Course: Programming Fundamental - ENSF 480
Lab #: Lab 2
Instructor: G. Gouri
Student Name: Daniel Rey, Aly Farouz
Lab Section: B01
Date Submitted: September 22, 2025

Exercise A

```cpp
/*
* File Name: dictionaryList.cpp
* Assignment: Lab 2 Exercise A
* Lab Section: B01
* Completed by: Aly Farouz, Daniel Rey
* Submission Date: Sept 11, 2025
*/
#include <assert.h>
#include <iostream>
#include <stdlib.h>
#include "dictionaryList.h"
using namespace std;

Node::Node(const int& keyA, const Datum& datumA, Node *nextA)
: keyM(keyA), datumM(datumA), nextM(nextA)
{
}

DictionaryList::DictionaryList()
: sizeM(0), headM(0), cursorM(0)
{
}

int DictionaryList::size() const
{
   return sizeM;
}

int DictionaryList::cursor_ok() const
{
   return cursorM != 0;
}

const int& DictionaryList::cursor_key() const
{
   assert(cursor_ok());
   return cursorM->keyM;
}

Datum& DictionaryList::cursor_datum() const
{
   assert(cursor_ok());
   return cursorM->datumM;
}


void DictionaryList::insert(const int& keyA, const string& 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;
}



// The following functions are supposed to be completed by the stuents, as part
// of the exercise B. the given code for this fucntion are just place-holders
// in order to allow successful linking when you're esting insert and remove.
// Replace them with the definitions that work.

DictionaryList::DictionaryList(const DictionaryList& source)
{
   // Students should replace these messages with proper code.
   cout << "\nWARNING: Copy constructor fails, because it is not properly
implemented.";
   cout << " Students should fix it nd remove this warning." << endl;
}

DictionaryList& DictionaryList::operator =(const DictionaryList& rhs)
{
 if (this != &rhs) {
   if (sizeM>=rhs.sizeM)
   {
     if (headM!=NULL)
     {
       Node *c, *p = headM;
       for(c=rhs.headM; c!=NULL; p=p->nextM)
       {
         p->keyM = c->keyM;
         p->datumM = c->datumM;
         c = c->nextM;
       }
       Node *next = p->nextM;
       p->nextM = NULL;
       while(next!=NULL)
       {
         p = next;
         next = next->nextM;
         delete p;
       }
     }
   }
   else
   {
     Node *prev, *p, *c = rhs.headM;
     if (headM==NULL)
     {
       prev = headM = new Node(c->keyM, c->datumM, NULL);
       c = c->nextM;
     }
     else
     {
       for(p=headM; p!=NULL; p=p->nextM)
       {
         p->keyM = c->keyM;
         p->datumM = c->datumM;
         c = c->nextM;
         prev = p;
       }
     }
     while(c!=NULL)
     {
       p = new Node(c->keyM, c->datumM, NULL);
       prev = prev->nextM = p;
       c = c->nextM;
     }
   }
   cursorM = rhs.cursorM;
   sizeM = rhs.sizeM;
 }
 return *this;
}


DictionaryList::~DictionaryList()
{
   // Students should replace these messages with proper code.
   exit(1);
   cout << "\nWARNING: the destructor of class DictionaryList fails, because it is not
properly implemented.";
   cout << " Students should fix it nd remove this warning." << endl;
}

void DictionaryList::find(const int& keyA)
{
   // Students should replace these messages with proper code.
   cout << "\nDon't know how to find " << keyA << " (or any other key).\n";
   cout << "... so exit is being called.\n";
   exit(1);
}

void DictionaryList::make_empty()
{
   // Students should replace these messages with proper code.
