THE BIG FOUR

Problem Solving with Computers-II

Read the syllabus. Know what's required. Know how to get help.

CLICKERS OUT

Freq. AB

How is h01 (specifically the CS16 final) going?

A. Done - I think I have done well

B. Attempted - found it a bit difficult

C. Attempted - found some concepts alien

D. Attempted - extremely difficult

E. Haven't attempted

Clickers out – frequency A

The Big Four : Functions

1. Constructor
2. Destructor
3. Copy Constructor
4. Copy Assignment

→ C++ provides default implementations

C++ (initializes) creates, destroys, copies & assigns objects

Standard way

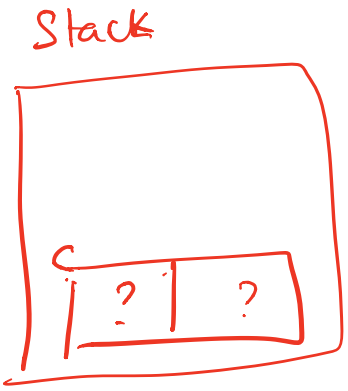
Constructor and Destructor

Every class has the following special functions:

- Constructor: Called right AFTER new objects are created in memory
- Destructor: Called right BEFORE an object is deleted from memory

The compiler automatically generates default versions, but you can override them

```
void foo () {

    Complex c;
    ==========

}
```



In this case object 'c' is removed from the stack when foo() returns

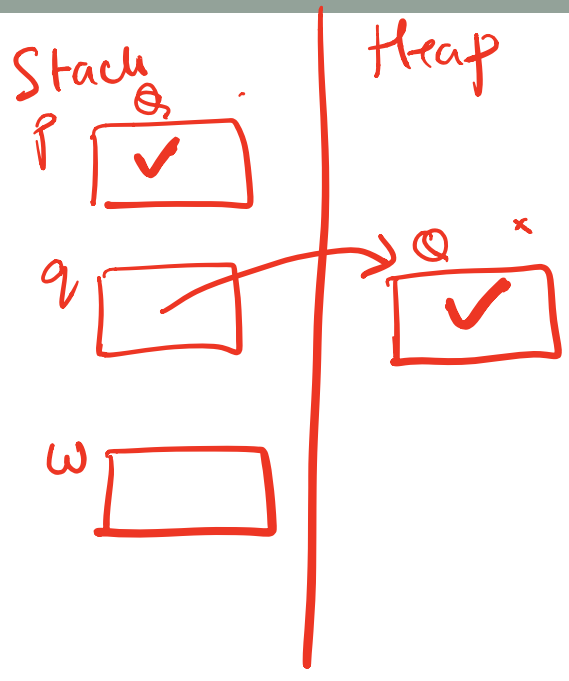
Before c is removed from the stack the destructor of Complex is called.

Constructor (last class)

```
void foo(){
    Quadratic p;
    Quadratic* q = new Quadratic;
    Quadratic w(10, 5, 1);
}
```

How many times is the constructor called in the above code?

A. Never
B. Once
C. Twice
D. Thrice Three times



Initialization lists 

* Used to initialize member variables at the time they are created
* Must be used to initialize constant member variables

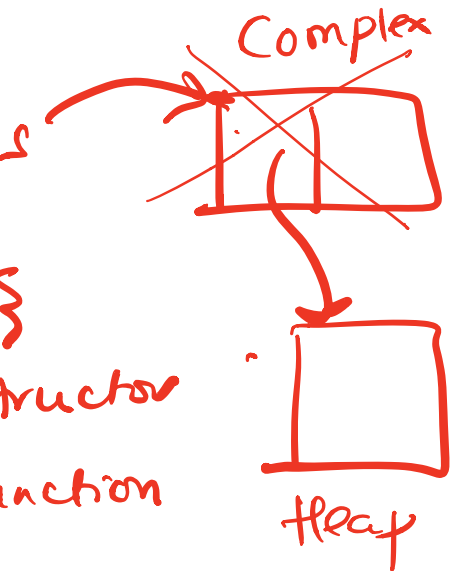
Destructor

"this" is a keyword
it is a self-pointer

- Must have the same name as the class preceded by a ~ (tilda)
- Does not have a return type
- Called right BEFORE an object is deleted from memory

