Classes

Ch 10.1 - 10.3

Highlights

- public/private
- constructor

```
class myName
{
    public:
        myName();
        myName(int x);
        char takeThis();
    private:
        char itsASecretToEveryone;
};
```

- operator overloading

```
Point Point::operator+(Point other)
{
    Point result;
    result.x=x+other.x;
    result.y=y+other.y;
    return result;
}
```

- friend functions

```
class Point{
public:
    friend bool equals(Point first, Point second);
```

class vs array

Arrays group together similar data types (any amount you want)

Classes (and structs) group together dissimilar types that are logically similar

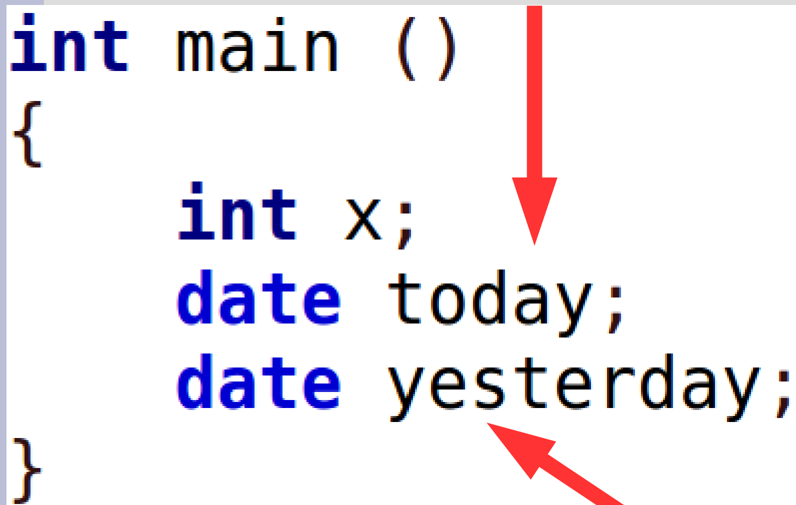
class

A class is a new type that you create (much like int, double, ...)

Blueprint for all objects

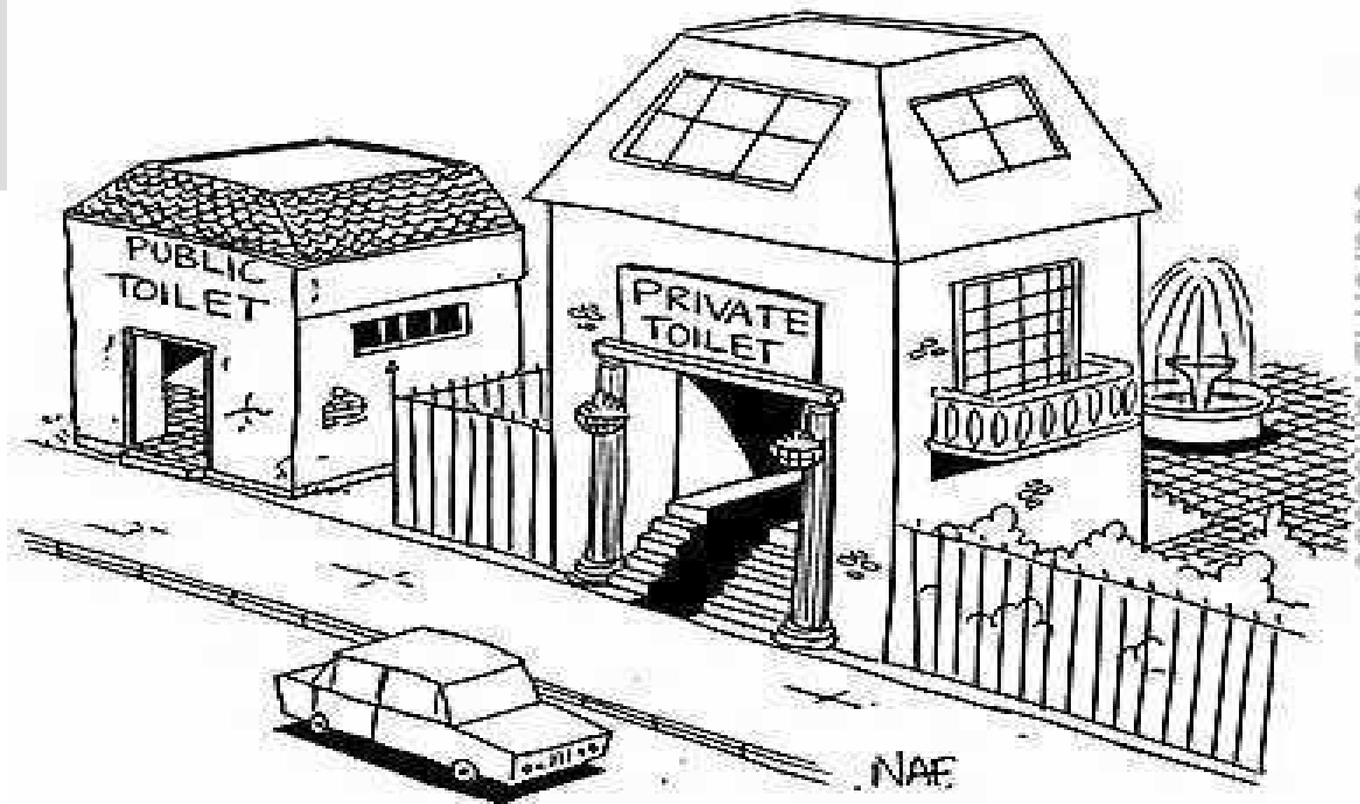
```
class date
{
public:
    int day;
    int month;
    int year;
    void print();
};
```

