



**Learning Object-Oriented
Programming and Design with TDD**

An Overview of Essential Collections

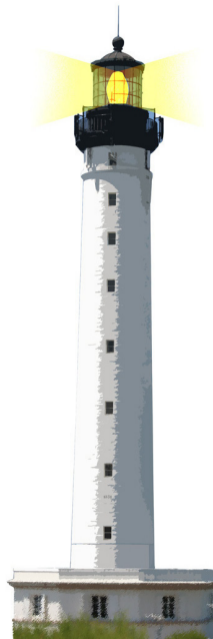
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<http://www.pharo.org>

W2S08



What You Will Learn

- Some basic collections
- Essential API to program collections
- Difference between literal and dynamic arrays



Collection Common Attributes

- Pharo has a rich hierarchy of collection
- **Common API:** size, do:, select:, includes:, collect:...
- First element is at index 1
- Can contain any object

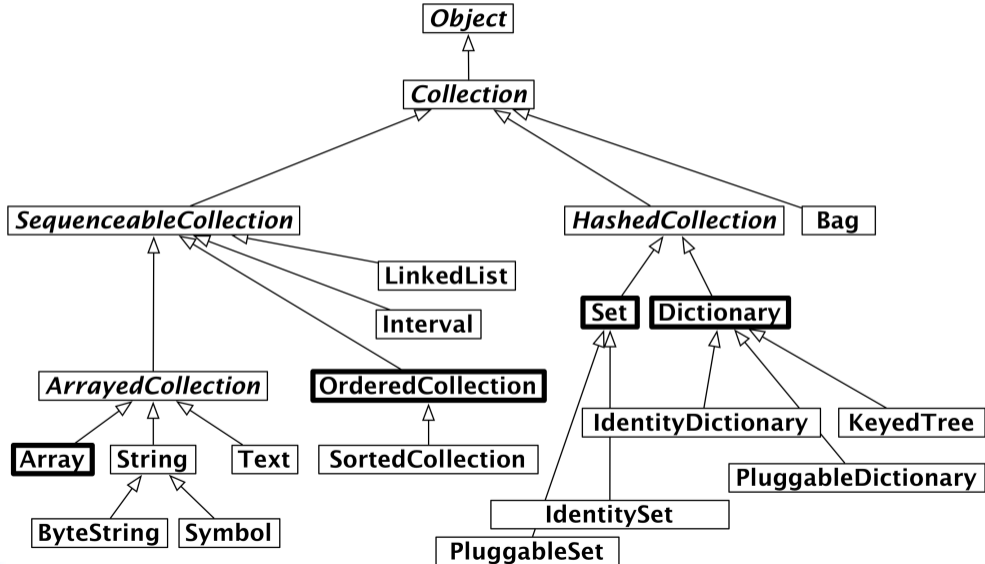


Most Common Collections

- OrderedCollection (dynamically growing)
- Array (fixed size, direct access)
- Set (no duplicates)
- Dictionary (key-based, *aka.* maps)



Essential Collection In a Nutshell



Common API Overview

Common messages work on all collections

1. **creation:** with: anElt, with:with:., withAll: aCollection
2. **accessing:** size, at: anIndex, at: anIndex put: anElt
3. **testing:** isEmpty, includes: anElt, contains: aBlock,
4. **adding:** add: anElement, addAll: aCollection
5. **removing:** remove: anElt, remove: anElt ifAbsent: aBlock, removeAll: aCollection
6. **enumerating:** do: aBlock, collect: aBlock, select: aBlock, reject: aBlock, detect: aBlock, ...
7. **converting:** asBag, asSet, asOrderedCollection, asSortedCollection, asArray



Variable Size Object Creation

- Message `new` instantiates one object
- Message `new: size` creates an object specifying its size

```
Array new: 4  
> #(nil nil nil nil)
```

```
Array new: 2  
>>> #(nil nil)
```

```
(OrderedCollection new: 1000)
```

With Specific Elements

```
OrderedCollection withAll: #(7 7 3 13)  
>>> an OrderedCollection(7 7 3 13)
```

```
Set withAll: #(7 7 3 13)  
>>> a Set( 7 3 13)
```

Remember: no duplicate in Sets

Creation with Default Value

```
OrderedCollection new: 5 withAll: 'a'  
>>> an OrderedCollection('a' 'a' 'a' 'a' 'a')
```

First Element Starts At 1

```
#('Calvin' 'hates' 'Suzie') at: 2
```

```
>>> 'hates'
```

```
#('Calvin' 'hates' 'Suzie') asOrderedCollection at: 2
```

```
>>> 'hates'
```



Collections can be Heterogenous

Collections can contain any sort of objects

```
#('calvin' (1 2 3))  
>>> #('calvin' #(1 2 3))
```

- An array composed of a string and an array

```
| s |  
s := Set new.  
s add: Set new;  
  add: 1;  
  add: 2.  
s asArray  
>>> an Array(1 2 a Set())
```

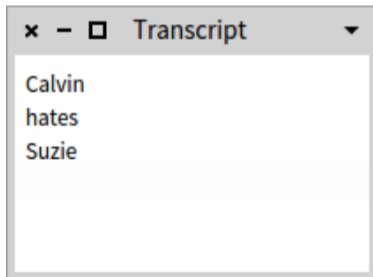
- A set containing an empty set and some numbers



