Module 12

R Programming

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R 'programming'

Now we are going to switch gears a little bit, and talk about some of the more traditional programming that you can do in R.

You can do very flexible things, but at a cost of more difficult notation, and having to actually write programming statements. There are slight notation differences as well, including the use of curly `{ }` brackets

We are going to cover `for` loops and `if` statements

'for' Loops

These allow you to iterate over certain observations or subsets of observations

The syntax is:

```
for(*var* in seq) {
do something
}
```

Typically they look something like:

```
for(i in 1:nrow(dat)) {
  something(dat[i,])
}
```

'for' loops

These are essentially fancier `apply` statements

For example,

```
> for(i in 1:10) {
+   print(i)
+ }
```

```
[1] 1
[1] 2
[1] 3
[1] 4
[1] 5
[1] 6
[1] 7
[1] 8
[1] 9
[1] 10
```

'for' loops

Here's how they can be more flexible:

```
> Index = c(3,6,7,20,32,100,234,1000,6543)
> for(i in 1:length(Index)) {
+   print(Index[i])
+ }
```

```
[1] 3
[1] 6
[1] 7
[1] 20
[1] 32
[1] 100
[1] 234
[1] 1000
[1] 6543
```

Note that the first time through the body of the loop, `i` takes the value 1, then evaluates the body. Then, `i` takes the value 2, and evaluates the body, until `i = length(Index)`, then it stops.

'for' loops

They are essentially more useful than apply statements when you are working with two sets of matching datasets or vectors.

```
> myList = vector("list",length=4)
> mat1=matrix(rnorm(8), nc = 4)
> mat2=matrix(rnorm(8), nc = 4)
> mat1
```

```
        [,1]     [,2]    [,3]    [,4]
[1,] -0.2854 -0.01147 -0.3855 -0.3403
[2,] -0.9100  0.52103  1.1067 -1.7502
```

```
> mat2
```

```
      [,1]    [,2]    [,3]    [,4]
[1,] 1.429 0.02987 -0.6456  0.5449
[2,] 1.775 0.30341 -0.3780 -0.6708
```

```
> for(i in seq(along=myList)) {
+   myList[[i]] = cbind(mat1[,i],mat2[,i])
+ }
> myList
```

```
[[1]]
        [,1]  [,2]
[1,] -0.2854 1.429
[2,] -0.9100 1.775

[[2]]
         [,1]    [,2]
[1,] -0.01147 0.02987
[2,]  0.52103 0.30341

[[3]]
        [,1]    [,2]
[1,] -0.3855 -0.6456
[2,]  1.1067 -0.3780

[[4]]
        [,1]    [,2]
[1,] -0.3403  0.5449
[2,] -1.7502 -0.6708
```

'for' loops

```
> i=1
> cbind(mat1[,i],mat2[,i])
```

```
        [,1]  [,2]
[1,] -0.2854 1.429
[2,] -0.9100 1.775
```

```
> i=2
> cbind(mat1[,i],mat2[,i])
```

```
         [,1]    [,2]
[1,] -0.01147 0.02987
[2,]  0.52103 0.30341
```

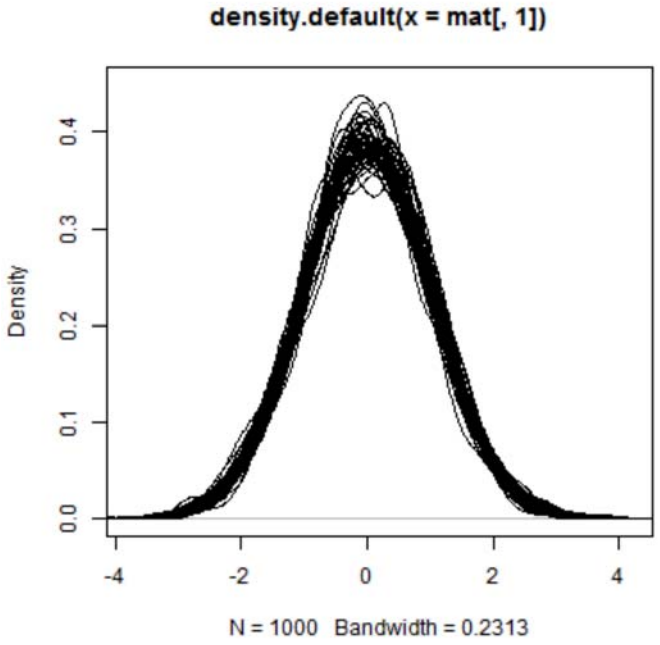
```
> i=3
> cbind(mat1[,i],mat2[,i])
```

```
        [,1]    [,2]
[1,] -0.3855 -0.6456
[2,]  1.1067 -0.3780
```

'for' loops

These are useful for making many columns worth of density plots

```
> mat = matrix(rnorm(1000*50), nc = 50)
> plot(density(mat[,1]), ylim = c(0,0.45))
> for(i in 2:ncol(mat)) {lines(density(mat[,i]))}
```



