```r
#Sign Test
library(BSDA)

## Loading required package:  lattice
##
## Attaching package:  'BSDA'
## The following object is masked from 'package:datasets':
##
##     Orange

x<-c(132, 134, 138, 139, 142, 132, 140, 136, 135,
     140, 139, 132, 131, 136, 138)
SIGN.test(x, md = 135, alternative="two.sided",
          conf.level = 0.95)

##
##  One-sample Sign-Test
##
## data:  x
## s = 9, p-value = 0.424
## alternative hypothesis: true median is not equal to 135
## 95 percent confidence interval:
##  132.3563 139.0000
## sample estimates:
## median of x
##         136
##
## Achieved and Interpolated Confidence Intervals:
##
##                   Conf.Level   L.E.pt U.E.pt
## Lower Achieved CI     0.8815 134.0000    139
## Interpolated CI       0.9500 132.3563    139
## Upper Achieved CI     0.9648 132.0000    139
```

```r
#library(BSDA)
#Signed Rank test or Wilcoxon Signed Rank Test
sh<-c(2053.5, 2061.3, 2158.7, 2165.2, 2200.5, 2207.5, 1784.7,
      1779.8, 1765.3, 1753.7, 2256.7, 1708.3, 2316, 1678.15,
      2336.75, 2357.9, 2399.55, 2414.4, 2575.1, 2654.2)
wilcox.test(sh, mu=2000, alternative="two.sided",
            conf.level = 0.95)

##
##  Wilcoxon signed rank exact test
##
```

```
## data:  sh
## V = 150, p-value = 0.09731
## alternative hypothesis: true location is not equal to 2000
```

```
library(BSDA)
y <- c(7.8, 6.6, 6.5, 7.4, 7.3, 7.0, 6.4, 7.1, 6.7, 7.6, 6.8)
SIGN.test(y, md = 6.5)

##
##  One-sample Sign-Test
##
## data:  y
## s = 9, p-value = 0.02148
## alternative hypothesis: true median is not equal to 6.5
## 95 percent confidence interval:
##  6.571273 7.457455
## sample estimates:
## median of x
##           7
##
## Achieved and Interpolated Confidence Intervals:
##
##                   Conf.Level L.E.pt U.E.pt
## Lower Achieved CI     0.9346 6.6000 7.4000
## Interpolated CI       0.9500 6.5713 7.4575
## Upper Achieved CI     0.9883 6.5000 7.6000
```

```
library(BSDA)
z<-c(9.4, 13.4, 15.6, 16.2, 16.4, 16.8, 18.1, 18.7, 18.9, 19.1,
     19.3, 20.1, 20.4, 21.6, 21.9, 23.4, 23.5, 24.8, 24.9, 26.8)
SIGN.test(z, md=22, alternative="less")

##
##  One-sample Sign-Test
##
## data:  z
## s = 5, p-value = 0.02069
## alternative hypothesis: true median is less than 22
## 95 percent confidence interval:
##      -Inf 21.66216
## sample estimates:
## median of x
##        19.2
##
```

```
## Achieved and Interpolated Confidence Intervals:
##
##                   Conf.Level L.E.pt  U.E.pt
## Lower Achieved CI     0.9423   -Inf 21.6000
## Interpolated CI       0.9500   -Inf 21.6622
## Upper Achieved CI     0.9793   -Inf 21.9000
```

```
library(BSDA)
# Sign Test for Paired Samples
x<-c(85, 89, 78, 72, 68, 65, 78, 75, 79, 78, 82, 85, 84, 73)
y<-c(88, 79, 85, 80, 75, 62, 79, 80, 85, 75, 80, 88, 85, 75)
SIGN.test(x, y, md = 0, alternative = "two.sided", paired=TRUE,
          conf.level = 0.95)

##
##  Dependent-samples Sign-Test
##
## data:  x and y
## S = 4, p-value = 0.1796
## alternative hypothesis: true median difference is not equal to 0
## 95 percent confidence interval:
##  -6.165934  2.165934
## sample estimates:
## median of x-y
##          -2.5
##
## Achieved and Interpolated Confidence Intervals:
##
##                   Conf.Level  L.E.pt U.E.pt
## Lower Achieved CI     0.9426 -6.0000 2.0000
## Interpolated CI       0.9500 -6.1659 2.1659
## Upper Achieved CI     0.9871 -7.0000 3.0000
```

```
# MANN{WHITNEY{WILCOXON RANK SUM TEST
x<-c(50.5, 37.5, 49.8, 56.5, 42, 56, 50, 54, 48)
length(x)

## [1] 9

y<-c(57, 52, 51, 44.2, 55, 62, 59, 45.2, 53.5, 44.4)
length(y)

## [1] 10
```

```r
wilcox.test(x, y, alternative = "two.sided", conf.level = 0.95,
            exact = TRUE, correct = FALSE, paired = FALSE)
```

```
##
##  Wilcoxon rank sum exact test
##
## data:  x and y
## W = 32, p-value = 0.3154
## alternative hypothesis: true location shift is not equal to 0
```

```r
# Wilcoxon-Singed Rank Test -Paired Sample
wx<-c(17.6,     19.4,   19.5,   17.1,   15.3,   15.9,   16.3,   18.4,   17.3,   19.1, 17.8,
wy<-c(16.8,     20,     18.2,   16.4,   16,     15.4,   16.5,   18,     16.4,   20.1, 16.7,
wilcox.test(wx, wy, alternative = "two.sided", conf.level = 0.95, exact = TRUE, correct = TR
