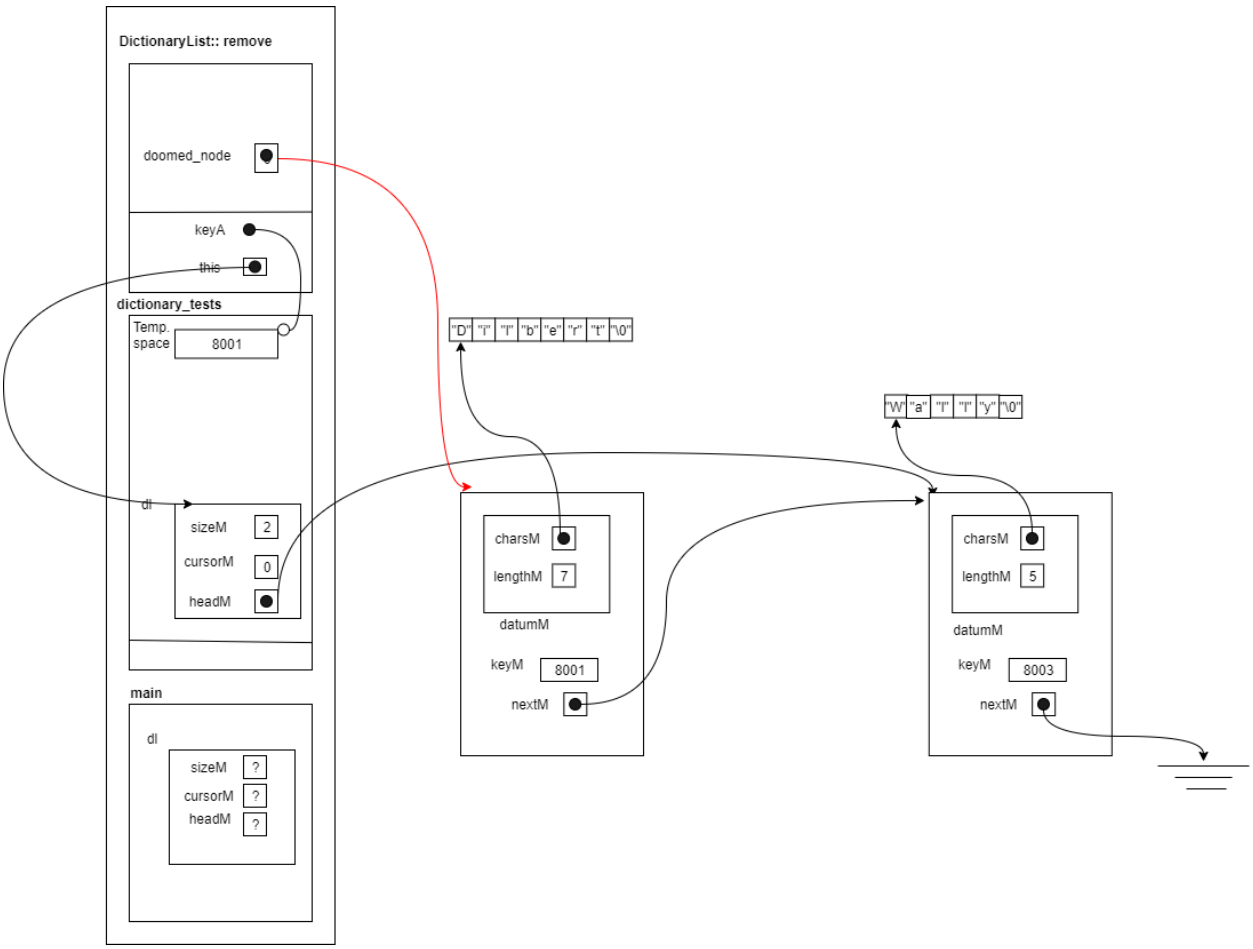
ENSF 619- Fall 2020

Lab 6

Completed by: Ziad Chemali & Lotfi Hasni

October 30, 2020

Exercise A:



Exercise B:

I] Code:

i) header files:

1) dictionaryList.h

```
// dictionaryList.h
// ENSF 619 - Lab 6 - Exercise B
//Completed by: Ziad Chemali & Lotfi Hasni
//Submission Date: October 30, 2020

#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.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.
 // friend ostream& operator <<(ostream& os, const DictionaryList& rhs);
  friend  ostream& operator<<(ostream& os, DictionaryList& rhs);
  const Mystring& operator[](int i);
  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
```