   cout << "\nWARNING: call to the function make_empty failed, because it is not
properly implemented.";
   cout << " Students should fix it and remove this warning." << endl;
}



ostream& operator << (ostream& os, DictionaryList& dl)
{
   os << dl.cursor_datum();
   return os;
}
bool DictionaryList::operator !=(const DictionaryList& rhs)
{
  return !(this->cursor_datum() == rhs.cursor_datum());
}
bool DictionaryList::operator >(const DictionaryList& rhs)
{
  return this->cursor_datum() > rhs.cursor_datum();
}
bool DictionaryList::operator <(const DictionaryList& rhs)
{
  return this->cursor_datum() < rhs.cursor_datum();
}
bool DictionaryList::operator <=(const DictionaryList& rhs)
```

```
{
  return !(this->cursor_datum() > rhs.cursor_datum());
}
bool DictionaryList::operator >=(const DictionaryList& rhs)
{
  return !(this->cursor_datum() < rhs.cursor_datum());
}
//above few functions were implemented by Farouz
Datum DictionaryList::operator[](int i)const{ //will cause an error if i >= sizeM
   Node* p=headM;
   while(i>0){
       p=p->nextM;
       i--;
   }
   return p->datumM;
}
```

```
/*
* File Name: Lab2_exAmain.cpp
* Assignment: Lab 2 Exercise A
* Lab Section: B01
* Completed by: Aly Farouz, Daniel Rey
* Submission Date: Sept 11, 2025
*/

#include <assert.h>
#include <iostream>
#include "dictionaryList.h"

using namespace std;

DictionaryList dictionary_tests();

void print(DictionaryList& dl);

void test_operator_overloading(DictionaryList& dl);

int main()
{
 DictionaryList dl = dictionary_tests();
#if 0
test_operator_overloading(dl);
#endif
 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 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';
 }
}



#if 1
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
```

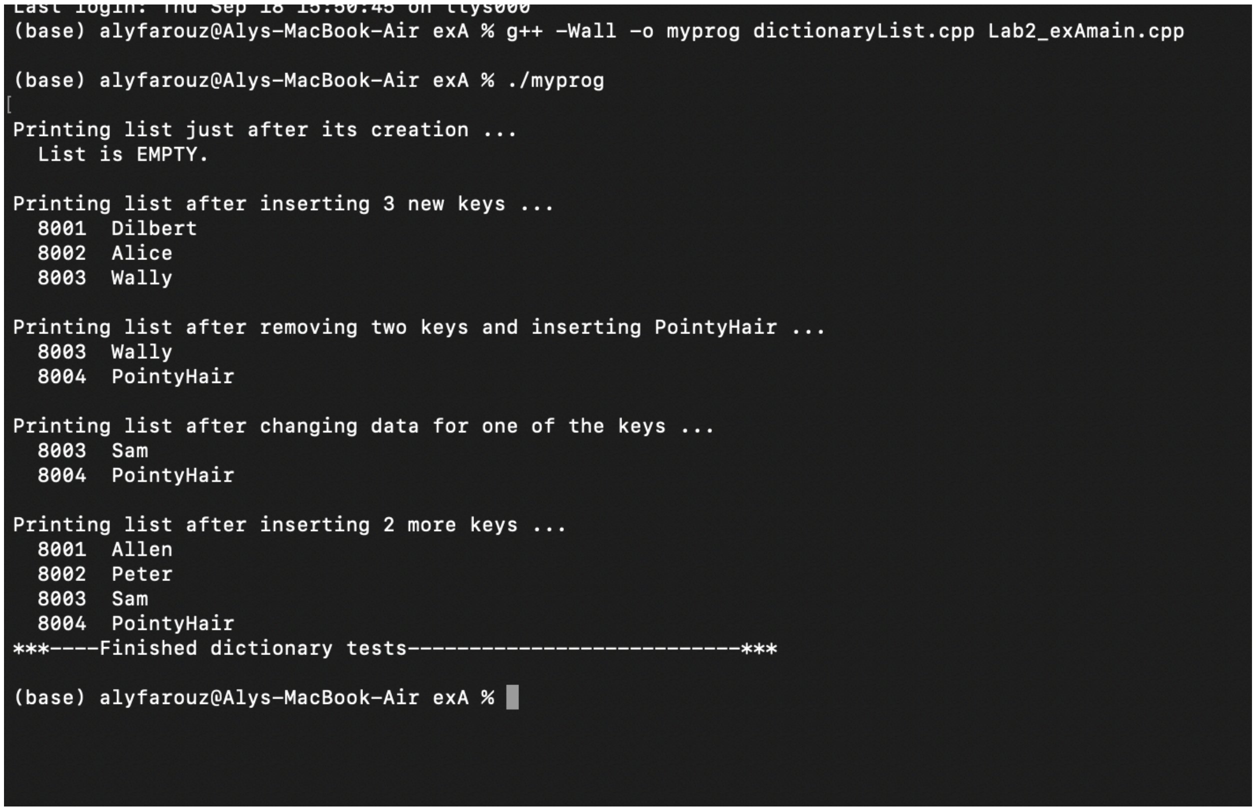
```
     *   Sam
     *   PointyHair
     */

   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
```

```
/*
* File Name: dictionaryList.h
* Assignment: Lab 2 Exercise A
* Lab Section: B01
* Completed by: Aly Farouz, Daniel Rey
* Submission Date: Sept 11, 2025
*/

#ifndef DICTIONARY_H
#define DICTIONARY_H
#include <iostream>
#include <string>
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.


// You can edit this typedef to change the datum types, if necessary (it is not
necessary
// for this lab exercise).

typedef string 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; // makeing DictionaryList a fried to have access to
private data member in a node.
private:
   int keyM;
   Datum datumM;
   Node *nextM;

   // This ctor should be convenient in insert and copy operations.
   Node(const int& 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 int& cursor_key() const;
// REQUIRES: cursor_ok()
// PROMISES: Returns key of key/datum pair to which cursor is attached.

Datum& cursor_datum() const;
// REQUIRES: cursor_ok()
// PROMISES: Returns datum of key/datum pair to which cursor is attached.

