CS 213 -- Lecture #3 "Late Night Guide to C++" Chapter 3 pages 51 - 68 **CLASSES**

Administrative...

- Assignment #1 Due Today
- Assignment #2 up, Due 9/9/04

Classes

- · What is a class?
 - LNG, pg 51 says: "A class is a user-defined type"
 - Are all user-defined types classes?

 - C++ supports the C notion of a "struct"
 - A struct allows programmers to define their own data type structures
 Similar to RECORDs in Pascal
 - Are all classes user-defined types?
 - Yes
 - There are no "built in classes" in C++
 - · There are provided standard class libaries
 - OK, that's great. But, what is a class?

- ${\it Classes \ (cont)} \\ \bullet \ \ A \ class \ is \ a \ traditional \ data \ structure \ with \ a \ set \ of functions.$
- Let's start with a simple C style structure definition

```
typedef struct{
 string name;
 string instructor;
 int numStudents;
} Course;
```

• Once defined I could use this "user defined" data type anywhere in my code:

int main() Course cs213; cs213.name = "COM S 213"; cs213.instructor = "DiNapoli"; cs213.numStudents = 45;

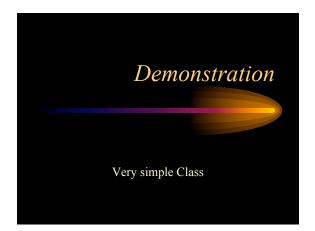
Demonstration

C-style data structure

Classes (cont)

- Now, where do these functions fit in?
 - The functions (called member functions) are tied to the data structure
 - Any "field" of the data structure may be accessed by any member function as if it were in a global scope.
 - Let's take a look at this before we go any further...

```
class Course
 // Define member functions
 int getStudentCount() { return numStudents; }
 // Define member variables
  string name;
  string instructor;
  int numStudents;
```



**Classes: Public vs. Private* • Why bother with simple functions like getStudentCount()? • It's a bad idea to directly access member variables • Circumvent error checking, easy to screw up data. • Can't I just use the member variables directly anyway? class Course { public: // These can be seen outside the class // Define member functions int getStudentCount() { return numStudents; } private: // These can be seen inside the class only // Define member variables string name; string instructor; int numStudents; };

Demonstration Public vs. Private

Classes: Public vs. Private (cont) • OK, so how do I access private data outside of the class? - You don't, that's the whole idea! - You can use get/set functions (public) to return the values for you class Course { public: // These can be seen outside the class // Define member functions string getCourseName() { return name; } string getCourseName() { return instructor; } int getStudentCount() { return numStudents; } void setCourseName(string theName) { name = theName; } void setInstructor(string theInstructor) { instructor = theInstructor; } void setStudentCount(int count) { numStudents = count; } private: // These can be seen inside the class only ...



Classes: Lots of Member Functions

- Alright, declarations are cool, but then where do the member functions get defined?
 - Anywhere you want them to be defined :-)
 - No, seriously, with the help of some added notation they can be defined just about anywhere...

```
string Course::getCourseName()
{
   return name;
}
int Course::getStudentCount()
{
   return numStudents;
}
```

- Note the use of Course:: to specify the class in question
- Note how I'm using member variables as if they were some sort of global variable

Demonstration

Member Function Definitions

Classes: More on Public vs. Private

• The public and private labels can appear as many times as you want them to in a class definition.

```
class Course
{
public: // These can be seen outside the class
    // Getter functions
    string getCourseName();
    string getInstructor();
    int getStudentCount();
public:
    // Setter functions
    void setCourseName(string theName);
    void setInstructor(string theInstructor);
    void setStudentCount(int count);
private: // These can be seed inside the class only
    // Member variables
```

Classes: More on Public vs. Private

• Member functions can be private as well.

```
class Course
{
public: // These can be seen outside the class
    // Getter and Setter functions
    string getCourseName();
    string getInstructor();
    int getStudentCount();
    void setCourseName(string theName);
    void setInstructor(string theInstructor);
    void setStudentCount(int count);

private: // These can be seed inside the class only
    // private member functions
    bool validateStudentCount(int count);
...
```

Classes: More on Public vs. Private

- You can still have public member variables
- · If no public or private label is specified, private is assumed

```
class Course
{
  bool validateStudentCount(int count); // implicit
  private

public:
  bool isFull; // publicly accessible member variable

  // Getter and Setter functions
  string getCourseName();
  string getInstructor();
  int getStudentCount();
  void setCourseName(string theName);
  void setInstructor(string theInstructor);
  void setStudentCount(int count);
```

Where Should We Define Member Functions?

- How do you know when to define a member function in the class definition vs defining it outside of the class definition?
- There is a simple technical explanation.
- I'm not going to tell you yet :-)
- A good rule of thumb is:
 - $-\,$ If the definition is simple (one line of code) you should define it in the class definition.
 - Getter/Setter functions are prime examples.
 - Otherwise, define outside of the class definition, usually in a separate file.

What Files Should These Definitions Go In? // Course.h -- Header file for Course class class Course { public: // These can be seen outside the class // Define member functions string getCourseName(); string getInstructor(); int getStudentCount(); void setCourseName(string theName); void setCourseName(string theInstructor); void setStudentCount(int count); private: // These can be seed inside the class only string name,instructor;

```
What Files Should These Definitions Go In?

// Course.cpp -- Definition file for Course class
#include "Course.h"
string Course::getCourseName()
{
   return name;
}

String Course::getInstructor()
{
   return instructor;
}

String Course::getStudentCount()
{
   return count;
}

// etc., etc.
```

Final Thoughts

- Assignment #2 up on web site
- Due 2/8/01

int count;