CS 247: Software Engineering Principles

Essential Operators

Readings: Eckel, Vol. 1

Ch. 11 References and the Copy Constructor

Ch. 12 Operator Overloading (operator=)

Essential Methods

C++ member functions that are so important that the compiler will provide default versions if we don't provide them

- default constructor (generated iff we define *no* constructor)
- destructor
- copy constructor
- assignment (operator=)

not provided by compiler but equally important: operator==

Copy Constructor

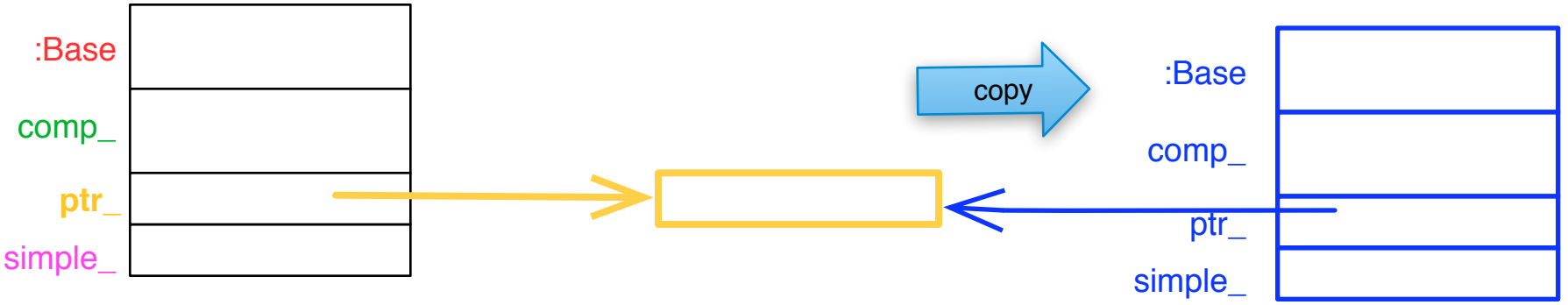
A copy constructor constructs a new object whose value is equal to an existing object.

- used by the compiler to copy objects of the ADT

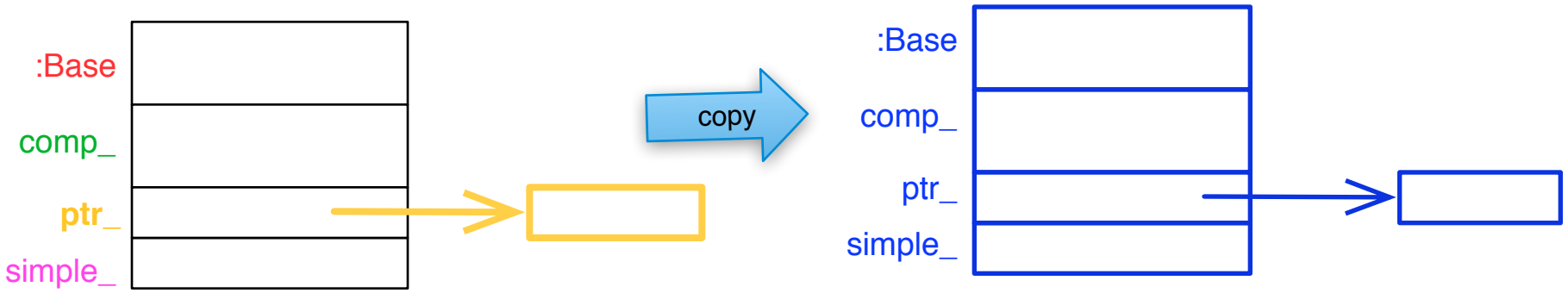
```
class Money;

Money operator+ (Money m, Money n);

int main() {
  Money m;
  Money n(m);
  Money p = m;
  p = p + n;
}
```

Copying Objects with Pointers

Shallow copy copies the object and its pointers' addresses, so that the original and copied pointers refer to the same object.



