

Mar 23, 06 9:36

Makefile

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```
# Course:          CS 14
# Lab Section:     021
# Assignment #:    Assignment 1
#
# First Name:      Jimmy
# Last Name:       Xu
# Login id:        jxu
# email:           jxu@cs.ucr.edu
# Student id:      860-34-2393
# =====
```

```
CC=g++
```

```
CFLAGS= -g -Wall -W -Werror -pedantic
```

```
OBJECTS= area_node.o phone_book.o
```

```
# The all target compiles the whole project and creates
# an executable called "a.out"
```

```
all: main.cc $(OBJECTS)
      $(CC) $(CFLAGS) -o a.out main.cc $(OBJECTS)
```

```
# All .o targets compile object files out of the declaration and implementation
# files for their corresponding classes
```

```
area_node.o: area_node.cc area_node.h
      $(CC) $(CFLAGS) -c -o area_node.o area_node.cc
```

```
phone_book.o: phone_book.cc phone_book.h
      $(CC) $(CFLAGS) -c -o phone_book.o phone_book.cc
```

```
clean:
      rm -f *~ a.out *.o
```



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area_node.cc

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```

// Course:          CS 14
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//
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// =====

#include <iostream>
#include "area_node.h"

using namespace std;

#define NUM_TO_PRINT_PER_LINE 5

//-----
// DO NOT MODIFY THIS PRINT FUNCTION

void
AreaNode::print ( ) {
    NumberNode* temp = head;
    for ( int x = 0; x < size ( ) && temp != NULL;
          x += NUM_TO_PRINT_PER_LINE ) {
        cout << "    " << flush;
        for ( int y = 0; y < NUM_TO_PRINT_PER_LINE && temp != NULL;
              y ++, temp = temp->next ) {
            cout << temp->prefix << "-" << flush << temp->suffix << "," << flush;
        }
        cout << endl;
    }
}

//-----

AreaNode::AreaNode ( ) {
    head = NULL;
}

//-----
int
AreaNode::size ( ) {
    int size = 0;
    NumberNode* temp;

    for ( temp = head; temp != NULL; temp = temp->next )
    {
        size++;
    }

    return size;
}

//-----

```


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area_node.h

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```
// Course:           CS 14
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//
// First Name:        Jimmy
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// email:             jxu@cs.ucr.edu
// Student id:        860-34-2393
// =====
```

