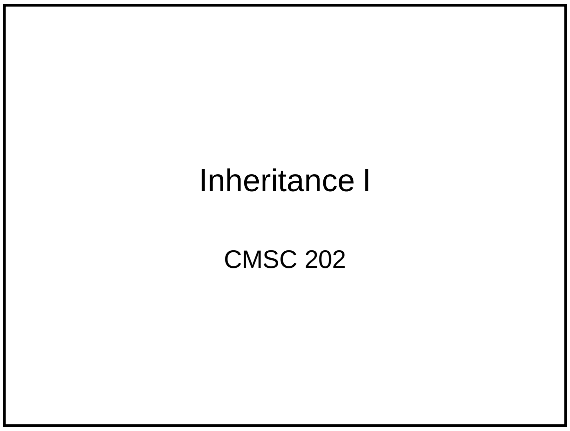
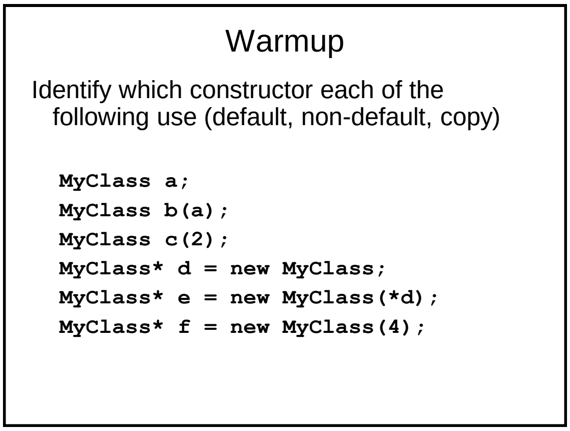


Inheritance I

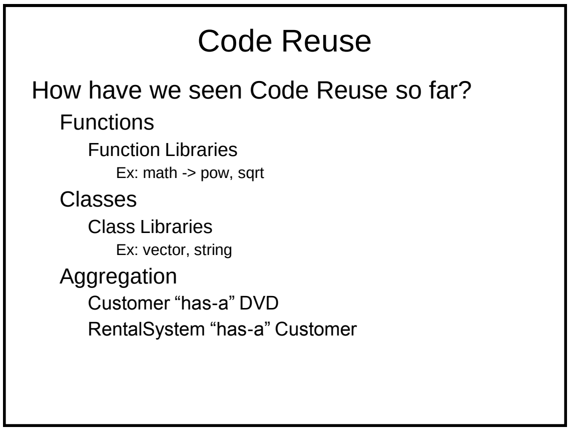
CMSC 202



Warmup

Identify which constructor each of the following use (default, non-default, copy)

```
MyClass a;
MyClass b(a);
MyClass c(2);
MyClass* d = new MyClass;
MyClass* e = new MyClass(*d);
MyClass* f = new MyClass(4);
```



Code Reuse

How have we seen Code Reuse so far?

- Functions
  - Function Libraries
    - Ex: math -> pow, sqrt
- Classes
  - Class Libraries
    - Ex: vector, string
- Aggregation
  - Customer “has-a” DVD
  - RentalSystem “has-a” Customer

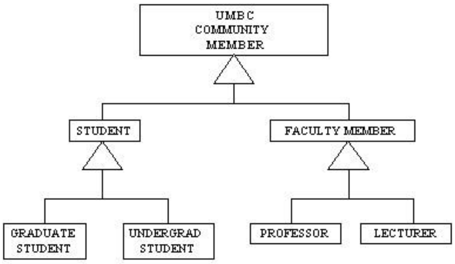
Object Relationships

- “Uses a”
  - Object_A “uses a” Object_B
    - Ex: Student sits in a chair
- “Has a”
  - Object_A “has a” Object_B
    - Ex: Student has a name
- “Is a” or “Is a kind of”
  - Object_A “is a” Object_B
    - Ex: Student is a kind of Person

