Inheritance II

CMSC 202

Warmup

Define a class called Giraffe that inherits publicly from a class called Mammal

Inheritance Review

Base class
- More general class

Derived class
- More specific class
- Uses, adds, extends, or replaces base-class functionality

```
class BaseClass
{ };

class DerivedClass : public BaseClass
{ };
```

Inherited Functionality

Derived class
- Has access to all public methods of base class
- "Owns" these public methods
  - Can be used on derived class objects!

```
BaseClass b;
b.BaseClassMethod();
b.DerivedClassMethod();

DerivedClass d;
d.BaseClassMethod();
d.DerivedClassMethod();
```

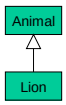
Protection Mechanism

Public
- Anything can access these methods/data

Private
- Only this class can access these methods/data

Protected
- Only derived classes (and this class) can access these methods/data

Trip to the Zoo




```
class Animal
{
public:
     void Print() { cout << "Hi, my name is" << m_name; }
protected:
     string m_name;
};

class Lion : public Animal
{
public:
     Lion(string name) { m_name = name; }
};

void main()
{
     Lion lion("Fred");
     lion.Print();
}
```

Hi, my name is Fred

Constructors and Destructors

- Constructors
  - Not inherited
  - Base class constructor is called ***before*** Derived class constructor
  - Use initializer-list to call non-default base-class constructor
  - Similar for copy constructor
- Destructors
  - Not inherited
    - Derived class destructor is called ***before*** Base class
  - We'll look more carefully at these next week

Constructor and Destructor

```
class Animal
{
public:
    Animal() { cout << "Base constructor" << endl; }
    ~Animal() { cout << "Base destructor" << endl; }
};

class Lion : public Animal
{
public:
    Lion() { cout << "Derived constructor" << endl; }
    ~Lion() { cout << "Derived destructor" << endl; }
};

int main()
{
    Lion lion;
    return 0;
}
```

Will print:

Base constructor
Derived constructor
Derived destructor
Base destructor

Non-default Constructor

```
class Animal
{
public:
   Animal(string name) { m_name = name; }
protected:
   string m_name;
};

class Lion : public Animal
{
public:
   Lion(string name) : Animal(name) { }
};
```

What's going on here?

operator=

operator=
- Not inherited
  - Well, at least not exactly
- Need to override this!
- Can do:

```
Base base1 = base2;
Base base1 = derived1;
```

Why won't this work??

- Cannot do:

```
Derived derived1 = base1;
```

Operator=

```
class Animal
{
public:
    Animal(string name)
       { m_name = name; }
    Animal& operator=(Animal& a)
       { m_name = a.m_name; }
protected:
    string m_name;
};

class Lion : public Animal
{
public:
    Lion(string name)
       : Animal(name) { }
};
```

```
int main()
{
    Lion lion("Fred");
    Animal animal1("John");
    Animal animal2("Sue");

    animal1 = animal2;
    animal2 = lion;

    lion = animal1;
      // Uh Oh!!!

    return 0;
}
```

Compiler looks for an operator= that takes a Lion on the left-hand side – doesn't find one!!!

Method Overriding

Overriding
- Use ***exact same signature***
- Derived class method can
  - Modify, add to, or replace base class method
- Derived method will be called for derived objects
- Base method will be called for base objects
- Pointers are special cases
  - More on this next week!

Method Overriding

```
class Animal
{
public:
     void Eat() { cout << "I eat stuff" << endl; }
};

class Lion : public Animal
{
public:
     void Eat() { cout << "I eat meat" << endl; }
};

void main()
{
     Lion lion;
     lion.Eat();              I eat meat

     Animal animal;
     animal.Eat();            I eat stuff
}
```

Method Overloading

Overloading

- Use ***different signatures***
- Derived class has access to both…
- Not usually thought of as an inheritance topic
- Pointers are tricky
  - More on this next week!

Method Overloading

```
class Animal
{
public:
     void Eat() { cout << "I eat stuff" << endl; }
};

class Lion : public Animal
{
public:
     void Eat(string food) { cout << "I ate a(n) " << food << endl; }
};

void main()
{
     Lion lion;
     lion.Eat("steak");       I ate a(n) steak

     lion.Eat();              I eat stuff
}
```

Challenge

Complete the Giraffe and Mammal classes

- Implement at least one overloaded method
- Implement at least one protected data member
- Implement a constructor
- Implement a destructor
- Implement a non-default constructor