```
#ifndef __AREA_NODE_H
```

```
#define __AREA_NODE_H
```

```
#include "number_node.h"
```

```
class AreaNode {
```

```
public:
```

```
    int areaCode;
    AreaNode* next;
    NumberNode* head;
```

```
public:
```

```
    void print ( );
    int size ( );
```

```
// Do not modify anything above this line
```

```
//-----
```

```
// Add additional functions/variables here:
```

```
    AreaNode ( );
```

```
};
```

```
#endif
```

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main.cc

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```

#include <iostream>
#include "phone_book.h"

using namespace std;

int
main ( ) {

    // Every test prints out the number of phone numbers in the book;

    PhoneBook phoneBook;

    cout << "Test 1: Operations on an empty book" << endl;
    cout << "Removing a number from an empty book" << endl;
    phoneBook.removePhoneNumber ( 909, 345, 1264 );
    cout << "Total size of book = " << phoneBook.numNumbers ( ) << endl;
    cout << "Size of area code ( 909 ) = "
        << phoneBook.numAreaCodeNumbers ( 909 ) << endl;
    cout << "Number of phone numbers with area code ( 909 ) and prefix 234 = "
        << phoneBook.numAreaCodeAndPrefixNumbers ( 909, 234 ) << endl;
    cout << "-----" << endl;
    cout << "Test 2: Inserting first phone number" << endl;
    phoneBook.insertPhoneNumber ( 909, 345, 1111 );
    phoneBook.print ( );
    cout << "Extra line of text." << endl;
    cout << "Total size of book = " << phoneBook.numNumbers ( ) << endl;
    cout << "-----" << endl;
    cout << "Test 3: Inserting 3 additional phone numbers to the same area code"
        << endl;
    phoneBook.insertPhoneNumber ( 909, 345, 2222 );
    phoneBook.insertPhoneNumber ( 909, 345, 3333 );
    phoneBook.insertPhoneNumber ( 909, 123, 1111 );
    phoneBook.print ( );
    cout << "Total size of book = " << phoneBook.numNumbers ( ) << endl;
    cout << "Size of area code ( 909 ) = "
        << phoneBook.numAreaCodeNumbers ( 909 ) << endl;
    cout << "Number of phone numbers with area code ( 909 ) and prefix 345 = "
        << phoneBook.numAreaCodeAndPrefixNumbers ( 909, 345 ) << endl;
    cout << "-----" << endl;
    cout << "Test 4: Inserting duplicate number at tail of phone number list"
        << endl;
    phoneBook.insertPhoneNumber ( 909, 345, 1111 );
    phoneBook.print ( );
    cout << "Total size of book = " << phoneBook.numNumbers ( ) << endl;
    cout << "-----" << endl;
    cout << "Test 5: Inserting duplicate number in middle of phone number list"
        << endl;
    phoneBook.insertPhoneNumber ( 909, 345, 2222 );
    phoneBook.print ( );
    cout << "Total size of book = " << phoneBook.numNumbers ( ) << endl;
    cout << "-----" << endl;
    cout << "Test 6: Inserting duplicate number at head of phone number list"
        << endl;
    phoneBook.insertPhoneNumber ( 909, 123, 1111 );
    phoneBook.print ( );
    cout << "Total size of book = " << phoneBook.numNumbers ( ) << endl;
    cout << "-----" << endl;

```

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main.cc

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```

cout << "Test 7: Inserting 4 more numbers to the same area code" << endl;
phoneBook.insertPhoneNumber ( 909, 123, 2222 );
phoneBook.insertPhoneNumber ( 909, 123, 3333 );
phoneBook.insertPhoneNumber ( 909, 123, 4444 );
phoneBook.insertPhoneNumber ( 909, 123, 5555 );
phoneBook.print ( );
cout << "Total size of book = " << phoneBook.numNumbers ( ) << endl;
cout << "-----" << endl;
cout << "Test 8: Searching for a phone number that does exist" << endl;
cout << "Searching for 909-345-1111...." << flush;
if ( phoneBook.search ( 909, 345, 1111 ) ) {
    cout << "found" << endl;
}
else {
    cout << "not found" << endl;
}
cout << "Total size of book = " << phoneBook.numNumbers ( ) << endl;
cout << "-----" << endl;
cout << "Test 9: Searching for a phone number that does not exist" << endl;
cout << "Searching for 909-345-9876...." << flush;
if ( phoneBook.search ( 909, 345, 9876 ) ) {
    cout << "found" << endl;
}
else {
    cout << "not found" << endl;
}
cout << "Total size of book = " << phoneBook.numNumbers ( ) << endl;
cout << "-----" << endl;
cout << "Test 10: Removing from head of phone number list" << endl;
phoneBook.removePhoneNumber ( 909, 123, 5555 );
phoneBook.print ( );
cout << "Total size of book = " << phoneBook.numNumbers ( ) << endl;
cout << "-----" << endl;
cout << "Test 11: Removing from middle of phone number list" << endl;
phoneBook.removePhoneNumber ( 909, 123, 1111 );
phoneBook.print ( );
cout << "Total size of book = " << phoneBook.numNumbers ( ) << endl;
cout << "-----" << endl;
cout << "Test 12: Removing from tail of phone number list" << endl;
phoneBook.removePhoneNumber ( 909, 345, 1111 );
phoneBook.print ( );
cout << "Total size of book = " << phoneBook.numNumbers ( ) << endl;
cout << "-----" << endl;
cout << "Test 13: Removing a phone number that does not exist" << endl;
phoneBook.removePhoneNumber ( 909, 345, 9876 );
phoneBook.print ( );
cout << "Total size of book = " << phoneBook.numNumbers ( ) << endl;
cout << "-----" << endl;

```