---

2) myString.h

```
/* File: mystring.h */
// ENSF 619 - Lab 6 - Exercise B
//Completed by: Ziad Chemali & Lotfi Hasni
//Submission Date: October 30, 2020
#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.

 bool operator >=(const Mystring& rhs) const;
 bool operator >( const Mystring& rhs) const;
 bool operator <(const Mystring& rhs) const;
 bool operator ==(const Mystring& rhs) const;
 bool operator <=( const Mystring& rhs) const;
 bool operator !=( const Mystring& rhs) const;
 friend ostream& operator <<(ostream& os, const Mystring& rhs);
  char& operator [](int n) const;
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
```

---

ii) cpp files

1) dictionaryList.cpp

```
// dictionaryList.cpp
// ENSF 619 - Lab 6 - Exercise B
//Completed by: Ziad Chemali & Lotfi Hasni
//Submission Date: October 30, 2020

#include <assert.h>
#include <iostream>
#include <stdlib.h>
#include "dictionaryList.h"
#include "mystring.h"
#include<string>
#pragma warning(disable : 4996)
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;
}

const Mystring& DictionaryList::operator[](int i)
```

```
{
    assert(this->sizeM >= i);
    Node* p = headM;
    int count = 0;
    while (p != 0)
    {
        if (count == i)
            return p->datumM;
        count++;
        p = p->nextM;
    }
}

ostream& operator<<(ostream& os, DictionaryList& rhs)
{

        for (rhs.go_to_first(); rhs.cursor_ok(); rhs.step_fwd()) {
           os << "   " << rhs.cursor_key();
            os << "   " << rhs.cursor_datum().c_str() << '\n';
        }
    return os;
}


void DictionaryList::copy(const DictionaryList& source)
{
    if (source.headM == 0) {
        headM = 0;
        return;
    }

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

    const Node *source_node = source.headM;

    while (true) {
        source_node = source_node->nextM;
        if (source_node == 0)
            break;
        newest_node->nextM = new Node(source_node->keyM, source_node->datumM, NULL);
        newest_node = newest_node->nextM;
    }

    cursorM = source.cursorM;
    sizeM = source.sizeM;
}

void DictionaryList::find(const int& keyA)
{
    for (Node *p = headM; p != 0; p=p->nextM)
        if (keyA == p->keyM)
        {
            cout << "'" << keyA <<"' was found with datum value " << p->datumM.c_str() <<
".\n";
            cursorM = p;
            return;
        }
```

```
    cout << "'" << keyA <<"' was not found.\n";
    cursorM = 0;
}

void DictionaryList::destroy()
{
    Node *p = headM;
    Node *prev;
    while (p != 0)
    {
        prev = p;
        p = p->nextM;
        delete prev;
    }
    headM = 0;
    sizeM = 0;
}
```

---

2) myString.cpp

```
/*  mystring.cpp
// ENSF 619 - Lab 6 - Exercise B
//Completed by: Ziad Chemali & Lotfi Hasni
//Submission Date: October 30, 2020*/
#include "mystring.h"
#include <string.h>
#include <iostream>
#include <cassert>
#pragma warning(disable : 4996)
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);
}









 char& Mystring::operator[](int n) const
 {
    if (n >= 0 && n < lengthM)
     return this->charsM[n];
 }

 void Mystring::memory_check(char* s)
{
  if(s == 0)
    {
      cerr <<"Memory not available.";
      exit(1);
    }
}

    bool Mystring::operator>=( const Mystring& rhs) const
 {
     if (strcmp(this->charsM, rhs.charsM) >= 0)
         return true;
     return false;
 }

    bool Mystring::operator>(const Mystring& rhs)const
```

```
{
    if (strcmp(this->charsM, rhs.charsM) > 0)
        return true;
    return false;
}

   bool Mystring:: operator<(const Mystring& rhs)const
{
    if (strcmp(this->charsM, rhs.charsM) < 0)
        return true;
    return false;
}

   bool Mystring::operator==(const Mystring& rhs)const
{
    if (strcmp(this->charsM, rhs.charsM) == 0)
        return true;
    return false;
}

   bool Mystring:: operator<=(const Mystring& rhs)const
{
    if (strcmp(this->charsM, rhs.charsM) <= 0)
        return true;
    return false;
}

   bool Mystring:: operator!=(const Mystring& rhs)const
{
    if (strcmp(this->charsM, rhs.charsM) != 0)
        return true;
    return false;
}

ostream& operator<<(ostream& os, const Mystring& rhs)
{
    return os << rhs.charsM;
}
```

---

3) exBmain.cpp

```
// exBmain.cpp
// ENSF 619 - Lab 6 - Exercise B
//Completed by: Ziad Chemali & Lotfi Hasni
//Submission Date: October 30, 2020
#include <assert.h>
#include <iostream>
#include "dictionaryList.h"
#pragma warning(disable : 4996)
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_operator_overloading(dl);

  return 0;
}

DictionaryList dictionary_tests()
{

  DictionaryList dl;

  assert(dl.size() == 0);
  std::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);
  std::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);
  std::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);
  std::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);
  std::cout << "\nPrinting list after inserting 2 more keys ...\n";
  print(dl);

  std::cout << "***----Finished dictionary tests---------------------------***\n\n";
  return dl;
}

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";
}

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';
    }
}
```

II] Output:

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----------

Testig a few comparison and insertion operators.

