CS202: Programming Systems

Week 6: Multiple inheritance

11/2018

CS202 – What will be discussed?

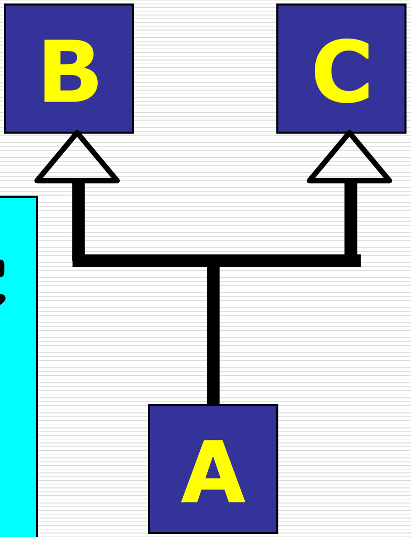
- Multiple inheritance
- Diamond problem
- Virtual inheritance

Multiple inheritance

- When a class has 2 or more direct base classes, it is called ***multiple inheritance***.

- For example

```
class A: public B, public C
{
      ...
};
```



Multiple inheritance

- Data members and operations from B and C will be inherited to class A similarly to ***single inheritance*** mentioned last time.
- Virtual functions work as usual

Example

```
class B {
   void draw();
};
class C {
   void calc();
};
class A: public B,
         public C
{
   void doSth();
};
```

```
void test(A& a)
{
   // B::draw()
   a.draw();
   // C::calc()
   a.calc();
   // A::doSth()
   a.doSth();
}
```

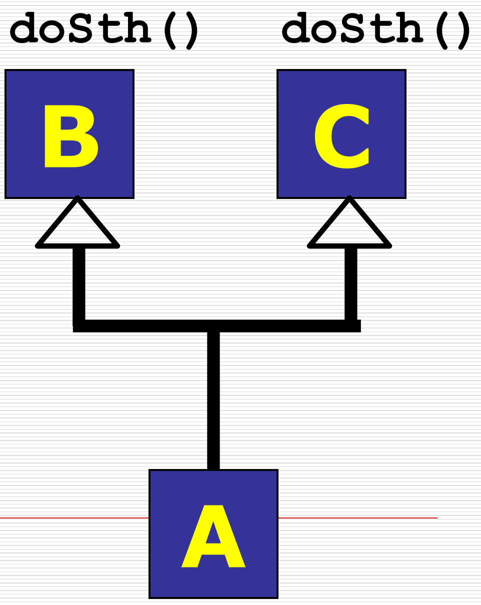
Dynamic binding

```
class B {
   virtual void draw() = 0;
};
class C {
   virtual void calc() = 0;
};
class A: public B, public C
{
   void draw(); //override B::draw()
   void calc(); //override C::calc()
};
```

Function name clash: ambiguity

- Overload resolution is not applied across different class scopes. It means function ambiguities from different base classes are not resolved based on function signatures.

```
int main()
{
    A a;
    a.doSth();      //error:ambiguous
    a.B::doSth();   // OK
    a.C::doSth();   // OK
}
```



`using` keyword

- If the use of the same name in different base classes is deliberately and the user would like to choose the function based on its signature

➔`using` declaration can bring the functions into a common scope.

Function name clashes!!!

```
class B {
   void doSth(int);
};
class C {
   void doSth(double);
};
class A: public B, public C {...};

void test() {
   A a;
   a.doSth(10); //Error: ambiguous!
};
```

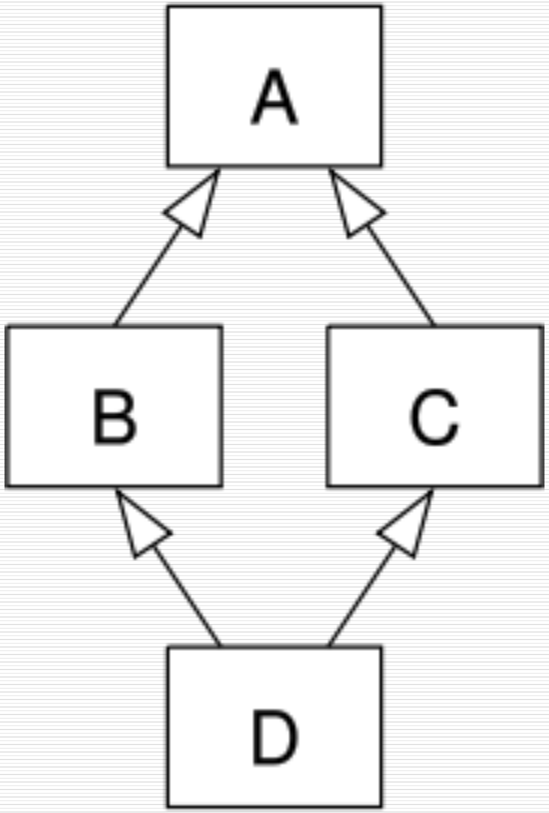
```
class B {
   void doSth(int);
};
class C {
   void doSth(double);
};
class A: public B, public C {
   using C::doSth;
   using B::doSth;
   void doSth(char);
};

void test(A& a) {
   a.doSth(10);    // B::doSth(int)
   a.doSth(‘a’);   // A::doSth(char)
   a.doSth(5.2);   // C::doSth(double)
};
```

Replicated based class

- With the ability of specifying more than one base class, there may be a chance of having the same base class more than once.

Diamond problem!

```
class A {...};
class B: public A
{...};
class C: public A
{...};
class D: public B,
         public C
{...};
```



Replicated based class

```
void test(D* p)
{
    p->doSth();  // error: ambiguous
    p->A::doSth();  // error: ambiguous
    p->B::doSth();  // ok
    p->C::doSth();  // ok
    // ...
}
```

Virtual base class

```
class A {...};
class B: public virtual A
{...};
class C: public virtual A
{...};
class D: public B, public C
{...};
```

- D has only 1 `class A`