void insert(const int& 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 int& 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 int& 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.
```

```cpp
   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, DictionaryList& dl);
   bool operator !=(const DictionaryList& rhs);
   bool operator >(const DictionaryList& rhs);
   bool operator <(const DictionaryList& rhs);
   bool operator <=(const DictionaryList& rhs);
   bool operator >=(const DictionaryList& rhs);
   Datum operator[](int i) const;


private:
   int sizeM;
   Node *headM;    // a pointer that points to the first node in the list. Or is set
to zero,
   Node *cursorM;  // a pointer that can be used to traverse through list. Or set to
zero, if not used.
#if 0
   void destroy();
   // REQUIRES: A helper function that deallocate all nodes, set headM to zero.

   void copy(const DictionaryList& source);
   // REQUIRES: A helper function to establishe *this as a copy of source.  Cursor of
*this will
   // point to the twin of whatever the source's cursor points to.
#endif
};

#endif
```



```
Last login: Thu Sep 18 15:50:45 on ttys000
(base) alyfarouz@Alys-MacBook-Air exA % g++ -Wall -o myprog dictionaryList.cpp Lab2_exAmain.cpp

(base) alyfarouz@Alys-MacBook-Air exA % ./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---------------------------***

(base) alyfarouz@Alys-MacBook-Air exA % 
```

Exercise B

```
/*
* File Name: graphicsWorld.h
* Assignment: Lab 2, Exercise B
* Lab Section: B01
* Completed by: Daniel Rey
* Submission Date: Sept 22, 2025
*/

#ifndef GRAPHICSWORLD_H
#define GRAPHICSWORLD_H
#include "point.h"
#include "shape.h"
#include "square.h"
#include "rectangle.h"
using namespace std;

class GraphicsWorld {
public:
  GraphicsWorld();
  ~GraphicsWorld();
  static void run();
};
#endif



/*
* File Name: graphicsWorld.cpp
* Assignment: Lab 2, Exercise B
* Lab Section: B01
* Completed by: Daniel Rey
* Submission Date: Sept 22, 2025
*/
```

```
#include <iostream>
#include "graphicsWorld.h"
using namespace std;

void GraphicsWorld::run(){
  #if 1 // Change 0 to 1 to test Point
    Point m (6, 8);
    Point n (6,8);
    n.setx(9);
    cout << "\nExpected to dispaly the distance between m and n is: 3";
    cout << "\nThe distance between m and n is: " << m.distance(n);
    cout << "\nExpected second version of the distance function also print: 3";
    cout << "\nThe distance between m and n is again: "
         << Point::distance(m, n);
  #endif // end of block to test Point
  #if 1 // Change 0 to 1 to test Square
