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#ST204 Tutorial – Colm Mooney - 20325583

library(BSDA)

#(1)

X <- c(1.2,-0.3,4.6,7.8,2.1)

?wilcox.test


wilcox.test(X)


wilcox.test(X, alternative = "two.sided" )

#We fail to reject H0, because the p-value is greater than 0.05

#p-value is 0.125



#2.

#It's hypothesised that the true population median is 69.

#(a) For this data, would using the sign test or the Wilcoxon signed-rank test approach be more
appropriate for constructing a confidence interval for the median? You may use R as a guide.

rainfall <- c(54, 73, 75, 58, 69, 72, 63, 72, 66, 57, 69, 84, 73, 63, 62, 69, 78, 68, 48, 49, 71, 75, 76, 70,
70, 82, 71, 78, 51, 51, 85, 67, 78, 84,)

rainfall

?wilcox.test

?SIGN.test

wilcox.test(rainfall, md = 69)                #p-value = 3.791e-07

wilcox.test(rainfall, md = 69, conf.level = 0.95)#p-value = 3.791e-07

SIGN.test(rainfall, md = 69)                  #p-value = 0.4731

SIGN.test(rainfall, md = 69, conf.level = 0.95)  #p-value = 0.4731

#95% confidence interval: 66.77143 73.00000 for SIGN.test

#It is better to use the SIGN test for constructing a confidence interval for the median


#(b) Using R, construct a confidence interval with at least 99% coverage for the median using the

#most appropriate method identified in (a). Interpret the CI and state the exact confidence

#level achieved.
```

```
?SIGN.test

SIGN.test(rainfall, md = 69, conf.level = 0.99)

#The 99% confidence interval is between 63.18843 and 74.87438. The confidence level is 0.99



#(c) Are there any potential problems with the computed confidence interval for this data?

#The median is actually 70. True Median is not equal to 69. Other than that, the confidendence, the size of the interval is 11.68

#Making it a very large interval.



#3. The survival times in weeks of ten patients suffering from a serious disease were recorded during a

#medical study as: 49, 58, 75, 110, 112, 132, 151, 276, 281, 362.

#Answer the questions below by hand, using the statistical tables provided on Moodle where necessary.

#(a) Use a sign test to test the hypothesis that the median survival time, θ, differs from 200. You

#must calculate the p-value by hand. State your conclusion.

#Fail to reject H0, no evidence to suggest that true survival time differs from 200.

?binom.test

n = 10

Values <- c(49,58,75,110,112,132,151,276,281,362)

Successes <- 3

binom.test(3, 10, alternative ="two.sided", conf.level =0.95) #p-value = 0.3438

#(b) Repeat the above test using the normal approximation to the sign test. Do you reach the same

#conclusion?

?SIGN.test

SIGN.test(3,10, alternative = "two.sided", conf.level = 0.95)  #1.96
```

#4. The average energy expenditures for eight elderly women were estimated on the basis of information

#received from a battery powered heart rate monitor that each subject wore. Two overall averages

#were calculated for each woman, one for the summer months and one for the winter months. Here

#is the dataset:

Subject, i 1 2 3 4 5 6 7 8

#Summer, xi 1458 1553 2209 1804 1912 1366 1686 1556

#Winter, yi 1424 1103 1495 1739 2031 934 1401 1339

```
i <- c(1,2,3,4,5,6,7,8)

xi <- c(1458, 1553 ,2209, 1804, 1912, 1366, 1686, 1556)

yi <- c(1424 ,1103 ,1495 ,1739, 2031, 934, 1401, 1339)
```

#(a) Is there evidence of a difference in energy consumption between the two seasons, according to

#the Wilcoxon signed-rank test?

```
?wilcox.test

difference <- xi - yi

wilcox.test(difference, mu = 0, alternative = "greater")
```

#Yes there is evidence of a differency in energy consumption between the two seasons.

#(b) Give one reason why you think such a test is appropriate to use for these data.

#It's important the women have enough batteries for the Summer, highlights the fact more energy is used during Summer.

#This is most likely due to the good weather and holidays allowing them to partake in more activities than ones done in the winter.

#(c) Verify that [65, 441] is an approximate 90% confidence interval for the median population

#difference using the normal approximation to the Wilcoxon distribution, this time without

#using the continuity correction.

```
?wilcox.test
```

```
wilcox.test(difference, mu = 0, alternative = "greater",conf.int=TRUE, conf.level = .90)
#It's close enough. The Pseudo Median is 249.75 And the middle value in [65,441] is 253.
```