2))The normal population variance test and confidence interval.

2.1)The normal population variance test and confidence interval when population mean μ is knwon.

2.1.1)*two-tailed test* (*two-sided test*)：

(i) $H_0 : \sigma = \sigma_0 , H_1 : \sigma \neq \sigma_0$, σ_0 is known value.

(ii) $\alpha = P(reject \quad H_0 | H_0 : \sigma = \sigma_0)$

(iii) χ^2 test statistic, $\chi_n^2 = \dfrac{\sum_{i=1}^{n}(X_i - \mu)^2}{\sigma_0^2}$,

$$\frac{\sum_{i=1}^{n}(X_i - \mu)^2}{\sigma_0^2} < \chi^2_{\alpha/2,n}, \frac{\sum_{i=1}^{n}(X_i - \mu)^2}{\sigma_0^2} > \chi^2_{1-\alpha/2,n} \text{ is reject } H_0 .$$

(iv) $(1-\alpha)\times 100\% \quad C.I. \quad for \quad \sigma^2$

$$\frac{\sum_{i=1}^{n}(X_i - \mu)^2}{\chi^2_{\alpha/2,n}} \leq \sigma^2 \leq \frac{\sum_{i=1}^{n}(X_i - \mu)^2}{\chi^2_{1-\alpha/2,n}}$$

2.1.2)*right-tailed test* (*right-sided test*)：

(i) $H_0 : \sigma \leq \sigma_0 , H_1 : \sigma > \sigma_0$, σ_0 is known value.

(ii) $\alpha = P(reject \quad H_0 | H_0 : \sigma = \sigma_0)$

(iii) χ^2 test statistic, $\chi_n^2 = \dfrac{\sum_{i=1}^{n}(X_i - \mu)^2}{\sigma_0^2}$,

$$\frac{\sum_{i=1}^{n}(X_i - \mu)^2}{\sigma_0^2} > \chi^2_{\alpha,n} \text{ is reject } H_0 .$$

2.1.3)*left-tailed test* (*left-sided test*)：

(i) $H_0 : \sigma \geq \sigma_0 , H_1 : \sigma < \sigma_0$, σ_0 is known value.

(ii) $\alpha = P(reject \quad H_0 | H_0 : \sigma = \sigma_0)$

(iii) χ^2 test statistic, $\chi_n^2 = \dfrac{\sum_{i=1}^{n}(X_i - \mu)^2}{\sigma_0^2}$,

$$\frac{\sum_{i=1}^{n}(X_i - \mu)^2}{\sigma_0^2} < \chi^2_{1-\alpha,n} \text{ is reject } H_0 .$$

2.2)The normal population variance test and confidence interval when population mean μ is unknown.

2.2.1)*two-tailed test* (*two-sided test*)：

(i) $H_0 : \sigma = \sigma_0, H_1 : \sigma \neq \sigma_0$, σ_0 is known value.

(ii) $\alpha = P(reject \quad H_0 | H_0 : \sigma = \sigma_0)$

(iii) χ^2 test statistic, $\chi^2_{n-1} = \dfrac{\sum_{i=1}^{n}(X_i - \overline{X})^2}{\sigma_0^2}$,

$$\frac{\sum_{i=1}^{n}(X_i - \overline{X})^2}{\sigma_0^2} < \chi^2_{\alpha/2,n-1}, \frac{\sum_{i=1}^{n}(X_i - \overline{X})^2}{\sigma_0^2} > \chi^2_{1-\alpha/2,n-1} \text{ is reject } H_0.$$

(iv) $(1-\alpha)\times 100\% \quad C.I. \quad for \quad \sigma^2$

$$\frac{\sum_{i=1}^{n}(X_i - \overline{X})^2}{\chi^2_{\alpha/2,n-1}} \leq \sigma^2 \leq \frac{\sum_{i=1}^{n}(X_i - \overline{X})^2}{\chi^2_{1-\alpha/2,n-1}}$$

2.2.2)*right-tailed test* (*right-sided test*)：

(i) $H_0 : \sigma \leq \sigma_0, H_1 : \sigma > \sigma_0$, σ_0 is known value.

(ii) $\alpha = P(reject \quad H_0 | H_0 : \sigma = \sigma_0)$

(iii) χ^2 test statistic, $\chi^2_{n-1} = \dfrac{\sum_{i=1}^{n}(X_i - \overline{X})^2}{\sigma_0^2}$,

$$\frac{\sum_{i=1}^{n}(X_i - \overline{X})^2}{\sigma_0^2} > \chi^2_{\alpha,n-1} \text{ is reject } H_0.$$

1.5.3.3)*left-tailed test* (*left-sided test*)：

(i) $H_0 : \sigma \geq \sigma_0, H_1 : \sigma < \sigma_0$, σ_0 is known value.

