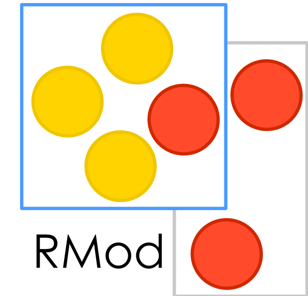
INRIA



A Little Journey in the Smalltalk Syntax

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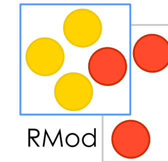
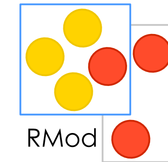
http://stephane.ducasse.free.fr/

Goal

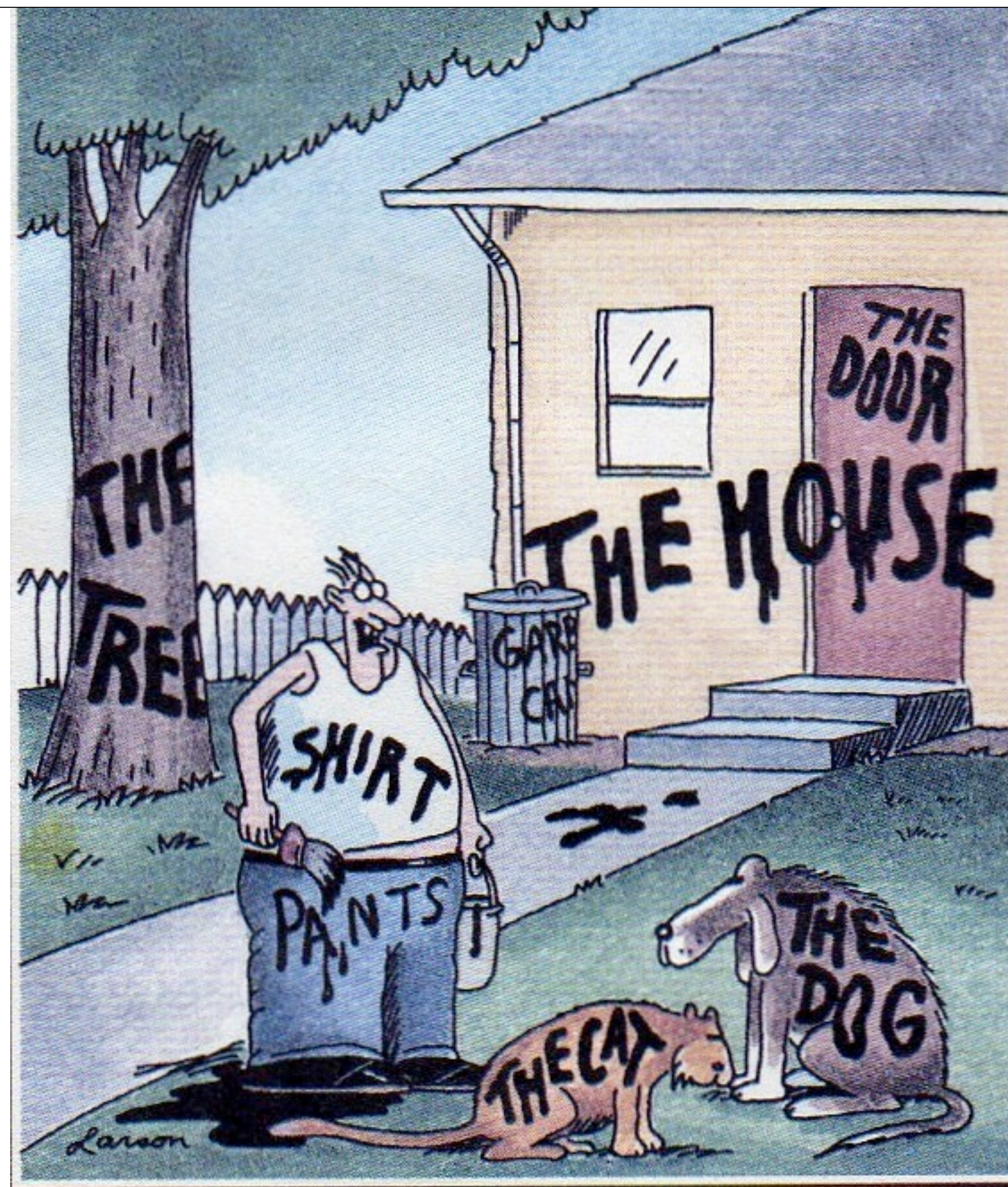


Lower your stress :)

Show you that this is simple

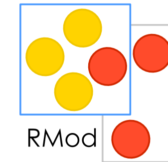


Appetizer!



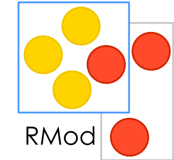
"Now! ... *That* should clear up a few things around here!"

RMod



Yeah!

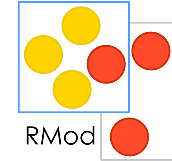
Smalltalk is a dynamically typed language




```
ArrayList<String> strings
        = new ArrayList<String>();
```

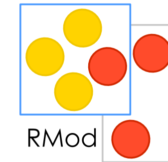
```
strings := ArrayList new.
```

Shorter




```
Thread regThread = new Thread(
   new Runnable() {
     public void run() {
            this.doSomething();}
            });
regThread.start();
```

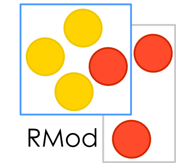
[self doSomething] fork.



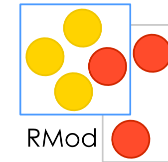
Smalltalk = Objects + Messages + (...)

