Advanced R in Korean

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Contents

Preface

- Wickham Advanced R .
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- .
- , / .
- (@) .

Chapter 1

Introduction

Chapter 2

Names and values

2.1 Introduction

R (object) (name) . ,

- .
- , .
- R .

(names) (values) , R (object) .

Quiz

. Section 2.7 .

1. , `1` `2` “3” ? `[[` , `$` . `1`, `2`, `3` ?

```
df <- data.frame(runif(3), runif(3))
names(df) <- c(1, 2)
```

2. , `y` ?

```
x <- runif(1e6)
y <- list(x, x, x)
```

3. `a` ?

```r
a <- c(1, 5, 3, 2)
b <- a
b[[1]] <- 10
```

Outline

- Section 2.2 (names) (values) , `<-` (binding) (reference) .
- Section 2.3 R ' ' . , . `tracemem()` . , , , .
- Section 2.4 (object) , . , `utils::object.size()` , `lobstr::obj_size()` .
- Section 2.5 'copy-on-modify'(@ ' ' .) . (environments) , .
- Section 2.6 , garbage collector .

Prerequisites

R lobstr .

```r
library(lobstr)
```

2.2 Binding basics

.

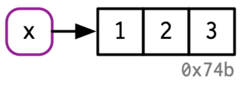
```r
x <- c(1, 2, 3)
```

" x , 1, 2, 3 . " . , R . .

- `c(1, 2, 3)` .
- x .

, . .

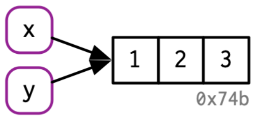
, .



x , . c(1, 2, 3) (,) .
<- , <- (binding) .

, (name) (value) (reference) .(@ ‘ ’ ?)
, c(1, 2, 3) . ’ ’ .(@ ,
)

```
y <- x
```



c(1, 2, 3) 0x74b . , . ,
(ID) . ID ’ ’ . .
, ID .

lobstr::obj_addr() ID . x y ID .

```
obj_addr(x)
#> [1] "0x18308880"
obj_addr(y)
#> [1] "0x18308880"
```

ID R .

. , . .

2.2.1 Non-syntactic names

R . **(syntactic)** , , ., _ , _ .
TRUE, NULL, if, function **(reserved words)** .(@ R
.) **non-syntactic** , .

```
_abc <- 1
#> Error: unexpected input in "_"

if <- 10
#> Error: unexpected assignment in "if <-"
```

. backticks .

```
`_abc` <- 1
`_abc`
#> [1] 1

`if` <- 10
`if`
#> [1] 10
```

, R , .

2.2.2 Exercises

1. a, b, c, d .

```
a <- 1:10
b <- a
c <- b
d <- 1:10
```

2. . ? `lobstr::obj_addr()` .

```
mean
base::mean
get("mean")
evalq(mean)
match.fun("mean")
```

3. `read.csv` R , non-syntactic syntactic . ? ?

4. non-syntactic syntactic `make.names()` ?

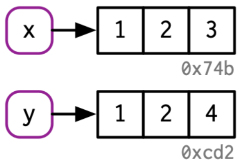
5. syntactic . `.123e1` syntactic ? `?makes.names` .

2.3 Copy-on-modify

. x y . y .

```r
x <- c(1, 2, 3)
y <- x

y[[3]] <- 4
x
#> [1] 1 2 3
```

y x . ? y , . , R 0x74b 0xcd2 , y .



copy-on-modify . R . , R (unchangeable), **(immutable)** . , Section 2.5 copy-on-modify .

copy-on-modify , RStudio . (environment pane) , . , . . , R , RMarkdown .

2.3.1 tracemem()

base::tracemem() . , .

```r
x <- c(1, 2, 3)
cat(tracemem(x), "\n")
#> <0x7f80c0e0ffc8>
```

tracemem() , .

```r
y <- x
y[[3]] <- 4L
#> tracemem[0x7f80c0e0ffc8 -> 0x7f80c4427f40]:
```

y , . , R modify-in-place . Section 2.5 .

```
y[[3]] <- 5L

untracemem(x)
```

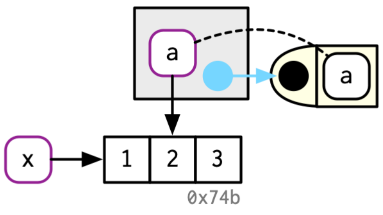
untracemem() tracemem() , .

