

Classes in C++

- Version 1: Dr. Ofir Pele
- Version 2: Dr. Miri Ben-Nissan
- Version 3: Dr. Erel Segal-Halevi

	C	C++	Java
Keyword	struct	class/struct	class
Attributes	Yes	Yes	Yes
Methods	No	Yes	Yes
Access control	all public	public or private	public or private
Memory	stack/heap	stack/heap	heap
Operators	No	Yes	No
Filename	any (usually: <i>name.h</i>)	any (usually: <i>name.hpp</i> <i>name.cpp</i>)	<i>name.java</i>

structs and classes

Where did `structs` go?

- In C++ `class`==`struct`, except that by default `struct` members are **public** and `class` members are **private**:

```
struct MyStruct
{
    int x;
};
class MyClass
{
    int x;
};
```

```
int main()
{
    MyStruct s;
    s.x = 1; // ok
    MyClass c;
    c.x = 1; // error
}
```

structs & classes

All of these are the same:

```
struct A
{
    int x;
};
```

```
struct A
{
    public:
    int x;
};
```

```
class A
{
    public:
    int x;
};
```

All of these are the same (and useless):

```
class A
{
    int x;
};
```

```
class A
{
    private:
    int x;
};
```

```
struct A
{
    private:
    int x;
};
```

Arrangement of Classes in Memory

- Version 1: Dr. Ofir Pele
- Version 2: Dr. Miri Ben-Nissan
- Version 3: Dr. Erel Segal-Halevi

C

```
struct Cplx {  
    double re, im;  
};  
  
Cplx sumCplx(  
    Cplx a, Cplx b)  
{...}
```

C++

```
class Cplx {  
    double re, im;  
public:  
    Cplx sum  
        (Cplx b) {...}  
    Cplx  
        (double re,  
         double im) {...}  
};
```

Java

```
class Cplx {  
    private double  
        re, im;  
    public Cplx sum  
        (Cplx b) {...}  
    public Cplx  
        (double re,  
         double im) {...}  
};
```

C

C++

Java

```
int main() {  
    Cplx a;  
    a.re=5;  
    a.im=10;  
}
```

```
int main() {  
    Cplx a(5,10);  
}
```

```
void main(...) {  
    Cplx a =  
        new  
        Cplx(5,10);  
}
```

C, C++

Java

Stack:

a.re

a.im

b.re

b.im

c.re

c.im

Heap:

a

b

c

c.re

c.im

b.re

b.im

a.re

a.im

```
int main () { Cplx a, b, c; };
```


Two ways to implement a method *(folder 1)*

```
class Complex {  
    double re, im;  
public:  
    Complex () { re=0; im=0; } // inline constructor  
    Complex (double re, double im);    // “outline”  
  
    Complex sum (Complex b) { return  
Complex(a.re+b.re, a.im+b.im); } // inline method  
    Complex diff (Complex b);        // “outline”  
};
```

Implementing methods out-of-line (folder 1)

```
Complex::Complex (double re, double im) {
```

```
    this→re = re;
```

```
    this→im = im;
```

```
}
```

Scope operator

The address of the instance for which the member method was invoked.

```
Complex Complex::diff(Complex b) {
```

```
    return Complex(a.re-b.re, a.im-b.im);
```

```
}
```

What file-names should we use?

- The C++ compiler does not care how your files are called.
- It is common to put a class declaration in file `ClassName.hpp` (or `ClassName.h`) and the class implementation in file `ClassName.cpp`.
- **Why is it better?**
 - Hiding implementation details.
 - Saving compilation time – when you have a good **Makefile** (*see folder 4*).

Class Basics – member/static *(folder 3)*

```
class List
{
public:
    static int getMaxSize();
    int getSize();
    static int max_size; // = 1000; // error! (declare outside)
    int size = 0;
};
```

```
int List::max_size = 1000; // ok, in one cpp file
```

```
int main()
{
    List l;
    l.getSize();
    List::getMaxSize();
    l.getMaxSize(); // compiles ok, but bad style
}
```

this

```
static int List::getMaxSize() //no this!
{
    return this->size; // compile error!
    return max_size; // ok
}
int List::getSize()
{
    return this->size; //ok
}
```