Roadmap

Fun with numbers

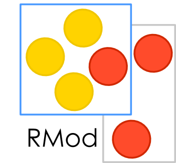


1 class

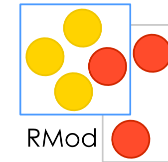


1 class

>SmallInteger

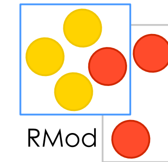


1 class maxVal

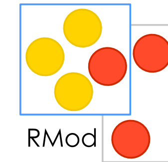


1 class maxVal

>1073741823

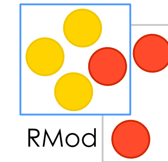


1 class maxVal + 1

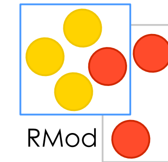


1 class maxVal + 1

>1073741824

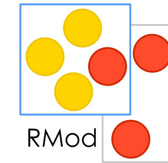


(1 class maxVal + 1) class

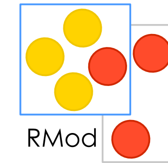


(1 class maxVal + 1) class

>LargePositiveInteger

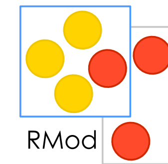


(1/3) + (2/3)

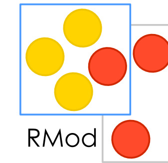


(1/3) + (2/3)

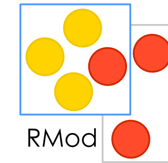
>1



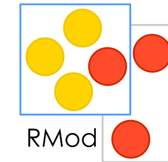
2/3 + 1




```
2/3 + 1
> 5/3
```



1000 factorial



1000 factorial

4023872600770937735437024339230039857193748642107146325437999104299385123986290205920442084869694048004799
8861019719605863166687299480855890132382966994459099742450408707375991882362772718873251977950595099527612
0874975462497043601418278094646496291056393887437886487337119181045825783647849977012476632889835955735432
5131853239584630755574091142624174743493475534286465766116677973966688202912073791438537195882498081268678
3837455973174613608537953452422158659320192809087829730843139284440328123155861103697680135730421616874760
9675871348312025478589320767169132448426236131412508780208000261683151027341827977704784635868170164365024
1536913982812648102130927612448963599287051149649754199093422215668325720808213331861168115536158365469840
4670897560290095053761647584772842188967964624494516076535340819890138544248798495995331910172335555660213
9450399736280750137837615307127761926849034352625200015888535147331611702103968175921510907788019393178114
1945452572238655414610628921879602238389714760885062768629671466746975629112340824392081601537808898939645
1826324367161676217916890977991190375403127462228998800519544441428201218736174599264295658174662830295557
0299024324153181617210465832036786906117260158783520751516284225540265170483304226143974286933061690897968
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6179970235619389701786004081188972991831102117122984590164192106888438712185564612496079872290851929681937
2388642614839657382291123125024186649353143970137428531926649875337218940694281434118520158014123344828015
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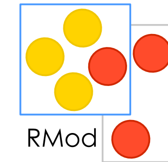
000000000000000000000000

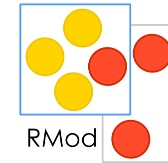


1000 factorial / 999 factorial

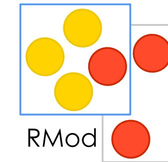
RMod

1000 factorial / 999 factorial

> 1000

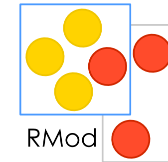


10 @ 100



10 @ 100

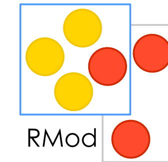
(10 @ 100) x



10 @ 100

(10 @ 100) x

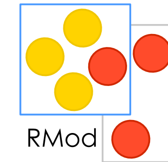
> 10



10 @ 100

(10 @ 100) x
> 10

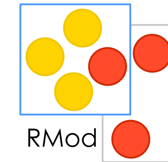
(10 @ 100) y



10 @ 100

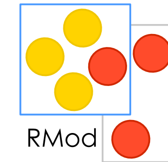
(10 @ 100) x
> 10

(10 @ 100) y
>100



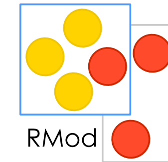
Points!

Points are created using @



Puzzle

(10@100) + (20@100)



Puzzle

(10@100) + (20@100)

>30@200

RMod

Puzzle

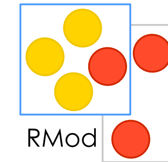
(10@100) + (20@100)

>30@200

Roadmap

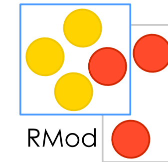
Fun with characters, strings, arrays

$C $h $a $r $a $c $t $e $r



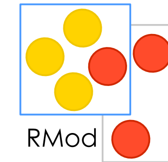
$F, $Q $U $E $N $T $i $N

space tab?!



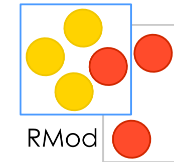
Character space
Character tab
Character cr

‘Strings’



‘Tiramisu’

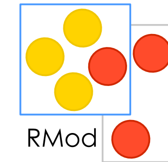
Characters



12 printString

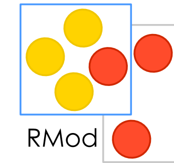
> '12'

Strings are collections of chars




```
'Tiramisu' at: 1
```

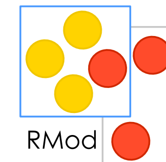
Strings are collections of chars



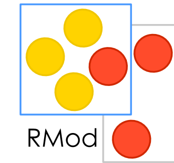

```
'Tiramisu' at: 1

  > $T
```

A program! -- finding the last char

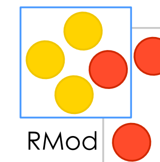


A program!




```
| str |
```

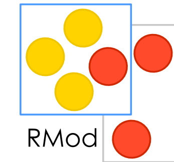
A program!



| str |

local variable

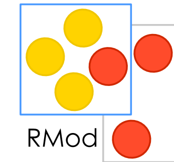
A program!




```
| str |
str := ‘Tiramisu’.
```

local variable

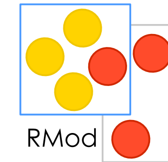
A program!




```
| str |
str := 'Tiramisu'.
```

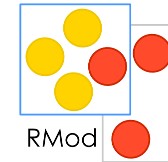
local variable
assignment

A program!




```
| str |                          local variable
str := 'Tiramisu'.               assignment
str at: str length
```

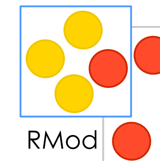
A program!




```
| str |                      local variable
str := 'Tiramisu'.           assignment
str at: str length           message send
```

```
> $u
```

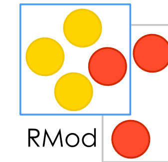
double ‘ to get one



‘L”Idiot’

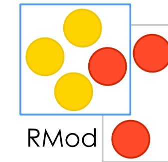
> one string

For concatenation use ,



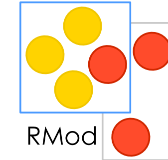
‘Calvin’ ,‘ & ‘,‘Hobbes’

For concatenation use ,



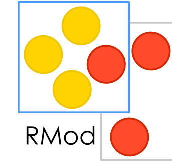
'Calvin' ,' & ','Hobbes'
> 'Clavin & Hobbes'

For concatenation use ,



‘Calvin’ ,‘ & ‘,‘Hobbes’
 > ‘Calvin & Hobbes’