2.3.2 Function calls

. .

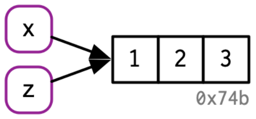
```
f <- function(a) {
  a
}

x <- c(1, 2, 3)
cat(tracemem(x), "\n")
#> <000000001A2688D0>

z <- f(x)
# there's no copy here!

untracemem(x)
```

f() , a x .



Section 7.4.4 . , f() . a , ( ) ( ) .

f() , x z . 0x74b , . f() x , R , z .

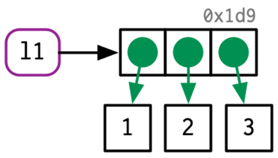


2.3.3 Lists

(,) . . , .

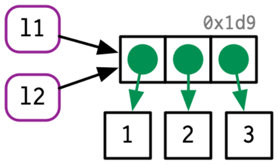
```
l1 <- list(1, 2, 3)
```

, , ( ) .

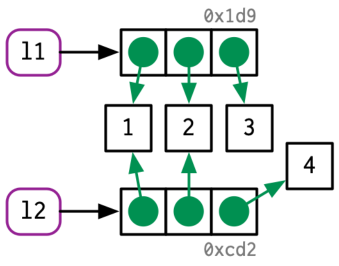


.

```
l2 <- l1
```



```
l2[[3]] <- 4
```



, copy-on-modify . , . . , , . , . R 3.1.0 .

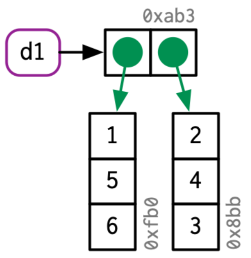
, lobstr::ref() . ref() ID , .

```
ref(l1, l2)
#> o [1:0x17fa8250] <list>
#> +-[2:0x17f958d8] <dbl>
#> +-[3:0x17f958a0] <dbl>
#> \-[4:0x17f95868] <dbl>
#>
#> o [5:0x18843c58] <list>
#> +-[2:0x17f958d8]
#> +-[3:0x17f958a0]
#> \-[6:0x18a12310] <dbl>
```

2.3.4 Data frames

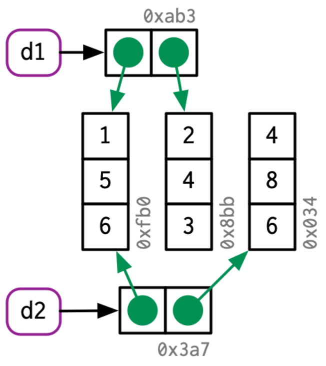
. copy-on-modify . .

```
d1 <- data.frame(x = c(1, 5, 6), y = c(2, 4, 3))
```



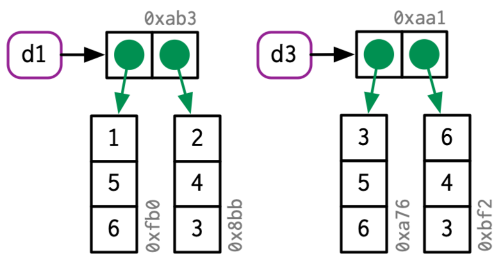
, . .

```
d2 <- d1
d2[, 2] <- d2[, 2] * 2
```



, . .

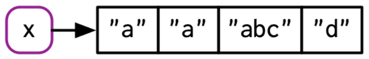
```
d3 <- d1
d3[1, ] <- d3[1, ] * 3
```



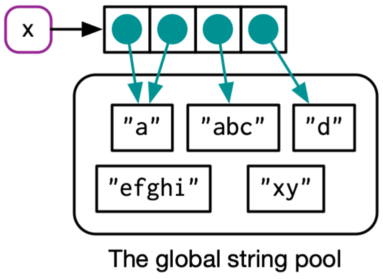
2.3.5 Character vectors

R . .

```
x <- c("a", "a", "abc", "d")
```



. R **global string pool** , .



ref() character TRUE .

```
ref(x, character = TRUE)
#> o [1:0x18fd9000] <chr>
#> +-[2:0x12f376d0] <string: "a">
#> +-[2:0x12f376d0]
#> +-[3:0x1994f480] <string: "abc">
#> \-[4:0x13135330] <string: "d">
```

, , .

