```
R version 3.4.1 (2017-06-30) -- "Single Candle"
Copyright (C) 2017 The R Foundation for Statistical Computing
Platform: x86_64-w64-mingw32/x64 (64-bit)

R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
Type 'license()' or 'licence()' for distribution details.

  Natural language support but running in an English locale

R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

> (Name <- "Dilip Lalwani")
[1] "Dilip Lalwani"
> Sys.time()
[1] "2017-09-02 17:47:20 CDT"
> help.start()
starting httpd help server ... done
If nothing happens, you should open
‘http://127.0.0.1:18900/doc/html/index.html’ yourself
> x <- rnorm(50)
> y <- rnorm(x)
```

```
> plot(x, y)
> ls()
[1] "Name" "x"    "y"
> rm(x, y)
> x <- 1:20
> w <- 1 + sqrt(x)/2
> dummy <- data.frame(x=x, y= x + rnorm(x)*w)
> dummy
   x         y
1   1 -1.4843134
2   2 -0.5085761
3   3  0.4547670
4   4  3.3682265
5   5  2.8191620
6   6  6.5935203
7   7  7.4425468
8   8 10.3159952
9   9 11.5355121
10 10  7.5071793
11 11 11.9684244
12 12  3.6365454
13 13 14.2159602
14 14 16.5024358
15 15 16.5054442
16 16 22.1532957
17 17 15.4224216
18 18 21.9985925
19 19 18.6046195
20 20 16.9779585
```

```
> fm <- lm(y ~ x, data=dummy)
> summary(fm)

Call:
lm(formula = y ~ x, data = dummy)

Residuals:
   Min     1Q Median     3Q    Max
-8.380 -1.306  0.778  1.629  5.561

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  -1.7075     1.4470  -1.180    0.253
x             1.1437     0.1208   9.468 2.06e-08 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 3.115 on 18 degrees of freedom
Multiple R-squared:  0.8328,    Adjusted R-squared:  0.8235
F-statistic: 89.65 on 1 and 18 DF,  p-value: 2.056e-08

> fm1 <- lm(y ~ x, data=dummy, weight=1/w^2)
> summary(fm1)

Call:
lm(formula = y ~ x, data = dummy, weights = 1/w^2)

Weighted Residuals:
    Min      1Q  Median      3Q     Max
```

```
-3.0835 -0.5146  0.3243  0.7259  1.7836


Coefficients:
          Estimate Std. Error t value Pr(>|t|)
(Intercept)  -2.1644     1.0205  -2.121   0.0481 *
x             1.1854     0.1041  11.392 1.16e-09 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1


Residual standard error: 1.128 on 18 degrees of freedom
Multiple R-squared:  0.8782,    Adjusted R-squared:  0.8714
F-statistic: 129.8 on 1 and 18 DF,  p-value: 1.161e-09


> attach(dummy)
The following object is masked _by_ .GlobalEnv:


   x


> lrf <- lowess(x, y)
> plot(x, y)
> lines(x, lrf$y)
> abline(0, 1, lty=3)
> abline(coef(fm))
> abline(coef(fm1), col = "red")
> detach()
> plot(fitted(fm), resid(fm), xlab="Fitted values",ylab="Residuals",main="Residuals vs Fitted")
> qqnorm(resid(fm), main="Residuals Rankit Plot")
> rm(fm, fm1, lrf, x, dummy) '
+
```

```
+ rm(fm, fm1, lrf, x, dummy)
+ >
+ s,dm,s
+ rm(fm, fm1, lrf, x, dummy)

+ > rm(fm, fm1, lrf, x, dummy)
> filepath <- system.file("data", "morley.tab" , package="datasets")
> filepath
[1] "C:/PROGRA~1/R/R-34~1.1/library/datasets/data/morley.tab"
> file.show(filepath)
> mm <- read.table(filepath)
> mm
    Expt Run Speed
001    1   1   850
002    1   2   740
003    1   3   900
004    1   4  1070
005    1   5   930
006    1   6   850
007    1   7   950
008    1   8   980
009    1   9   980
010    1  10   880
011    1  11  1000
012    1  12   980
013    1  13   930
014    1  14   650
015    1  15   760
016    1  16   810
```