Symbols: #Pharo

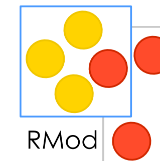


#Something is a symbol

Symbol is a unique string in the system

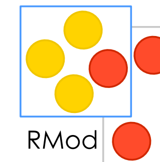
#Something == #Something
 > true

“Comment”



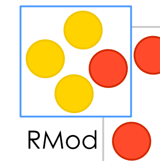
“what a fun language lecture.
I really liked the desserts”

#(Array)



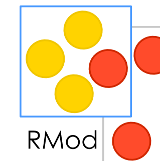
#('Calvin' 'hates' 'Suzie')

#(Array)



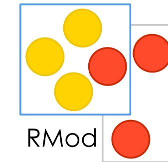
#('Calvin' 'hates' 'Suzie') size

#(Array)



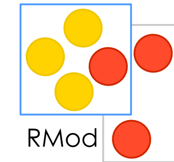

```
#('Calvin' 'hates' 'Suzie') size
  > 3
```

First element starts at 1



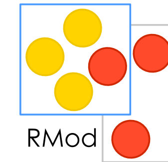
#('Calvin' 'hates' 'Suzie') at: 2

First element starts at 1



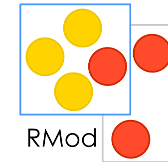

```
#('Calvin' 'hates' 'Suzie') at: 2
   > 'hates'
```

at: to access, at:put: to set



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

#(Array)



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

> #('Calvin' 'loves' 'Suzie')

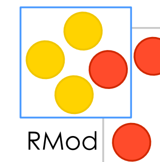
Syntax Summary

comment:	“a comment”
character:	$c $h $a $r $a $c $t $e $r $s $# $@
string:	‘a nice string’ ‘lulu’ ‘l’’idiot’
symbol:	#mac #+
array:	#(1 2 3 (1 3) $a 4)
byte array:	#[1 2 3]
integer:	1, 2r101
real:	1.5, 6.03e-34,4, 2.4e7
fraction:	1/33
boolean:	true, false
point:	10@120

Roadmap

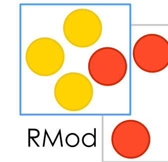
Fun with keywords-based messages

Keyword-based messages



arr **at:** 2 **put:** ‘loves’

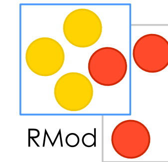
Keyword-based messages



arr **at:** 2 **put:** 'loves'

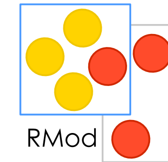
somehow like arr.atput(2,'loves')

From Java to Smalltalk



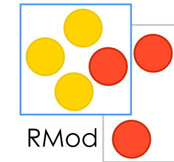

```
postman.send(mail,recipient);
```

Removing



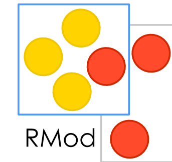

```
postman.send(mail,recipient);
```

Removing unnecessary

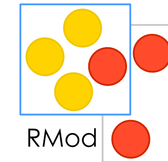


postman send mail recipient

But without losing information



postman send mail to recipient



postman send: mail to: recipient

```
postman.send(mail,recipient);
```

RMod

postman send: mail to: recipient

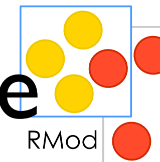
```
postman.send(mail,recipient);
```

The message is send:to:

Roadmap

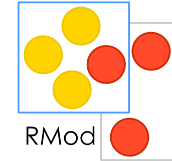
Fun with variables

Shared or Global starts with Uppercase



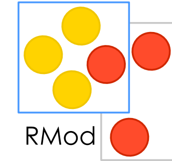

```
Transcript cr .
Transcript show: 'hello world'.
Transcript cr .
```

local or temps starts with lowercase




```
| str |
str := 'Tiramisu'
```

self, super, true, false, nil



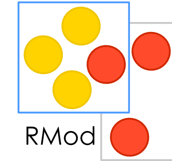
self = this

super

true, false are for Booleans

nil is UndefinedObject instance

self, super, true, false, nil



self = this in Java

super

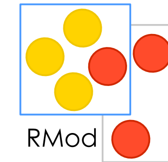
true, false are for Booleans

nil is UndefinedObject instance

Roadmap

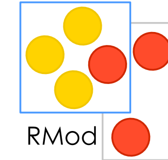
Fun with classes

A class definition!



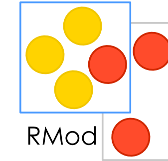

```
Superclass subclass: #Class
        instanceVariableNames: 'a b c'
      ...
        category: 'Package name'
```

A class definition!




```
Object subclass: #Point
        instanceVariableNames: 'x y'
        classVariableNames: ''
        poolDictionaries: ''
        category: 'Graphics-Primitives'
```

A class definition!

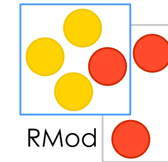



```
Object subclass: #Point
        instanceVariableNames: 'x y'
        classVariableNames: ''
        poolDictionaries: ''
        category: 'Graphics-Primitives'
```

Roadmap

Fun with methods

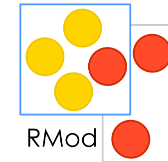
On Integer




```
asComplex
	"Answer a Complex number that represents value of
	the the receiver."

	^ Complex real: self imaginary: 0
```

On Boolean

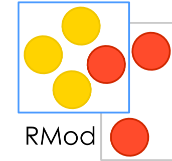


xor: ***aBoolean***

"Exclusive OR. Answer true if the receiver is not equivalent to aBoolean."

^(self == ***aBoolean***) not

Summary



self, super

can access instance variables

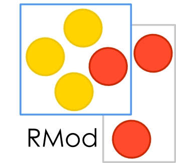
can define local variable | ... |

Do not need to define argument types

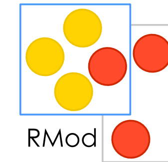
^ to return

Roadmap

Fun with unary messages

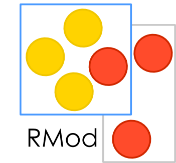


I class

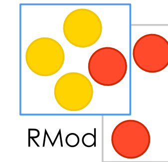


1 class

> SmallInteger

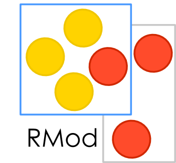


false not

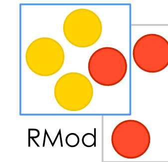


false not

> true

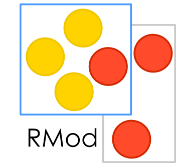


Date today

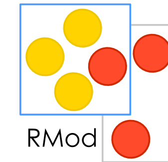


Date today

> 24 May 2009

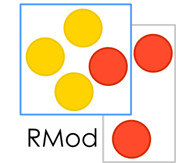


Time now

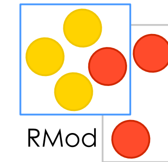


Time now

> 6:50:13 pm

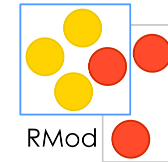


Float pi



Float pi

> 3.141592653589793



We sent messages to objects or classes!

```
1 class
Date today
```

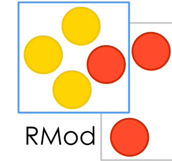
We sent messages to objects or classes!