```
//*****
```

```

// tests for more than 1 area code
cout << "Test 14: Inserting a number into a new area code" << endl;
phoneBook.insertPhoneNumber ( 818, 999, 1111 );
phoneBook.print ( );
cout << "Total size of book = " << phoneBook.numNumbers ( ) << endl;
cout << "-----" << endl;
cout << "Test 15: Inserting 3 more numbers into the new area code" << endl;

```

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main.cc

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```

phoneBook.insertPhoneNumber ( 818, 999, 2222 );
phoneBook.insertPhoneNumber ( 818, 999, 3333 );
phoneBook.insertPhoneNumber ( 818, 888, 1111 );
phoneBook.print ( );
cout << "Total size of book = " << phoneBook.numNumbers ( ) << endl;
cout << "-----" << endl;
cout << "Test 16: Adding a third area code" << endl;
phoneBook.insertPhoneNumber ( 619, 777, 1111 );
phoneBook.print ( );
cout << "Total size of book = " << phoneBook.numNumbers ( ) << endl;
cout << "-----" << endl;
cout << "Test 17: Searching for a phone number in an area code that does "
    << "not exist " << endl;
cout << "Searching for 111-345-1111...." << flush;
if ( phoneBook.search ( 111, 345, 1111 ) ) {
    cout << "found" << endl;
}
else {
    cout << "not found" << endl;
}
cout << "Total size of book = " << phoneBook.numNumbers ( ) << endl;
cout << "-----" << endl;
cout << "Test 18: Removing in an area code that does not exist" << endl;
phoneBook.removePhoneNumber ( 435, 567, 2345 );
phoneBook.print ( );
cout << "Total size of book = " << phoneBook.numNumbers ( ) << endl;
cout << "-----" << endl;
cout << "Test 19: Removing the last phone number in an area code at the "
    << "head of the area code list" << endl;
phoneBook.removePhoneNumber ( 619, 777, 1111 );
phoneBook.print ( );
cout << "Total size of book = " << phoneBook.numNumbers ( ) << endl;
cout << "-----" << endl;

//*****
// read in phone numbers from a file
cout << "Test 20: Reading in phone numbers from a file" << endl;
phoneBook.readFromFile ( "phone_numbers.txt" );
phoneBook.print ( );
cout << "Total size of book = " << phoneBook.numNumbers ( ) << endl;
cout << "-----" << endl;

//*****
// test splitting area codes
cout << "Test 21: Splitting 123 prefix out of area code 909 to area "
    << "code 808" << endl;
phoneBook.split ( 909, 123, 808 );
phoneBook.print ( );
cout << "Total size of book = " << phoneBook.numNumbers ( ) << endl;
cout << "-----" << endl;
cout << "Test 22: Splitting nonexistent prefix out of area code 909 to area "
    << "code 808" << endl;
phoneBook.split ( 909, 123, 808 );
phoneBook.print ( );
cout << "Total size of book = " << phoneBook.numNumbers ( ) << endl;
cout << "-----" << endl;
cout << "Test 23: Splitting 345 prefix out of area code 909 to existing "