An instance of date class



Another instance

public vs private




```
class date
{
private:
    int day;
    int month;
    int year;
public:
    void print();
    void setDate(int day, int month, int year);
};
```

public vs private

SST
SST25VF080B
1 MB Serial Flash

SAMSUNG
Application
Processor and
DDR SDRAM

ST MICROELECTRONICS
LIS331 DL
Accelerometer

INFINEON
SMP3i
SMARTi Power
Management IC

SKYWORKS
SKY77340
Power Amp. Module

INFINEON
UMTS Transceiver

NATIONAL
SEMICONDUCTOR
LM2512AA
Display Interface

TRIQUINT
TQM666032
WCDMA/HSUPA
Power Amp.

TRIQUINT
TQM676031
WCDMA/HSUPA
Power Amp.

BROADCOM
BCM5974
Touchscreen
Controller

TRIQUINT
TQM616035
WCDMA/HSUPA
Power Amp.

WOLFSON
WM6180C
Audio Codec

NUMONYX
PF38F3050M0Y0CE
16 MB NOR + 8 MB
Pseudo - SRAM

Semiconductor
insights inc.

INFINEON
PMB2525
Hammerhead II GPS

LINEAR TECHNOLOGY
LTC4088-2
Battery Charger/
USB Controller

NXP
Power Management

INFINEON
Digital Baseband
Processor

public vs private

Creating interfaces with public allows users to not worry about the private implementation

So... more work for you (programmer) less work for everyone else

public vs private

The public keyword allows anyone anywhere to access the variable/method

The private keyword only allows access by/in the class where the variable/method is defined
(i.e. only variables of this type can access this within itself)

public vs private

All variables should be private

While this means you need methods to set variables, users do not need to know how the class works

This allows an easier interface for the user (also easier to modify/update code)

(See: datePrivate.cpp)

public vs private

The idea is: if the stuff underneath changes, it will not effect how you use it

For example, you change from a normal engine to a hybrid engine... but you still fill it up the same way

public vs private

An important point: private just means only “date” things can modify the private variables of a “date” object

However, two different “date” objects can access each other's privates

(see: privateDates.cpp)