1 class
Date today

Roadmap

Fun with binary messages

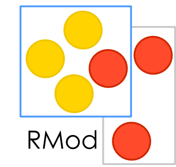
aReceiver aSelector anArgument



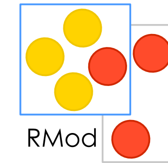
Used for arithmetic, comparison and logical operations

One or two characters taken from:

+ - / \ * ~ < > = @ % | & ! ? ,

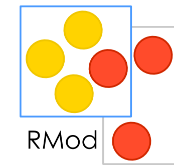


1 + 2

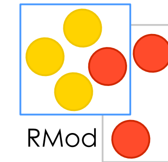


1 + 2

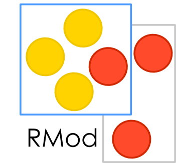
>3



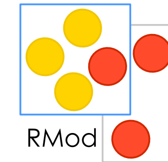
2 => 3




```
2 => 3
> false
```



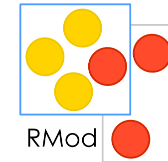
10 @ 200



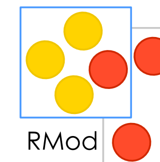
‘Black chololate’ ,‘ is good’

Roadmap

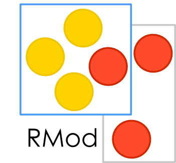
Fun with keyword-based messages



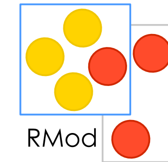
#('Calvin' 'hates' 'Suzie') at: 2 put: 'loves'



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

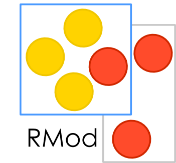


10@20 setX: 2

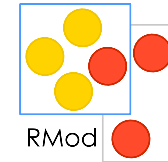


10@20 setX: 2

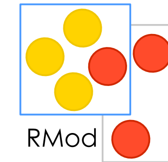
> 2@20



12 between: 10 and: 20



12 between: 10 and: 20
> true



receiver
keyword1: argument1
keyword2: argument2

equivalent to

receiver.keyword1keyword2(argument1, argument2)

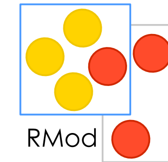
receiver
keyword1: argument1
keyword2: argument2

equivalent to

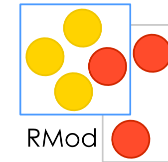
receiver.keyword1keyword2(argument1, argument2)

