



Classes (Chapter 6.2-6.3)

Data with natural operations

Classes

Using Classes

[Data and Associate Operations]

As we saw last time there is an natural set of operations associate with strings:

Initializing

Printing

Matching substrings

Concatenating strings

Extracting substrings.

Copying strings

Data and Associate Operations

But copying a string is a different operation than copying an integer.

Likewise printing a string is a different operation than printing a double.

Generally it is the case that a specific type of data must have a specific set of operations associated with it to manipulate that data.

Moreover the programs designed to manipulate the data are dependent on the specific way the data is stored in the computer.

[Data and Associate Operations]

The form of the data's representation may need to differ on machines with different architectures but the natural operations remain the same.

That is, for a given type of data, we should implement a set of operations that is associated with it without requiring the user to know details of how it is implemented.

Classes

These observations led to the development of the concept of a **class** that defines both the implementation and the natural operations associated with the type of data.

Classes are the basic underlying idea of a **object oriented programming languages** like C++, Java, Python, etc

Computer Science Fact

Barbara Liskov won the 2008 Turing award (the CS equivalent of the Nobel Prize) for her work on Object Oriented Programming Languages.



A Simple Class

class name

Access specifier

Object declaration

```
#include <iostream>
using namespace std;
class Point { // point in Cartesian plane
public:
    Point() {}
    Point( double, double );
    double getX() const { return x; }
    double getY() const { return y; }
private:
    double x, y;
};

//
// Create a Point object, initializing data members to parameter values
//
Point::Point( double xval, double yval )
{
    x = xval;
    y = yval;
}

int main()
{
    Point pt1( 5.1, -4.7 );
    cout << "The point is (" << pt1.getX() << ", " << pt1.getY() <<
        "\n";
    return 0;
}
```

constructor

class data

Using Classes

gplot.h

graph.cpp

Homework: (Due Thursday November 12 before class). Write a program to plot the function $f(x)=\sin(\exp(x))+x/4$. The program should ask the user for the range of x over which the program should be graphed and the number of points to plot. Then it should plot $f(x)$ for x in the specified range. Five points extra credit if you can use that program to find the first positive zero of that function to 3 digits accuracy. Explain how you did it.

Homework

Problem: Compute the average and standard deviation of a set of n integer test scores, where the user is asked to input n and then the n test scores.

A solution is [here](#).