

Fact Sheet – Paired Difference Test (11.2)

This test is used to compare the difference between paired data. There must be a one-to-one relationship between one value in the first sample and one value in the second sample. n represents the number of pairs in the sample.

Example: Student scores improve from the “by hand” version of an exam to the “StatCrunch” version of the exam.

Conditions

To test hypotheses regarding paired quantitative data, the following two conditions must be met.

- The differences between the paired data come from a population that is normally distributed (QQ Plot) and has no outliers (Boxplot) **OR** the sample size is at least 30 ($n \geq 30$)
- $20n \leq N$

Hypothesis Test

Step 1

You must identify which direction you will be subtracting: $d = A - B$.

The null hypothesis will be $\mu_d = 0$. H_1 will be either $\mu_d < 0$, $\mu_d > 0$, or $\mu_d \neq 0$.

Step 3

The test statistic is $t = \frac{\bar{d}}{\left(\frac{s_d}{\sqrt{n}}\right)}$.

Just write “Paired Difference Test”, rather than writing the test statistic.

Step 4

To compute the test statistic and P-value using StatCrunch ...

Enter the data in two columns.

Stat > T Statistics > Paired

Select the correct column for each sample. Select the “Save Differences” box. Click Next.

Leave the value for null: mean diff. as 0. Select the appropriate sign for H_1 . Click Calculate.

Once you have calculated the test statistic and P -value, you must construct the QQ plot & boxplot for the “Differences” column.

Classroom Examples (11.2)

1) Here are the prices of a dose of 10 medications in Canada and the United States.

Drug	Canada	United States
Prilosec	\$1.47	\$3.31
Prozac	\$1.07	\$2.27
Lipitor	\$1.34	\$2.54
Prevacid	\$1.34	\$3.13
Epogen	\$21.44	\$23.40
Zocor	\$1.47	\$3.16
Zoloft	\$1.07	\$1.98
Zyprexa	\$3.39	\$5.27
Claritin	\$1.11	\$1.96
Paxil	\$1.13	\$2.22

At the 0.05 level of significance, test the claim that prescription medications cost less in Canada than in the United States.

2) Here are the number of free throws attempted by the home team and the away team in 13 randomly selected NBA games.

Home Team

28 27 34 26 29 30 34 27 37 16 46 48 29

Away Team

26 31 27 14 21 22 18 23 27 30 53 43 28

At the 0.05 level of significance, test the claim that there is no difference between the number of free throws for the home team and the away team.

3) Here are the midterm exam scores of 20 algebra students, along with their score on the final exam.

Student	Midterm	Final	Student	Midterm	Final
1	65	85	11	38	56
2	50	77	12	92	95
3	75	90	13	59	60
4	70	84	14	66	87
5	68	61	15	61	83
6	58	70	16	71	77
7	49	76	17	68	79
8	92	78	18	82	74
9	68	80	19	85	94
10	93	92	20	67	80

At the 0.05 level of significance, test the claim that student's scores improve from the midterm to the final.