Roadmap

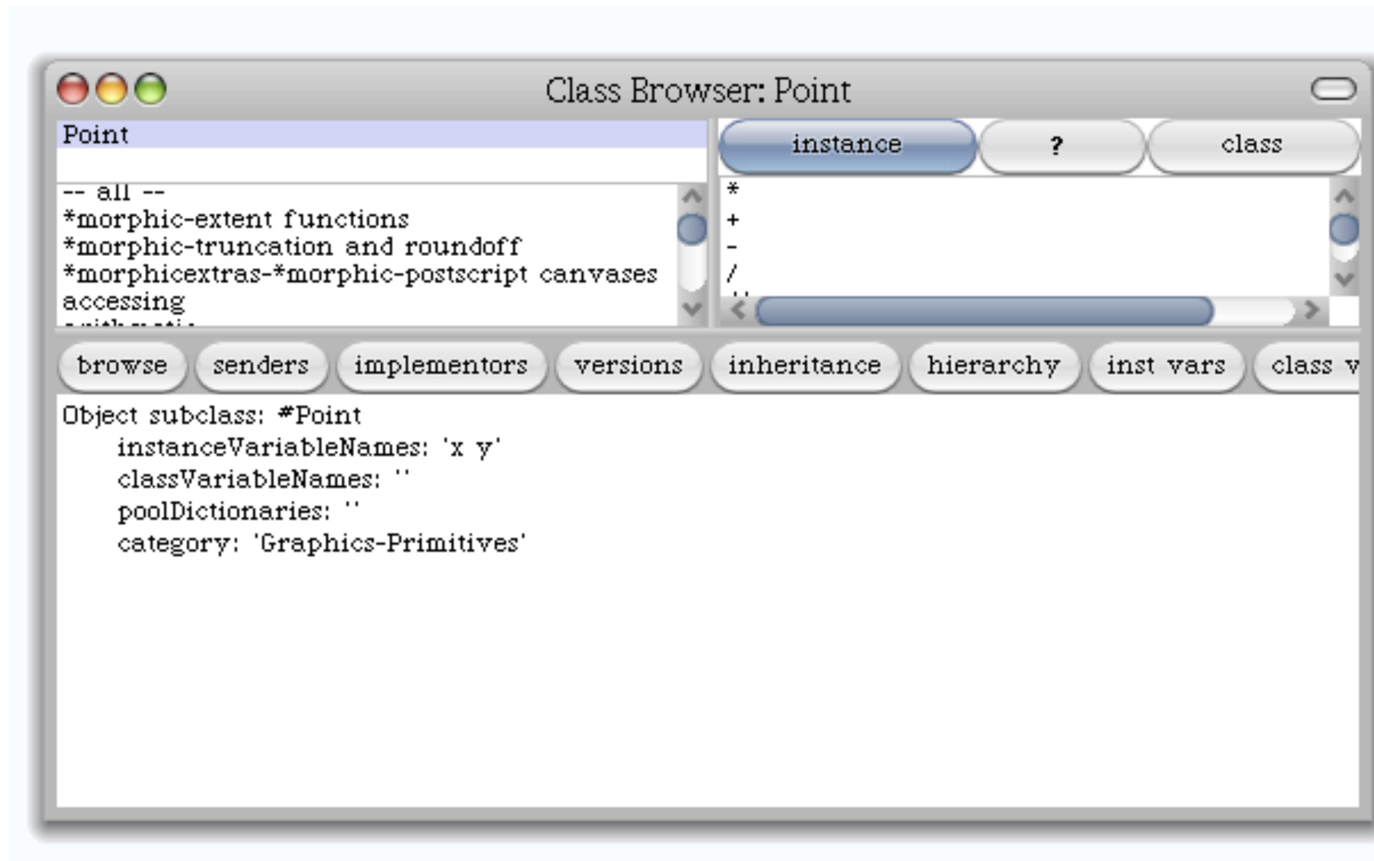
Browser newOnClass: Point

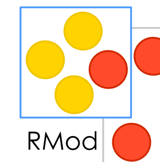


Browser newOnClass: Point

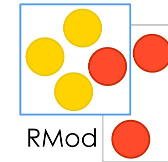


Browser newOnClass: Point





Yes there is a difference between
doing (side effect)
and returning an object

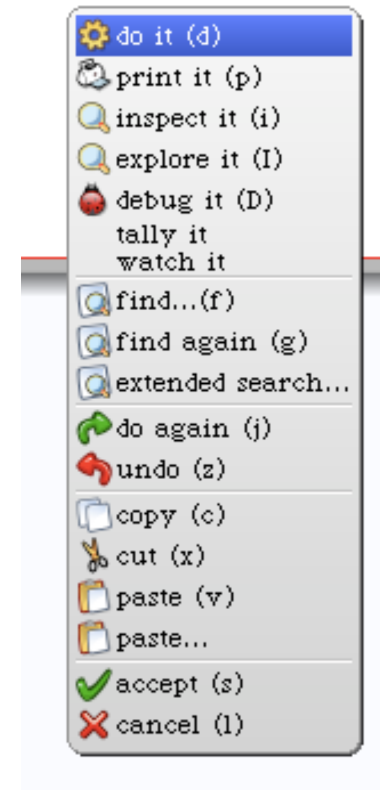


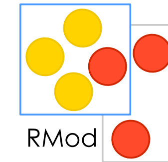
Browser newOnClass: Point

> a Browser

Doing and do not care of the returned result

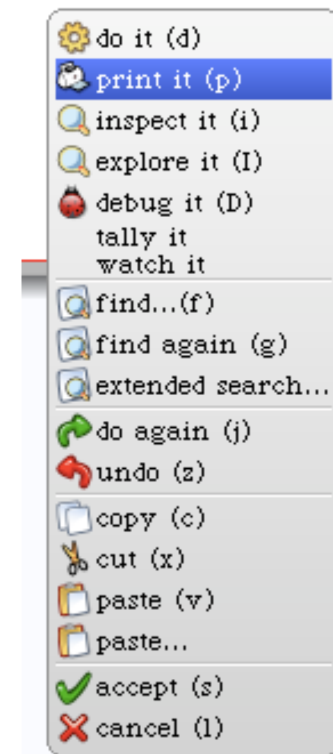
Browser newOnClass: Point

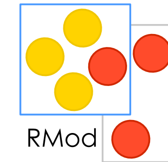




Doing and really want to see the result!

10@20 setX: 2
> 2@20





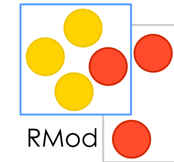
Doing vs printing (doing + print result)

RMod

Doing vs printing (doing + print result)

Roadmap

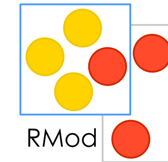
Messages messages
messages
again messages
....



Yes there are only messages

- unary
- binary
- keywords

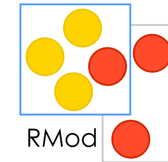
Composition: from left to right!



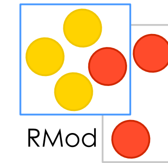
69 class inspect

69 class superclass superclass inspect

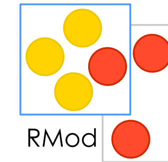
Precedence



Unary> Binary> Keywords

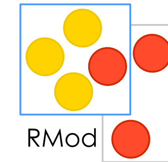


2 + 3 squared



2 + 3 squared

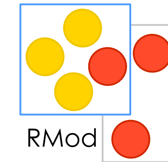
> 2 + 9



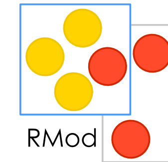
2 + 3 squared

> 2 + 9

> 11

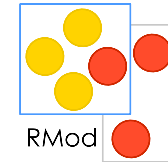


Color gray - Color white = Color black



Color gray - Color white = Color black

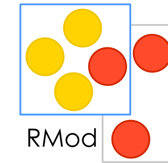
> aColor = Color black



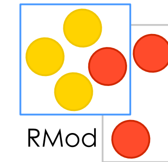
Color gray - Color white = Color black

> aColor = Color black

> true

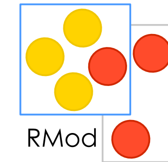


2 raisedTo: 3 + 2



2 raisedTo: 3 + 2

> 2 raisedTo: 5

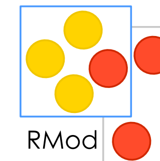


2 raisedTo: 3 + 2

> 2 raisedTo: 5

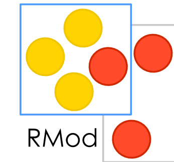
> 32

No mathematical precedence



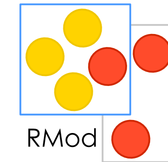
1/3 + 2/3

No mathematical precedence

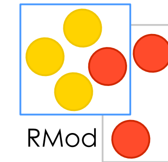


1/3 + 2/3
>7/3 /3

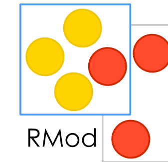
(Msg) > Unary> Binary> Keywords



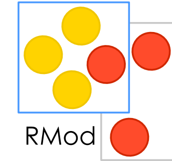
Parenthesized takes precedence!