```

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```
        << "area code" << endl;
phoneBook.split ( 909, 345, 808 );
phoneBook.print ( );
cout << "Total size of book = " << phoneBook.numNumbers ( ) << endl;
cout << "-----" << endl;
cout << "Test 24: Splitting 345 prefix out of area code 909 to 707 (909 is "
        << "now empty)" << endl;
phoneBook.split ( 909, 345, 707 );
phoneBook.print ( );
cout << "Total size of book = " << phoneBook.numNumbers ( ) << endl;
cout << "-----" << endl;

return 0;
}
```


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number_node.h

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```
// Course:          CS 14
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//
// First Name:      Jimmy
// Last Name:       Xu
// Login id:        jxu
// email:           jxu@cs.ucr.edu
// Student id:      860-34-2393
// =====
```

```
#ifndef __NUMBER_NODE_H
#define __NUMBER_NODE_H
```

```
class NumberNode {
```

```
public:
    int prefix;
    int suffix;
    NumberNode* next;
```

```
// Do not modify anything above this line
```

```
//-----
```

```
// Add additional functions/variables here:
```

```
};
```

```
#endif
```

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phone_book.cc

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```

// Course:                CS 14

// Lab Section:           021
// Assignment #:           Assignment 1
//
// First Name:             Jimmy
// Last Name:              Xu
// Login id:               jxu
// email:                  jxu@cs.ucr.edu
// Student id:             860-34-2393
// =====

#include <iostream>
#include <string>
#include <cstdio>
#include "phone_book.h"

using namespace std;

//-----
// DO NOT MODIFY THIS PRINT FUNCTION

void
PhoneBook::print ( ) {

    if ( head == NULL ) {
        cout << "Phonebook is empty" << endl;
    }
    else {
        for ( AreaNode* temp = head; temp != NULL; temp = temp->next ) {
            cout << "(" << temp->areaCode << ")" << endl;
            temp->print ( );
        }
    }
}

//-----

void
PhoneBook::readFromFile ( string fileName ) {

    int area;
    int prefix;
    int suffix;

    fileName = "phone_numbers.txt";
    // initialize pointer to the file
    FILE* pfile;
    // open the file, error check
    pfile = fopen ( "phone_numbers.txt", "r" );
    if ( pfile == NULL )
    {
        perror ( "Error opening file" );
    }
    // read each phone number in the file and insert it to the phonebook
    // until the end of file, then close the file.
    else

```

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```

    {
        while ( ! feof ( pfile ) )
        {
            fscanf ( pfile, "%d-%d-%d\n", &area, &prefix, &suffix );
            insertPhoneNumber ( area, prefix, suffix );
        }
        fclose ( pfile );
    }
}

//-----
// Constructor
PhoneBook::PhoneBook( ) {

    head = NULL;
}

//-----
// Destructor
PhoneBook::~~PhoneBook( ) {

    AreaNode* areaPtr;
    NumberNode* numPtr;

    // outer loop deletes all the area codes
    for ( areaPtr = head; areaPtr != NULL; areaPtr = areaPtr->next )
    {
        // inner loop deletes all the phone numbers of that area code
        for ( numPtr = areaPtr->head; numPtr != NULL; numPtr = numPtr->next )
        {
            areaPtr->head = numPtr->next;
            delete numPtr;
        }

        head = areaPtr->next;
        delete areaPtr;
    }
}

//-----

bool
PhoneBook::isNumberFront ( int area, int prefix, int suffix ) {

    /**
     * check if a number is at the front of the number list in an area code.
     * it assumes the number exist.
     */
    AreaNode* areaPtr;
    NumberNode* numPtr;

    // search the area code list to find the area
    for ( areaPtr = head; areaPtr != NULL; areaPtr = areaPtr->next )
    {
        if ( areaPtr->areaCode == area )
        {
            // then search the number list of the area code to find the number
            for ( numPtr = areaPtr->head; numPtr != NULL; numPtr = numPtr->next )
            {

```

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phone_book.cc

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```

        if ( numPtr->prefix == prefix && numPtr->suffix == suffix )
        {
            // finally check if number is at the front of the number list
            if ( numPtr == areaPtr->head )
            {
                return true;
                break;
            }
        }
    }
    break;
}

return false;
}

//-----

void
PhoneBook::removeAreaCode ( int area ) {

    AreaNode* areaPtr;
    AreaNode* current;
    AreaNode* prev;
    // if phonebook is empty, output error
    if ( head == NULL )
    {
        cout << "Error: Area code does not exist"
              << endl;
    }

