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Lesson Note #13
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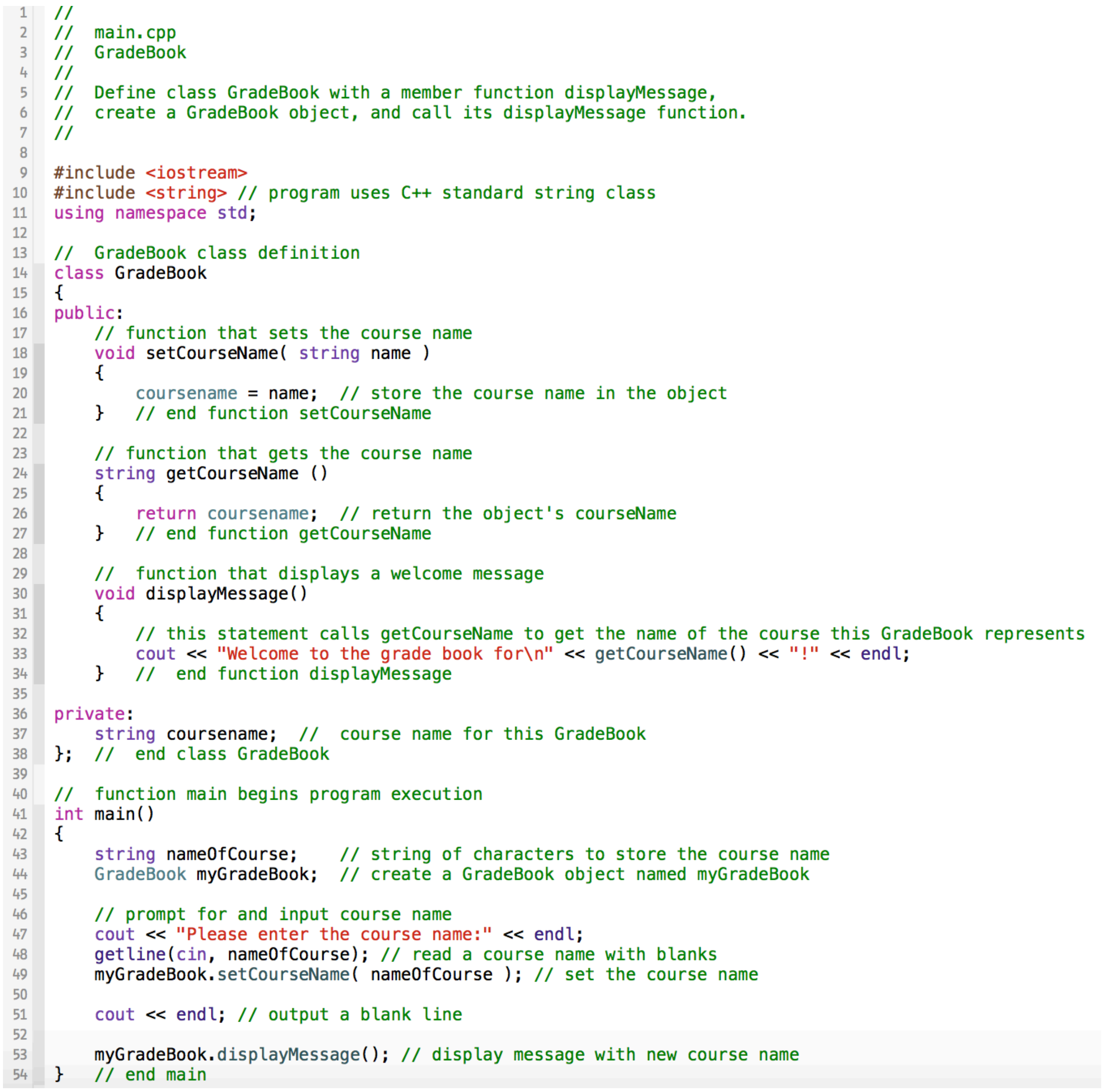
# Data Members, set Functions and get Functions

- Variables declared in a function definition's body are known as local variables and can be used only from the line of their declaration in the function to closing right brace ( *}* ) of the block in which they're declared.
- A local variable must be declared before it can be used in a function.
- A local variable cannot be accessed outside the function in which it's declared.
- When a function terminates, the values of its local variables are lost. (You'll see an exception to this when we discuss static local variables.)
- A class normally consists of one or more member functions that manipulate the attributes that belong to a particular object of the class.
- Attributes are represented as variables in a class definition.
- Such variables are called data members and are declared inside a class definition but outside the bodies of the class's member-function definitions.
- Each object of a class maintains its own copy of its attributes in memory. These attributes exist throughout the life of the object.