```

```
##
##  Wilcoxon signed rank exact test
##
## data:  wx and wy
## V = 56, p-value = 0.2036
## alternative hypothesis: true location shift is not equal to 0
```

```r
SIGN.test(wx, wy, md = 0, alternative = "greater", paired=TRUE,
          conf.level = 0.95)
```

```
##
##  Dependent-samples Sign-Test
##
## data:  wx and wy
## S = 8, p-value = 0.1938
## alternative hypothesis: true median difference is greater than 0
## 95 percent confidence interval:
##  -0.3712727        Inf
## sample estimates:
## median of x-y
##          0.45
##
## Achieved and Interpolated Confidence Intervals:
##
##                   Conf.Level  L.E.pt U.E.pt
## Lower Achieved CI     0.9270 -0.2000    Inf
## Interpolated CI       0.9500 -0.3713    Inf
## Upper Achieved CI     0.9807 -0.6000    Inf
```

```r
#Example -2
wx1<-c(5.02,    5.08,   4.75,   5.25,   4.8,    5.77,   4.85,   5.09,   6.05,   4.77)
wy1<-c(4.66,    5.15,   4.3,    5.07,   5.38,   5.1,    4.8,    4.91,   5.22,   4.5)
wilcox.test(wx1, wy1, alternative = "two.sided", conf.level = 0.95, exact = FALSE, correct =

##
##  Wilcoxon signed rank test with continuity correction
##
## data:  wx1 and wy1
## V = 45, p-value = 0.08293
## alternative hypothesis: true location shift is not equal to 0
```

```r
# MANN-WHITNEY WILCOXON U TEST
a1<-c(920, 840, 780, 850, 830, 930, 800, 860, 760, 730, 740, 680, 670, 540, 710)
b1<-c(870, 890, 620, 650, 700, 720, 750, 660, 810, 790, 950,  690, 640, 600, 770)
wilcox.test(a1, b1, alternative = "two.sided", exact = FALSE, paired = FALSE)

##
##  Wilcoxon rank sum test with continuity correction
##
## data:  a1 and b1
## W = 139, p-value = 0.2808
## alternative hypothesis: true location shift is not equal to 0
```

```r
ax<-c(1,2,3,5,7,9,11,18)
ay<-c(4,6,8,10,12,13,14,15,19)
wilcox.test(ax, ay, alternative = "two.sided", exact = NULL, correct= TRUE, paired = FALSE)

##
##  Wilcoxon rank sum exact test
##
## data:  ax and ay
## W = 18, p-value = 0.09272
## alternative hypothesis: true location shift is not equal to 0
```

```r
b1<-c(80, 100, 90, 110, 125, 130, 70)
b2<-c(100, 120, 80, 140, 130, 160, 115, 120)
ks.test(b1, b2)

##
##  Exact two-sample Kolmogorov-Smirnov test
##
## data:  b1 and b2
```

```
## D = 0.46429, p-value = 0.292
## alternative hypothesis: two-sided
```

```
b11<-c(22.1,    30.6,   17.8,   28.5,   19.3,   21.4,   18.9,   30.2)
b21<-c(19.8,    26.7,   30.8,   27.4,   34.2,   18.7,   16.9,   17.9)
ks.test(b11, b21)

##
##  Exact two-sample Kolmogorov-Smirnov test
##
## data:  b11 and b21
## D = 0.25, p-value = 0.9801
## alternative hypothesis: two-sided
```

```
# DescTools - package
# Run test
library(DescTools)

## Warning:  package 'DescTools' was built under R version 4.4.2

ra<-c(11, 15, 17, 19, 25, 27, 31, 33)
rb<-c(12, 16, 20, 22, 28, 30, 36, 38, 42)
RunsTest(ra, rb, exact = TRUE, alternative = "two.sided")

##
##  Wald-Wolfowitz Runs Test
##
## data:  ra and rb
## runs = 10, m = 8, n = 9, p-value = 0.8186
## alternative hypothesis: true number of runs is not equal the expected number
```

```
r3<-c(21.02, 20.08, 20.05, 19.70, 19.13, 17.09, 20.09, 19.40,20.56, 20.97, 20.17, 21.35, 19.
RunsTest(r3, exact=TRUE, alternative = "two.sided")

##
##  Runs Test for Randomness
##
## data:  r3
## runs = 6, m = 12, n = 12, p-value = 0.005566
## alternative hypothesis: true number of runs is not equal the expected number
## sample estimates:
## median(x)
##     20.13
```

```r
x<-c(5.02,      5.08,   4.75,   5.25,   4.80,   5.77,   4.85,   5.09,   6.05,   4.77)
y<-c(4.66,      5.15,   4.30,   5.07,   5.38,   5.10,   4.80,   4.91,   5.22,   4.5)
SIGN.test(x, y, md = 0, alternative = "two.sided", paired =TRUE)

##
##  Dependent-samples Sign-Test
##
## data:  x and y
## S = 8, p-value = 0.1094
## alternative hypothesis: true median difference is not equal to 0
## 95 percent confidence interval:
##  -0.03106667  0.59862222
## sample estimates:
## median of x-y
##         0.225
##
## Achieved and Interpolated Confidence Intervals:
##
##                   Conf.Level  L.E.pt U.E.pt
## Lower Achieved CI     0.8906  0.0500 0.4500
## Interpolated CI       0.9500 -0.0311 0.5986
## Upper Achieved CI     0.9785 -0.0700 0.6700
```