Types in languages: Smalltalk

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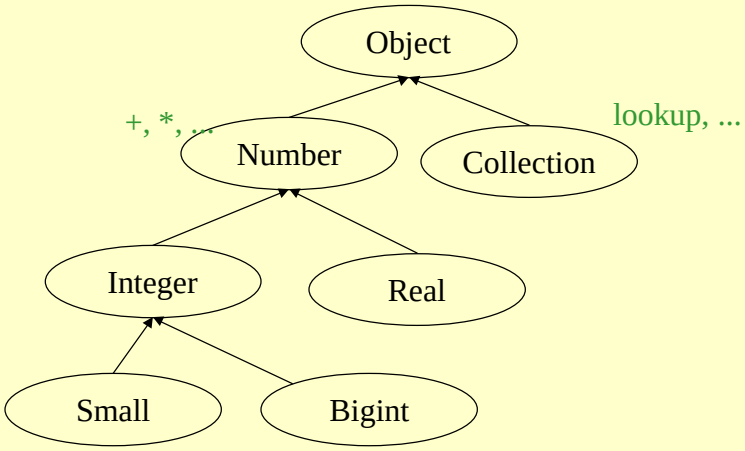
What is Smalltalk

- Very different from Modula-3 and Java
  - Everything is an object (including classes and control structures)
  - All type checking happens at run time
- Similar to Modula-3 and Java
  - Garbage collection
  - Safe from unchecked type errors

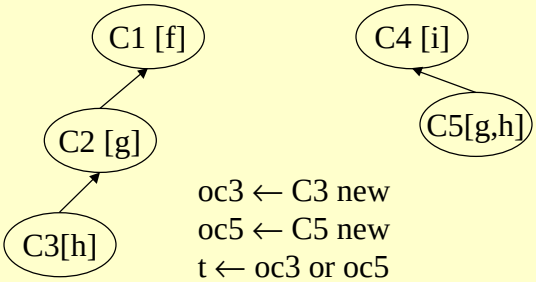
Example hierarchy



Run-time "type compatibility"

- Defined by the set of methods that may be invoked
- Consider invoking method *m* of object *o*
  - If o has an m method, then it is invoked
  - Otherwise a "method not understood" message
- A "method not understood" is a kind of a type failure at run time

An example



oc3 ← C3 new
oc5 ← C5 new
t ← oc3 or oc5
t f
t g
t h
t i

Classes are objects too

- Members in classes are like static fields
- Methods in classes are available to all instances
  - class Point

```
; class members
allPoints
; class methods
newPoint |t|
  t <- Point new
  allPoints add: newPoint
  ^t
```

Metaclasses: the class of a class

- If classes are objects too, what is the class of a class?
  - It's *metaclass*
  - Provides a reflection mechanism
    - A program can inspect its own types and manipulate them

Discussion: how does it compare to Java etc.?

- Advantages?
- Disadvantages?

Next lecture: Polymorphism

- Polymorphism:
  - Kinds of polymorphism
- Reading: Cardelli and Wegner (follow link on syllabus page)
  - A dense paper: give yourself some time!