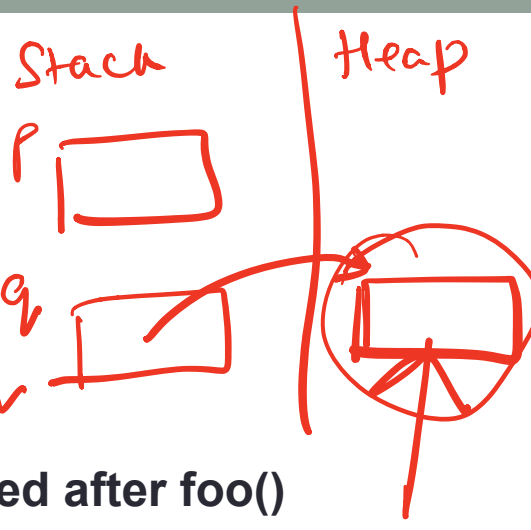
```
class Complex {
    ~Complex();
};

Complex::~Complex() {
    ⋮
}
```

Default destructor
empty function



Destructor

```
void foo(){
     Quadratic p;
     Quadratic *q = new Quadratic;
} //delete q; If we had this line then destructor will be called.
```



The destructor of which of the objects is called after foo() returns?

A. p
B. q
C. *q
D. None of the above

Copy constructor

- Creates a new object and initializes it using an existing object

default (no parameters)

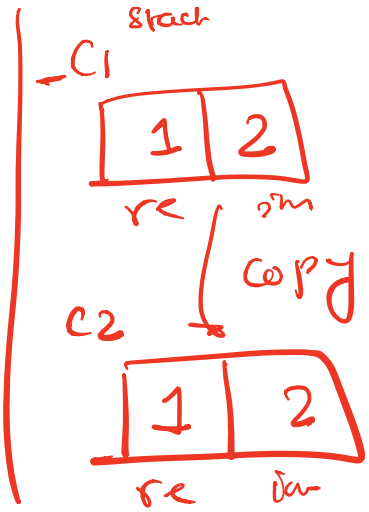
parameterized constructor.

Complex (Complex& other)

Copy constructor

```
main ( ) {
    Complex c1(1,2);
    Complex c2(c1);
}
```

Copy constructor



Copy constructor

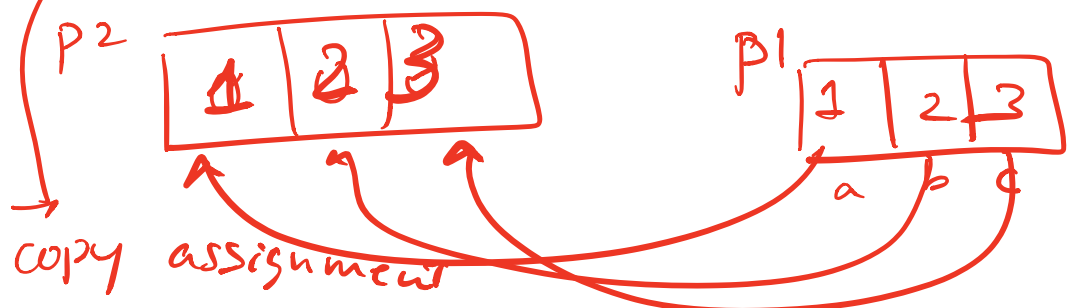
- In which of the following cases is the copy constructor called?

A. `Quadratic p1; Quadratic p2(1, 2, 3);`
B. `Quadratic p1(1, 2, 3); Quadratic p2(p1);`
C. `Quadratic *p1 = new Quadratic(1, 2, 3);`
   `Quadratic p2 = *p1;`
D. B&C
E. A, B & C

Copy assignment

- Default behavior: Copies the member variables of one object into another

```
Quadratic p1(1, 2, 3); // Parametrized constructor
Quadratic p2; // Assume constructor initializes to 0
p2 = p1; // Copy assignment function is called
```



```
double foo(Quadratic p){
    return p.evaluate(10);
}
int main(){
     Quadratic q(1, 2, 3);
     foo(q);
     }
```

Which of the following special methods is called as a result of calling foo?

A. Parameterized constructor

B. Copy constructor

C. Copy Assignment

D. Destructor

Summary

- Classes have member variables and member functions (method). An object is a variable where the data type is a class.
- You should know how to declare a new class type, how to implement its member functions, how to use the class type.
- Frequently, the member functions of an class type place information in the member variables, or use information that's already in the member variables.
- New functionality may be added using non-member functions, friend functions, and operator overloading (next lectures)

Next time

- Linked Lists and operator overloading