Constructors

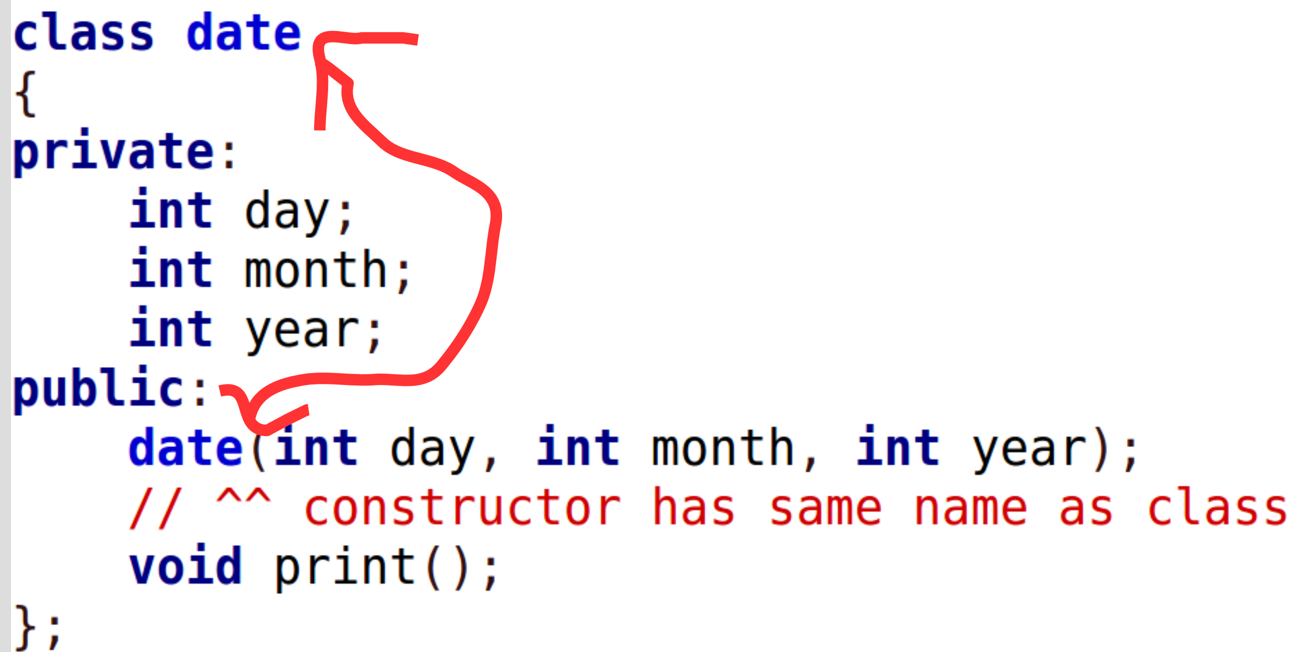
The date class has two functions: setDate() and print()

As we need to run setDate() on a variable before it is useful anyways

In fact, such a thing exists and is called a <u>constructor</u> (run every time you create a variable)

Constructors

The class name and the constructor must be identical
(constructors also have no return type)



```
class date
{
private:
    int day;
    int month;
    int year;
public:
    date(int day, int month, int year);
    // ^^ constructor has same name as class
    void print();
};
```

(See: dateConstructor.cpp)

Constructors

If you don't put a constructor, C++ will make a default constructor for you (no arguments)

```
date();   <- default constructor

date(int day, int month, int year);
```

To use the default constructor say this:

```
date never;
```

.... or ...

```
date never = date();
```

... not this:

```
date notWhatYouWant();
// ^ function declaration
```

Constructors

If you declared constructors you must use one of those

Only if you declare no constructors, does C++ make one for you (the default)

Note: our dateConstructor.cpp has no way to change the value of the date after it is created
(thus gives control over how to use class)

TL;DR Constructors

Constructors are functions, but with a few special properties:

(1) They have no return type
(2) They must have the same name as the class they are constructing
(3) If you want to make an instance of a class you MUST run a constructor
(and if you ever run a constructor, you are making an object)

#include

Just as writing very long main() functions can start to get confusing...