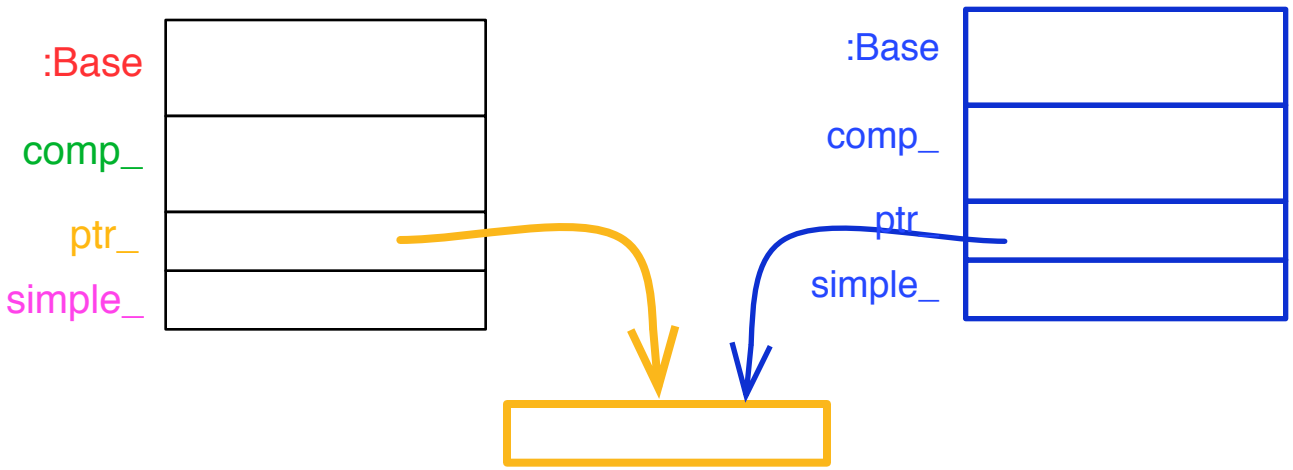
Deep copy copies the object and what its pointers point to, so that the pointer data members refer to distinct objects.



Compiler-Generated Copy Constructor

If we do not declare a copy constructor for our class, the compiler will generate one for us: based on memberwise initialization

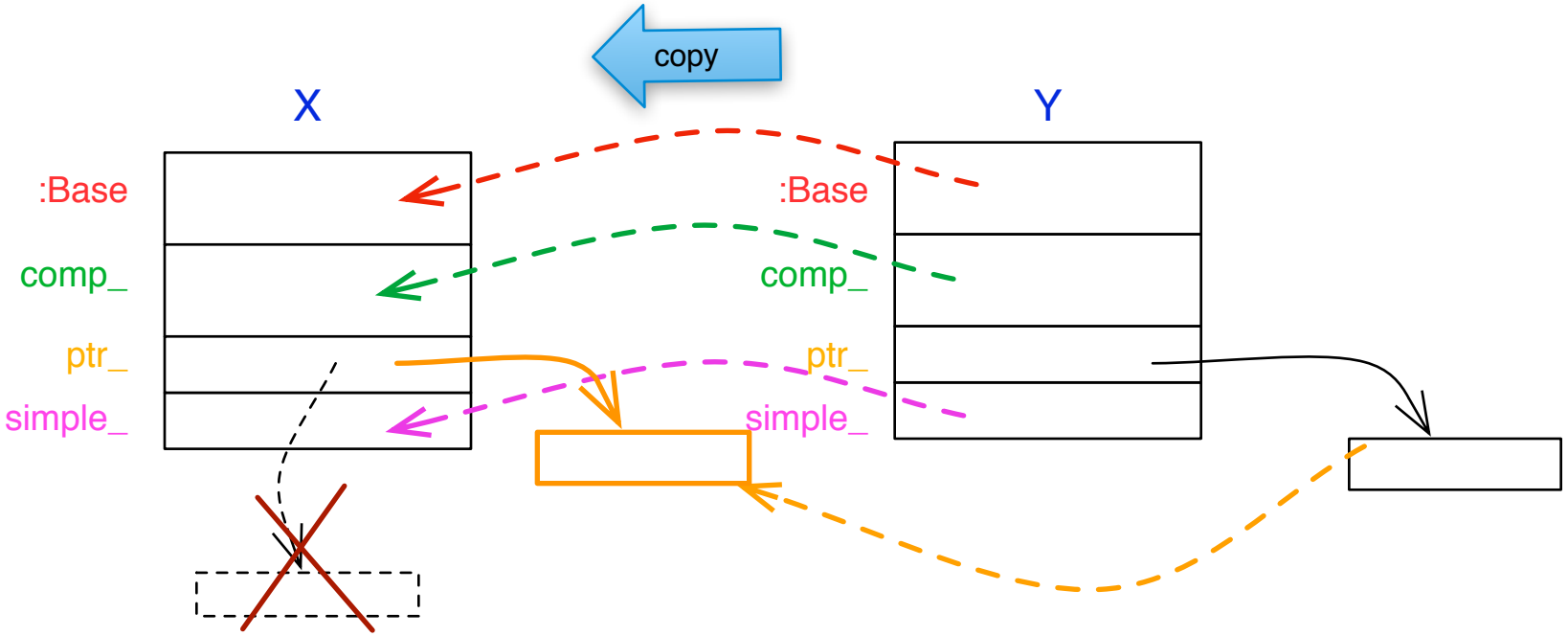
- simple data members: bitwise copy
- pointer members: bitwise copy
- member objects: copied using members' copy constructors
- inherited members: copied using base class's copy constructor