    cout << "\n\nTesting Functions in class Square:" <<endl;
    Square s(5, 7, 12, "SQUARE - S");
    s.display();
  #endif // end of block to test Square
  #if 1 // Change 0 to 1 to test Rectangle
    cout << "\nTesting Functions in class Rectangle:" << endl;
    Rectangle a(5, 7, 12, 15, "RECTANGLE A");
    a.display();
    Rectangle b(16 , 7, 8, 9, "RECTANGLE B");
    b.display();
    double d = a.distance(b);
    cout <<"\nDistance between square a, and b is: " << d << endl;
    Rectangle rec1 = a;
    rec1.display();
    cout << "\nTesting assignment operator in class Rectangle:" <<endl;
    Rectangle rec2 (3, 4, 11, 7, "RECTANGLE rec2");
    rec2.display();
    rec2 = a;
    a.set_side_b(200);
    a.set_side_a(100);
    cout << "\nExpected to display the following values for objec rec2: " << endl;
    cout << "Rectangle Name: RECTANGLE A\n" << "X-coordinate: 5\n" << "Y-coordinate: 7\n"
         << "Side a: 12\n" << "Side b: 15\n" << "Area: 180\n" << "Perimeter: 54\n" ;
    cout << "\nIf it doesn't there is a problem with your assignment operator.\n" << endl;
    rec2.display();

    cout << "\nTesting copy constructor in class Rectangle:" <<endl;
    Rectangle rec3 (a);
    rec3.display();
    a.set_side_b(300);
    a.set_side_a(400);
    cout << "\nExpected to display the following values for objec rec2: " << endl;
    cout << "Rectangle Name: RECTANGLE A\n" << "X-coordinate: 5\n" << "Y-coordinate: 7\n"
    << "Side a: 100\n" << "Side b: 200\n" << "Area: 20000\n" << "Perimeter: 600\n" ;
    cout << "\nIf it doesn't there is a problem with your copy constructor.\n" << endl;
    rec3.display();
  #endif // end of block to test Rectangle
  #if 1 // Change 0 to 1 to test using array of pointer and polymorphism
    cout << "\nTesting array of pointers and polymorphism:" <<endl;
    Shape* sh[4];
    sh[0] = &s;
    sh[1] = &b;
    sh [2] = &rec1;
    sh [3] = &rec3;
    sh [0]->display();
    sh [1]->display();
    sh [2]->display();
    sh [3]->display();
  #endif // end of block to test array of pointer and polymorphism
}

#if 1
main(){GraphicsWorld::run();}
// g++ -Wall graphicsWorld.cpp point.cpp shape.cpp square.cpp rectangle.cpp -o exB.exe
#endif
```

```
/*
* File Name: point.h
* Assignment: Lab 2, Exercise B
* Lab Section: B01
* Completed by: Daniel Rey
* Submission Date: Sept 22, 2025
*/

#ifndef POINT_H
#define POINT_H
using namespace std;

class Point{
private:
  double x;
  double y;
  static int count;
  const int id;
public:
  Point(double x, double y);
  Point(const Point& other);
  Point& operator=(const Point& rhs);
  double getx() const;
  void setx(double a);
