Copy Constructors

Prof. Wade Fagen-Ulmschneider

In C++, a **copy constructor** is a special constructor that exists to make a copy of an existing object.

Object:

Automatic Copy Constructor

If we do not provide a custom copy constructor, the C++ compiler provides an **automatic copy constructor** for our class for free!

The automatic copy constructor will copy the contents of all member variables.

Custom Copy Constructor

A custom copy constructor is:

- A class constructor
- Has exactly one argument
  - The argument must be const reference of the same type as the class.

Example:

```
Cube::Cube(const Cube & obj)
```

cpp-cctor/Cube.cpp

```
 8 #include "Cube.h"
 9 #include <iostream>
10
11 namespace uiuc {
12   Cube::Cube() {
13     length_ = 1;
15   }
16
17   Cube::Cube(const Cube & obj) {
18     length_ = obj.length_;
20   }
21
...    ...
```

Copy Constructor Invocation

Often, copy constructors are invoked automatically:

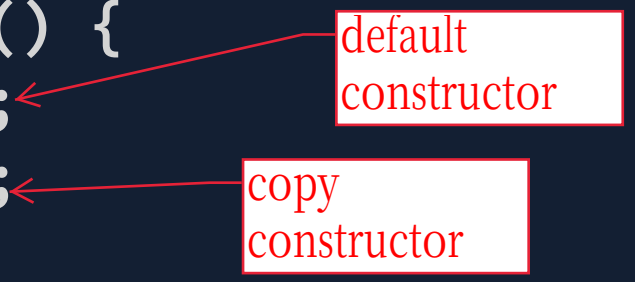
- Passing an object as a parameter (by value)
- Returning an object from a function (by value)
- Initializing a new object

cpp-cctor/Cube.cpp

```
 8 #include "Cube.h"
 9 #include <iostream>
10
11 namespace uiuc {
12   Cube::Cube() {
13     length_ = 1;
14     std::cout << "Default constructor invoked!" << std::endl;
15   }
16
17   Cube::Cube(const Cube & obj) {
18     length_ = obj.length_;
19     std::cout << "Copy constructor invoked!" << std::endl;
20   }
21
...    ...
```

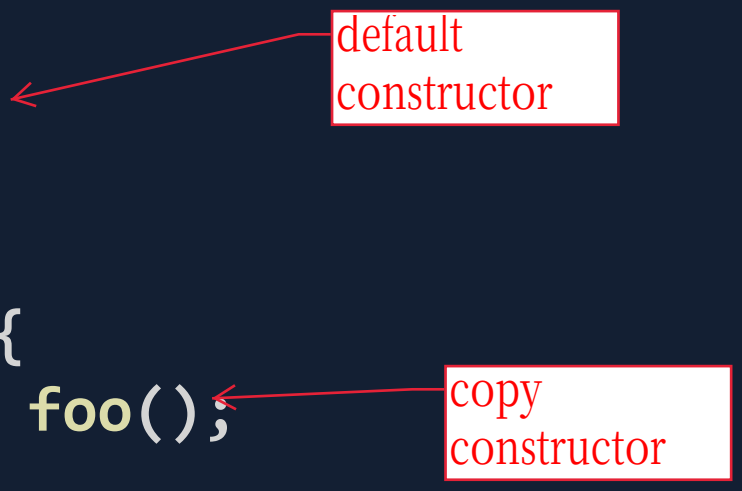
cpp-cctor/ex1/main.cpp

```
 8 #include "../Cube.h"
 9 using uiuc::Cube;
10
11 void foo(Cube cube) {
12   // Nothing :)
13 }
14
15 int main() {
16   Cube c;
17   foo(c);
18
19   return 0;
20 }
```



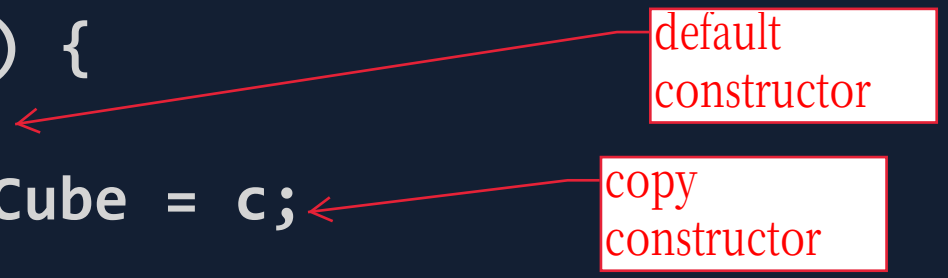
cpp-cctor/ex2/main.cpp

```
8  #include "../Cube.h"
9  using uiuc::Cube;
10
11 Cube foo() {
12   Cube c;
13   return c;
14 }
15
16 int main() {
17   Cube c2 = foo();
18   return 0;
19 }
```



cpp-cctor/ex3/main.cpp

```
8  #include "../Cube.h"
9  using uiuc::Cube;
10
11 int main() {
12   Cube c;
13   Cube myCube = c;
14
15   return 0;
16 }
```



cpp-cctor/ex4/main.cpp

```
8  #include "../Cube.h"
9  using uiuc::Cube;
10
11 int main() {
12   Cube c;
13   Cube myCube;
14
15   myCube = c;
16
17   return 0;
18 }
```