'for' loops

You can also integrate with lists.

```
> outList = vector("list",10)
> start=1:10
> end = sample(1:100, 10)
> for(i in seq(along=outList)) {
+   outList[[i]] = start[i]:end[i]
+ }
> outList
```

```
[[1]]
 [1]  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
[24] 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46
[47] 47 48 49 50 51 52 53 54 55 56 57 58 59

[[2]]
 [1]  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
[24] 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47
[47] 48 49 50 51 52 53 54

[[3]]
 [1]  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
[24] 26 27 28 29 30 31 32 33 34 35 36

[[4]]
 [1]  4  5  6  7  8  9 10 11 12 13 14 15 16 17

[[5]]
[1]  5  6  7  8  9 10
```

'if' statements

You can put 'if' statements inside of 'for' loops

```
for(i in 1:nrow(dat)) {
  if(dat$x > num) {
    dat$y[i] = something
  } else {
    dat$y[i] = something else
  }
}
```

Example

```
> makeIndexes=split(1:nrow(cars), cars$Make)
> lapply(makeIndexes, head, n=4)[1:3]
```

```
$ACURA
[1] 10039 13026 13631 14250

$BUICK
[1] 185 233 258 346

$CADILLAC
[1] 3372 4517 8500 9664
```

```
> pval = rep(NA,length(makeIndexes))
> for(i in 1:length(makeIndexes)) {
+   ind = makeIndexes[[i]]
+   if(length(ind)>1) {
+     f = lm(VehBCost~VehOdo, data=cars,subset=ind)
+     pval[i] = summary(f)$coef[2,4]
+   }
+ }
> names(pval)=names(makeIndexes)
>
> i = 1
> ind = makeIndexes[[i]]
> str(ind)
```

```
 int [1:33] 10039 13026 13631 14250 16392 17289 17889 17979 18166 22044 ...
```

```
> f = lm(VehBCost~VehOdo, data=cars,subset=ind)
> summary(f)$coef[2,4]
```

```
[1] 0.4932
```

```
> pval
```

```
      ACURA       BUICK    CADILLAC   CHEVROLET     CHRYSLER
   4.932e-01    1.877e-05    1.064e-06    2.834e-06    1.128e-78
      DODGE        FORD         GMC       HONDA       HUMMER
   1.494e-10    2.584e-27    1.626e-01    2.490e-13           NA
    HYUNDAI     INFINITI       ISUZU        JEEP          KIA
   1.072e-04    9.737e-04    2.697e-04    2.723e-16    3.765e-18
      LEXUS      LINCOLN        MAZDA      MERCURY         MINI
   5.014e-09    7.061e-01    1.364e-41    2.953e-04    8.709e-02
  MITSUBISHI       NISSAN   OLDSMOBILE    PLYMOUTH      PONTIAC
   3.357e-26    3.594e-10    6.956e-08          NaN   3.305e-154
     SATURN        SCION       SUBARU       SUZUKI       TOYOTA
   4.363e-40    3.115e-07    8.062e-01    4.285e-32    1.395e-16
TOYOTA SCION   VOLKSWAGEN        VOLVO
          NA    4.738e-06    1.269e-02
```

Note you can also do with with `sapply`

```
> pval2 = sapply(makeIndexes, function(ind) {
+   if(length(ind)>1) {
+     f = lm(VehBCost~VehOdo, data=cars,subset=ind)
+     summary(f)$coef[2,4]
+   } else NA
+ })
> all.equal(pval,pval2)
```

```
[1] TRUE
```

Example

Now we can read in many files into a list

```
> fn = list.files("Reports/",pattern=".txt",full.names=TRUE)
> name = list.files("Reports/",pattern=".txt",full.names=FALSE)
> head(fn)
```

```
[1] "Reports/April_2009_Report.txt"  "Reports/April_2010_Report.txt"
[3] "Reports/April_2011_Report.txt"  "Reports/August_2009_Report.txt"
[5] "Reports/August_2010_Report.txt" "Reports/August_2011_Report.txt"
```

```
> fileList = lapply(fn, read.delim, header=TRUE, as.is=TRUE)
> names(fileList) = name
> sapply(fileList,dim)[,1:5]
```

```
     April_2009_Report.txt April_2010_Report.txt April_2011_Report.txt
[1,]                   287                   324                   359
[2,]                    10                    10                    10
     August_2009_Report.txt August_2010_Report.txt
[1,]                    353                   369
[2,]                     10                    10
```

```
> lapply(fileList[1:5],head,n=2)
```

```
$April_2009_Report.txt
    id    sex   treat   age bgDrugs height weight block recruitDate   bmi
1 1072 Female Control 51.00  asprin  63.84  131.3     d          21 22.64
2 1073 Female Control 54.81 tylenol  66.10  117.2     b           1 18.85

$April_2010_Report.txt
    id    sex treat   age bgDrugs height weight block recruitDate   bmi
1 4337 Female  Case 46.91    none  64.95  140.6     f          25 23.43
2 4338 Female  Case 47.95    none  66.47  143.3     f          14 22.81

$April_2011_Report.txt
    id  sex   treat   age bgDrugs height weight block recruitDate   bmi
1 7780 Male    Case 53.93  asprin  70.12  175.0     f          29 25.02
2 7781 Male Control 62.77 tylenol  71.02  153.1     b          29 21.34

$August_2009_Report.txt
    id  sex   treat   age bgDrugs height weight block recruitDate   bmi
1 2051 Male Control 56.76 tylenol  70.47  168.0     f           2 23.78
2 2052 Male    Case 50.14  asprin  69.56  172.3     c           1 25.04
```