... writing very long .cpp files can also get confusing

Classes are a good way to split up code among different files

#include

You can #include your class back in at the top or link to it at compile time

You have to be careful as #include basically copies/pastes text for you

Will not compile if class declared twice (used in two different classes you #include)

#include

```cpp
date::date(int m, int d, int y)
{
    day = d;
    month = m;
    year = y;
}

void date::showDate()
{
    cout << month <<
    "/" << day <<
    "/" << year;
}
```

```cpp
class date
{
public:
    date(int m, int d, int y);
    void showDate();

private:
    int day;
    int month;
    int year;
};
```

```cpp
int main ()
{
    date today = date(3, 20, 2017);
    today.showDate();
}
```

Then compile with: g++ runDate.cpp date.cpp

#include

To get around this, you can use compiler commands in your file

"if not defined"

"define"

```
#ifndef DATE
#define DATE
class date
{
public:
	int day;
	int month;
	int year;
	void print() const;
};
#endif
```

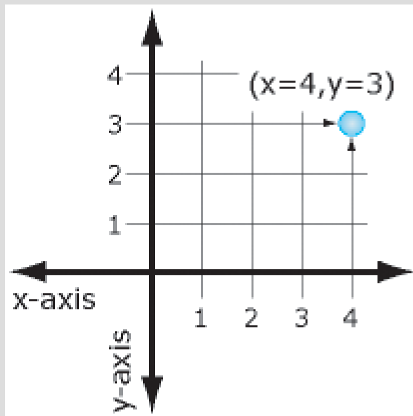
This ensures you only have declarations once (See: dateClass.hpp, dateClass.cpp, runDate.cpp)

Operator Overload

Ch 11.1

Basic point class

Suppose we wanted to make a simple class to represent an (x,y) coordinate point

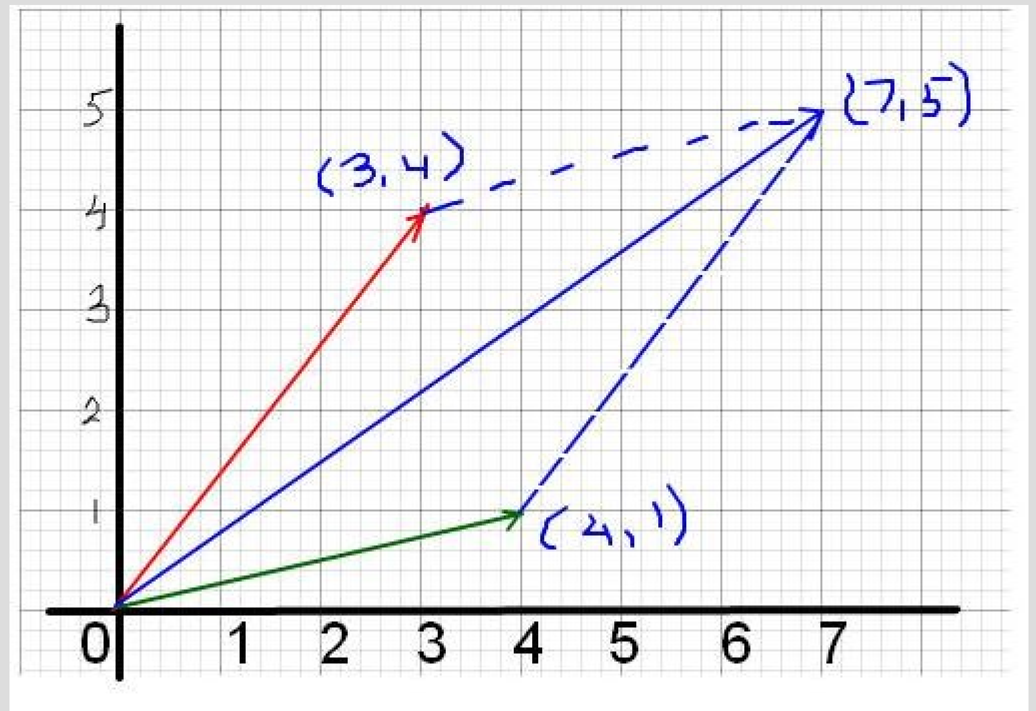



```
class Point{
private:
    int x;
    int y;
public:
    Point();
    Point(int startX, int startY);
    void showPoint();
};
```

(See: pointClass.cpp)

Basic point class

Now let's extend the class and make a function that can add two (x,y) coordinates together (like vectors)



With two ints?

