Basic Objects, Conditionals and Loops

Stéphane Ducasse
Stephane.Ducasse@inria.fr
http://stephane.ducasse.free.fr

License: CC-Attribution-ShareAlike 2.0

http://creativecommons.org/licenses/by-sa/2.0/

creative commons

COMMONS DEED

Attribution-ShareAlike 2.0

You are free:

- to copy, distribute, display, and perform the work
- to make derivative works
- to make commercial use of the work

Under the following conditions:

BY: **Attribution**. You must give the original author credit.

Share Alike. If you alter, transform, or build upon this work, you may distribute the resulting work only under a license identical to this one.

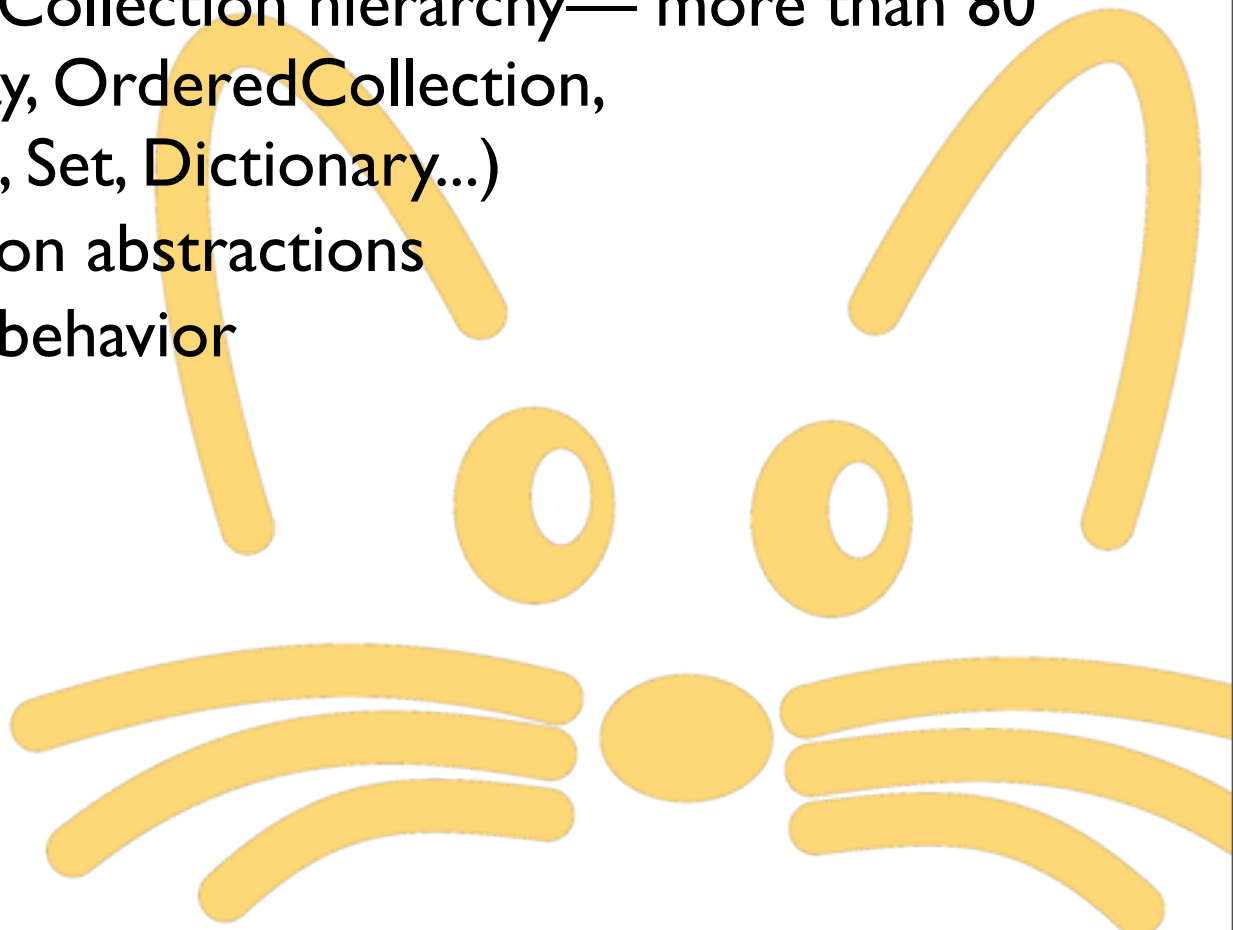
- For any reuse or distribution, you must make clear to others the license terms of this work.
- Any of these conditions can be waived if you get permission from the copyright holder.

