C++ BIG FOUR

Problem Solving with Computers-II

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

Learning Goals (Last Week)

- Review basics of classes
  - Defining classes and declaring objects
  - Access specifiers: private, public
  - Different ways of initializing objects and when to use each:
    - Default constructor
    - Parametrized constructor
    - Parameterized constructor with default values
    - Initializer lists

Learning Goals (today)

- Develop a mental model of how programs are represented in memory.
- Identify situations when data needs to be created on the heap vs. stack
- Identify the big four and when you need to implement these vs. use the default versions provided by C++

The Big Four

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

Constructor and Destructor

Every class has the following special methods:

- 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 p;
    complex* q = new complex;
    complex w{10, 5};
}
```

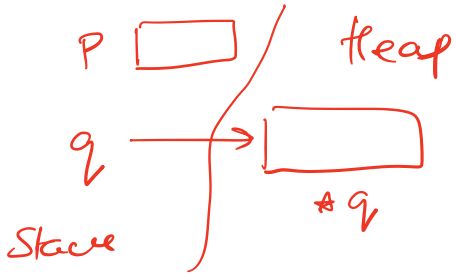
of class complex

How many times is the constructor called above?

Complex *q;

A. Never
B. Once
C. Two times
D. Three times

```
void foo(){
     complex p;
     complex *q = new complex;
}
```



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

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

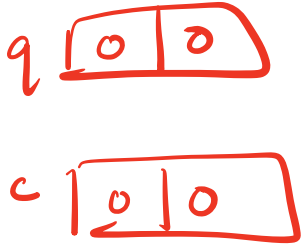
only stack objects are deleted when foo() returns

*q is not of type complex

Copy constructor

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

```
Complex c;
① Complex q(c);
② Complex q = c;
③ Complex q {c};
```



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

A.
```
complex p1;
complex p2{1, 2};
```

B.
```
complex p1{1, 2};
complex p2{p1};
```

C.
```
complex *p1 = new complex{1, 2};
complex p2 = *p1;
```

D. B&C

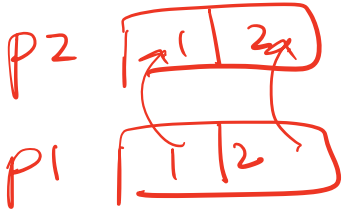
E. A, B & C

Copy assignment

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

```
complex p1{1, 2}; // Parametrized constructor
Complex p2;
p2 = p1; // Copy assignment function is called
```

operator = (Complex other) {
real = other.real ;
img = other.img ;
}



```
double foo(complex p){
    return p.magnitude();
}
int main(){
     complex q{1, 2};
     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

Constant pointers and pointers to constants

```
const char* p1;
char* const p2;
const char* const p3;
```

Operator Overloading

We would like to be able to compare two objects of the class using the following operators

==

!=

and possibly others

```
bool operator==(const complex & c1, const complex &c2){
    return c1.real==c2.real && c1.imag == c2.imag;

}
```

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 the rule of three