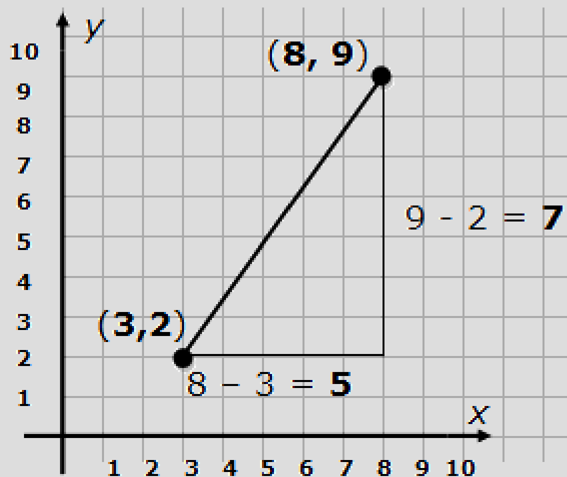
With another point?

(See: pointClassAdd.cpp)

Operator overloading

We can overload the + operator to allow easy addition of points

This is nothing more than a “fancy” function




```
Point Point::operator+(Point other)
{
    Point result;
    result.x=x+other.x;
    result.y=y+other.y;
    return result;
}
```

(See: pointOverload.cpp)

Operator overloading

When overload operators in this fashion,
the computer will convert a statement such as:

```
Point c = a+b;
```

function!

... into ...

```
Point c = a.operator+(b);
```

... where the left side of the operator is the "calling" class and the right side is a argument

Operator overloading

You cannot change the number of parts to an operator ('+' only gets 2, '!' only gets 1)

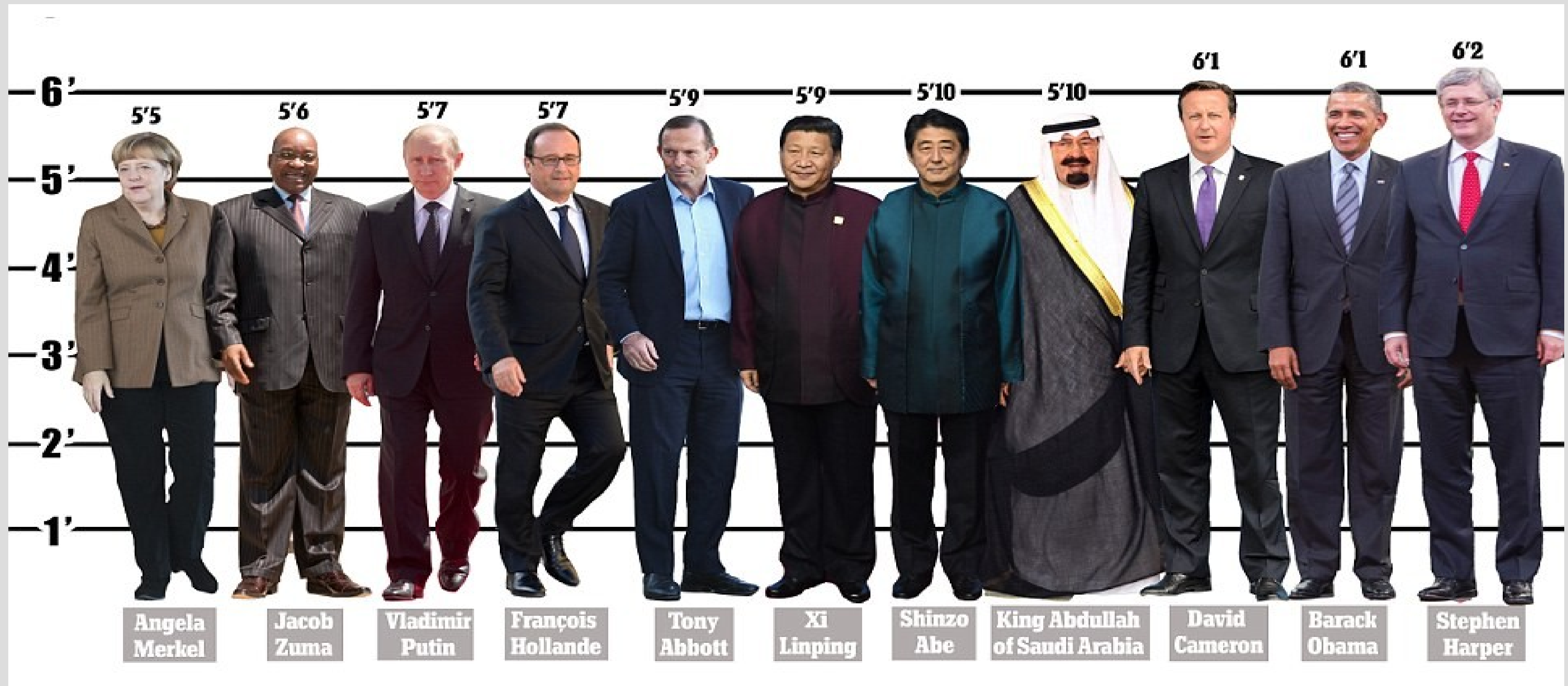
Cannot create “new” operators
(can only overload existing ones)