  double gety() const;
  void sety(double a);

  void display()const;
  const static int counter();
  static double distance(const Point& the_point, const Point& other);
  double distance(const Point& other)const;
};
#endif
```

```
/*
* File Name: point.cpp
* Assignment: Lab 2, Exercise B
* Lab Section: B01
* Completed by: Daniel Rey
* Submission Date: Sept 22, 2025
*/

#include <iostream>
#include <iomanip>
#include <cmath>
using namespace std;

#ifndef POINT_H
#include "point.h"
int Point::count = 0;
#endif


Point::Point(double h, double v): x(h), y(v), id(++count+1000){}

Point::Point(const Point& other): x(other.getx()), y(other.gety()), id(++count+1000){}

Point& Point::operator=(const Point& rhs){
  x=rhs.getx();
  y=rhs.gety();
  return *this;
}

double Point::getx()const{return x;}
void Point::setx(double a){x=a;}
double Point::gety()const{return y;}
```

```
void Point::sety(double a){y=a;}

void Point::display()const{
  cout << "X-coordinate: ";
  cout << right << setw(9) << fixed << setprecision(2) << this->x << endl;
  cout << "Y-coordinate: ";
  cout << right << setw(9) << fixed << setprecision(2) << this->y << endl;
}

const int Point::counter(){return count;}

double Point::distance(const Point& the_point, const Point& other){
  double dx=the_point.getx()-other.getx();
  double dy=the_point.gety()-other.gety();
  return sqrt(dx*dx+dy*dy);
}
double Point::distance(const Point& other)const{
  double dx=this->x-other.getx();
  double dy=this->y-other.gety();
  return sqrt(dx*dx+dy*dy);
}
```

```
/*
* File Name: shape.h
* Assignment: Lab 2, Exercise B
* Lab Section: B01
* Completed by: Daniel Rey
* Submission Date: Sept 22, 2025
*/

#ifndef SHAPE_H
#define SHAPE_H
#include "point.h"
using namespace std;

class Shape{
protected:
  Point origin;
  char* shapeName;
public:
  Shape(double x, double y, const char* name);
  Shape(const Shape& other);
  virtual ~Shape();
  Shape& operator=(const Shape& rhs);
  const Point& getOrigin() const;
  const char* getName() const;

  virtual void display();
  double distance(const Shape& other)const;
  static double distance(const Shape& the_shape, const Shape& other);
  void move(double dx, double dy);
};
#endif
```

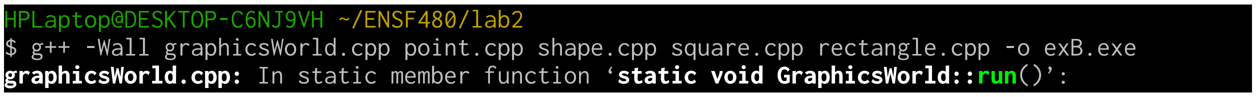
```
/*
* File Name: shape.cpp
* Assignment: Lab 2, Exercise B
* Lab Section: B01
* Completed by: Daniel Rey
* Submission Date: Sept 22, 2025
*/

#include <iostream>
#include <cstring>
#include "shape.h"
using namespace std;
```

```
Shape::Shape(double x, double y, const char* name):
origin(Point(x,y)),
shapeName(new char[strlen(name)+1]){