Your fair use and other rights are in no way affected by the above.

This is a human-readable summary of the Legal Code (the full license).

Conditionals and Loops

- Booleans
- Basic Loops
- Overview of the Collection hierarchy— more than 80 classes: (Bag, Array, OrderedCollection, SortedCollection, Set, Dictionary...)
- Loops and Iteration abstractions
- Common object behavior



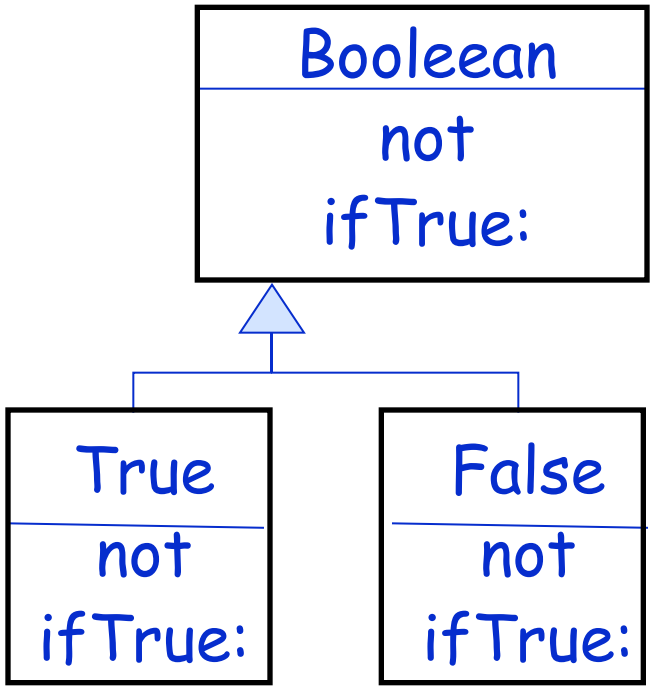
Booleans

Boolean Objects

- false and true are objects described by classes Boolean, True and False
- Uniform, but optimized and inlined (macro expansion at compile time)
- Logical Comparisons &, |, xor:, not
  - aBooleanExpr comparison anotherBooleanExpr
  - (1 isZero) & false

Boolean Hierarchy

- Please open your browser and analyse it
- How to implement in OO true and false without conditional?



Boolean Lazy Logical Operators

- Lazy Logical operators
  aBooleanExpr and: andBlock

- andBlock will only be valued if aBooleanExpression is true

- aBooleanExpression or: orBlock
  orBlock will only be valued if aBooleanExpression is false

false and: [1 error: 'crazy']

PrIt-> false and not an error

Conditional are Messages to Boolean Objects

- aBoolean ifTrue: aTrueBlock ifFalse: aFalseBlock
- aBoolean ifFalse: aFalseBlock ifTrue: aTrueBlock
- aBoolean ifTrue: aTrueBlock
- aBoolean ifFalse: aFalseBlock

- Hint: Take care — true is the boolean value and True is the class of true, its unique instance!

Why Block Use in Conditional

- Why do conditional expressions use blocks?

- Because, when a message is sent, the receiver and the arguments of the message are *always* evaluated. Blocks are necessary to avoid evaluating both branches.