(0@0 extent: 100@100) bottomRight



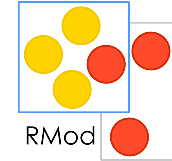
(0@0 extent: 100@100) bottomRight
> (aPoint extent: anotherPoint) bottomRight



(0@0 extent: 100@100) bottomRight

> (aPoint extent: anotherPoint) bottomRight

> aRectangle bottomRight

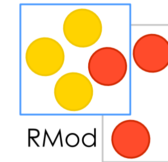


(0@0 extent: 100@100) bottomRight

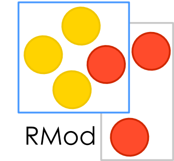
> (aPoint extent: anotherPoint) bottomRight

> aRectangle bottomRight

> 100@100



0@0 extent: 100@100 bottomRight

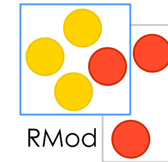


0@0 extent: 100@100 bottomRight

> Message not understood

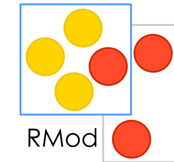
> 100 does not understand bottomRight

No mathematical precedence



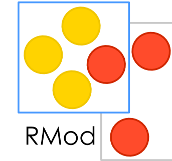
3 + 2 * 10

No mathematical precedence



3 + 2 * 10
> 5 * 10

No mathematical precedence



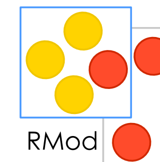
3 + 2 * 10

> 5 * 10

> 50

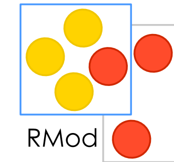
argh!

No mathematical precedence



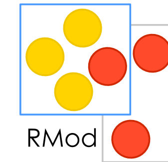
3 + (2 * 10)

No mathematical precedence



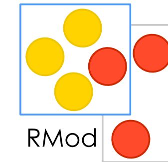
3 + (2 * 10)
> 3 + 20

No mathematical precedence



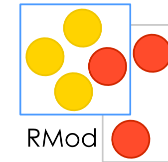

```
3 + (2 * 10)
> 3 + 20
> 23
```

No mathematical precedence



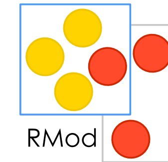
1/3 + 2/3
> 7/3 /3

No mathematical precedence



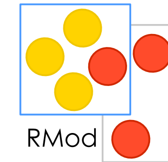

```
1/3 + 2/3
> (7/3) /3
> 7/9
```

No mathematical precedence



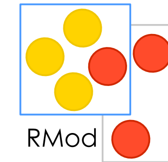
(1/3) + (2/3)

No mathematical precedence



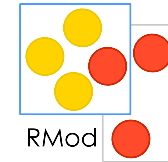

```
(1/3) + (2/3)
> 1
```

Only Messages



(Msg) > Unary > Binary > Keywords
from left to right
No mathematical precedence

Only Messages

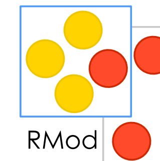


(Msg) > Unary > Binary > Keywords
from left to right
No mathematical precedence

Roadmap

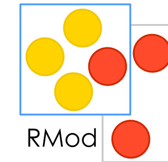
Fun with blocks

Function definition



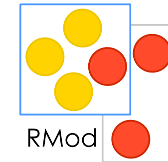
fct(x) = x * x + x

Function Application



fct (2) = 6
fct (20) = 420

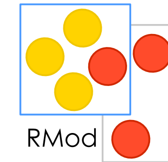
Function definition



fct(x) = x * x + x

```
|fct|
fct:= [:x | x * x + x].
```

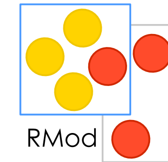
Function Application



fct (2) = 6
fct (20) = 420

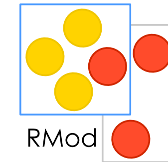
fct value: 2
> 6
fct value: 20
> 420

Other examples




```
[2 + 3 + 4 + 5] value
[:x | x + 3 + 4 + 5 ] value: 2
[:x :y | x + y + 4 + 5] value: 2 value: 3
```

Block



anonymous method

[:*variable1* :*variable2* |
    | ***tmp*** |
    expression1.
    ...*variable1* ...]

value: ...

Block

anonymous method
Really really cool!
Can be passed to methods, stored in instance variables

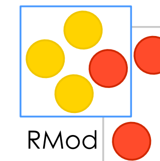
```
[ :variable1 :variable2 |
        | tmp |
        expression1.
        ...variable1 ...   ]

value: ...
```

Roadmap

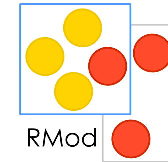
Fun with conditional

Example




```
3 > 0
   ifTrue:['positive']
   ifFalse:['negative']
```

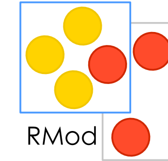
Example




```
3 > 0
   ifTrue:['positive']
   ifFalse:['negative']

> 'positive'
```

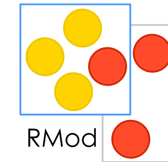
Yes ifTrue:ifFalse: is a message!




```
Weather isRaining
    ifTrue: [self takeMyUmbrella]
    ifFalse: [self takeMySunglasses]
```

ifTrue:ifFalse is sent to an object: a boolean!

Booleans



& | not

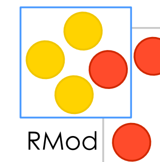
or: and: (lazy)

xor:

ifTrue:ifFalse:

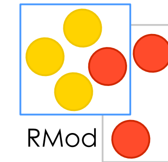
ifFalse:ifTrue:

...

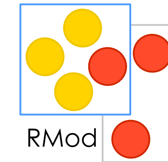


Yes! ifTrue:ifFalse: is a message send to a Boolean.

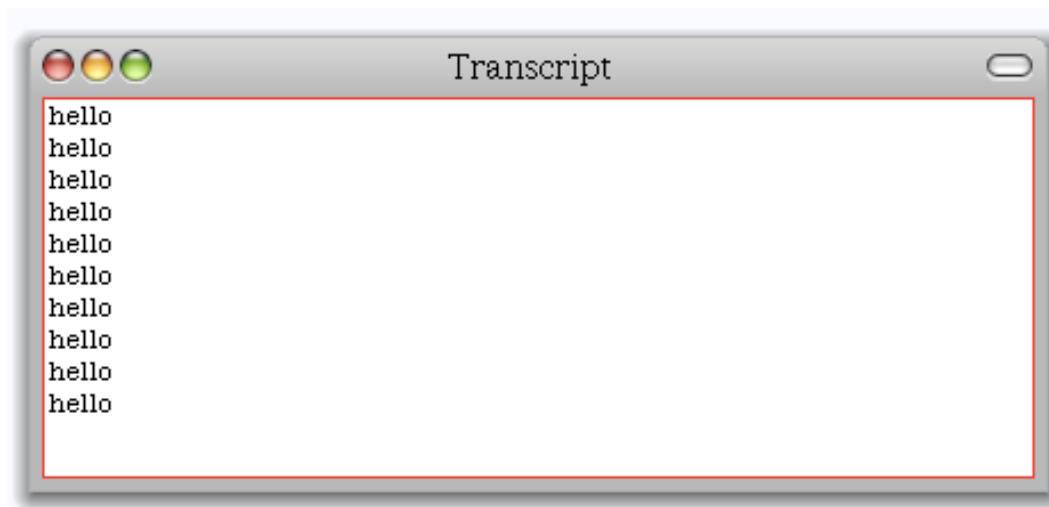
But optimized by the compiler :)

