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FACULTY OF ENGINEERING & TECHNOLOGY

CSPS103: Object Oriented Programming

Lecture-31

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OBJECTIVES

In this lecture, you will learn to:

- ❖ **Virtual base classes**
- ❖ **Example of Virtual base classes**

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VIRTUAL BASE CLASSES

- A potential problem exists when multiple base classes are directly inherited by a derived class.
- To understand what this problem is, consider the following class hierarchy:

Here the base class Base is inherited by both Derived1and Derived2. Derived3 directly inherits both Derived1and Derived2.However, this implies that Base is actually inherited twice by Derived3.First it is inherited through Derived1, and then again through Derived2.This causes ambiguity when a member of Base is used by Derived3. Since two copies of Base are included in Derived3, is a reference to a member of Base referring to the Base inherited indirectly through Derived1or to the Base inherited indirectly through Derived2? To resolve this ambiguity, C++ includes a mechanism by which only one copy of Base will be included in Derived3. This feature is called a virtual base class.

VIRTUAL BASE CLASSES (Contd.)

❑A derived class indirectly inherits the same base class more than once, it is possible to prevent multiple copies of the base from being present in the derived class by having that base class inherited as virtual by any derived classes.

❑Doing this prevents two or more copies of the base from being present in any subsequent derived class that inherits the base class indirectly.

❑The virtual keyword precedes the base class access specifier when it is inherited by a derived class.

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EXAMPLE OF VIRTUAL BASE CLASSES

```
// This program uses a virtual base class.
#include <iostream>
using namespace std;
class Base {
public:
int i;
};
// Inherit Base as virtual
classDerived1 : virtual publicBase {
public:
int j;
};
// Inherit Base as virtual here, too
classDerived2 : virtual publicBase {
public:
int k;
};
```

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EXAMPLE OF VIRTUAL BASE CLASSES (Contd.)

```
// Here Derived3 inherits both Derived1 and Derived2.
// However, only one copy of base is inherited.
class Derived3 : publicDerived1, publicDerived2 {
public:
int product( ) { return i*j*k; }
};
int main( ) {
Derived3 ob;
ob.i = 10; // unambiguous because virtual Base
ob.j = 3;
ob.k = 5;
cout << "Product is: " << ob.product( ) << "\n";
return 0;
}
```

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Multiple Choice Question:

Q1. Pick the correct statement.

a) Pure virtual functions and virtual functions are the same

b) Both Pure virtual function and virtual function have an implementation in the base class

c) Pure virtual function has no implementation in the base class whereas virtual function may have an implementation in the base class

d) The base class has no pure virtual function

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Multiple Choice Question:

Q2. What is virtual inheritance?

a) C++ technique to avoid multiple copies of the base class into children/derived class

b) C++ technique to avoid multiple inheritances of classes

c) C++ technique to enhance multiple inheritance

d) C++ technique to ensure that a private member of the base class can be accessed somehow

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Multiple Choice Question:

Q3. A virtual base class ?

a) is qualified as virtual in base class definition.

b) do not qualified as virtual in base class definition.

c) allows to inherit more than one copy of the base class members.

d) strict the path of inheritance.

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Multiple Choice Question:

Q4. The ……. inherits some or all of the properties of the …….. class.

a) base, derived

b) derived, base

c) derived, initial

d) base, final

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Multiple Choice Question:

Q5. A member declared as …….. is accessible by the member functions within its class and any class immediately derived from it.

a) Protected

b) private

c) public

d) friend

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Summary

In this lecture, you learned that:

- A potential problem exists when multiple base classes are directly inherited by a derived class.