Iteration

- Using message do: aBlock
- But many iterators (see Iterators Lecture)

```
#('Calvin' 'hates' 'Suzie')  
do: [ :each | Transcript show: each ; cr ]
```



Arrays

- Fixed size collection
- Direct access: `at:` and `at:put:`
- Has literal syntax: `#(...)`
- Can also be created using `new:`

```
#('Calvin' 'hates' 'Suzie') size  
>>> 3
```

is equivalent to

```
((Array new: 3)  
  at: 1 put: 'Calvin';  
  at: 2 put: 'hates';  
  at: 3 put: 'Suzie') size  
>>> 3
```



Accessing Elements

Getting the size of a collection

```
#('Calvin' 'hates' 'Suzie') size  
>>> 3
```

Accessing the 2nd element using at: anIndex

```
#('Calvin' 'hates' 'Suzie') at: 2  
>>> 'hates'
```

Remember collection index starts at 1



Accessing Out of Bounds Elements

```
#('Calvin' 'hates' 'Suzie') at: 55  
>>> SubscriptOutOfBounds Error
```

Modifying Elements

Use the message `at: anIndex put: anObject`
Modifying the second element of the receiver

```
#('Calvin' 'hates' 'Suzie') at: 2 put: 'loves'  
>>> #('Calvin' 'loves' 'Suzie')
```


Literal Arrays

Literal arrays contain objects that have a textual (literal) representation: numbers, strings, nil, symbols

```
 #(45 'milou' 1300 true #tintin)  
>>> #(45 'milou' 1300 true #tintin)
```

They are instances of the class `Array`

```
 #(45 38 1300 8) class  
>>> Array
```



Literals Arrays are Array Instances

Literal arrays are equivalent to a dynamic version

A literal array

```
 #(45 38 'milou' 8)  
>>> #(45 38 'milou' 8)
```

An array

```
 Array with: 45 with: 38 with: 'milou' with: 8  
>>> #(45 38 'milou' 8)
```



OrderedCollection

- Sequenceable
- Growing size
- add:, remove:

```
| ordCol |  
ordCol := OrderedCollection new.  
ordCol add: 'Reef'; add: 'Pharo'; addFirst: 'Pharo'.  
ordCol  
>>> an OrderedCollection('Pharo' 'Reef' 'Pharo')  
ordCol add: 'Seaside'.  
ordCol  
>>> an OrderedCollection('Pharo' 'Reef' 'Pharo' 'Seaside')
```



Conversion

```
#('Pharo' 'Reef' 'Pharo' 'Pharo') asOrderedCollection  
>>> an OrderedCollection('Pharo' 'Reef' 'Pharo' 'Pharo')
```

Set

- No duplicates
- Growing size
- add:, remove:
- Can contain any object including other Sets

```
#('Pharo' 'Reef' 'Pharo' 'Pharo') asSet  
>>> a Set('Pharo' 'Reef')
```

```
Set with: (Set with: 1) with: (Set with: 2)  
>>> a Set(a Set(1) aSet(2))
```



Conversion

Collections can be converted simply to other collections

`asOrderedCollection`

`asSet`

`asArray`

Dictionary

- Key/values
- Growing size
- Accessing `at:`, `at:ifAbsent:`
- Changing/adding `at:put:`, `at:ifAbsentPut:`
- Iterating: `do:`, `keysDo:`, `keysAndValuesDo:`



Dictionary Creation

```
| days |  
days := Dictionary new.  
days  
  at: #January put: 31;  
  at: #February put: 28;  
  at: #March put: 31.
```


Alternate Dictionary Creation

```
| days |  
days := Dictionary new.  
days  
  at: #January put: 31;  
  at: #February put: 28;  
  at: #March put: 31.
```

is equivalent to

```
{ #January -> 31.  
  #February -> 28.  
  #March -> 31} asDictionary
```



Pairs

```
(#January → 31) key
```

```
>>> #January
```

```
(#January → 31) value
```

```
>>> 31
```



Dictionary Access

```
| days |  
days := Dictionary new.  
days  
  at: #January put: 31;  
  at: #February put: 28;  
  at: #March put: 31.
```

```
days at: #January
```

```
>>> 31
```

```
days at: #NoMonth
```

```
>>> KeyNotFound Error
```

```
days at: #NoMonth ifAbsent: [0]
```

```
>>> 0
```



Dictionary Iteration

```
days do: [ :each | Transcript show: each ;cr ]
```

prints

```
31  
28  
31
```

Why? Because

```
Dictionary >> do: aBlock  
  ^ self valuesDo: aBlock
```

Keys and Values Iteration

days keysAndValuesDo:

```
[ :k :v | Transcript show: k asString, ' has ', v printString, ' days' ; cr ]
```

shows:

```
January has 31 days  
February has 28 days  
March has 31 days
```

Summary

- Easy to use collections
- Common vocabulary
- Simple conversion between them
- Easy to discover!



Resources

- Pharo Mooc - W3S07 Videos <http://mooc.pharo.org>
- Pharo by Example <http://books.pharo.org>



A course by Stéphane Ducasse
<http://stephane.ducasse.free.fr>

Reusing some parts of the Pharo Mocc by

Damien Cassou, Stéphane Ducasse, Luc Fabresse
<http://mocc.pharo.org>



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