  strcpy(this->shapeName, name);
}

Shape::Shape(const Shape& other):
origin(Point(other.getOrigin())),
shapeName(new char[strlen(other.getName())+1]){
  strcpy(this->shapeName, other.getName());
}

Shape::~Shape(){
  delete [] shapeName;
}

Shape& Shape::operator=(const Shape& rhs){
  if (this!=&rhs){
    delete [] shapeName;
    shapeName = new char[strlen(rhs.getName())+1];
    strcpy(this->shapeName, rhs.getName());
    origin = rhs.getOrigin();
  }
  return *this;
}

const Point& Shape::getOrigin()const{
  const Point& p=origin;
  return p;
}

const char* Shape::getName()const{return shapeName;}


void Shape::display(){
  cout << "Shape Name: " << shapeName << endl;
  origin.display();
}

double Shape::distance(const Shape& other)const{
  return Point::distance(this->origin, other.getOrigin());
}
double Shape::distance(const Shape& the_shape, const Shape& other){
  return Point::distance(the_shape.getOrigin(), other.getOrigin());
}

void Shape::move(double dx, double dy){
  origin.setx(origin.getx()+dx);
  origin.sety(origin.gety()+dy);
}



/*
* File Name: square.h
* Assignment: Lab 2, Exercise B
* Lab Section: B01
* Completed by: Daniel Rey
* Submission Date: Sept 22, 2025
*/

#ifndef SQUARE_H
#define SQUARE_H
#include "shape.h"
using namespace std;
```

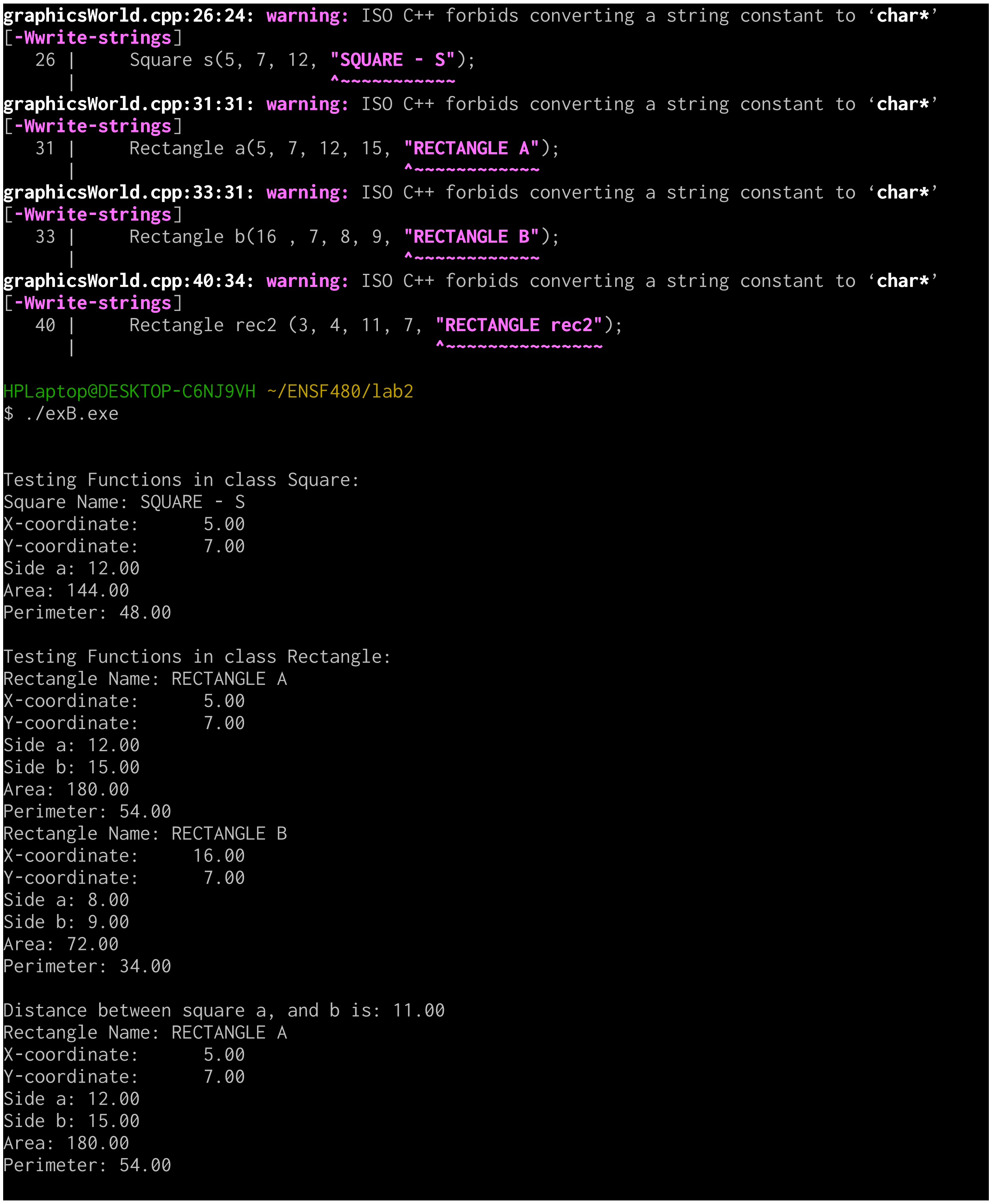
```
class Square: public Shape{
protected:
  double side_a;
public:
  Square(double x, double y, double a, char* name);
  Square(const Square& other);
  Square& operator =(const Square& rhs);
  const double get_side_a()const;
  void set_side_a(double a);

  double area()const;
  double perimeter()const;
  virtual void display()const;
};
#endif



/*
* File Name: square.cpp
* Assignment: Lab 2, Exercise B
* Lab Section: B01
* Completed by: Daniel Rey
* Submission Date: Sept 22, 2025
*/

#include <iostream>
#include "square.h"
using namespace std;

Square::Square(double x, double y, double a, char* name): Shape(x,y,name), side_a(a){}

Square::Square(const Square& other): Shape(other), side_a(other.get_side_a()){}

Square& Square::operator=(const Square& rhs){
  if (this!=&rhs){
    Shape::operator=(rhs);
    side_a = rhs.get_side_a();
  }
  return *this;
}

const double Square::get_side_a()const{return side_a;}
void Square::set_side_a(double a){side_a=a;}

double Square::area()const{return side_a*side_a;}
double Square::perimeter()const{return side_a*4;}

void Square::display()const{
  cout << "Square Name: " << shapeName << endl;
  origin.display();
  cout << "Side a: " << side_a << endl
       << "Area: " << area() << endl
       << "Perimeter: " << perimeter() << endl;