Peter is greater than or equal Allen

Allen is less than Peter

Peter is not equal to Allen

Peter is greater than Allen

Peter is not less than Allen

Peter is not equal to Allen

Using square bracket [] to access elements of Mystring objects.

The socond element of Peter is: e

The socond element of Poter is: o

Using << to display key/datum pairs in a Dictionary list:

8001 Allen

8002 Peter

8003 Sam

8004 PointyHair

Using [] to display the datum only:

Allen

Peter

Sam

PointyHair

Using [] to display sequence of charaters in a datum:

A

l

l

e

n

----finished tests for overloading operators ----------

Exercise C & D:

I] Code:

1) BubbleSorter.java:

```
/*
 * BubbleSorter.java
 * ENSF 619-Lab 6- Exercise C&D
 * Completed by: Ziad Chemali & Lotfi Hasni
```

```
 * Submission date: October 30, 2020
 */
package exercise_C_D;

import java.util.ArrayList;

public class BubbleSorter<E extends Number & Comparable<E>> implements Sorter<E>{

	@Override
	public void sort(ArrayList<Item<E>> s) {
		for(int i = 0; i < s.size() - 1; i++) {
			for(int j = s.size() - 1; j > i; j--) {
				// Swaps elements if previous is found to be greater than following
				if(s.get(j).getItem().compareTo(s.get(j-1).getItem()) < 0 ) {
					Item<E> temp = s.get(j-1);
					s.set(j-1, s.get(j));
					s.set(j,temp);
				}
			}
		}
	}

}
```

2) InsertionSorter.java:

```
/*
 * InsertionSorter.java
 * ENSF 619-Lab 6- Exercise C&D
 * Completed by: Ziad Chemali & Lotfi Hasni
```

```
 * Submission date: October 30, 2020
 */
package exercise_C_D;

import java.util.ArrayList;

public class InsertionSorter <E extends Number & Comparable<E>> implements Sorter<E>{

	@Override
	public void sort(ArrayList<Item<E>> s) {
	// Traverses unsorted portion of array
		for(int i = 1; i < s.size(); i++) {
			Item<E> current = s.get(i);
			int j = i - 1;
			// If current element smaller than preceding element, shifts elements forward to make space
			while(j >= 0 && s.get(j).getItem().compareTo(current.getItem()) > 0) {
				s.set(j+1, s.get(j));
				j = j - 1;
			}
			// Inserts current element in its proper place
			s.set(j+1, current);
		}
	}

}
}
```

3) SelectionSorter.java:

```
/*
 * SelectionSorter.java
 * ENSF 619-Lab 6- Exercise C&D
 * Completed by: Ziad Chemali & Lotfi Hasni
 * Submission date: October 30, 2020
 */
package exercise_C_D;
import java.util.ArrayList;
public class SelectionSorter<E extends Number & Comparable<E>> implements Sorter<E> {

	@Override
	public void sort(ArrayList<Item<E>> s) {
		for (int i = 0; i < s.size() - 1; i++)
		{
			int j = i;

	for (int k = i + 1; k < s.size(); k++){
		if (s.get(k).getItem().compareTo(s.get(j).getItem())< 0){
			j = k;
		}
	}
	Item<E> temp= s.get(j);
	s.set(j, s.get(i));
	s.set(i, temp);
	}
	}

}
```

4) Sorter.java:

```
/*
 * Sorter.java
 * ENSF 619-Lab 6- Exercise C&D
 * Completed by: Ziad Chemali & Lotfi Hasni
 * Submission date: October 30, 2020
 */
package exercise_C_D;

import java.util.ArrayList;

public interface Sorter <E extends Number & Comparable<E>> {

	void sort(ArrayList<Item <E>> s);
}
```

