Hiding & Overriding

C++ Object Oriented Programming
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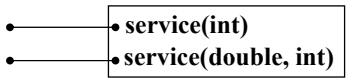
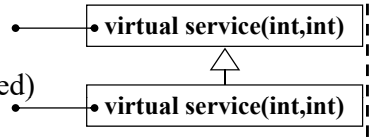
Overloading, Overriding, Hiding

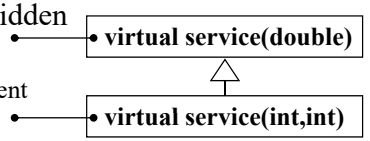
- ***Overloading***: two functions in the same scope, have the same name, different signatures (virtual is not required)



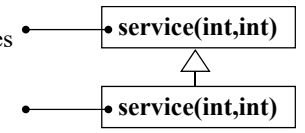
- ***Overriding***: two functions in different scopes (parent vs child), have the same name. same signatures (**virtual** is required)



- ***Hiding***: base class member function is hidden
  1. When a base class and a derived class declare virtual member functions with different signatures but **with** the same name.



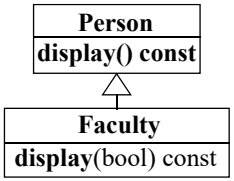
  2. When a base class declares a non-virtual member function and a derived class declares a member function **with** the same name but **with** or **without** the same signature.



Hiding

```
class Person{
public:
   virtual void display() const;
};

class Faculty: public Person {
public:
   virtual void display(bool showDetail) const;
};
```



different signature

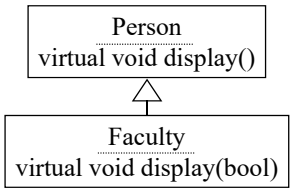
```
Person p;
p.display();
Faculty f;
f.display();
f.display(true);
Person *ptr = &f;
ptr->display();
ptr->display(true);
Faculty *fptr = &f;
fptr->display();
fptr->display(true);
```

different scope

- In **Faculty** class, **display(**bool**)** does **NOT** *override* **Person::display()**
  ⇒ **different entries in virtual table**
- **display(**bool**)** does **NOT** *overload* **Person::display()**
- Only **display(**bool**)** can be called with a **Faculty** object, reference, or pointer, cannot see **display**(), although **Person::display()** can be called.

Member Function Calling Rule

referrer.function()
referrer->function()



1. Search in the scope of the static type of the referrer pointer/reference/object to find the specified function in its **explicitly** defined functions
2. If it is a virtual function and referrer is a pointer (including ***this*** pointer) or reference, use dynamic binding otherwise use static one

What functions are **explicit** in the scope of a class?

1. **Defined in the class declaration**
2. **Search upward the inheritance tree, match all functions not hidden/overridden previously (by any function having the same name)**

Calling Member Functions

```
class Base {
public:
   void funcA() { cout << "Base::funcA() #1\n"; }
   virtual void funcB() { cout << "Base::funcB() #2\n"; }
   void funcC() { cout << "Base::funcC() #3\n"; }
   virtual void funcD() { cout << "Base::funcD() #4\n"; }
   virtual void funcE() { cout << "Base::funcE() #5\n"; }
   virtual void funcE(int, int) { cout << "Base::funcE(int,int) #6\n"; }
};
```

Virtual table: 2, 4, 5, 6

Explicit: 1,2,3,4,5,6

```
Base b;
b.funcA(); // #1
b.funcB(); // #2
b.funcC(); // #3
b.funcD(); // #4
b.funcE(); // #5
b.funcE(1,2); // #6
```


Calling Member Functions

```
class Base {
public:
   void funcA() { cout << "Base::funcA() #1\n"; }
   virtual void funcB() { cout << "Base::funcB() #2\n"; }
   void funcC() { cout << "Base::funcC() #3\n"; }
   virtual void funcD() { cout << "Base::funcD() #4\n"; }
   virtual void funcE() { cout << "Base::funcE() #5\n"; }
   virtual void funcE(int, int) { cout << "Base::funcE(int,int) #6\n"; }
};
```

Virtual table: 2, 4, 5, 6

Explicit: 1,2,3,4,5,6

Virtual table: 2, 8, **5**, **6**, 9

```
class Derived: public Base {
public:
   void funcC() {
      cout << "Derived::funcC() #7\n";
   }
   void funcD() {
      cout << "Derived::funcD() #8\n";
   }
   virtual void funcE(int) {
      cout << "Derived::funcE(int) #9\n";
   }
};
```

Explicit: 1,2,7,8,9
Implicit: 3,4,5,6

```
Derived d;
d.funcA(); // #1
d.funcB(); // #2
d.funcC(); // #7
d.Base::funcC(); // hidden #3
d.funcD(); // #8
d.Base::funcD(); // overridden #4
//d.funcE(); error 'funcE' does not take 0 parame
d.Base::funcE(); // hidden #5
//d.funcE(1,2); error 'funcE' does not take 2 para
d.Base::funcE(1,2); // hidden #6
d.funcE(3); // #9
```


