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

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

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

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

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

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

=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

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

n3/eda353.htm

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

set1	set2
12,45	14,41
16,38	15,10
17,77	15,11
18,10	15,46
18,85	16,84
19,00	16,99
19,10	18,10
19,12	
19,15	
19,28	

Grubbs test

set1 n=10				set2
mean	17,9200			mean
stand. dev. (sample)	2,123247			stand. dev. (sample)
T1	2,5762429	T1<2,2900	NOT OK	
T10	0,6405284	T10<2,2900	OK	T1
				T10

set1 - n=9			
mean	18,5278		
stand. dev. (sample)	0,95709		
T1	2,2440731	T1<2,2150	NOT OK
T9	0,785948	T10<2,2150	OK

set1 - n=8			
mean	18,7963		
stand. dev. (sample)	0,5527		
T1	1,8566869	T1<2,1266	OK
T8	0,8751983	T10<2,1266	OK

12,45 and 16,38 are outliers because T10, respectively T9 values are higher than

F-test

8	7	= N
#NAME?	#NAME?	= variance (var.s) = s^2
18,7963	16,0014	= mean

H0: $s_1^2 = s_2^2$

F = #NAME?

Fcrit2 = #NAME? = F.INV.RT()

F < Fcrit2 >> H0 is accepted => variances are equal

H0: the means of the two samples are practically equal

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

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

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

16,001429
1,3239767

1,2020065 T1<2,0200 OK
1,5850516 T10<2,0200 OK

Gcrit.

t-test

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

$$v = \frac{(s_1^2}{(s_1^2/N_1)^2/(N_1}$$

where N_1 and N_2 are the
s_2^2 are the sample varianc

If equal variances are ass

$$T = \frac{\bar{Y_1} - \bar{Y_2}}{s_p\sqrt{1/N_1 + 1/}}$$

$$v = N_1 + N_2 - 2$$

dof =	13	degrees of freedom
s^2p =	#NAME?	
T =	#NAME?	#NAME?
Tcrit2 =	#NAME?	= t.ivn.2t()
	T > Tcrit2	>> H0 is rejected
		>> There is difference between new data and old data
		>> the data not come from the same population

$$T = \frac{Y_1 - Y_2}{s_p\sqrt{1/N_1 + 1/}}$$

$$v = N_1 + N_2 - 2$$

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

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

where N_1 and N_2 are the sample sizes, $\bar{Y_1}$ and $\bar{Y_2}$ are the sample means, and s_1^2 and s_2^2 are the sample variances.

If equal variances are assumed, then

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

$$v = N_1 + N_2 - 2$$

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

$$v = N_1 + N_2 - 2$$

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.

I

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