CS180 - Error Handling

Note Title 9/19/2011

Announcements

- Program due tonight
- Office hours 2-3
- Next HW out today or tomorrow

(No check-in for this program.)

- readme, comment & indent

Large Projects

In C++, we often seperate a class into multiple files.

- Easier version control.
- Allows division of files.
- Easy reference for later use.

.h files

Header files are used to declare the interface of a class or function.

Don't actually define or program the code/ here!

Example: CreditCard.h

private variables

each function is listed

Point.h

include if you haven't already

```
#ifndef POINT_H
#define POINT_H
#include <iostream>      // need ostream definition for operator<< signature

class Point {
private:
  double _x;
  double _y;

public:
  Point(double initialX=0.0, double initialY=0.0);
  double getX( ) const { return _x; }              // in-lined function body
  void setX(double val) { _x = val; }              // in-lined function body
  double getY( ) const { return _y; }              // in-lined function body
  void setY(double val) { _y = val; }              // in-lined function body
  void scale(double factor);
  double distance(Point other) const;
  void normalize( );
  Point operator+(Point other) const;
  Point operator*(double factor) const;
  double operator*(Point other) const;
};    // end of Point class

// Free-standing operator definitions, outside the formal Point class definition
Point operator*(double factor, Point p);
std::ostream& operator<<(std::ostream& out, Point p);
#endif
```

short functions may be included

just declaring the function

Cpp files

We then have 2 kinds of cpp files.

- One to declare functions. (CreditCard.cpp)
- One to test program (& contain the main function). → TestCreditCard.cpp

Point.cpp

```
#include "Point.h"
#include <iostream>                // for use of ostream
#include <cmath>                   // for sqrt definition
using namespace std;               // allows us to avoid qualified std::ostream syntax

Point::Point(double initialX, double initialY) : _x(initialX), _y(initialY) { }

void Point::scale(double factor) {
  _x *= factor;
  _y *= factor;
}

double Point::distance(Point other) const {
  double dx = _x − other._x;
  double dy = _y − other._y;
  return sqrt(dx * dx + dy * dy);          // sqrt imported from cmath library
}

void Point::normalize( ) {
  double mag = distance( Point( ) );       // measure distance to the origin
  if (mag > 0)
    scale(1/mag);
}
  ⋮
void   scale( ... ) { }
```

include .h's of necessary classes

Compiling

Complication: main can't run without functions or classes!
(include relevant .h file)

Need to compile in correct order.

So:

```
        output file
g++ -o TestCreditCard  CreditCard.cpp
                       TestCreditCard.cpp
```

OR

```
g++ CreditCard
g++ -o TestCreditCard  TestCreditCard.cpp
```

Alternative:

Makefiles are used to automate this.

I generally provide this.

If you use the names I suggest, can just type "make" at command prompt.

(I'll post a template of how these work...)

Error Handling

In C++, we do error handling by throwing exceptions.

(These are really just classes themselves.)

What exceptions were there in Python?

Index Out Of Bounds
TypeError
NameError
ValueError

} classes

C++ Exceptions

The book uses its own error classes.
(See end of Ch. 2)

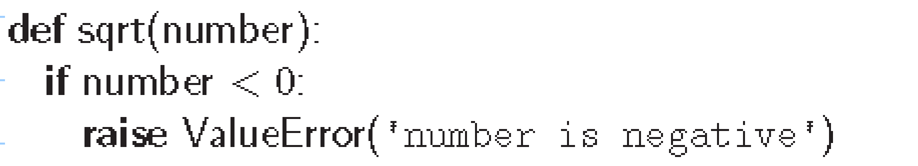
Most of mine will be based on C++'s included exception classes.

So:

```
#include <stdexcept>
```

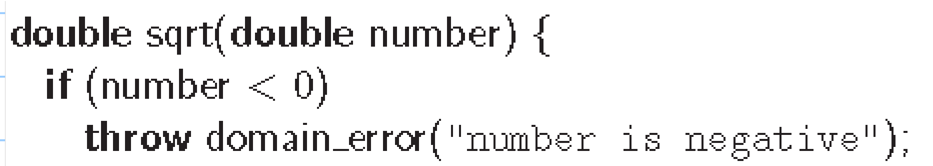
(check cplusplus.com)

Python:



```
def sqrt(number):
  if number < 0:
    raise ValueError('number is negative')
```

C++:



```
double sqrt(double number) {
  if (number < 0)
    throw domain_error("number is negative");
```

