

Using The `iterators` Package

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1 Introduction

An *iterator* is a special type of object that generalizes the notion of a looping variable. When passed as an argument to a function that knows what to do with it, the iterator supplies a sequence of values. The iterator also maintains information about its state, in particular its current index. The `iterators` package includes a number of functions for creating iterators, the simplest of which is `iter`, which takes virtually any R object and turns it into an iterator object. The simplest function that operates on iterators is the `nextElem` function, which when given an iterator, returns the next value of the iterator. For example, here we create an iterator object from the sequence 1 to 10, and then use `nextElem` to iterate through the values:

```
> library(iterators)
> i1 <- iter(1:10)
> nextElem(i1)
```

```
[1] 1
```

```
> nextElem(i1)
```

```
[1] 2
```

You can create iterators from matrices and data frames, using the `by` argument to specify whether to iterate by row or column:

```
> istate <- iter(state.x77, by = "row")
> nextElem(istate)
```

	Population	Income	Illiteracy	Life Exp	Murder	HS Grad	Frost	Area
Alabama	3615	3624	2.1	69.05	15.1	41.3	20	50708

```
> nextElem(istate)
```

	Population	Income	Illiteracy	Life Exp	Murder	HS Grad	Frost	Area
Alaska	365	6315	1.5	69.31	11.3	66.7	152	566432

Iterators can also be created from functions, in which case the iterator can be an endless source of values:

```
> ifun <- iter(function() sample(0:9, 4, replace = TRUE))
> nextElem(ifun)
```

```
[1] 8 7 4 1
```

```
> nextElem(ifun)
```

```
[1] 2 8 6 0
```

For practical applications, iterators can be paired with `foreach` to obtain parallel results quite easily:

```
> library(foreach)
```

foreach: simple, scalable parallel programming from REvolution Computing
 Use REvolution R for scalability, fault tolerance and more.
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```
> x <- matrix(rnorm(1e+06), ncol = 10000)
> itx <- iter(x, by = "row")
> foreach(i = itx, .combine = c) %dopar% mean(i)
```

```
[1] 5.598411e-04 -2.153718e-03 4.085562e-03 -1.250595e-02 1.276493e-02
[6] 1.883588e-03 9.240690e-03 2.423629e-02 9.050483e-03 2.931787e-03
[11] -3.277863e-03 1.674872e-02 7.092496e-03 1.049359e-02 7.752138e-04
[16] -1.352968e-02 -6.434772e-04 2.158897e-03 6.517852e-03 -2.162657e-02
[21] -8.236094e-03 -2.011664e-03 -3.501026e-05 -1.550284e-02 -1.621283e-02
[26] 1.695340e-02 1.226310e-02 2.790762e-03 -4.947976e-03 1.130475e-02
```

```
[31]  2.616515e-03 -3.308298e-03 -3.716513e-03 -3.071134e-03  6.585699e-03
[36]  1.610752e-02 -9.119145e-03  5.838017e-03 -2.614282e-02 -4.420001e-03
[41] -6.974423e-03  5.488280e-03 -8.645145e-03 -6.367476e-03  2.852167e-03
[46]  1.502190e-03  3.143107e-03 -1.355292e-03 -8.037321e-03 -3.674336e-03
[51]  2.701780e-02  1.967549e-02 -7.572475e-03 -5.852956e-03  1.533058e-02
[56]  1.452239e-03  6.601189e-03 -1.263151e-02  1.207797e-02 -1.539291e-02
[61]  2.171335e-02  1.769894e-02  5.765391e-03  1.838979e-02  9.095710e-03
[66]  1.890239e-02  8.658411e-05  2.371254e-03  1.876639e-03 -5.899046e-03
[71] -1.194215e-03  3.679712e-03  4.306028e-03  1.937262e-02  3.252362e-03
[76] -7.364175e-05  7.307403e-03 -7.823781e-03 -1.183696e-03 -1.646598e-02
[81]  2.136166e-02  2.407001e-02 -3.583337e-03  1.461787e-02  8.226403e-03
[86]  4.056301e-03  6.113045e-03  2.127791e-03  1.403554e-02  7.413708e-03
[91]  9.115975e-03  1.055226e-02  6.526606e-03 -2.484804e-03 -6.735931e-03
[96] -2.034838e-03 -6.615105e-03  5.382362e-03 -1.348632e-02  8.697772e-03
```

2 Some Special Iterators

The notion of an iterator is new to R, but should be familiar to users of languages such as Python. The `iterators` package includes a number of special functions that generate iterators for some common scenarios. For example, the `irnorm` function creates an iterator for which each value is drawn from a specified random normal distribution:

```
> library(iterators)
> itrn <- irnorm(10)
> nextElem(itrn)

[1] -0.5970720 -0.7062364  0.6537851  1.3108956 -1.1370049  0.5609816
[7]  0.3509439 -0.9622147  0.8730565  0.7503263

> nextElem(itrn)

[1]  2.4169555  0.1388308  0.5524143  1.8739470 -0.9225754 -0.4617322
[7] -1.1359893 -0.1658092 -0.7161804 -1.4352360
```

Similarly, the `irunif`, `irbinom`, and `irpois` functions create iterators which drawn their values from uniform, binomial, and Poisson distributions, respectively.

We can then use these functions just as we used `irnorm`:

```
> itru <- irunif(10)
> nextElem(itru)
```

```
[1] 0.3747124 0.1417081 0.5093042 0.5868144 0.2901295 0.6077143 0.7034091
[8] 0.6518006 0.3109992 0.3491662
```

```
> nextElem(itru)
```

```
[1] 0.3310245 0.7353534 0.2382373 0.5580570 0.9359709 0.2802553 0.2501998
[8] 0.6652205 0.2218577 0.1366753
```

The `icount` function returns an iterator that counts starting from one:

```
> it <- icount(3)
> nextElem(it)
```

```
[1] 1
```

```
> nextElem(it)
```

```
[1] 2
```

```
> nextElem(it)
```

```
[1] 3
```