OOP with Different Programming Languages (C++, C# and Java)

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Topics

- Introduction
- Object-Oriented Programming
- Support for Object-Oriented Programming in C++
- Support for Object-Oriented Programming in Java
- Support for Object-Oriented Programming in C#

What is OOP?

- Object Oriented Programming (OOP) is centered around the object, which packages together both the data and the functions that operate on the data.

Important outlines in OOP

- Class
- Encapsulation
- Abstraction
- Constructor & Destructor
- Dynamic allocation and de-allocation.
- Inheritance
  - Inheritance is the central theme in OOP and languages that support it
- Polymorphism

Support for OOP in C++

- General Characteristics:
- OOP in C++ Covers almost everything the students should know about.
- The class is the construct primarily used to create objects.

```
class class-name
{
   // declaration statements here
};
```

  - a class is a data type.
    - (1) built-in class such as string class.
    - (2) User defined class such as Rectangle class.

Support for OOP in C++ (continued)

- Inheritance
  - A class need not be the subclass of any class
  - Access controls for members are
    - Private (visible only in the class and friends) (disallows subclasses from being subtypes)
    - Public (visible in subclasses and clients)
    - Protected (visible in the class and in subclasses, but not clients)

- Clear implementation of Constructor and Destructor.

Support for OOP in Java

- Because of its close relationship to C++, focus is on the differences from that language
- General Characteristics
  - All data are objects except the primitive types
  - All primitive types have wrapper classes that store one data value
  - All objects are heap-dynamic, are referenced through reference variables, and most are allocated with `new`
  - A `finalize` method is implicitly called when the garbage collector is about to reclaim the storage occupied by the object

Support for OOP in C#

- General characteristics
  - Support for OOP similar to Java
  - Includes both classes and `structs`
  - Classes are similar to Java's classes
  - No need to implement Destructor. It will be created automatically.

Support for OOP in C# (continued)

- Inheritance
  - Uses the syntax of C++ for defining classes
  - A method inherited from parent class can be replaced in the derived class by marking its definition with `new`

Support for OOP in C# (continued)

- Nested Classes
  - A C# class that is directly nested in a nesting class behaves like a Java static nested class
  - C# does not support nested classes that behave like the non-static classes of Java

Support for OOP in C#

- Evaluation
  - C# is the most recently designed C-based OO language
  - The differences between C#'s and Java's support for OOP are relatively minor
  - If you have a background of C, you should start OOP with C++ as it covers almost every topic in terms of dealing with objects.

Summary

- OO programming involves three fundamental concepts: ADTs, inheritance, dynamic binding
- Major design issues: exclusivity of objects, subclasses and subtypes, type checking and polymorphism, single and multiple inheritance, dynamic binding, explicit and implicit de-allocation of objects, and nested classes
- Smalltalk is a pure OOL
- C++ has two distinct type system (hybrid)
- Java is not a hybrid language like C++; it supports only OO programming
- C# is based on C++ and Java