}



/*
* File Name: rectangle.h
* Assignment: Lab 2, Exercise B
* Lab Section: B01
* Completed by: Daniel Rey
* Submission Date: Sept 22, 2025
*/

#ifndef RECTANGLE_H
#define RECTANGLE_H
#include "square.h"
using namespace std;
```

```
class Rectangle: public Square{
private:
  double side_b;
public:
  Rectangle(double x, double y, double a, double b, char* name);
  Rectangle(const Rectangle& other);
  Rectangle& operator =(const Rectangle& rhs);
  const double get_side_b()const;
  void set_side_b(double b);

  double area()const;
  double perimeter()const;
  void display()const;
};
#endif
```

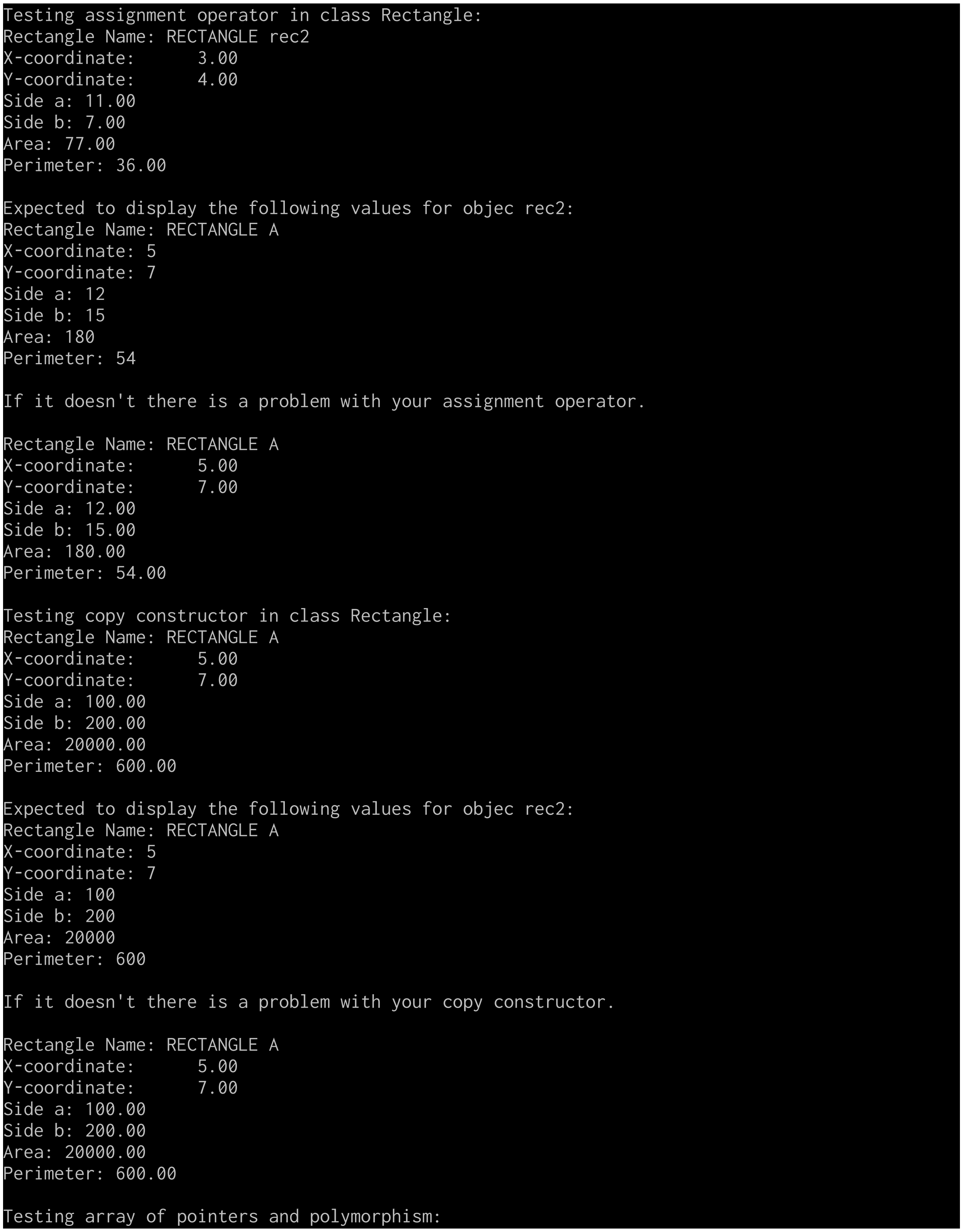
```
/*
* File Name: rectangle.cpp
* Assignment: Lab 2, Exercise B
* Lab Section: B01
* Completed by: Daniel Rey
* Submission Date: Sept 22, 2025
*/

#include <iostream>
#include "rectangle.h"
using namespace std;

Rectangle::Rectangle(double x, double y, double a, double b, char* name):
Square(x,y,a,name),
side_b(b){}

Rectangle::Rectangle(const Rectangle& other):
Square(other),
side_b(other.get_side_b()){}

Rectangle& Rectangle::operator=(const Rectangle& rhs){
  if (this!=&rhs){
    Square::operator=(rhs);
    side_b = rhs.get_side_b();
  }
  return *this;
}

const double Rectangle::get_side_b()const{return side_b;}
void Rectangle::set_side_b(double b){side_b=b;}

double Rectangle::area()const{return side_a*side_b;}
double Rectangle::perimeter()const{return side_a*2+side_b*2;}

void Rectangle::display()const{
  cout << "Rectangle Name: " << shapeName << endl;
  origin.display();
  cout << "Side a: " << side_a << endl
       << "Side b: " << side_b << endl
       << "Area: " << area() << endl
       << "Perimeter: " << perimeter() << endl;
}
```



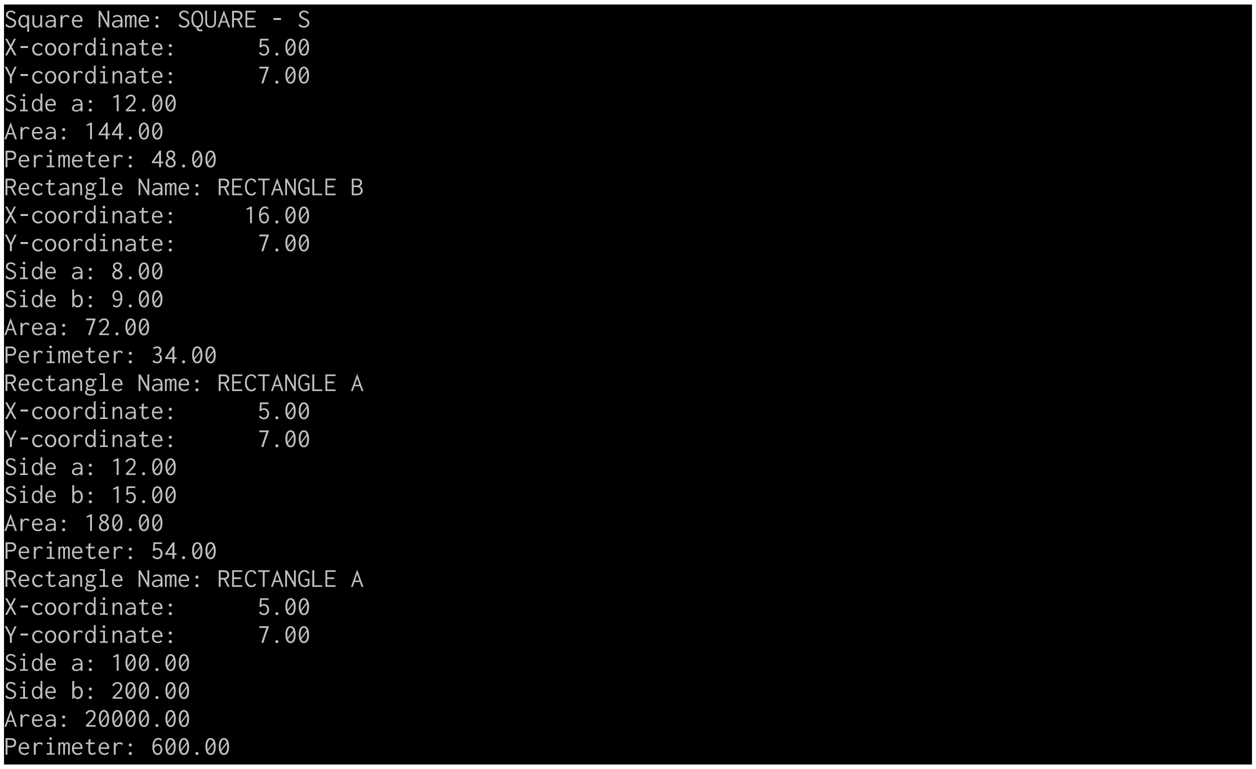
```
HPLaptop@DESKTOP-C6NJ9VH ~/ENSF480/lab2
$ g++ -Wall graphicsWorld.cpp point.cpp shape.cpp square.cpp rectangle.cpp -o exB.exe
graphicsWorld.cpp: In static member function ‘static void GraphicsWorld::run()’:
```



```
graphicsWorld.cpp:26:24: warning: ISO C++ forbids converting a string constant to ‘char*’
[-Wwrite-strings]
   26 |     Square s(5, 7, 12, "SQUARE - S");
      |                        ^~~~~~~~~~~~
graphicsWorld.cpp:31:31: warning: ISO C++ forbids converting a string constant to ‘char*’
[-Wwrite-strings]
   31 |     Rectangle a(5, 7, 12, 15, "RECTANGLE A");
      |                               ^~~~~~~~~~~~~
graphicsWorld.cpp:33:31: warning: ISO C++ forbids converting a string constant to ‘char*’
[-Wwrite-strings]
   33 |     Rectangle b(16 , 7, 8, 9, "RECTANGLE B");
      |                               ^~~~~~~~~~~~~