017 1 17 1000

018 1 18 1000

019 1 19 960

020 1 20 960

021 2 1 960

022 2 2 940

023 2 3 960

024 2 4 940

025 2 5 880

026 2 6 800

027 2 7 850

028 2 8 880

029 2 9 900

030 2 10 840

031 2 11 830

032 2 12 790

033 2 13 810

034 2 14 880

035 2 15 880

036 2 16 830

037 2 17 800

038 2 18 790

039 2 19 760

040 2 20 800

041 3 1 880

042 3 2 880

043 3 3 880

044 3 4 860

045 3 5 720

046 3 6 720

047 3 7 620

048 3 8 860

049 3 9 970

050 3 10 950

051 3 11 880

052 3 12 910

053 3 13 850

054 3 14 870

055 3 15 840

056 3 16 840

057 3 17 850

058 3 18 840

059 3 19 840

060 3 20 840

061 4 1 890

062 4 2 810

063 4 3 810

064 4 4 820

065 4 5 800

066 4 6 770

067 4 7 760

068 4 8 740

069 4 9 750

070 4 10 760

071 4 11 910

072 4 12 920

073 4 13 890

074 4 14 860

075 4 15 880

076 4 16 720

077 4 17 840

078 4 18 850

079 4 19 850

080 4 20 780

081 5 1 890

082 5 2 840

083 5 3 780

084 5 4 810

085 5 5 760

086 5 6 810

087 5 7 790

088 5 8 810

089 5 9 820

090 5 10 850

091 5 11 870

092 5 12 870

093 5 13 810

094 5 14 740

095 5 15 810

096 5 16 940

097 5 17 950

098 5 18 800

099 5 19 810

100 5 20 870

```
> mm$Expt <- factor(mm$Expt)
> mm$Run <- factor(mm$Run)
> attach(mm)
```

```
> plot(Expt, Speed, main="Speed of Light Data", xlab="Experiment No.")
> fm <- aov(Speed ~ Run + Expt, data=mm)
> summary(fm)
            Df Sum Sq Mean Sq F value  Pr(>F)
Run         19 113344    5965   1.105 0.36321
Expt         4  94514   23629   4.378 0.00307 **
Residuals   76 410166    5397
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
> fm0 <- update(fm, . ~ . - Run)
> anova(fm0, fm)
Analysis of Variance Table

Model 1: Speed ~ Expt
Model 2: Speed ~ Run + Expt
  Res.Df    RSS Df Sum of Sq      F Pr(>F)
1     95 523510
2     76 410166 19    113344 1.1053 0.3632
> detach()
> rm(fm, fm0)
> x <- seq(-pi, pi, len=50)
> y <- x
> f <- outer(x, y, function(x, y) cos(y)/(1 + x^2))
> oldpar <- par(no.readonly = TRUE)
> par(pty="s")
> contour(x, y, f)
> contour(x, y, f, nlevels=15, add=TRUE)
> fa <- (f-t(f))/2
> contour(x, y, fa, nlevels=15)
```

```
> par(oldpar)
> image(x, y, f)
> image(x, y, fa)
> objects(); rm(x, y, f, fa)
[1] "f"        "fa"       "filepath" "mm"       "Name"     "oldpar"   "w"
[8] "x"        "y"
> th <- seq(-pi, pi, len=100)
> z <- exp(1i*th)
> par(pty="s")
> plot(z, type="l")
> w <- rnorm(100) + rnorm(100)*1i
> w <- ifelse(Mod(w) > 1, 1/w, w)
> plot(w, xlim=c(-1,1), ylim=c(-1,1), pch="+",xlab="x", ylab="y")
> lines(z)
> w <- sqrt(runif(100))*exp(2*pi*runif(100)*1i)
> plot(w, xlim=c(-1,1), ylim=c(-1,1), pch="+", xlab="x", ylab="y")
> lines(z)
>
```