2.3.6 Exercises

1. `tracemem(1:10)` ?
2. , `tracemem()` . : .

```
x <- c(1L, 2L, 3L)
tracemem(x)

x[[3]] <- 4
```

3. .

```
a <- 1:10
b <- list(a, a)
c <- list(b, a, 1:10)
```

4. ?

```
x <- list(1:10)
x[[2]] <- x
```

.

2.4 Object size

`lobstr::obj_size()` .

```
obj_size(letters)
#> 1,712 B
obj_size(ggplot2::diamonds)
#> 3,456,344 B
```

, .

```
x <- runif(1e6)
obj_size(x)
#> 8,000,048 B

y <- list(x, x, x)
obj_size(y)
#> 8,000,128 B
```

y x 80 , .

```
obj_size(list(NULL, NULL, NULL))
#> 80 B
```

, R global string pool . 100 100
.

```
banana <- "bananas bananas bananas"
obj_size(banana)
#> 136 B
obj_size(rep(banana, 100))
#> 928 B
```

. `obj_size(x) + obj_size(y)` `obj_size(x, y)` . , x y y .

```
obj_size(x, y)
#> 8,000,128 B
```

, 3.5.0 R ALTREP , **alternative representation**
. R . : ,
. , .

```
obj_size(1:3)
#> 680 B
obj_size(1:1e3)
#> 680 B
obj_size(1:1e6)
#> 680 B
obj_size(1:1e9)
#> 680 B
```

2.4.1 Exercises

1. , `object.size(y)` `obj_size(y)` ? `object.size()` .

```
y <- rep(list(runif(1e4)), 100)

object.size(y)
#> 8005648 bytes
obj_size(y)
#> 80,896 B
```

2. , ?

```
funns <- list(mean, sd, var)
obj_size(funs)
#> 17,608 B
```

3. .

```
a <- runif(1e6)
obj_size(a)
#> 8,000,048 B

b <- list(a, a)
obj_size(b)
#> 8,000,112 B
obj_size(a, b)
#> 8,000,112 B

b[[1]][[1]] <- 10
obj_size(b)
#> 16,000,160 B
obj_size(a, b)
#> 16,000,160 B

b[[2]][[1]] <- 10
obj_size(b)
#> 16,000,160 B
obj_size(a, b)
#> 24,000,208 B
```

2.5 Modify-in-place

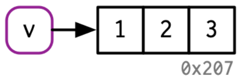
, R . .

- .
- (Environments) .(modified in place)

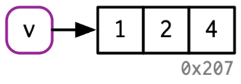
2.5.1 Objects with a single binding

, R .

```r
v <- c(1, 2, 3)
```



```r
v[[3]] <- 4
```



(ID , v 0bx207 .)

R .

- , R 0, 1 . , , , 1 . . R .
- , . “ ” C . R-core .

. R For , . . .

```r
x <- data.frame(matrix(runif(5 * 1e4), ncol = 5))
medians <- vapply(x, median, numeric(1))

for (i in seq_along(medians)) {
  x[[i]] <- x[[i]] - medians[[i]]
}
```

loop , loop . `tracemem()` .

```r
cat(tracemem(x), "\n")

#> <0x7f80c429e020>
for (i in 1:5) {
  x[[i]] <- x[[i]] - medians[[i]]
}
#> tracemem[0x7f80c429e020 -> 0x7f80c0c144d8]:
#> tracemem[0x7f80c0c144d8 -> 0x7f80c0c14540]: [[<-.data.frame [[<-
#> tracemem[0x7f80c0c14540 -> 0x7f80c0c145a8]: [[<-.data.frame [[<-
#> tracemem[0x7f80c0c145a8 -> 0x7f80c0c14610]:
#> tracemem[0x7f80c0c14610 -> 0x7f80c0c14678]: [[<-.data.frame [[<-
#> tracemem[0x7f80c0c14678 -> 0x7f80c0c146e0]: [[<-.data.frame [[<-
#> tracemem[0x7f80c0c146e0 -> 0x7f80c0c14748]:
#> tracemem[0x7f80c0c14748 -> 0x7f80c0c147b0]: [[<-.data.frame [[<-
#> tracemem[0x7f80c0c147b0 -> 0x7f80c0c14818]: [[<-.data.frame [[<-
#> tracemem[0x7f80c0c14818 -> 0x7f80c0c14880]:
#> tracemem[0x7f80c0c14880 -> 0x7f80c0c148e8]: [[<-.data.frame [[<-
#> tracemem[0x7f80c0c148e8 -> 0x7f80c0c14950]: [[<-.data.frame [[<-
#> tracemem[0x7f80c0c14950 -> 0x7f80c0c149b8]:
#> tracemem[0x7f80c0c149b8 -> 0x7f80c0c14a20]: [[<-.data.frame [[<-
#> tracemem[0x7f80c0c14a20 -> 0x7f80c0c14a88]: [[<-.data.frame [[<-

untracemem(x)
```