Some Simple Loops

- timeRepeat:
- while

Some Basic Loops

- aBlockTest whileTrue
- aBlockTest whileFalse
- aBlockTest whileTrue: aBlockBody
- aBlockTest whileFalse: aBlockBody
- anInteger timesRepeat: aBlockBody

```
[x<y] whileTrue: [x := x + 3]

10 timesRepeat: [ Transcript show: 'hello'; cr]
```

For the Curious...

```
Integer>>timesRepeat: aBlock
 "Evaluate the argument, aBlock, the number of times
represented by the receiver."

    | count |
    count := 1.
    [ count <= self ] whileTrue:
            [ aBlock value.
             count := count + 1 ]
```

Collections

- A lot but key abstraction
- Key iterators

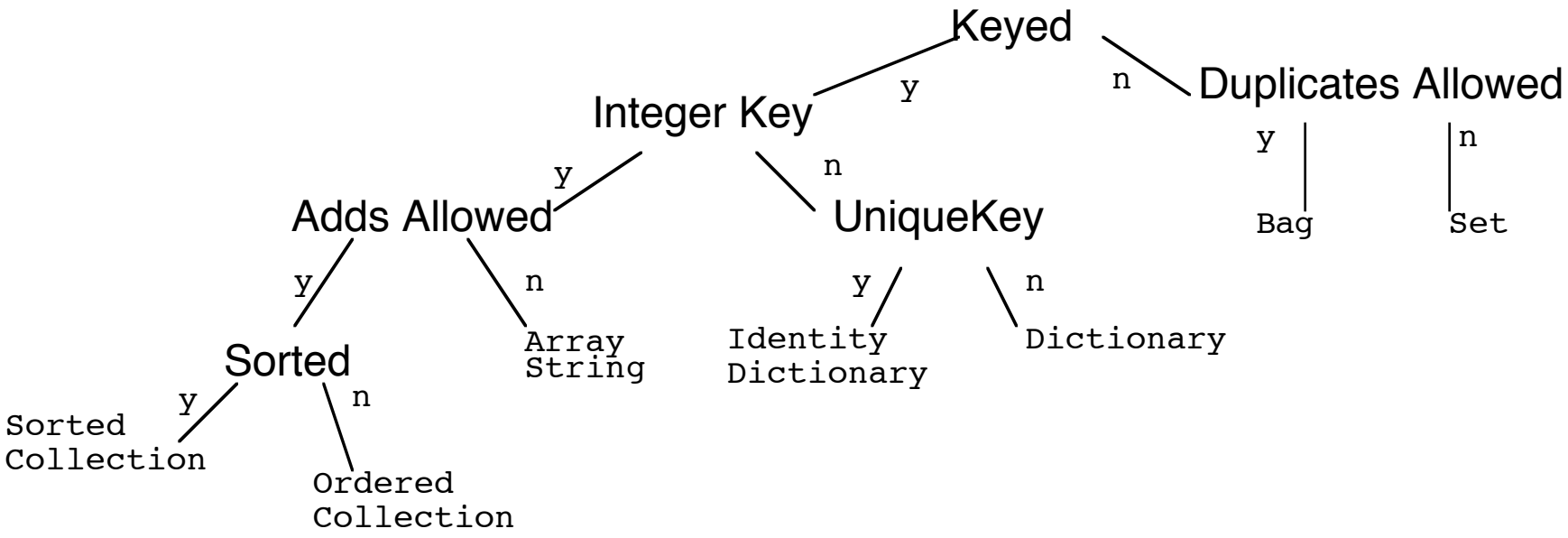
Collections

- Some criteria to identify them
  - Access: indexed, sequential or key-based.
  - Size: fixed or dynamic.
  - Element type: any or well-defined type.
  - Order: defined, defineable or none.
  - Duplicates: possible or not

Essential Collection

Sequenceable	ordered
ArrayedCollection	fixed size + key = integer
Array	any kind of elements
CharacterArray	elements = character
String	
IntegerArray	
Interval	arithmetique progression
LinkedList	dynamic chaining of the element
OrderedCollection	size dynamic + arrival order
SortedCollection	explicit order
Bag	possible duplicate + no order
Set	no duplicate + no order
IdentitySet	identification based on identity
Dictionary	element = associations + key based
IdentityDictionary	key based on identity

