Some random reviews

- Why do we have 2 overloads for operator[]?
- What is the difference between a shallow copy and a deep copy?
  - Which happens by default?
- When is the copy constructor implicitly called on an object?
- Why is the parameter to the copy constructor passed by const reference?
  - What would happen if we passed by value?
- What are the differences between operator= and the copy constructor?
  - What does operator=() return?

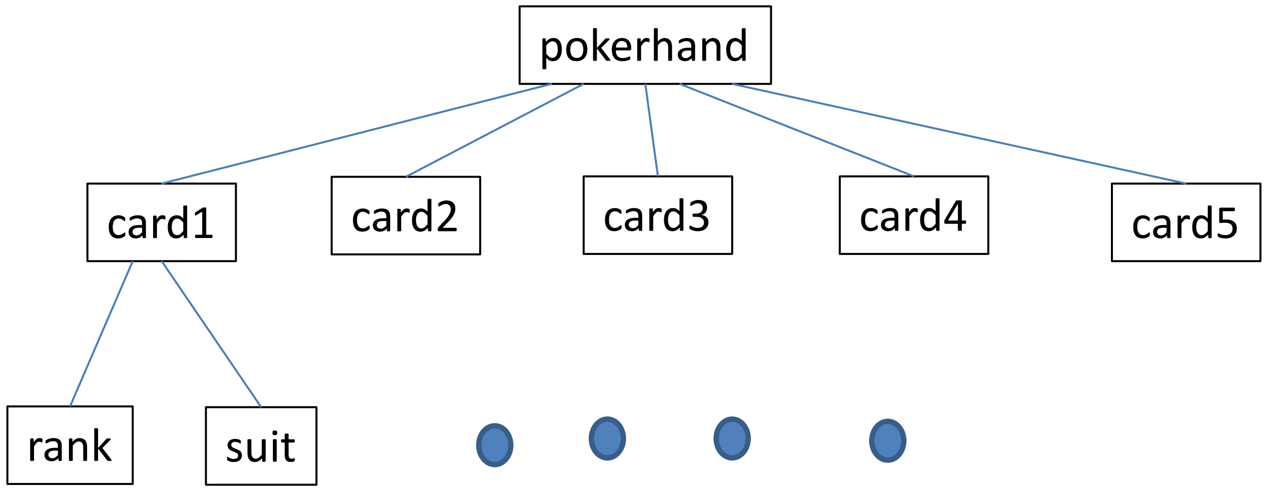
Inheritance

Introduction

Relation among objects: the “has a “ relationship

- PlayList “has a” Song
- PokerHand “has a” Card

How does C++ capture the “has a” relationship?

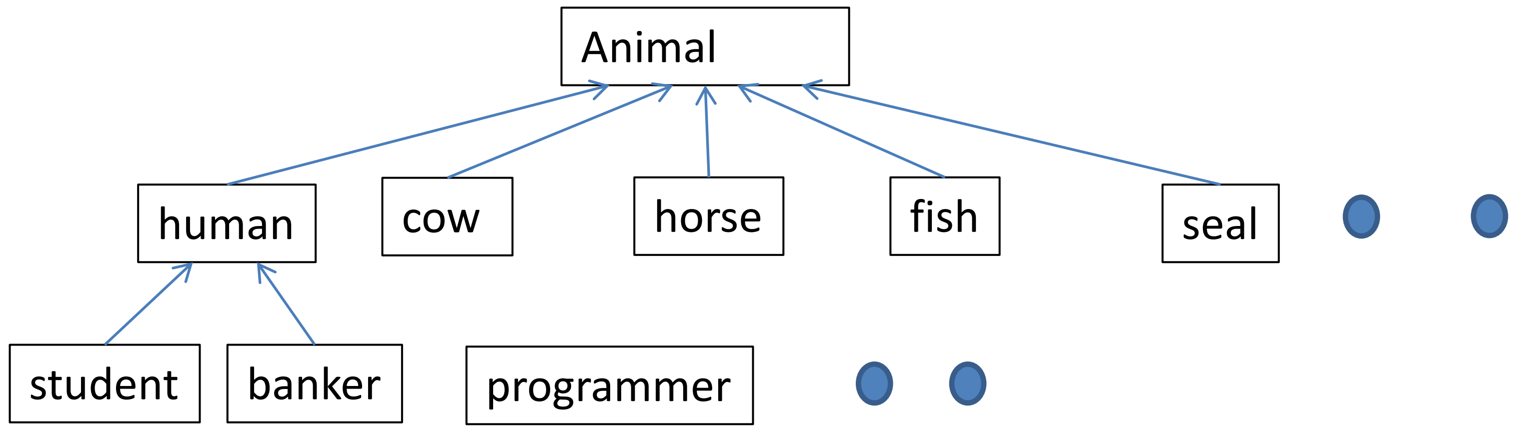


Introduction

Another common relationship between objects is the “is-a” relationship.

- A FSU CS student is a FSU student
- A FSU student is a student.

Need a way to capture this relationship.



Introduction

The “inheritance” in C++ allows programmers to define the “is-a” relationship.

- A class can be defined as a derived class of another class (called based class).
- The derived class then becomes a type/kind of the base class.
  - An object of a derived class “is an” object of the base class.
- Another way of thinking of this is that the derived class is everything the base class is and (possibly) more.
- This allows us to use the derived class object as though it were a base class object in certain scenarios.

Inheritance, base and derived class.

The “is a” relationship is realized though **Inheritance** using the following declaration syntax, which means a derivedClass object is a baseClass object (can use all functions in the base class interface).

class derivedClassName : public baseClassName

```
class Mammal {
public:
  void PrintInfo() const;
};

class Cow: public Mammal {   // Cow is a derived class of Mammal
  public:
    void sound() const;
}
…
Cow xyz;
xyz.PrintInfo();  // any Cow object can call functions in both base class and derived class
```

See sample1.cpp

Protection Levels

A derived class can access to all public members in the base class, but not the private members.

- A derived class is however in a way different from the “public”.
- We might want to allow some members to be accessed only by derived classes, but not the general public.
  - A new protection level: **protected**.

A summary of the three protection levels:

public - Members that can be accessed by name from within any function.

private - Members that can only be accessed within member and friend functions of the class in which they are declared.

protected - Members that can only be accessed within member and friend functions of the class in which they are declared **AND** from within derived class's member and friend functions.

See sample2.cpp

Constructors/Destructors

Since a derived class instance (object) is also a base class instance, both the base and derived class constructors must run when a derived object is instantiated.

Constructors run from most general (most base) to most derived.

Destructors run from most specific (most derived) to most base.

- See sample3.cpp

What about constructors with parameters?

- Control with initialization list
- See sample4.cpp

Function Overriding

- One of the most useful features Inheritance include and allows us to customize the behavior of derived objects.
- A derived class can declare it's own version of a function declared in the base class from which it inherits.
  - The derived class version of the function will supersede (override) the version in the base class.
  - See sample5.cpp
- We can even still access the original base class version of the function through an explicit call.
  - This is because a derived class must, by definition, be everything the base class is and (possibly) more.
  - See sample6.cpp