Object-oriented Programming

Function Overriding

Function Overriding

- A way to support polymorphism in the program is by using **Function Overriding**

- A derived class can define a function with the same name and same type signature as defined in its base class

- The child "***extends***" the functionality of its base class through the overridden function

Example

```
 class Base
{
 public:
 void f()
 { cout << “This is base”; }
};
```

Base class implementation (overriden function)

```
 class Derived
{
 public:
 void f()
 { cout << “This is derived”; }
};
```

Derived class implementation (overriding function)

Function Overriding

- The compiler determines which *version* of the function to call based on the type of object used for the call

- For the previous example:

```
Base b;
Derived d;
b.f();  // base version of f() is called
d.f();  // derived version of f() is called
```

Overloading *vs* Overriding

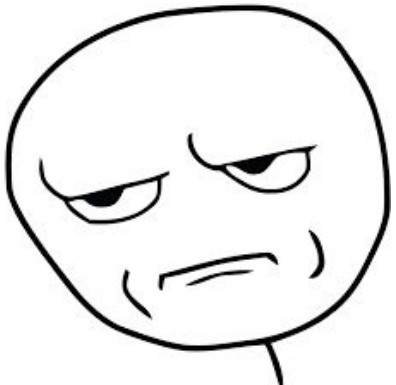
- **Function overloading** is use of the same name but different parameter signature; whereas **function overriding** is the use of same name and same type signatures

- **Function overriding** requires an inheritance relationship; whereas **function overloading** does not require an inheritance relationship

Using Base class Pointer

- Recall that a parent class variable can be used to hold reference of its child class

- When the parent and child classes have overridden functions, this can lead to unexpected results



Example

```
 class Base
{
 public:
 void f()
 { cout << “This is base”; }
};

 class Derived
{
 public:
 void f()
 { cout << “This is derived”; }
};
```

```
int main()
{
     Derived d;
     Base * b = &d;
      b->f();
 }
```

Output:

This is base

Early/Compile-time Binding

- In the previous example, we had a *derived class reference* stored in *base class pointer* but still the compiler called the base class version of the overridden function

- This behavior is called **Early Binding** or **Compile-time Binding**

- The compiler only "***sees***" the "***type"*** of object and use it for calling the appropriate function regardless of what type of reference is stored in it

Late or Runtime Binding

- With **Late Binding** or **Runtime Binding**, the compiler checks the reference stored in the base class pointer for calling the appropriate overridden function

- We can enforce runtime binding by declaring the function as ***virtual***

Virtual Function

- A **virtual function** allows the compiler to choose the correct overridden function to call
- **Virtual functions** allow late binding or runtime binding
- We can declare a function to be virtual by using the keyword ***virtual***

Example

```
 class Base
{
 public:
 virtual void f()
 { cout << “This is base”; }
};

 class Derived
{
 public:
 void f()
 { cout << “This is derived”; }
};
```

```
int main()
{
     Derived d;
     Base * b = &d;
      b->f();
 }
```

Output:

This is derived

Virtual Function

- If we declare a function as *virtual* in the parent class and override it, the overridden versions in all of the derived classes are also implicitly considered as *virtual*

- However, if we want, we can additionally use the *virtual* keyword with overridden functions in derived classes but that would just be needless