Cannot change order of precedence
('*' is always before '+')

Operator '=' is special... save for later

Terrible units

Let's make a class that stores people's heights using the terrible imperial units!



(see: heights.cpp)

Terrible units

Write the following operators to compare two different heights:

<

==

>

(see: heightsCompare.cpp)

Operator overloading

Long list of operators you can overload:

( ) // this is normal overloading

+, -, *, /, %

!, <, >, ==, !=, <=, >=, ||, &&

// should be able to do anything above here

<<, >>, [ ]

=, +=, -=, *=, /=, %=, ++ (before/after), --(b/a)

^, &, |, ~, (comma), ->*, ->

^=, &=, |=, <<=, >>=

Operator overloading

Functions define a general procedure (or code block) to run on some inputs

Constructors are nothing but “special” functions that initialize class variables

Operator overloading is a special function that is disguised as a symbol

Friend functions

Ch 11.2

Review: private

```
class height {
private:
    int inch;
    int feet;
```

Notice this line:

```
if(putin < barak)
```

Which runs...

```
if(feet > otherPerson.feet)
```

putin's feet barak's feet

This means putin is accessing barak's privates!

Private only means things NOT associated with the class (such as main) cannot use or access these variables/functions

friend functions

You can give a non-class function access to private variables by making it a friend

A friend function is not inside the class, but does have access to its private variables (friends don't mind sharing)

This allows you to give exceptions to the private rule for specific functions

friend functions

Instead of declaring a friend function at the top, do it inside the class:

```
class Point{
public:
    friend bool equals(Point first, Point second);
```

The function description/implementation is identical to as if it was a non-friend:

```
bool equals(Point first, Point second)
{
```

(See: pointFriends.cpp)

friend functions

How would you overload the << operator?
Would you use a friend?
What do you return?

Hint: cout is type "ostream"
Hint2: use call-by-reference

(See: pointFriendsOverload.cpp)

friend functions

How would you overload the << operator?

Would you use a friend?

Yes, so you can put cout first

What do you return?

ostream& so you can cout multiple things

How would cin work?

Any other case of when you can think you would need a friend with the point class?

friend functions

When would you want to use friend functions?

1. Typically when we want to involve two separate classes

(see: multiplePrivates.cpp)

2. When we care about the order of things...
   (as normal overloading needs your class to come first)