Example

myarray[12] = 56;

MyIntArray class needs operator []

a copy of

Code: ← int : return the #

```
int& operator[] (int index) {
    if (index >= _size)
        throw out_of_range("Index out of range");
    return _A[index];
}
```

To use:

```
MyIntArray myarray;
// code to put data in

 try {
     cout << myarray[73] << endl;
 }
 catch (out_of_range& e) {
     cout << e.what() << endl;
 }
```

← returns the string of error message

Catching exceptions

```
try {
  // any sequence of commands, possibly nested
} catch (domain_error& e) {
  // what should be done in case of this error
} catch (out_of_range& e) {
  // what should be done in case of this error
} catch (exception& e) {
  // catch other types of errors derived from exception class
} catch (...) {
  // catch any other objects that are thrown
}
```

1st

might just use 1 of these

Other errors

By default, cin doesn't raise errors when something goes wrong.

Instead, it sets flags.

Use cin.bad(), cin.fail(), etc., to detect these.

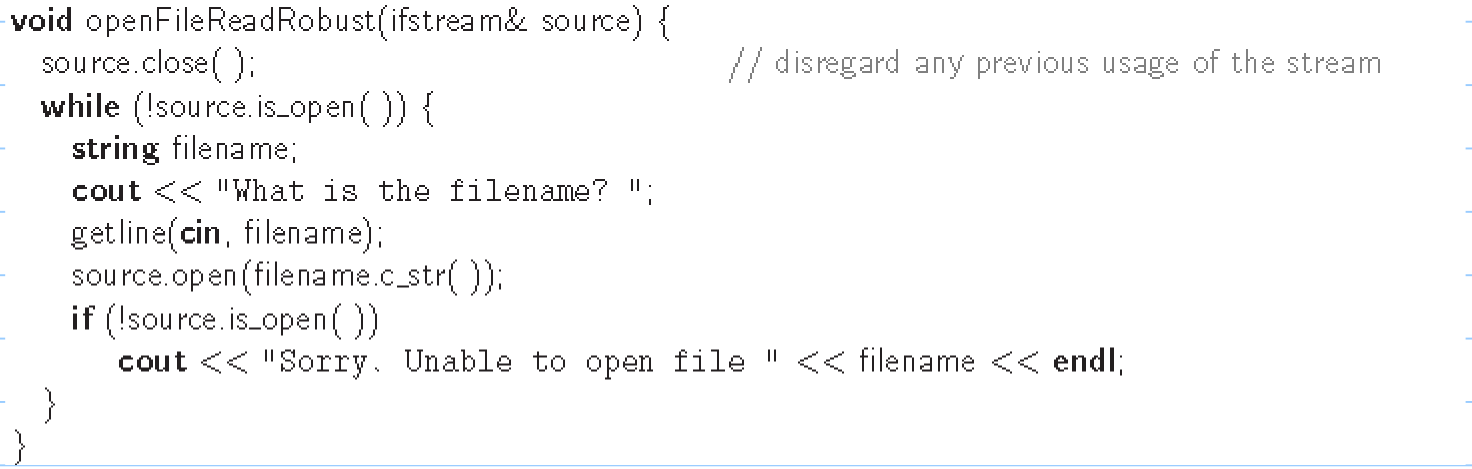
Can get a bit long... →

Ex (p.27)

```
number = 0;
while (number < 1 || number > 10) {
  cout << "Enter a number from 1 to 10: ";
  cin >> number;
  if (cin.fail( )) {
    cout << "That is not a valid integer." << endl;
    cin.clear( );                                          // clear the failed state
    cin.ignore(std::numeric_limits<int>::max( ), '\n');    // remove errant characters from line
  } else if (cin.eof( )) {
    cout << "Reached the end of the input stream" << endl;
    cout << "We will choose for you." << endl;
    number = 7;
  } else if (cin.bad( )) {
    cout << "The input stream had fatal failure" << endl;
    cout << "We will choose for you." << endl;
    number = 7;
  } else if (number < 1 || number > 10) {
    cout << "Your number must be from 1 to 10" << endl;
  }
}
```

File streams & errors

Similar to cin:



```
void openFileReadRobust(ifstream& source) {
  source.close( );                                 // disregard any previous usage of the stream
  while (!source.is_open( )) {
    string filename;
    cout << "What is the filename? ";
    getline(cin, filename);
    source.open(filename.c_str( ));
    if (!source.is_open( ))
       cout << "Sorry. Unable to open file " << filename << endl;
  }
}
```