A Brief Introduction to R

```
> 1+1
[1] 2
> 2^3 # Two to the power 3
[1] 8

> 1:30
 [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 25
[26] 26 27 28 29 30

> gamma(.5)^2     # Gamma(1/2) = Sqrt(Pi)
[1] 3.141593

> x <- 1          # Assigns the value 1 to x
> y <- 2
> x+y
[1] 3
> z <- x+y
> z
[1] 3
> x <- c(1,2,3,4,5,6)    #  Collect these numbers; x is now a vector

> z # No dynamic updating; it's not a spreadsheet
[1] 3
> x+y
[1] 3 4 5 6 7 8

> y = 1 + 2*x # Another way to do assignment
> cbind(x,y)
     x  y
[1,] 1  3
[2,] 2  5
[3,] 3  7
[4,] 4  9
[5,] 5 11
[6,] 6 13

> z <- y[x>4]             # z gets y such that x > 4
> z
[1] 11 13

> # If you put an array of integers inside the brackets, you get those
> # elements, in the order indicated.

> y[c(6,5,4,3,2,1)] # y in opposite order
[1] 13 11  9  7  5  3
> y[c(2,2,2,3,4)] # Repeats are okay
[1] 5 5 5 7 9
> y[7] # There is no seventh element.  NA is the missing value code
[1] NA
```

```
> # Random number generation
> # Maybe transforming a uniform by inverse CDF
> help(Exponential) # Could also use  help(rexp)
```

Exponential {stats}   R Documentation
### The Exponential Distribution

Description

Density, distribution function, quantile function and random generation for
the exponential distribution with rate `rate` (i.e., mean `1/rate`).

Usage

```
dexp(x, rate = 1, log = FALSE)
pexp(q, rate = 1, lower.tail = TRUE, log.p = FALSE)
qexp(p, rate = 1, lower.tail = TRUE, log.p = FALSE)
rexp(n, rate = 1)
```

```
> expdata = rexp(50,rate=1/2) # Random sample from exponential distribution, mean=theta=2
> expdata
 [1] 0.4330015 5.7893762 0.9803759 0.7172530 2.2696433 4.0045302 3.3989651 0.3104736
 [9] 1.2026790 0.8543951 1.0438012 5.5095891 0.7587579 1.9263300 6.0660176 9.3017992
[17] 1.0910204 0.6551285 1.5747176 5.9417700 0.8464761 7.6684436 0.1107589 1.6787699
[25] 2.4744338 3.3470232 0.3209082 4.4307811 4.5510434 1.4316870 0.3457547 0.1302476
[33] 0.5777305 1.0898631 1.4467458 3.2472808 1.8113195 0.5090032 2.4633656 0.8972205
[41] 0.7562905 2.4623634 0.3413955 2.3122374 0.4166320 2.6279765 1.5072294 3.5732947
[49] 3.5449348 2.6472542
> mean(expdata) # The MLE
[1] 2.267962
> hist(expdata)
```