Assignment Operator

Similar to the copy constructor, except that the destination of the copy already exists.

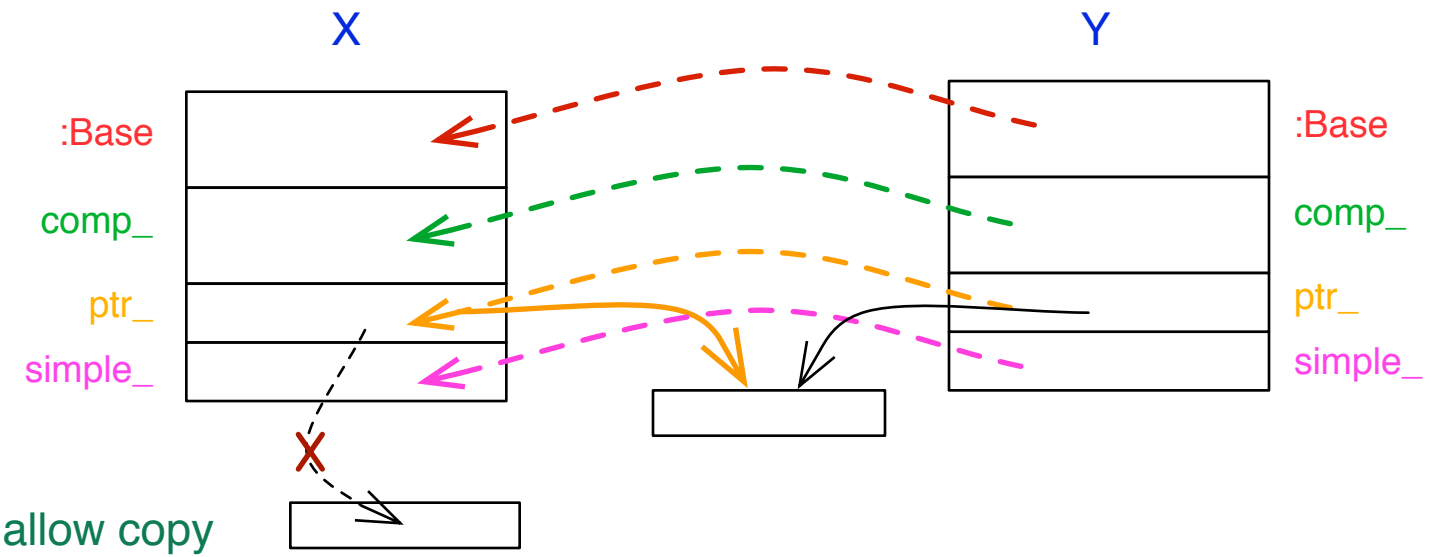
```
X = Y;   // deep copy
```



Compiler-Generated Assignment Operator

If we do not overload the assignment operator for our class, the compiler will create an `operator=` member function for us: based on memberwise assignment:

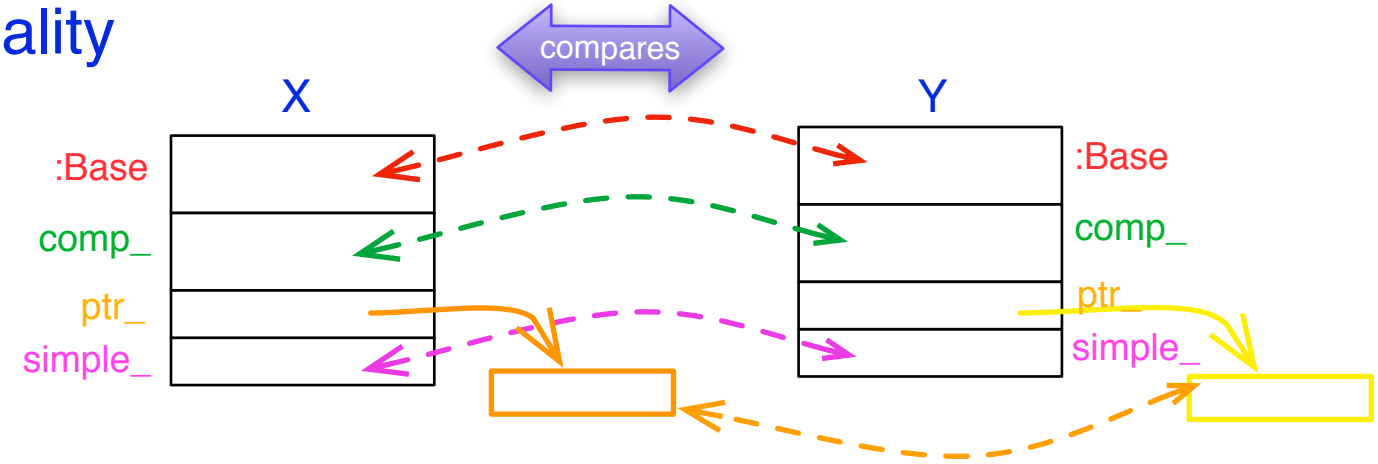
- simple data members: bitwise copy
- pointer members: bitwise copy
- member objects: uses members' assignment operators
- inherited members: uses base class's assignment operator



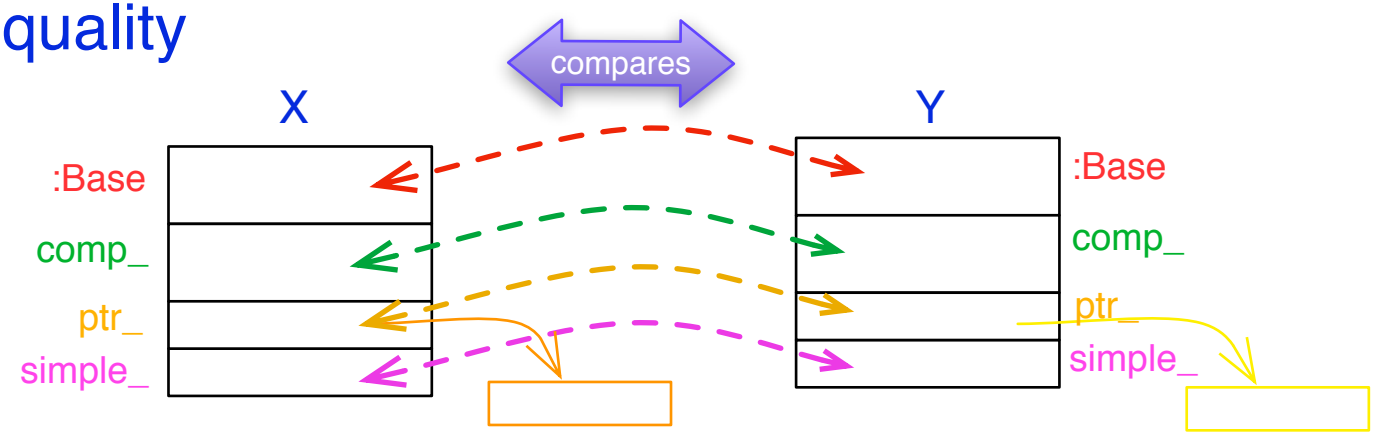
Equality

A copied/assigned object should be equal (`operator==`) to the original.

Deep equality



Shallow equality



The compiler does NOT generate a default version of the equality operator -- we are on our own.

Compiler-Generated Default Constructor

If we do not declare any constructor for our class, the compiler will generate a default constructor for us: based on memberwise initialization

- simple data members: uninitialized
- pointer members: uninitialized
- member objects: initialized using members' default constructors
- inherited members: initialized using base class default constructor

Computer-Generated Destructor

If we do not declare a destructor for our class, the compiler will generate a destructor for us: based on memberwise destruction

- simple data members: deallocated
- pointer members: pointer deallocated
- member objects: cleaned up using members' destructors
- inherited members: cleaned up using base class's destructor