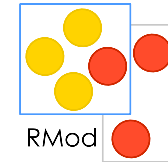



```
10 timesRepeat: [ Transcript show: 'hello'; cr]
```

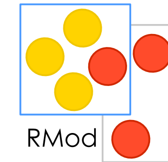


10 timesRepeat: [Transcript show: 'hello'; cr]






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



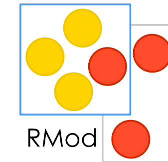
aBlockTest whileTrue

aBlockTest whileFalse

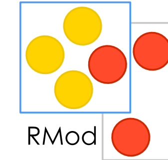
aBlockTest whileTrue: *aBlockBody*

aBlockTest whileFalse: *aBlockBody*

anInteger timesRepeat: *aBlockBody*



Confused with () and [] ?



Only put [ ] when you do not the number of times something may be executed

(x isBlue**)** ifTrue: **[** x schroumph **]**

10 timesRepeat: **[** self shout **]**

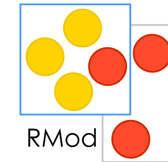
RMod

Conditions are messages sent to boolean

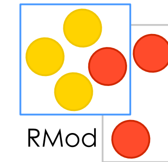
(x isBlue) ifTrue: [ ]

Roadmap

Fun with loops



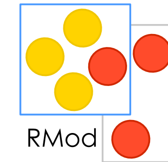

```
1 to: 100 do:
    [ :i | Transcript show: i ; space]
```




```
1 to: 100 do:
    [ :i | Transcript show: i ; space]
```

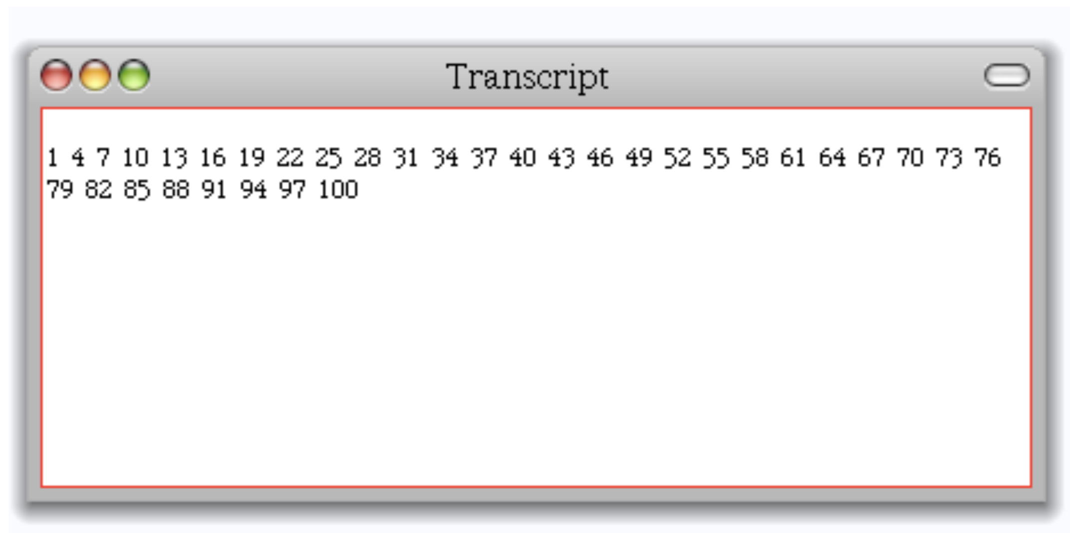
Transcript

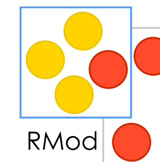
```
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78
79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100
```




```
1 to: 100 by: 3 do:
    [ :i | Transcript show: i ; space]
```

```
1 to: 100 by: 3 do:
    [ :i | Transcript show: i ; space]
```





So yes there are real loops in Smalltalk!

to:do:
to:by:do:
are just messages send to integers

RMod

So yes there are real loops in Smalltalk!

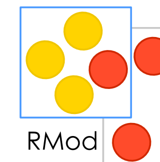
to:do:

to:by:do:

are just messages send to integers

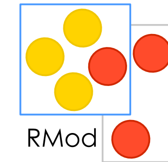
Roadmap

Fun with iterators

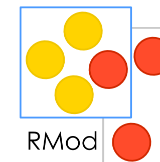



```
ArrayList<String> strings
            = new ArrayList<String>();
for(Person person: persons)
      strings.add(person.name());
```

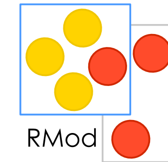
```
strings :=
persons collect [:person | person name].
```



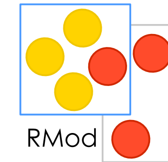
#(2 -3 4 -35 4) **collect:** [:each| each abs]




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

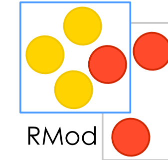


#(15 10 19 68) **collect:** [:i | i odd]



#(15 10 19 68) **collect:** [:i | i odd]

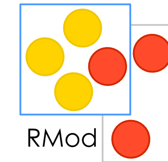
> #(true false true false)



#(15 10 19 68) **collect:** [:i | i odd]

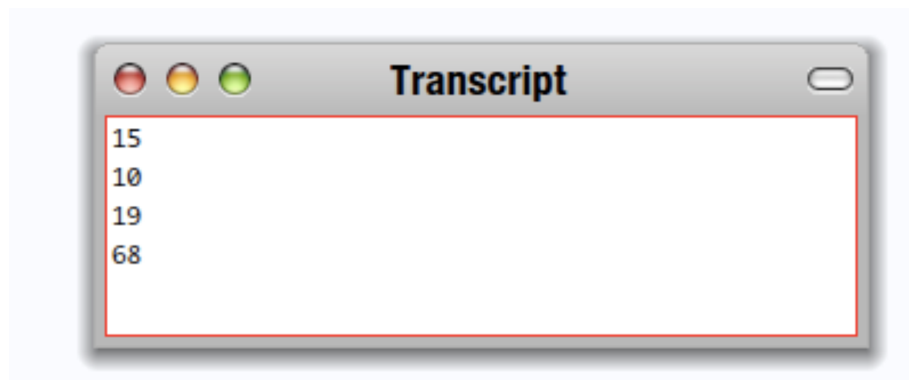
We can also do it that way!