(ii) $\alpha = P(reject \quad H_0 | H_0 : \sigma = \sigma_0)$

(iii) χ^2 test statistic, $\chi^2_{n-1} = \dfrac{\sum_{i=1}^{n}(X_i - \overline{X})^2}{\sigma_0^2}$,

$$\frac{\sum_{i=1}^{n}(X_i - \overline{X})^2}{\sigma_0^2} < \chi^2_{1-\alpha,n-1} \text{ is reject } H_0.$$

2.3)

3. One population sigma test , the population mu is known

there need input Ho sigma value and mu value

select 3:

The one population sigma test ,H0 sigma value, population mean value

H0: sigma= 5

population mean= 10

one sample population sigma test when mu is konwn

H0: sigma=5.000000 when mu=10.000000, chi-square test value(df=10)=0.002462

[The sample data X1 O.C. curve, P.F. and test value image]

~~~~~~~~~~~~~~ choose one ~~~~~~~~~~~~~~~~~

1. two tailes Operation characteristic curve
2. two tailes Power function
3. right tail Operation characteristic curve
4. right tail Power function
5. left tail Operation characteristic curve
6. left tail Power function
7. test value image
8. return

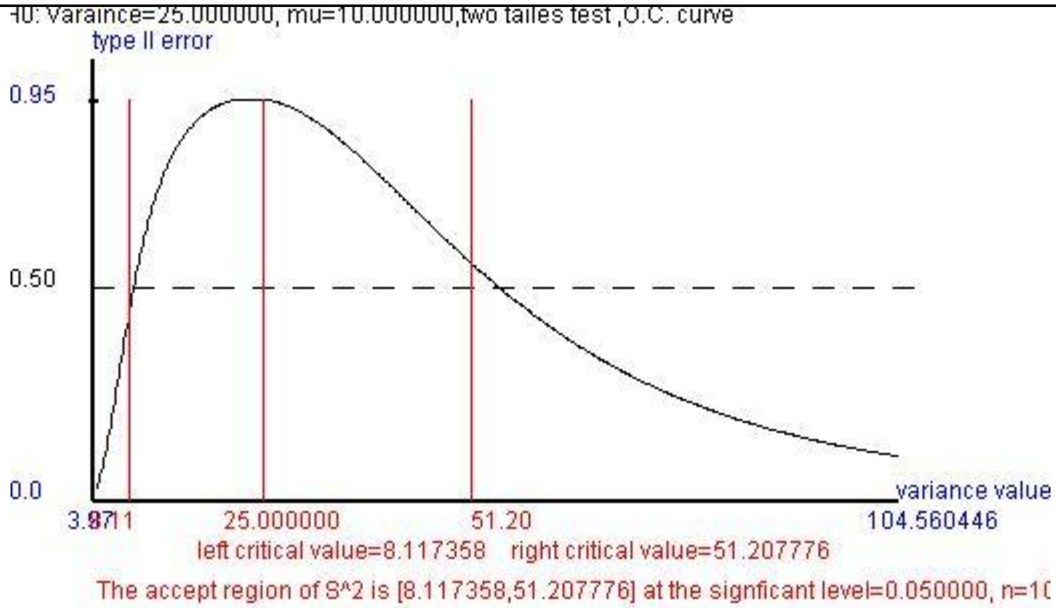
確定 取消

select 1:

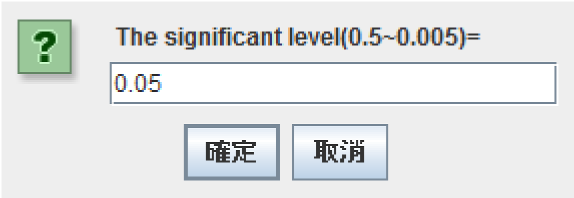
The significant level(0.5~0.005)=

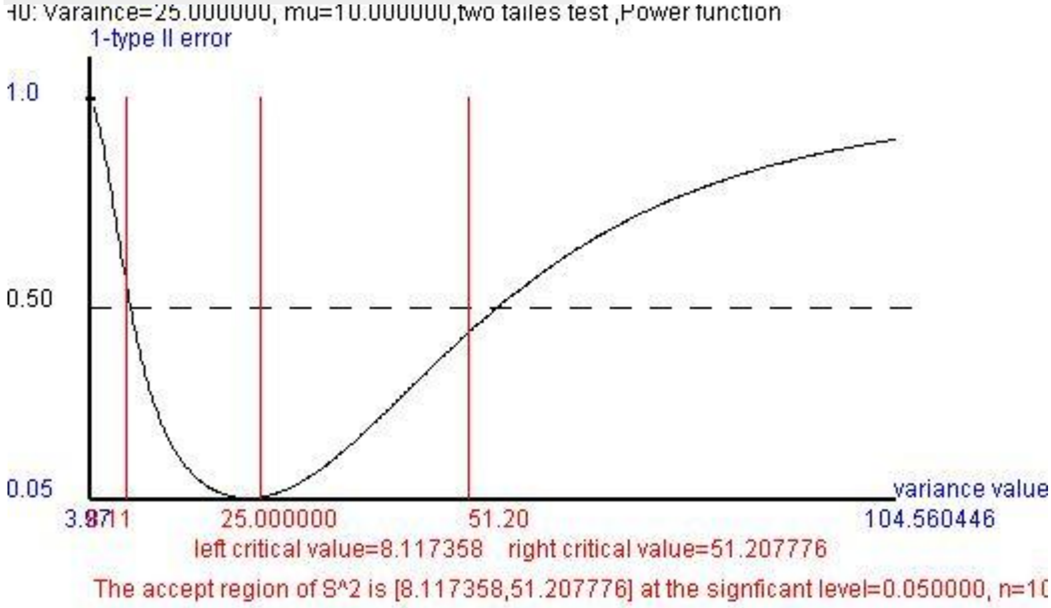
0.05

確定 取消
~~~~~~~~~~~~~~