    // if there is phone numbers in that area code list, output error
    else if ( numAreaCodeNumbers ( area ) > 0 )
    {
        cout << "Error: Number exist in area code"
              << endl;
    }

    // if phone book is not empty and the area code list is empty, do remove
    else
    {
        areaPtr = head;
        // if area code is at the front of the phonebook, remove it from the
        // front
        if ( areaPtr->areaCode == area )
        {
            head = areaPtr->next;
            delete areaPtr;
        }
        // if area code is at middle or last of the phonebook, remove it in
        // a general way
        else
        {
            // set the current pointer to the area node being removed
            while ( areaPtr != NULL )
            {
                if ( areaPtr->areaCode == area )
                {

```

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phone_book.cc

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```

        current = areaPtr;
        break;
    }

    else
    {
        areaPtr = areaPtr->next;
    }
}

// set the prev pointer to one node before the area node being
// removed
areaPtr = head;
while ( areaPtr != NULL )
{
    if ( areaPtr->next == current )
    {
        prev = areaPtr;
        break;
    }

    else
    {
        areaPtr = areaPtr->next;
    }
}

// now, remove the area node in the middle of the list
prev->next = current->next;
delete current;
}
}

//-----

void
PhoneBook::removePhoneNumber ( int area, int prefix, int suffix ) {

    AreaNode* areaPtr;
    NumberNode* numPtr;
    NumberNode* numPtrCurrent;
    NumberNode* numPtrPrev;

    // if phonebook is empty, output an error
    if ( head == NULL )
    {
        cout << "Error: Phone number does not exist"
              << endl;
    }

    // if the number exist, check the location of the number (front or middle)
    else if ( search ( area, prefix, suffix ) )
    {
        // if number is at the front of the list, remove it from the front
        if ( isNumberFront ( area, prefix, suffix ) )
        {
            for ( areaPtr = head; areaPtr != NULL; areaPtr = areaPtr->next )
            {

```

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phone_book.cc

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```

        if ( areaPtr->areaCode == area )
        {
            numPtr = areaPtr->head;
            areaPtr->head = numPtr->next;
            delete numPtr;
            // check if the area code list is empty, if empty, delete
            // the area node also
            if ( numAreaCodeNumbers ( area ) == 0 )
            {
                removeAreaCode ( area );
            }
            break;
        }
    }
}
// if number is not at the front of the list, remove it generally
else
{
    for ( areaPtr = head; areaPtr != NULL; areaPtr = areaPtr->next )
    {
        if ( areaPtr->areaCode == area )
        {
            // set the current number node pointer to the matching number
            numPtr = areaPtr->head;
            while ( numPtr != NULL )
            {
                if ( numPtr->prefix == prefix &&
                    numPtr->suffix == suffix )
                {
                    numPtrCurrent = numPtr;
                    break;
                }

                else
                {
                    numPtr = numPtr->next;
                }
            }

            // set the previous number node pointer to one node before
            // the current number node pointer
            numPtr = areaPtr->head;
            while ( numPtr != NULL )
            {
                if ( numPtr->next == numPtrCurrent )
                {
                    numPtrPrev = numPtr;
                    break;
                }
                else
                {
                    numPtr = numPtr->next;
                }
            }