**GradeBook Class with a Data Member, a set Function and a get Function**
In the following example, class GradeBook maintains the course name as a data member so that it can be used or modified at any time during a program's execution.

- The class contains member functions ***setCourseName***, ***getCourseName*** and ***displayMessage***.
- Member function ***setCourseName*** stores a course name in a GradeBook data member.
- Member function ***getCourseName*** obtains the course name from that data member.
- Member function ***displayMessage*** — which now specifies no parameters—still displays a welcome message that includes the course name.

However, as you'll see, the function now obtains the course name by calling another function in the same class — *getCourseName*.



```cpp
//
//  main.cpp
//  GradeBook
//
//  Define class GradeBook with a member function displayMessage,
//  create a GradeBook object, and call its displayMessage function.
//

#include <iostream>
#include <string> // program uses C++ standard string class
using namespace std;

//  GradeBook class definition
class GradeBook
{
public:
    // function that sets the course name
    void setCourseName( string name )
    {
        coursename = name;  // store the course name in the object
    }   // end function setCourseName

    // function that gets the course name
    string getCourseName ()
    {
        return coursename;  // return the object's courseName
    }   // end function getCourseName

    //  function that displays a welcome message
    void displayMessage()
    {
        // this statement calls getCourseName to get the name of the course this GradeBook represents
        cout << "Welcome to the grade book for\n" << getCourseName() << "!" << endl;
    }   //  end function displayMessage

private:
    string coursename;  //  course name for this GradeBook
};  //  end class GradeBook

//  function main begins program execution
int main()
{
    string nameOfCourse;    // string of characters to store the course name
    GradeBook myGradeBook;  // create a GradeBook object named myGradeBook

    // prompt for and input course name
    cout << "Please enter the course name:" << endl;
    getline(cin, nameOfCourse); // read a course name with blanks
    myGradeBook.setCourseName( nameOfCourse ); // set the course name

    cout << endl; // output a blank line

    myGradeBook.displayMessage(); // display message with new course name
}   // end main
```

Every instance (i.e., object) of class *GradeBook* contains one copy of each of the class's data members—if there are two *GradeBook* objects, each has its own copy of *courseName* (one per object).

A benefit of making *courseName* a data member is that all the member functions of the class can manipulate any data members that appear in the class definition (in this case, *courseName*).

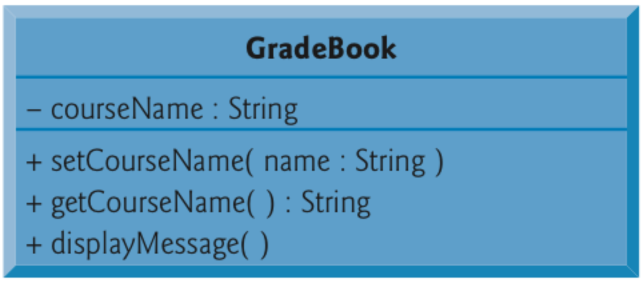
**Access Specifiers public and private**

- Most data-member declarations appear after the private access specifier. Variables or functions declared after access specifier private are accessible only to member functions of the class for which they're declared.

- Thus, data member courseName can be used only in member functions setCourseName, getCourse- Name and displayMessage of class GradeBook

**GradeBook's UML Class Diagram with a Data Member and set and get Functions**

- This diagram models GradeBook's data member courseName as an attribute in the middle compartment.
- The UML represents data members as attributes by listing the attribute name, followed by a colon and the attribute type.
- The UML type of attribute courseName is String, which corresponds to string in C++.
- Data member courseName is private in C++, so the class diagram lists a minus sign (–) in front of the corresponding attribute's name.
  - The minus sign in the UML is equivalent to the private access specifier in C++.
- Class GradeBook contains three public member functions, so the class diagram lists three operations in the third compartment.
- Operation setCourseName has a String parameter called name.
- The UML indicates the return type of an operation by placing a colon and the return type after the parentheses following the operation name.
- Member function getCourseName of class GradeBook has a string return type in C++, so the class diagram shows a String return type in the UML.



*Excerpt adapted from C++ How to Program, P.J. Deitel, H.M. Deitel. -- 8th ed*