Essential Collections: Another View



Some Collection Methods

- Will be defined, redefined, optimized or forbidden in the subclasses
- Accessing: size, capacity, at: anInteger, at: anInteger put: anElement
- Testing: isEmpty, includes: anElement, contains: aBlock, occurencesOf: anElement
- Adding: add: anElement, addAll: aCollection
- Removing: remove: anElement, remove:anElement ifAbsent: aBlock, removeAll: aCollection
- Enumerating (See generic enumerating): do: aBlock, collect: aBlock, select: aBlock, reject: aBlock, detect:, detect: aBlock ifNone: aNoneBlock, inject: avalue into: aBinaryBlock
- Converting: asBag, asSet, asOrderedCollection, asSortedCollection, asArray, asSortedCollection: aBlock
- Creation: with: anElement, with:with:, with:with:with:, with:with:with:with:, with:All: aCollection

Sequenceable Specific (Array)

```
|arr|
arr :=  (calvin hates suzie).
arr at: 2 put:  loves.
arr
PrIt->  ( calvin  loves  suzie)
```

- Accessing: first, last, atAllPut: anElement, atAll: anIndexCollection: put: anElement
- Searching (*: + ifAbsent:): indexOf: anElement, indexOf: anElement ifAbsent: aBlock
- Changing: replaceAll: anElement with: anotherElement
- Copying: copyFrom: first to: last, copyWith: anElement, copyWithout: anElement

KeyedCollection Specific (Dictionary)

```
|dict|
dict := Dictionary new.
dict at: 'toto' put: 3.
dict at: 'titi' ifAbsent: [4]. -> 4
dict at: 'titi' put: 5.
dict removeKey: 'toto'.
dict keys -> Set ('titi')
```

- Accessing: at: aKey, at: aKey ifAbsent: aBlock, at: aKey ifAbsentPut: aBlock, at: aKey put: aValue, keys, values, associations
- Removing: removeKey: aKey, removeKey: aKey ifAbsent: aBlock
- Testing: includeKey: aKey
- Enumerating: keysAndValuesDo: aBlock, associationsDo: aBlock, keysDo: aBlock

Iterators

Choose your Camp!

- To get all the absolute values of numbers you could write:

```
|result|
aCol :=  #( 2 -3 4 -35 4 -11).
result := aCol species new: aCol size.
1 to: aCollection size do:
        [ :each | result at: each put: (aCol at: each) abs].
result
```

Choose your Camp (II)

- You could also write:

```
#( 2 -3 4 -35 4 -11) collect: [:each| each abs]
```

- Really important: Contrary to the first solution, the second solution works well for indexable collections and also for sets.

Iteration Abstraction: do:/collect:

aCollection do: aOneParameterBlock
aCollection collect: aOneParameterBlock
aCollection with: anotherCollection do: aBinaryBlock

```
#(15 10 19 68) do:
  [:i | Transcript show: i printString ; cr ]

#(15 10 19 68) collect: [:i | i odd ]
  PrIt->  #(true false true false)

#(1 2 3) with:  #(10 20 30)
do: [:x :y| Transcript show: (y ** x) printString ; cr ]
```

select:/reject:/detect:

aCollection select: aPredicateBlock
aCollection reject: aPredicateBlock
aCollection detect:
aOneParameterPredicateBlock
aCollection
detect: aOneParameterPredicateBlock
ifNone: aNoneBlock

#(15 10 19 68) select: [:i|i odd] -> #(15 19)
#(15 10 19 68) reject: [:i|i odd] -> #(10 68)
#(12 10 19 68 21) detect: [:i|i odd] PrIt-> 19
#(12 10 12 68) detect: [:i|i odd] ifNone:[1] PrIt-> 1

inject:into:

aCollection inject: aStartValue into: aBinaryBlock

```
|acc|
acc := 0.
#(1 2 3 4 5) do: [:element | acc := acc + element].
acc
-> 15
```

Is equivalent to

```
#(1 2 3 4 5)
    inject: 0
    into: [:acc :element| acc + element]
-> 15
```

Do not use it if the resulting code is not crystal clear!