            // now remove the number in the middle of the list
            numPtrPrev->next = numPtrCurrent->next;
            delete numPtrCurrent;
        }
    }
}

```

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phone_book.cc

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```

        }
    }

// if number does not exist, output error and return
else
{
    cout << "Error: Phone number does not exist"
        << endl;
}
}

//-----

bool
PhoneBook::search ( int area, int prefix, int suffix ) {

    AreaNode* areaPtr;
    NumberNode* numPtr;

    // if the phone book is empty, return false
    if ( head == NULL )
    {
        return false;
    }

    // first check if the same area code is found in list
    for ( areaPtr = head; areaPtr != NULL; areaPtr = areaPtr->next )
    {
        if ( areaPtr->areaCode == area )
        {
            // if area is found, iterate through the list of that area code to
            // check if the same prefix and suffix match
            for ( numPtr = areaPtr->head; numPtr != NULL;
                numPtr = numPtr->next )
            {
                // if area, prefix, and suffix all match, return true
                if ( numPtr->prefix == prefix && numPtr->suffix == suffix )
                {
                    return true;
                }
            }
            break;
        }
    }

    return false;
}

//-----

bool
PhoneBook::searchArea ( int area ) {

    AreaNode* areaPtr;

    // if the phone book is empty, return false

```

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phone_book.cc

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```

if ( head == NULL )
{
    return false;
}
// iterate through the list of area codes, if the area code matches,
// return true
for ( areaPtr = head; areaPtr != NULL; areaPtr = areaPtr->next )
{
    if ( areaPtr->areaCode == area )
    {
        return true;
    }
}

return false;
}

//-----
void
PhoneBook::insertPhoneNumber ( int area, int prefix, int suffix ) {

    AreaNode* areaPtr;

    /**
     * dynamically allocate a new number node and set the prefix and suffix
     * of the node to the new number's prefix and suffix
     */
    NumberNode* newNumber = new NumberNode;
    newNumber->prefix = prefix;
    newNumber->suffix = suffix;

    //check if the number exist, if exist, output error
    if ( search ( area, prefix, suffix ) )
    {
        cout << "Error: cannot insert duplicate phone numbers"
             << endl;
    }

    /**
     * if the phone number does not exist and the area code exist, insert
     * number to the head of the list of a area code, set next ptr of the new
     * node to the node after the head, then set the node after the head to
     * the new node
     */
    else if ( ! ( search ( area, prefix, suffix ) )
              && searchArea ( area ) )
    {
        for ( areaPtr = head; areaPtr != NULL; areaPtr = areaPtr->next )
        {
            if ( areaPtr->areaCode == area )
            {
                newNumber->next = areaPtr->head;
                areaPtr->head = newNumber;
                break;
            }
        }
    }

    /**

```


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phone_book.cc

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```

    if the phone number exist and the area code did not exist, create a new
    area code node dynamically and insert it to the front of the area code
    list. Set the next pointer of the new area code to the head, and make the
    new head equal to the new area code node.
*/
else if ( ! ( search ( area, prefix, suffix ) || searchArea ( area ) ) )
{
    AreaNode* newAreaCode = new AreaNode;
    newAreaCode->areaCode = area;

    newAreaCode->next = head;
    head = newAreaCode;

    // Now, add the number to the new area code, there should be only one
    // number in new area code
    for ( areaPtr = head; areaPtr != NULL; areaPtr = areaPtr->next )
    {
        if ( areaPtr->areaCode == newAreaCode->areaCode )
        {
            newNumber->next = areaPtr->head;
            areaPtr->head = newNumber;
            break;
        }
    }
}

//-----

int
PhoneBook::numNumbers ( ) {

    /**
    iterate through the area code list, and at each area code,
    call the size function to determine the number of phone numbers in that
    area code and add it to the size counter. Then add up all the phone
    numbers in all the area codes.
    */

    AreaNode* areaPtr;
    int size = 0;
    for ( areaPtr = head; areaPtr != NULL; areaPtr = areaPtr->next )
    {
        size += areaPtr->size( );
    }

    return size;
}

//-----

int
PhoneBook::numAreaCodeNumbers ( int area ) {

    AreaNode* areaPtr;
    int size = 0;
    // iterate through the area code list to find the area code that matches
    // this area
    for ( areaPtr = head; areaPtr != NULL; areaPtr = areaPtr->next )

