Compare variances by F-test alpha=0.05

sample 1	sample 2
10,23	12,19
10,3	10,15
11,55	11,2
12,1	12,23
11,11	10,58
12,5	12,65
13,21	13,01
13,65	13,2
12	
10,98	

$$F = \frac{s_1{}^2}{s_2{}^2}$$

Equality test

At the beginning of your diploma thesis work, you had obtained replicate measurements "old". After five
Test on confidence level alpha=0.05 if the new data are equal to the old ones.

new	old
5,09	5,10
5,46	5,60
4,17	4,60
4,83	5,10
4,50	5,00
4,93	5,60
4,13	4,60
4,62	5,00
5,03	5,40
4,54	4,90
5,00	5,10
5,68	5,90
5,02	5,50
4,79	5,20
	5,20
	5,40
	4,60
	5,10
	4,60

$$T = \frac{\bar{Y}_1 - \bar{Y}_2}{\sqrt{s_1^2/N_1 + s_2^2/N_2}}$$

$$\nu = \frac{(s_1^2/N_1 + s_2^2/N_2)^2}{(s_1^2/N_1)^2/(N_1-1) + (s_2^2/N_2)^2/(N_2-1)}$$

where N_1 and N_2 are the sample sizes, $\bar{Y}_1$ and $\bar{Y}_2$ are the sample means, and
s_2^2 are the sample variances.

If equal variances are assumed, then

$$T = \frac{\bar{Y}_1 - \bar{Y}_2}{s_p\sqrt{1/N_1 + 1/N_2}} \qquad s_p^2 = \frac{(N_1-1)s_1^2 + (N_2-1)s_2^2}{N_1 + N_2 - 2}$$

$$\nu = N_1 + N_2 - 2$$

=N
=variance
=mean

e month you repeated the experiments and got "new".

http://www.itl.nist.gov/div898/handbook/eda/sectio

$$/(N_2 - 1)$$

$\bar{Y}_2$ are the sample means, and s_1^2 and

$$- 1)s_1^2 + (N_2 - 1)s_2^2 \over N_1 + N_2 - 2$$

n3/eda353.htm

Decide, if the two following data sets belong to the same population.

set1	set2	Grubbs
16,38	16,84	
16,15	15,46	
19,1	14,41	
12,45	18,1	
19,28	16,99	
20,12	15,11	
18,85	15,1	
18,1		
19		
17,77		

n	g_{crit} α=0.05
3	1.1543
4	1.4812
5	1.7150
6	1.8871
7	2.0200
8	2.1266
9	2.2150
10	2.2900
11	2.3547
12	2.4116
13	2.4620
14	2.5073

$$T = \frac{\bar{Y}_1 - \bar{Y}_2}{\sqrt{s_1^2/N_1 + s_2^2/N_2}}$$

$$v = \frac{(s_1^2/N_1 + s_2^2/\ldots}{(s_1^2/N_1)^2/(N_1-1) + (s_2^2\ldots}$$

where N_1 and N_2 are the sample sizes, ... s_2^2 are the sample variances.

If equal variances are assumed, then

$$T = \frac{\bar{Y}_1 - \bar{Y}_2}{s_p\sqrt{1/N_1 + 1/N_2}} \qquad s_p^2 \ldots$$

$$v = N_1 + N_2 - 2$$

There are no outliers in the data set
There is exactly one outlier in the data set
The Grubbs' test statistic is defined as:

$$G = \frac{\max|Y_i - \bar{Y}|}{s}$$

$$\frac{\bar{Y_1} - \bar{Y_2}}{\sqrt{s_1^2/N_1 + s_2^2/N_2}}$$

$$\frac{(s_1^2/N_1 + s_2^2/N_2)^2}{(s_1^2/N_1)^2/(N_1 - 1) + (s_2^2/N_2)^2/(N_2 - 1)}$$

$_1$ and N_2 are the sample sizes, $\bar{Y_1}$ and $\bar{Y_2}$ are the sample means, and s_1^2 and
e sample variances.

variances are assumed, then

$$\frac{\bar{Y_1} - \bar{Y_2}}{s_p\sqrt{1/N_1 + 1/N_2}} \qquad s_p^2 = \frac{(N_1 - 1)s_1^2 + (N_2 - 1)s_2^2}{N_1 + N_2 - 2}$$

$N_1 + N_2 - 2$

o outliers in the data set
actly one outlier in the data set
s' test statistic is defined as:

$$\frac{\max |Y_i - \bar{Y}|}{s}$$

One-sample t-test

A new analytical method for iron determination in blood was introduced. Replicates were obtainec
Decide, if the new method is reliable.

new method	reference method
11,23	
11,31	
11,55	
11,11	
11,14	
11,45	
11,21	
11,65	
11,95	
10,98	

11,11 =true value

Independent one-sample *t*-test

In testing the null hypothesis that the population mea

$$t = \frac{\overline{x} - \mu_0}{\frac{s}{\sqrt{n}}},$$

where s is the sample standard deviation of the samp l on a sample previously analyzed by a reference method.

an is equal to a specified value μ_0, one uses the statistic

ple and n is the sample size. The degrees of freedom used in this test is $n - 1$.

The normoglycaemia in healthy fasted subjects is considered to be 3.9-5.6 mmol / l. In diabetic pa
(which is the target of therapeutic intervention), the range of 6-7 mmol / l is judged satisfactory an
An effect of a drug on glycemia (glucoseemia) was tested on 16 subjects. Decide, if the drug has

	mmol/l before	mmol/l after
1	7,8	3,6
2	5,8	6,0
3	6,5	6,3
4	5,5	6,0
5	4,8	5,0
6	7,7	4,0
7	4,9	7,9
8	5,1	5,3
9	6,1	3,6
10	4,5	6,8
11	5,8	6,6
12	3,6	6,3
13	6,0	7,8
14	3,8	3,8
15	6,8	5,8
16	5,9	3,6

atients, the fasting range of 4-6 mmol / l is considered to be the optimal fasting blood glucose leve
d above 7 mmol / l the unsatisfactory blood glucose level
an effect.

Three pharmacies recorded their sales during a week.
Test, if there is a significant difference.

pharmacy A	pharmacy B	pharmacy C
55	54	47
54	50	53
58	51	49
61	51	50
52	49	46

T	grand mean
B	between groups
	MS
	d.o.f.
W	
	d.o.f.
	within groups
	MS

$$SS_T = \sum_j \sum_i (x_{ij} - \bar{x})^2$$

$$SS_W = \sum_j SS_j = \sum_j \sum_i (x_{ij} - \bar{x}_j)^2$$

$$SS_B = \sum_j n_j (\bar{x}_j - \bar{x})^2$$

?= 〖□□〗□ _?/ 〖□□〗□ _?

T
B
W

df	SS	MS
$n - 1$	$\sum_j \sum_i (x_{ij} - \bar{x})^2$	SS_T / df_T
$k - 1$	$\sum_j n_j (\bar{x}_j - \bar{x})^2$	SS_B / df_B
$n - k$	$\sum_j \sum_i (x_{ij} - \bar{x}_j)^2$	SS_W / df_W