Introduction to Object Oriented Programming 2E Timothy A. Budd

Chapter 13

Multiple Inheritance

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Orthogonal Classifications

Objects often characterized in different ways that are orthogonal to each other

For example, the instructor is

- North American
- Male
- Professor
- Computer scientist

None of these are proper subsets of each other

Cannot be placed into an inheritance hierarchy

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CS Example – Complex Numbers

Two abstract classifications:

Magnitude: things that can be compared to each other

Number: things that can perform arithmetic

Three specific classes:

Integer: comparable and arithmetic

Char: comparable but not arithmetic

Complex: arithmetic but not comparable

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Solutions

1. Make Number subclass of Magnitude, but redefine comparison operators in class Complex to print error message

   – *subclassing for limitation*

2. Don't use inheritance at all – redefine all operators in all classes

   – *flattening the inheritance tree*

3. Use inheritance for some relationships, but simulate others – use Number, but have each number implement all relational operators

4. Make Number and Magnitude independent, and have Integer inherit from both

   – *multiple inheritance*

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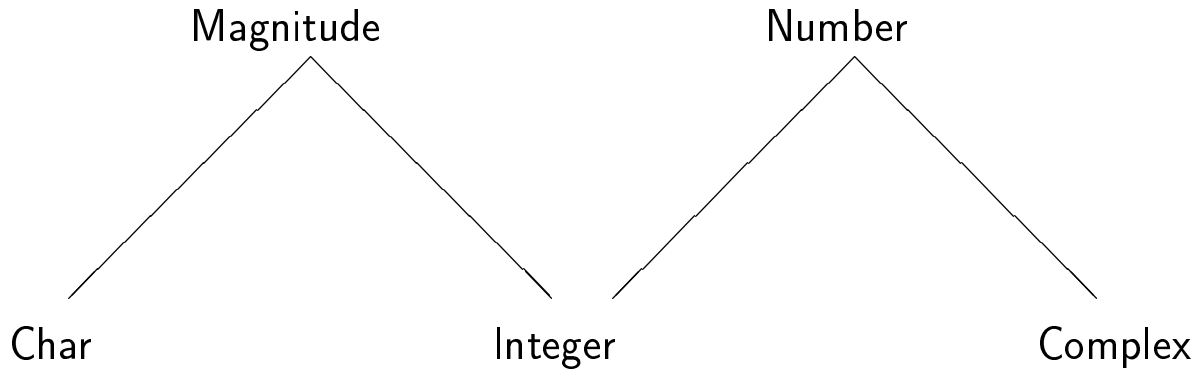
Inheritance as a Form of Combination



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Another Example – Walking Menus

- A Menu is structure charged with displaying itself when selected by users
- A Menu maintains collection of MenuItems
- Each MenuItem knows how to respond when selected
- A *cascading menu* is both a MenuItem and Menu

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Multiple Inheritance: Name Ambiguity Problem

What happens when same name is used in both parent classes?

- A CardDeck knows how to draw (select) a Card
- A GraphicalItem knows how to draw (display) an image on screen
- A GraphicalCardDeck should be able to draw – but which?

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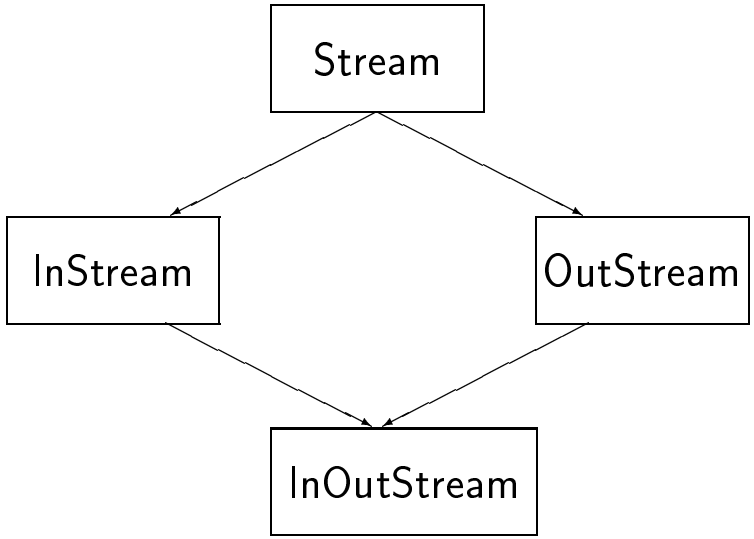
Multiple Inheritance: Common Ancestors?

What happens when parent classes have common root ancestor?

Does new object have one or two instances of common ancestor?



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Multiple Inheritance in Java

Java supports multiple inheritance of interfaces (subtypes) but not of classes (subclasses)

```
interface A { ... }

interface B { ... }

interface AB extends A, B { ... }

interface C { ... }

class X { ... }

class Y extends X implements AB, C { ... }
```

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