

# Chapter 15

## More Inheritance

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- Reading: pp. 929-945
- Good Problems to Work: pp. 917-918: 15.7, 15.8
- More Inheritance
- Polymorphism
- Virtual Functions

# Destructors

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- The opposite of constructors
- Have the same name as the class, with a ~ in front of it
- Called whenever an object is destroyed
- A destructor has no arguments and or return value
- Only one destructor allowed!
- No need for us to explicitly declare a destructor unless there are pointer variables in the class

# Constructor/Destructor Example

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```
class Test
{
    public:
        Test (int i);
        ~Test ();

    private:
        int mId;
};

Test::Test (int i)
{
    mId = i;
    std::cout << "C: " << mId << std::endl;
}

Test::~~Test ()
{
    std::cout << "D: " << mId << std::endl;
}
```

# What is the output?

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```
void funct ();

int main ()
{
    Test cTest1 (1);
    funct ();
    Test cTest3 (3);

    return EXIT_SUCCESS;
}

void funct ()
{
    Test cTest2 (2);
}
```

# Polymorphism

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- Code is said to be polymorphic if executing the code with different types of data (objects) produces different behavior
- Program in the general, rather than program in the specific
- *Virtual functions* make polymorphism possible

# Consider

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```
#include <iostream>

class Def1
{
    public:
        Def1() {std::cout << "Def1" << std::endl;}
        ~Def1 () {std::cout << "~Def1" << std::endl;}
        void Foo () {std::cout << "Def1->Foo" << std::endl;}
};

class Def2 : public Def1
{
    public:
        Def2 () {std::cout << "Def2" << std::endl;}
        ~Def2 () {std::cout << "~Def2" << std::endl;}
        void Foo () {std::cout << "Def2->Foo" << std::endl;}
};
```

# What is the output? Why?

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```
int main ()
{
    Def1 *pcDef1 = new Def1;
    Def2 *pcDef2 = new Def2;
    pcDef1->Foo();
    pcDef2->Foo();
    delete pcDef1;
    delete pcDef2;
}
```

# What is the output? Why?

---

```
int main ()
{
    Def1 *pcDef1 = new Def1;
    Def1 *pcDef2 = new Def2; // type Def2 to Def1
    pcDef1->Foo();
    pcDef2->Foo();
    delete pcDef1;
    delete pcDef2;
}
```



# Virtual Functions

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- You can tell the compiler to select the more specialized version of a member function by declaring the member function to be a virtual function
- Declare a virtual function by prefixing its declaration with the word `virtual`

# What is the output? Why?

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- If the following 2 changes are made to the previous program, what is the output? Why?

```
virtual void Foo () {std::cout << "Def1->Foo" << std::endl;}
```

```
virtual void Foo () {std::cout << "Def2->Foo" << std::endl;}
```

```
int main ()  
{  
    Def1 *pcDef1 = new Def1;  
    Def1 *pcDef2 = new Def2;  
    pcDef1->Foo();  
    pcDef2->Foo();  
    delete pcDef1;  
    delete pcDef2;  
}
```

# Virtual Destructor

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- Any potential base class should have a virtual destructor
- Why? The compiler performs static binding on any destructor not declared virtual
- If the following changes are made to the original program, what is the output? Why?

# Virtual Destructor

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```
virtual ~Def1 () {std::cout << "~Def1" << std::endl;}

virtual void Foo () {std::cout << "Def1->Foo" << std::endl;}

virtual void Foo () {std::cout << "Def2->Foo" << std::endl;}

int main ()
{
    Def1 *pcDef1 = new Def1;
    Def1 *pcDef2 = new Def2;
    pcDef1->Foo();
    pcDef2->Foo();
    delete pcDef1;
    delete pcDef2;
}
```