Inheritance

- What is Inheritance?
  - Unfortunately – not what your parents/grandparents will be giving you…
- Inheritance
  - “is a” or “is a kind of” relationship
  - Code reuse by sharing related methods
  - Specific classes “inherit” methods from general classes
- Examples
  - A student is a person
  - A professor is a faculty member
  - A lecturer is a faculty member

Inheritance Hierarchy



An Inheritance Heirarchy

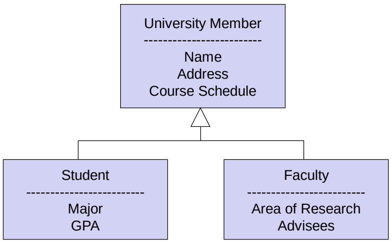
Why Inheritance?

- Abstraction for sharing similarities while retaining differences
- Group classes into related families
  - Share common operations and data
- Multiple inheritance is possible
  - Inherit from multiple base classes
  - Not advisable
- Promotes code reuse
  - Design general class once
    - Extend implementation through inheritance

Inheritance and Classes

- Base class (or superclass)
  - More general class
  - Contains common data
  - Contains common operations
- Derived class (or subclass)
  - More specific class
  - Inherits data from Base class
  - Inherits operations from Base class
  - Uses, modifies, extends, or replaces Base class behaviors

Inheritance Example



University Member

Name
Address
Course Schedule

Student

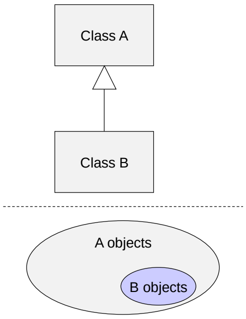
Major
GPA

Faculty

Area of Research
Advisees

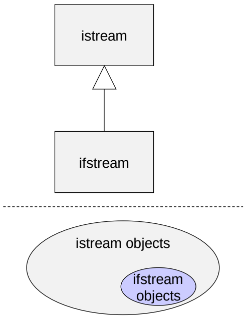
Inheritance

- Assume the hierarchy on the right…
  - A is Base class
  - B is derived class
  - B derives from A
  - Every B is an A
  - Every A is NOT a B
  - Some A's are B's

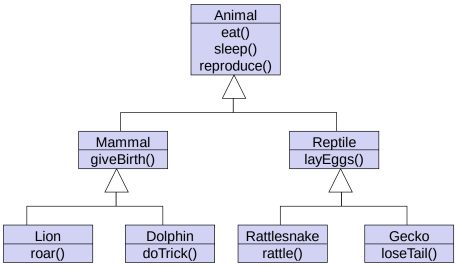


Inheritance

- Assume the hierarchy on the right…
  - Everywhere an A can be used, a B can be used
    - Parameters
    - Return values
    - Items in vectors
    - Items in arrays
  - Reverse is not true…
- Inheritance so far?
  - ifstream is an istream
  - ofstream is an ostream



Trip to the Zoo



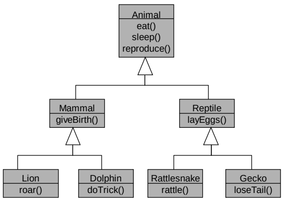
Inheritance

```
class BaseClass
{
   public:
      // operations
   private:
      // data
};

class DerivedClass : public BaseClass
{
   public:
      // operations
   private:
      // data
};
```

Indicates that this derived class inherits data and operations from this base class

Inheritance in Action

```
class Animal
{ };

class Mammal : public Animal
{ };

class Lion : public Mammal
{ };

class Dolphin : public Mammal
{ };

class Reptile : public Animal
{ };

class Gecko : public Reptile
{ };
```



Challenge

Draw the hierarchy for a Vehicle class

- What kinds of vehicles are there?
  - Personal, Commercial, etc.
- What kinds of personal vehicles are there?
  - Cars, Motorcycles, Trucks, etc.
- What kinds of commercial vehicles are there?
  - Planes, Trains, etc.