Calling Member Functions (cont'd)

```
class Base {
public:
   void funcA() { cout << "Base::funcA() #1\n"; }
   virtual void funcB() { cout << "Base::funcB() #2\n"; }
   void funcC() { cout << "Base::funcC() #3\n"; }
   virtual void funcD() { cout << "Base::funcD() #4\n"; }
   virtual void funcE() { cout << "Base::funcE() #5\n"; }
   virtual void funcE(int, int) { cout << "Base::funcE(int,int) #6\n"; }
};
```

Virtual table: 2, 4, 5, 6

Explicit: 1,2,3,4,5,6

Explicit: 1,2,7,8,9
Implicit: 3,4,5,6

Virtual table: 2, 8, **5**, **6**, 9

```
class Derived: public Base {
public:
   void funcC() {
      cout << "Derived::funcC() #7\n";
   }
   void funcD() {
      cout << "Derived::funcD() #8\n";
   }
   virtual void funcE(int) {
      cout << "Derived::funcE(int) #9\n";
   }
};
```

Explicit: 1,2,7,8,9
Implicit: 3,4,5,6

```
class FDerived1: public Derived {
};
FDerived1 fd1;
```

Virtual table: 2, 8, **5**, **6**, 9

```
fd1.funcA(); // #1
fd1.funcB(); // #2
fd1.funcC(); // #7
fd1.Base::funcC(); // hidden #3
fd1.funcD(); // #8
fd1.Base::funcD(); // overridden #4
//fd1.funcE(); error 'funcE' does not take 0 parar
fd1.Base::funcE(); // hidden #5
//fd1.funcE(1,2); error 'funcE' does not take 2 pa
fd1.Base::funcE(1,2); // hidden #6
fd1.funcE(3); // #9
```


Calling Member Functions (cont'd)

```
class Base {
public:
   void funcA() { cout << "Base::funcA() #1\n"; }
   virtual void funcB() { cout << "Base::funcB() #2\n"; }
   void funcC() { cout << "Base::funcC() #3\n"; }
   virtual void funcD() { cout << "Base::funcD() #4\n"; }
   virtual void funcE() { cout << "Base::funcE() #5\n"; }
   virtual void funcE(int, int) { cout << "Base::funcE(int,int) #6\n"; }
};
```

Virtual table: 2, 4, 5, 6

Explicit: 1,2,3,4,5,6

Explicit: 1,2,7,8,9
Implicit: 3,4,5,6

Virtual table: 2, 8, **5**, **6**, 9

```
class Derived: public Base {
public:
   void funcC() {
      cout << "Derived::funcC() #7\n";
   }
   void funcD() {
      cout << "Derived::funcD() #8\n";
   }
   virtual void funcE(int) {
      cout << "Derived::funcE(int) #9\n";
   }
};
```

Explicit: 1,2,7,8,9
Implicit: 3,4,5,6

```
class FDerived1: public Derived {
};
```

Virtual table: 2, 8, **5**, **6**, 9

Virtual table: 2, 8, 10, 11, 9

```
class FDerived2: public Derived {
public:
   void funcE() {
      cout << "FDerived2::funcE() #10\n";
   }
   void funcE(int, int) {
      cout << "FDerived2::funcE(int, int) #11\n";
   }
};
```

Explicit: 1,2,7,8,10,11
Implicit: 3,4,5,6,9

Calling Member Functions (cont'd)

```
FDerived2 fd2;
fd2.funcA(); // #1
fd2.funcB(); // #2
fd2.funcC(); // Derived::funcC() #7
fd2.Base::funcC(); // hidden by Derived::funcC() #3
fd2.funcD(); // Derived::funcD() #8
fd2.Base::funcD(); // overridden by Derived::funcD() #4
fd2.funcE(); // overiding Base::funcE() #10
fd2.Base::funcE(); // overridden #5
fd2.funcE(1,2); // overiding Base::funcE(int,int) #11
fd2.Base::funcE(1,2); // overridden #6
//fd2.funcE(3);// error  'funcE' does not take 1 params
fd2.Derived::funcE(3); // hidden #9
```

Virtual table: 2, 8, 10, 11, 9

```
Base *bp=&fd2;
bp->funcB(); // #2
bp->funcD(); // overriding Base::funcD() #8
bp->funcE(); // overriding Base::funcE() #10
bp->funcE(1,2); // overriding Base::funcE(1,2) #11
```

Virtual table: 2, 8, 10, 11, 9

```
Derived *dp=&fd2;
dp->funcB(); // #2
dp->funcD(); // #8
// dp->funcE(); // hidden
dp->Base::funcE(); // #5, static
// dp->funcE(1,2); // hidden
dp->Base::funcE(1,2); // #6, static
dp->funcE(3); // #9
```