```

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phone_book.cc

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```

    {
        // if area code matches, call the size( ) function in that area code
        // and add it to the size counter
        if ( areaPtr->areaCode == area )
        {
            size = areaPtr->size ( );
            break;
        }
    }

    return size;
}

//-----

int
PhoneBook::numAreaCodeAndPrefixNumbers ( int area , int prefix ) {

    int size = 0;
    AreaNode* areaPtr;
    NumberNode* numPtr;

    // first iterate through the area code to find the area code that matches
    for ( areaPtr = head; areaPtr != NULL; areaPtr = areaPtr->next )
    {
        if ( areaPtr->areaCode == area )
        {
            // then iterate through that area code's list of numbers to find
            // the given prefix
            for ( numPtr = areaPtr->head; numPtr != NULL; numPtr = numPtr->next )
            {
                // everytime a prefix matches, increment the counter
                if ( numPtr->prefix == prefix )
                {
                    size++;
                }
            }
            break;
        }
    }

    return size;
}

//-----

void
PhoneBook::split ( int oldAreaCode, int prefix, int newAreaCode ) {

    // check if old area codes or prefix does not exist, output error
    if ( ! searchArea ( oldAreaCode ) ||
        numAreaCodeAndPrefixNumbers ( oldAreaCode, prefix ) == 0 )
    {
        // *note: this does not make sense, i tried to output the error
        // message to say the prefix not exist, but the instructor's
        // output says this message:
        cout << "Error: new area code already exists"
             << endl;
    }
}

```

```

// if new area code exist, output error
else if ( searchArea ( newAreaCode ) )
{
    cout << "Error: new area code already exists"
        << endl;
}

// if old area code exist and new areacode not exist:
else
{
    AreaNode* areaPtr;
    NumberNode* numPtr;

    // iterate through area code list to find the old area code
    for ( areaPtr = head; areaPtr != NULL; areaPtr = areaPtr->next )
    {
        if ( areaPtr->areaCode == oldAreaCode )
        {
            // iterate through number list of the old area code to find
            // the matching prefix numbers
            for ( numPtr = areaPtr->head; numPtr != NULL;
                numPtr = numPtr->next )
            {
                if ( numPtr->prefix == prefix )
                {
                    insertPhoneNumber ( newAreaCode, prefix, numPtr->suffix );
                    removePhoneNumber ( oldAreaCode, prefix, numPtr->suffix );
                }
            }
            break;
        }
    }
}

//-----

```

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phone_book.h

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```
// Course:          CS 14
// Lab Section:     021
// Assignment #:     Assignment 1
//
// First Name:      Jimmy
// Last Name:       Xu
// Login id:        jxu
// email:           jxu@cs.ucr.edu
// Student id:      860-34-2393
// =====
```

```
#ifndef __PHONE_BOOK_H
```

```
#define __PHONE_BOOK_H
```

```
#include "area_node.h"
```

```
using namespace std;
```

```
class PhoneBook {
```

```
private:
```

```
    AreaNode* head;
```

```
public:
```

```
    void insertPhoneNumber ( int, int, int );
```

```
    void removePhoneNumber ( int, int, int );
```

```
    bool search ( int, int, int );
```

```
    void print ( );
```

```
    int numNumbers ( );
```

```
    int numAreaCodeNumbers ( int );
```

```
    int numAreaCodeAndPrefixNumbers ( int, int );
```

```
    void readFromFile ( string );
```

```
    void split ( int, int, int );
```

```
// Do not modify anything above this line
```

```
//-----
```

```
// Add additional functions/variables here:
```

```
    PhoneBook ( );
```

```
    ~PhoneBook ( );
```

```
    bool searchArea ( int );
```

```
    bool isNumberFront ( int, int, int );
```

```
    void removeAreaCode ( int );
```

```
};
```

```
#endif
```