, , , . `[[.data.frame` ,
`[[.data.frame` `x` (regular function) .(@ …)
. C , .

```
y <- as.list(x)
cat(tracemem(y), "\n")
#> <0x7f80c5c3de20>

for (i in 1:5) {
  y[[i]] <- y[[i]] - medians[[i]]
}
#> tracemem[0x7f80c5c3de20 -> 0x7f80c48de210]:
```

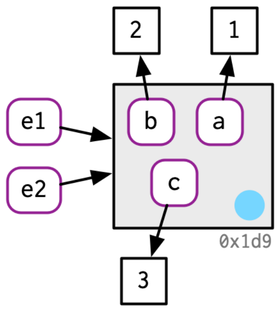
, . , Chapter 25 C++
.

2.5.2 Environments

Chapter 7 , . .
.(modified in place) **reference semantics** ,
.

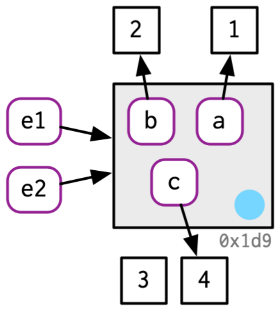
. `e1` `e2` .

```
e1 <- rlang::env(a = 1, b = 2, c = 3)
e2 <- e1
```



, modified in place .

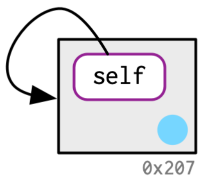
```
e1$c <- 4
e2$c
#> [1] 4
```



“ ” . Section 10.2.4 . Chapter 14
, R6 .

, .

```
e <- rlang::env()
e$self <- e

ref(e)
#> o [1:0x18631cf8] <env>
#> \-self = [1:0x18631cf8]
```



!

2.5.3 Exercises

1. .

```
x <- list()
x[[1]] <- x
```

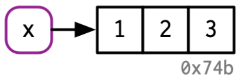
2. , 'bench' . ?

3. tracemem() ?

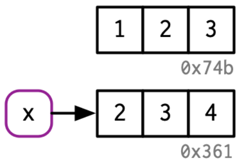
2.6 Unbinding and the garbage collector

.

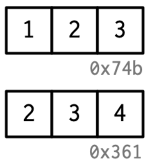
```
x <- 1:3
```



```
x <- 2:4
```



```
rm(x)
```



. , . ? **garbage collector** .(GC .) GC R , , .

R **(tracing)** GC . , .(, .) GC modify-in-place . , .(@ …)

GC R , . , GC . , . GC `gcinfo(TRUE)` , GC .

`gc()` garbage collection . `gc()` . `gc()` R , .

```
gc()
#>           used (Mb) gc trigger (Mb) max used (Mb)
#> Ncells  581300 31.1    1245795 66.6  1245795 66.6
#> Vcells 1083544  8.3    8388608 64.0  2191249 16.8
```

`lobstr::mem_used()` `gc()` , .

```
mem_used()
#> 41,258,096 B
```

, .

1. R R .
2. R . . R , OS .
3. R . . (fragmentation) .

2.7 Quiz answers

1. non-syntactic (`) .

```
df <- data.frame(runif(3), runif(3))
names(df) <- c(1, 2)

df$`3` <- df$`1` + df$`2`
```

2. 8MB .

```
x <- runif(1e6)
y <- list(x, x, x)
obj_size(y)
#> 8,000,128 B
```

3. `a` `b` `b[[1]] <- 10` .

2.8 Summary

- , .
- R , .
- , .
- modified-in-place .