Histogram of expdata
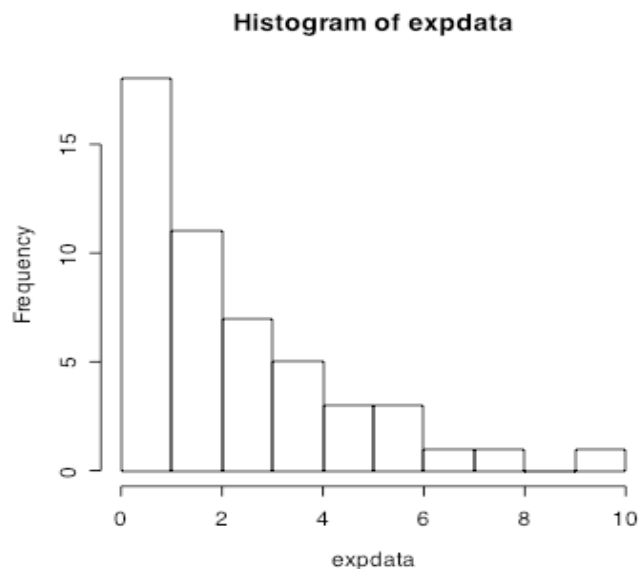
```
> # Linear Regression
> kars = read.table("http://www.utstat.toronto.edu/~brunner/appliedf12/data/mcars2.data")
> kars[1:10,] # Rows 1:10, all columns
   country    kpl weight length
1        1   5.04 2178.0 591.82
2        2  10.08 1026.0 431.80
3        1   9.24 1188.0 426.72
4        1   7.98 1444.5 510.54
5        1   7.98 1485.0 502.92
6        1   7.98 1485.0 502.92
7        3   9.66  972.0 436.88
8        1   7.56 1665.0 543.56
9        3   5.88 1539.0 487.68
10       1  10.92 1003.5 431.80


> modelkar = lm(kpl~weight+length,data=kars)
> summary(modelkar)

Call:
lm(formula = kpl ~ weight + length, data = kars)

Residuals:
     Min       1Q   Median       3Q      Max
-2.97979 -0.84152 -0.08533  0.84027  5.04694

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) 24.785719   2.693092   9.203 7.04e-15 ***
weight      -0.001616   0.001410  -1.146  0.25455
length      -0.028268   0.009270  -3.049  0.00296 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.643 on 97 degrees of freedom
Multiple R-Squared: 0.6291,   Adjusted R-squared: 0.6215
F-statistic: 82.26 on 2 and 97 DF,  p-value: < 2.2e-16

> weight = kars$weight; kpl = kars$kpl
> plot(weight,kpl)
```
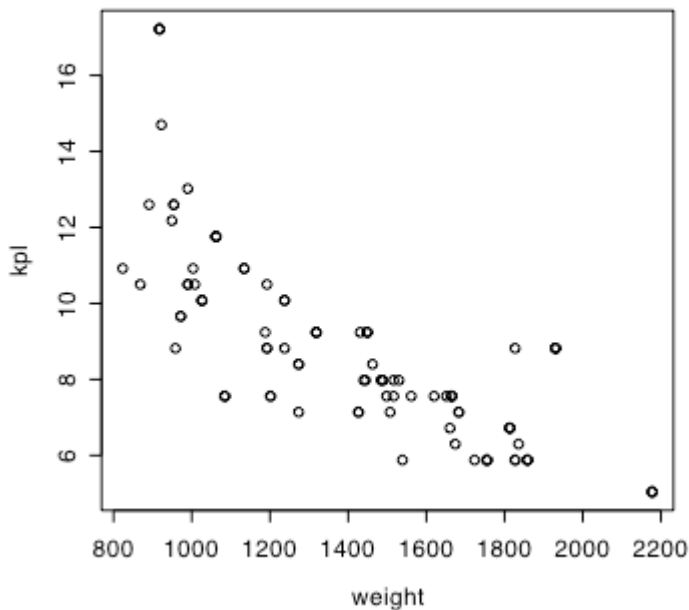
Going further on your own

Look at the free mini-book *An introduction to R* by Venables et al. A copy is available at http://www.utstat.toronto.edu/~brunner/help/R-intro.pdf. Or, try

```
> library(help="stats")
```

```
AIC                    Akaike's An Information Criterion
ARMAacf                Compute Theoretical ACF for an ARMA Process
ARMAtoMA               Convert ARMA Process to Infinite MA Process
Beta                   The Beta Distribution
Binomial               The Binomial Distribution
Box.test               Box-Pierce and Ljung-Box Tests
C                      Sets Contrasts for a Factor
Cauchy                 The Cauchy Distribution
Chisquare              The (non-central) Chi-Squared Distribution
Exponential            The Exponential Distribution
FDist                  The F Distribution
GammaDist              The Gamma Distribution
Geometric              The Geometric Distribution
HoltWinters            Holt-Winters Filtering
```

```
. . . list continues!
```

To see details on one of these packages, type something like

```
> help(t.test)
```

Generally, R's help assumes knowledge of the topic, but they often give references. For a quicker introduction to many statistical topics, try the Wikipedia:

<div align="center">

http://en.wikipedia.org

</div>

Or you could ask me, but I might have to look in the Wikipedia.