Other Collections Important Methods

aCollection includes: anElement
aCollection size
aCollection isEmpty
aCollection contains: aBooleanBlock

#(1 2 3 4 5) includes: 4 -> true
#(1 2 3 4 5) size -> 5
#(1 2 3 4 5) isEmpty -> false
#(1 2 3 4 5) contains: [:each | each isOdd] -> true

Common Shared Behavior

Common Shared Behavior

- Object is the root of the inheritance tree
- Defines the common and minimal behavior for all the objects in the system.

- Comparison of objects: ==, ~~, =, =~, isNil, notNil

Identity vs. Equality

- = anObject returns true if the structures are equivalent (the same hash number)
- (Array with: 1 with: 2) = (Array with:1 with:2) PrIt-> true

- == anObject returns true if the receiver and the argument point to the same object. == should never be overridden.

```
Object>>= anObject
    ^ self == anObject
```

~= is: not =
~~ is: not ==

(Array with: 1 with: 2) == (Array with: 1 with:2) PrIt-> false
(Array with: 1 with: 2) = (Array with: 1 with:2) PrIt-> true

- Take care when redefining = . One should override hash too!

Common Behavior: Printing

- Print and store objects: printString, printOn: aStream. printString calls printOn: aStream

```
(123 1 2 3) printString
        -> ' (123 1 2 3)'
Date today printString
        -> 'October 5, 1997'
```

Storing

- storeString, storeOn: aStream.
- storeString calls storeOn: aStream

```
Date today storeString
 -> '(Date readFromString: "10/5/1997")'
OrderedCollection new add: 4 ; add: 3 ; storeString
-> '((OrderedCollection new) add: 4; add: 3; yourself)'
```

- You need the compiler, so for a deployment image this is not convenient

readFromString: recreating Objects

- Create instances from stored objects: class methods readFrom: aStream, readFromString: aString

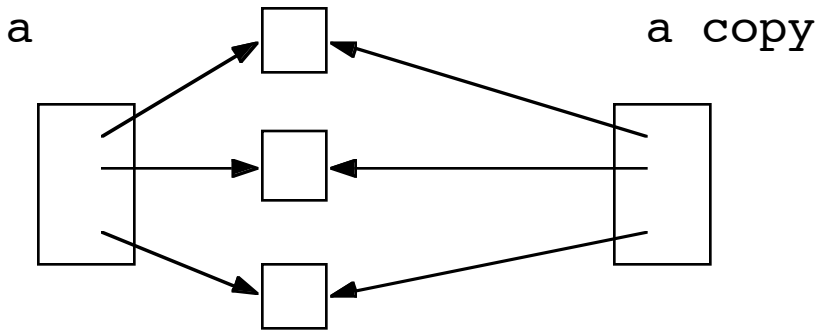
- Object readFromString: '((OrderedCollection new) add: 4; yourself)'
- -> OrderedCollection (4)

Notifying the Programmer

- error: aString,
- doesNotUnderstand: aMessage,
- halt, halt: aString,
  - To invoke the debugger
  - Input defaultState ifTrue:[self halt]
- shouldNotImplement
  - Sign of bad design: subclassing
- subclassResponsibility
  - Abstract method

Copying in VW

- Copying of objects: shallowCopy, copy
- shallowCopy : the copy shares instance variables with the receiver.
- default implementation of copy is shallowCopy



Copying in VW

```
Object>>copy
    ^ self shallowCopy postCopy

Object>>postCopy
    ^ self
```

- postCopy is a hook method
- copy is a template method

Summary

timesRepeat:, to:do:,
Array, OrderedCollection, Dictionary, Set
do:, select:, collect: