Classes

- A class is a data type whose variables are objects
  - Some pre-defined classes in C++ include `int`, `char`, `ifstream`
  - Of course, you can define your own classes too
- A class definition says two basic things
  - The kinds of values an object can hold
  - A description of the member functions

Example: class DayOfYear

- Decide on the values to represent
- This example's values are dates such as July 4 using an integer for the number of the month
  - Member variable month is int (Jan = 1, Feb = 2, etc.)
  - Member variable day is int
- Decide on the member functions needed
- Just one member function named output in the first version of this class

Simplest version of DayOfYear

```
class DayOfYear {
public:
    void output();
    int month;
    int day;
};
void DayOfYear::output() {
    cout << "month = " << month
         << ",  day = " << day << endl;
 }
```

- Like a struct with an added method
  - All parts public
  - Clients access month, day directly

Notes about '::' and '.'

- '::' used with classes to identify a member
  `void DayOfYear::output() { … }`
  - Also used with namespaces – identifies scope
  - Called scope resolution operator
- '.' used with variables to identify object
  ```
  DayOfYear birthday;
  birthday.output( );
  ```
  - Object reference is passed to the method as an implicit parameter

What's wrong with DayOfYear?

- Most important: data are exposed to users
- Why is that a problem?
- Two major reasons:
  - No way to insure consistent object states – e.g. user could `birthday.month = 74;` // huh?
  - Developer can't change data names/meanings – e.g. can't change int to string for month, can't save Date instead of month, day, …
- What's the solution (in C++)?

An access specifier: `private`

- Private members of a class can only be referenced within the definitions of member functions (and `friend`s – later)
  - If the program tries to access a private member, the compiler gives an error message
- Private members can be data or functions
  - Should have public set methods to change data
  - Need public get methods to access the data
- Btw: default for class is private (public for struct)

Better class DayOfYear

```
class DayOfYear {
public:
    void input( );
    void output( );
    void set(int new_month, int new_day);
    int get_month( );
    int get_day( );
private:
    void check_date( );
    int month;
    int day;
};
```

DISPLAY 10.4

First Exam
Thursday, October 18