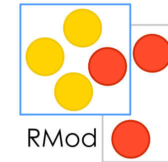
```
|result|
aCol :=  #( 2 -3 4 -35 4).
result := aCol species new: aCol size.
1 to: aCollection size do:
        [ :each | result at: each put: (aCol at: each) odd].
result
```



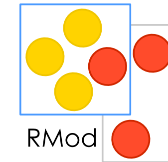

```
#(15 10 19 68) do:
    [:i | Transcript show: i ; cr ]
```

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

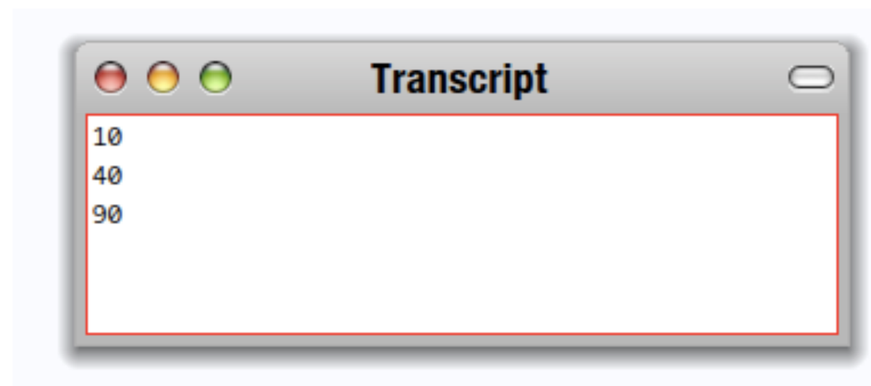


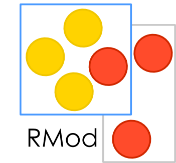



```
#(1 2 3)
    with:  #(10 20 30)
    do: [:x :y| Transcript show: (y ** x) ; cr ]
```

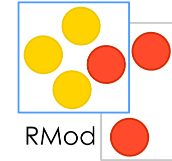



```
#(1 2 3)
    with:  #(10 20 30)
    do: [:x :y| Transcript show: (y ** x) ; cr ]
```





How do: is implemented?

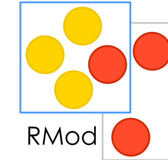


How do: is implemented?

```
SequenceableCollection>>do: aBlock
  "Evaluate aBlock with each of the receiver's elements as the
  argument."

  1 to: self size do: [:i | aBlock value: (self at: i)]
```

Some others... friends



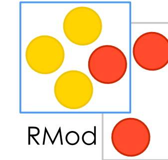

```
#(15 10 19 68) select: [:i|i odd]

#(15 10 19 68) reject: [:i|i odd]

#(12 10 19 68 21) detect: [:i|i odd]

#(12 10 12 68) detect: [:i|i odd] ifNone:[1]
```

Some others... friends



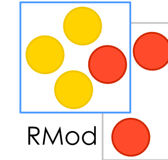

```
#(15 10 19 68) select: [:i|i odd]
  > #(15 19)

#(15 10 19 68) reject: [:i|i odd]

#(12 10 19 68 21) detect: [:i|i odd]

#(12 10 12 68) detect: [:i|i odd] ifNone:[1]
```

Some others... friends



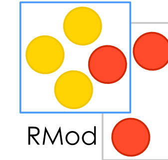

```
#(15 10 19 68) select: [:i|i odd]
  > #(15 19)

#(15 10 19 68) reject: [:i|i odd]
  > #(10 68)

#(12 10 19 68 21) detect: [:i|i odd]


#(12 10 12 68) detect: [:i|i odd] ifNone:[1]
```

Some others... friends



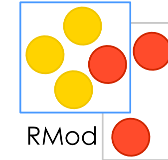

```
#(15 10 19 68) select: [:i|i odd]
  > #(15 19)

#(15 10 19 68) reject: [:i|i odd]
  > #(10 68)

#(12 10 19 68 21) detect: [:i|i odd]
  > 19

#(12 10 12 68) detect: [:i|i odd] ifNone:[1]
```

Some others... friends

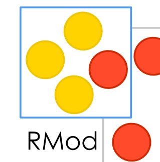



```
#(15 10 19 68) select: [:i|i odd]
   > #(15 19)

#(15 10 19 68) reject: [:i|i odd]
   > #(10 68)

#(12 10 19 68 21) detect: [:i|i odd]
   > 19

#(12 10 12 68) detect: [:i|i odd] ifNone:[1]
   > 1
```



Iterators are your best friends

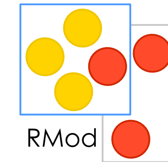
- compact
- nice abstraction
- Just messages sent to collections

RMod

Iterators are your best friends

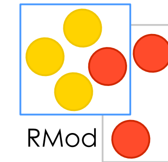
- compact
- nice abstraction
- Just messages sent to collections

A simple exercise



How do you define the method that does that?

#() -> ‘’
#(a) ->’a’
#(a b c) -> ‘a, b, c’

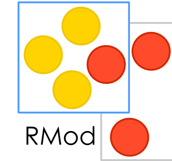



```
#(a b c)
    do: [:each | Transcript show: each printString]
    separatedBy: [Transcript show: ‘,’]
```

RMod

```
#(a b c)
    do: [:each | Transcript show: each printString]
    separatedBy: [Transcript show: ‘,’]
```

Messages Sequence

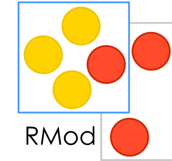



```
message1 .
message2 .
message3
```

. is a separator, not a terminator

```
| macNode pcNode node1 printerNode |
macNode := Workstation withName: #mac.
Transcript cr.
Transcript show: 1 printString.
Transcript cr.
Transcript show: 2 printString
```

Multiple messages to an objects ;



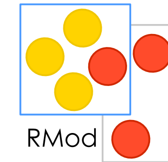
To send multiple messages to the same object

```
Transcript show: 1 printString.
Transcript cr
```

is equivalent to:

```
Transcript show: 1 printString ; cr
```

Hints ...



x isNil ifTrue: [...]

x includes: 3 ifTrue: [...]

is read as the message includes:ifTrue:

(x includes: 3) ifTrue: [...]

RMod

Smalltalk is fun

Pure simple powerful

www.seaside.st
(www.dabbledb.com)
www.pharo-project.org