---

5) MyVector.java:

```
/*
 * MyVector.java
 * ENSF 619-Lab 6- Exercise C&D
 * Completed by: Ziad Chemali & Lotfi Hasni
 * Submission date: October 30, 2020
 */
package exercise_C_D;

import java.util.ArrayList;

public class MyVector<E extends Number & Comparable<E>>{
```

```
private ArrayList <Item<E>> storageM;
private Sorter<E> sorter;

MyVector(int n){
	storageM = new ArrayList<Item<E>>(n);
}

MyVector(ArrayList <Item<E>> arr){
	ArrayList <Item<E>> newStorageM = new ArrayList<Item<E>>(arr.size());
	for(Item<E> i: arr) {
		newStorageM.add(new Item<E> (i.getItem()));
	}
	storageM = newStorageM;
}

public void add(Item<E> value) {
	storageM.add(value);
}

public void setSortStrategy(Sorter<E> s) {
	sorter = s;
}

public void performSort() {
	sorter.sort(storageM);
}

public void display() {
```

```
		for(Item<E> i: storageM)
			System.out.print(i.getItem() + " ");
		System.out.println();
	}

}
```

6) Item.java:

```
package exercise_C_D;

/* ENSF 480 - Lab 5 Exercise A and B
 * M. Moussavi, October 2020
 *
 */

class Item <E extends Number & Comparable<E>>{
	private E item;
	public Item(E value) {
		item = value;
	}

	public void setItem(E value){
		item = value;
	}

	public E getItem(){
		return item;
	}
}
```

7) DemoStrategyPattern.java:

```
/*
 * DemoStrategyPattern.java
 * ENSF 619-Lab 6- Exercise C&D
 * Completed by: Ziad Chemali & Lotfi Hasni
 * Submission date: October 30, 2020
 */
package exercise_C_D;

import java.util.Random;
public class DemoStrategyPattern {
	public static void main(String[] args) {
		// Create an object of MyVector with capacity of 50 elements
		MyVector<Double> v1 = new MyVector<Double> (50);

		// Create a Random object to generate values between 0
		Random rand = new Random();

		// adding 5 randomly generated numbers into MyVector object v1
	  for(int i = 4; i >=0; i--) {
		    Item<Double> item;
		    item = new Item<Double> (Double.valueOf(rand.nextDouble()*100));
		   v1.add(item);
	  }

	   // displaying original data in MyVector v1
      System.out.println("The original values in v1 object are:");
		v1.display();
```

```
                // choose algorithm bubble sort as a strategy to sort object v1
                v1.setSortStrategy(new BubbleSorter<Double> ());

                // perform algorithm bubble sort to v1
                v1.performSort();

        System.out.println("\nThe values in MyVector object v1 after performing BubbleSorter is:");
                v1.display();

                // create a MyVector<Integer> object V2
                MyVector<Integer> v2 = new MyVector<Integer> (50);

                // populate v2 with 5 randomly generated numbers
                for(int i = 4; i >=0; i--) {
                        Item<Integer> item;
                                                                        //WAS DOUBLE
                        item = new Item<Integer> (Integer.valueOf(rand.nextInt(50)));
                        v2.add(item);
                        }

                System.out.println("\nThe original values in v2 object are:");
                        v2.display();
                        v2.setSortStrategy(new InsertionSorter<Integer>());;
                        v2.performSort();
                System.out.println("\nThe values in MyVector object v2 after performing InsertionSorter
is:");
                        v2.display();
```

```
                    // create a MyVector<Float> object V3
                    MyVector<Float> v3 = new MyVector<Float> (50);


                    // populate v3 with 5 randomly generated numbers
                    for(int i = 4; i >=0; i--) {
                            Item<Float> item;

                            item = new Item<Float> (Float.valueOf(rand.nextFloat()*50));
                            v3.add(item);
                            }


                System.out.println("\nThe original values in v3 object are:");
                v3.display();
                v3.setSortStrategy(new SelectionSorter<Float>());;
                v3.performSort();
                System.out.println("\nThe values in MyVector object v3 after performing
SelectionSorter is:");
                            v3.display();
        }
}
```

II] Output:

```
The original values in v1 object are:
64.6632757171382 50.2906303930178 3.5911397130729217 24.188280109085557 80.86764526035275

The values in MyVector object v1 after performing BubbleSorter is:
3.5911397130729217 24.188280109085557 50.2906303930178 64.6632757171382 80.86764526035275

The original values in v2 object are:
48 16 40 47 42

The values in MyVector object v2 after performing InsertionSorter is:
16 40 42 47 48

The original values in v3 object are:
28.18698 7.250863 1.4084786 10.945305 9.357071

The values in MyVector object v3 after performing SelectionSorter is:
1.4084786 7.250863 9.357071 10.945305 28.18698
```