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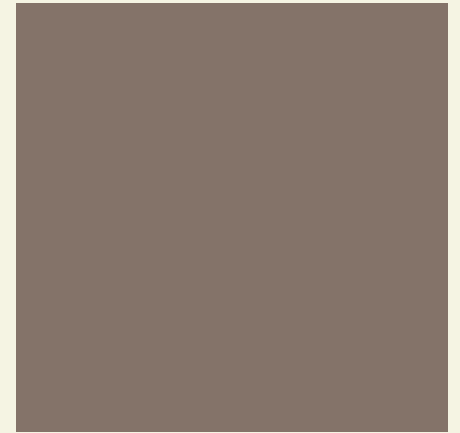
# ICCPP-STATISTICS

- Sign test

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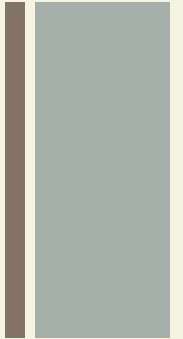


# John Arbuthnot (1667-1735)

Sign Test



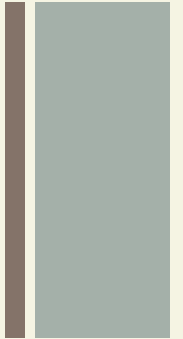
# Definition



- The sign test compares the sizes of two groups. It is a non-parametric test, which means the test doesn't assume the data comes from a particular distribution.



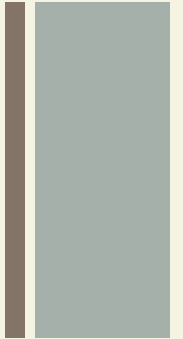
# Sign Test



- The sign test is a statistical method to test for consistent differences between pairs of observations.

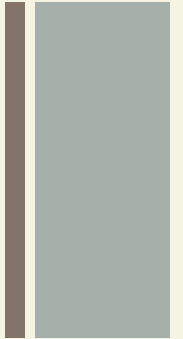


## Uses



- The sign test is used to test the null hypothesis that the median of a distribution is equal to some value.
- It can be used
  - a) in place of a one-sample t-test
  - b) in place of a paired t-test or
  - c) for ordered categorical data where a numerical scale is inappropriate but where it is possible to rank the observations.

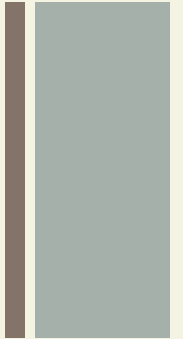
# + Assumptions



1.

The data should be from two samples.

# + Assumptions

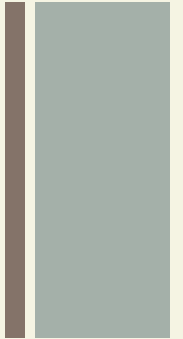


## 2.

The two dependent samples should be paired or matched. For example, depression scores from before a medical procedure and after.



# How to Calculate

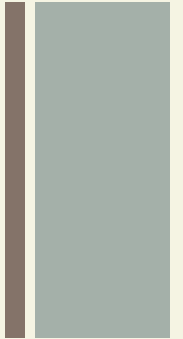


To set up the test, put your two sets of sample data into a table (I used Excel). This set of data represents test scores at the end of Spring and the beginning of the Fall semesters. The hypothesis is that the summer break means a significant drop in test scores.



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# How to Calculate



H0: No difference in median of the signed differences.

H1: Median of the signed differences is less than zero.



# Solution Step Wise

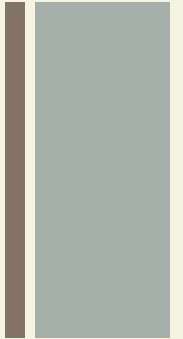
## Step 1

Subtract set 2 from set 1 and put the result in the third column.

#	Set 1	Set 2	Set 1 – Set 2	Sign
1	443	57	386	+
2	421	352	69	+
3	436	587	-151	-
4	376	415	-39	-
5	458	458	0	NA
6	408	424	-16	-
7	422	463	-41	-
8	431	583	-152	-
9	459	432	27	+
10	369	379	-10	-
11	360	370	-10	-
12	431	584	-153	-
13	403	422	-19	-
14	436	587	-151	-
15	376	415	-39	-
16	370	419	-49	-
17	443	57	386	+

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# Solution Step Wise

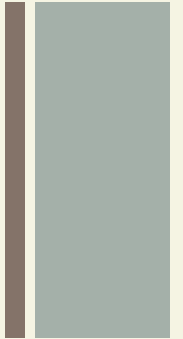


## Step 2

Add a fourth column indicating the sign of the number in column 3.



# Solution Step Wise



## Step 3

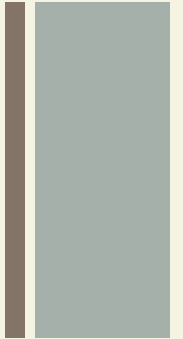
Count the number of positives and negatives.

- 4 positives.
- 12 negatives.

12 negatives seems like a lot, but we can't say for sure that it's significant (i.e. that it didn't happen by chance) until we run the sign test.



# Solution Step Wise



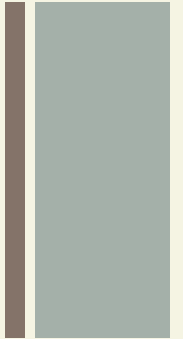
## Step 4

Add up the number of items in your sample and subtract any you had a difference of zero for (in column 3).

The sample size in this question was 17, with one zero, so  $n = 16$ .



# Solution Step Wise



## Step 5\_1

Find the p-value using a binomial distribution table or use a binomial calculator.

I used the calculator, putting in:

- .5 for the probability. The null hypothesis is that there are an equal number of signs (i.e. 50/50). Therefore, the test is a simple binomial experiment with a .5 chance of the sign being negative and .5 of it being positive (assuming the null hypothesis is true).

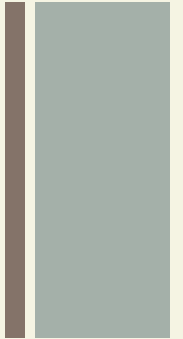
# + Solution Step Wise

## Step 5\_2

- 16 for the number of trials
- 4 for the number of successes. “Successes” here is the smaller of either the positive or negative signs from Step 2



# Solution Step Wise



## Step 6

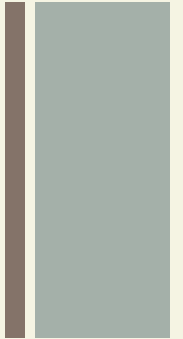
The p-value is 0.038, which is smaller than the alpha level of 0.05.

We can reject the null hypothesis and say there is a significant difference.





# References



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