graphicsWorld.cpp:40:34: warning: ISO C++ forbids converting a string constant to ‘char*’
[-Wwrite-strings]
   40 |     Rectangle rec2 (3, 4, 11, 7, "RECTANGLE rec2");
      |                                  ^~~~~~~~~~~~~~~~

HPLaptop@DESKTOP-C6NJ9VH ~/ENSF480/lab2
$ ./exB.exe


Testing Functions in class Square:
Square Name: SQUARE - S
X-coordinate:      5.00
Y-coordinate:      7.00
Side a: 12.00
Area: 144.00
Perimeter: 48.00

Testing Functions in class Rectangle:
Rectangle Name: RECTANGLE A
X-coordinate:      5.00
Y-coordinate:      7.00
Side a: 12.00
Side b: 15.00
Area: 180.00
Perimeter: 54.00
Rectangle Name: RECTANGLE B
X-coordinate:     16.00
Y-coordinate:      7.00
Side a: 8.00
Side b: 9.00
Area: 72.00
Perimeter: 34.00

Distance between square a, and b is: 11.00
Rectangle Name: RECTANGLE A
X-coordinate:      5.00
Y-coordinate:      7.00
Side a: 12.00
Side b: 15.00
Area: 180.00
Perimeter: 54.00
```



```
Testing assignment operator in class Rectangle:
Rectangle Name: RECTANGLE rec2
X-coordinate:      3.00
Y-coordinate:      4.00
Side a: 11.00
Side b: 7.00
Area: 77.00
Perimeter: 36.00

Expected to display the following values for objec rec2:
Rectangle Name: RECTANGLE A
X-coordinate: 5
Y-coordinate: 7
Side a: 12
Side b: 15
Area: 180
Perimeter: 54

If it doesn't there is a problem with your assignment operator.

Rectangle Name: RECTANGLE A
X-coordinate:      5.00
Y-coordinate:      7.00
Side a: 12.00
Side b: 15.00
Area: 180.00
Perimeter: 54.00

Testing copy constructor in class Rectangle:
Rectangle Name: RECTANGLE A
X-coordinate:      5.00
Y-coordinate:      7.00
Side a: 100.00
Side b: 200.00
Area: 20000.00
Perimeter: 600.00

Expected to display the following values for objec rec2:
Rectangle Name: RECTANGLE A
X-coordinate: 5
Y-coordinate: 7
Side a: 100
Side b: 200
Area: 20000
Perimeter: 600

If it doesn't there is a problem with your copy constructor.

Rectangle Name: RECTANGLE A
X-coordinate:      5.00
Y-coordinate:      7.00
Side a: 100.00
Side b: 200.00
Area: 20000.00
Perimeter: 600.00

Testing array of pointers and polymorphism:
```



```
Square Name: SQUARE - S
X-coordinate:      5.00
Y-coordinate:      7.00
Side a: 12.00
Area: 144.00
Perimeter: 48.00
Rectangle Name: RECTANGLE B
X-coordinate:     16.00
Y-coordinate:      7.00
Side a: 8.00
Side b: 9.00
Area: 72.00
Perimeter: 34.00
Rectangle Name: RECTANGLE A
X-coordinate:      5.00
Y-coordinate:      7.00
Side a: 12.00
Side b: 15.00
Area: 180.00
Perimeter: 54.00
Rectangle Name: RECTANGLE A
X-coordinate:      5.00
Y-coordinate:      7.00
Side a: 100.00
Side b: 200.00
Area: 20000.00
Perimeter: 600.00
```