



Introduction to the R Language

Loop Functions

Roger D. Peng, Associate Professor of Biostatistics
Johns Hopkins Bloomberg School of Public Health

Looping on the Command Line

Writing `for`, `while` loops is useful when programming but not particularly easy when working interactively on the command line. There are some functions which implement looping to make life easier.

- `lapply`: Loop over a list and evaluate a function on each element
- `sapply`: Same as `lapply` but try to simplify the result
- `apply`: Apply a function over the margins of an array
- `tapply`: Apply a function over subsets of a vector
- `mapply`: Multivariate version of `lapply`

An auxiliary function `split` is also useful, particularly in conjunction with `lapply`.

lapply

`lapply` takes three arguments: (1) a list `x`; (2) a function (or the name of a function) `FUN`; (3) other arguments via its `...` argument. If `x` is not a list, it will be coerced to a list using `as.list`.

```
lapply
```

```
## function (X, FUN, ...)  
## {  
##     FUN <- match.fun(FUN)  
##     if (!is.vector(X) || is.object(X))  
##         X <- as.list(X)  
##     .Internal(lapply(X, FUN))  
## }  
## <bytecode: 0x7ff7a1951c00>  
## <environment: namespace:base>
```

The actual looping is done internally in C code.

lapply

`lapply` always returns a list, regardless of the class of the input.

```
x <- list(a = 1:5, b = rnorm(10))  
lapply(x, mean)
```

```
## $a  
## [1] 3  
##  
## $b  
## [1] 0.4671
```

lapply

```
x <- list(a = 1:4, b = rnorm(10), c = rnorm(20, 1), d = rnorm(100, 5))  
lapply(x, mean)
```

```
## $a  
## [1] 2.5  
##  
## $b  
## [1] 0.5261  
##  
## $c  
## [1] 1.421  
##  
## $d  
## [1] 4.927
```

lapply

```
> x <- 1:4
> lapply(x, runif)
[[1]]
[1] 0.2675082

[[2]]
[1] 0.2186453 0.5167968

[[3]]
[1] 0.2689506 0.1811683 0.5185761

[[4]]
[1] 0.5627829 0.1291569 0.2563676 0.7179353
```

lapply

```
> x <- 1:4  
> lapply(x, runif, min = 0, max = 10)  
[[1]]  
[1] 3.302142  
  
[[2]]  
[1] 6.848960 7.195282  
  
[[3]]  
[1] 3.5031416 0.8465707 9.7421014  
  
[[4]]  
[1] 1.195114 3.594027 2.930794 2.766946
```

lapply

`lapply` and friends make heavy use of *anonymous* functions.

```
> x <- list(a = matrix(1:4, 2, 2), b = matrix(1:6, 3, 2))
> x
$a
      [,1] [,2]
[1,]    1    3
[2,]    2    4

$b
      [,1] [,2]
[1,]    1    4
[2,]    2    5
[3,]    3    6
```


lapply

An anonymous function for extracting the first column of each matrix.

```
> lapply(x, function(elt) elt[,1])  
$a  
[1] 1 2  
  
$b  
[1] 1 2 3
```

sapply

`sapply` will try to simplify the result of `lapply` if possible.

- If the result is a list where every element is length 1, then a vector is returned
- If the result is a list where every element is a vector of the same length (> 1), a matrix is returned.
- If it can't figure things out, a list is returned

supply

```
> x <- list(a = 1:4, b = rnorm(10), c = rnorm(20, 1), d = rnorm(100, 5))  
> lapply(x, mean)  
$a  
[1] 2.5  
  
$b  
[1] 0.06082667  
  
$c  
[1] 1.467083  
  
$d  
[1] 5.074749
```

sapply

```
> sapply(x, mean)
```

a	b	c	d
2.50000000	0.06082667	1.46708277	5.07474950

```
> mean(x)
```

```
[1] NA
```

Warning message:

In mean.default(x) : argument is not numeric or logical: returning NA