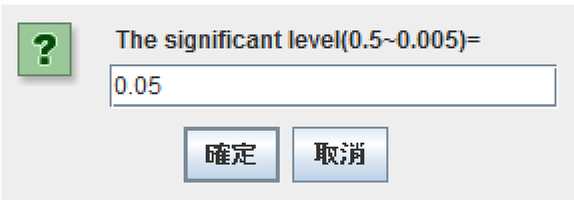


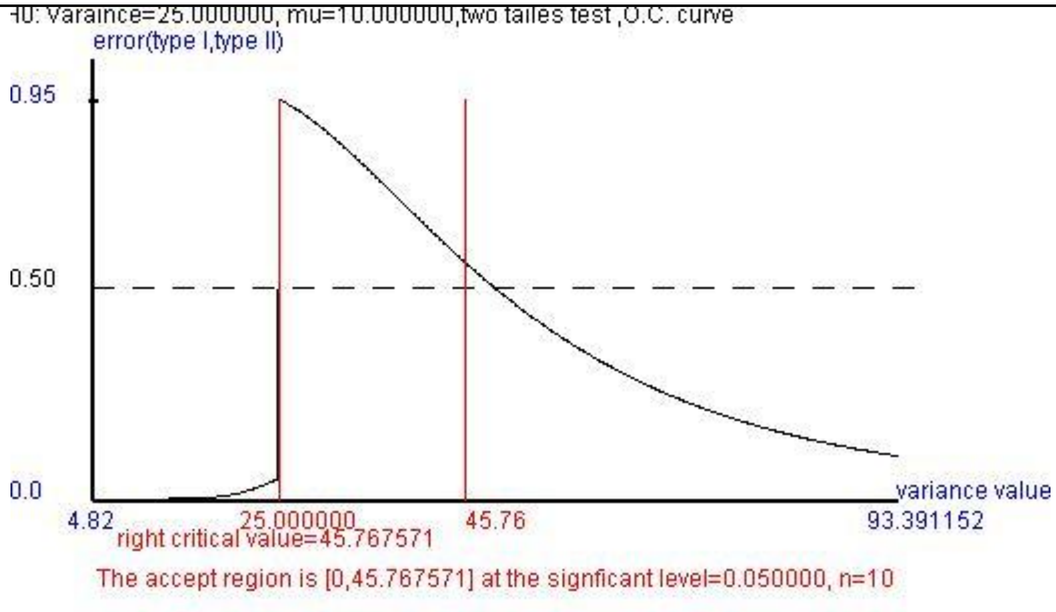
select 2:



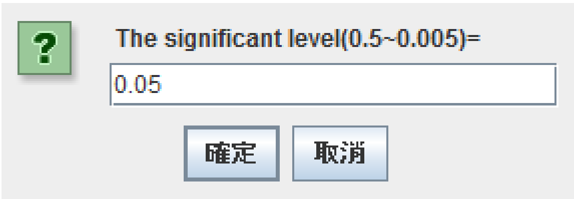


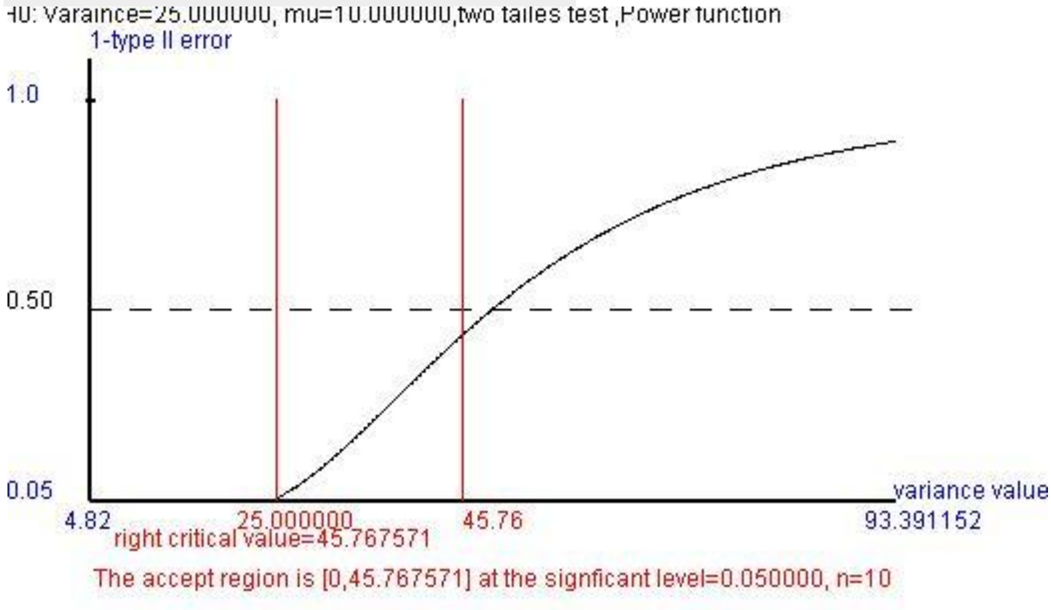
select 3:



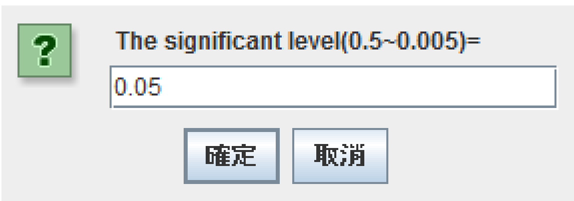


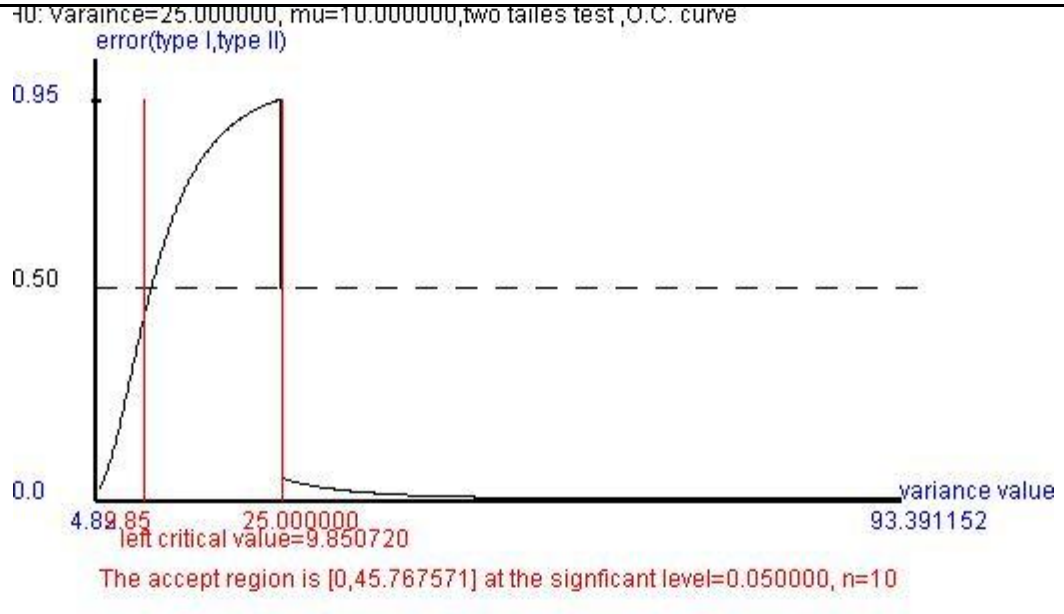
select 4:



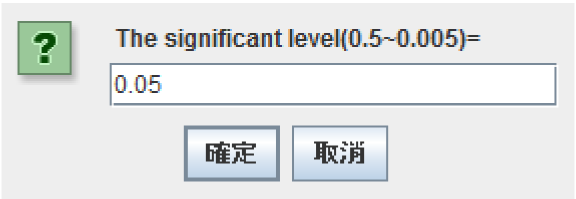


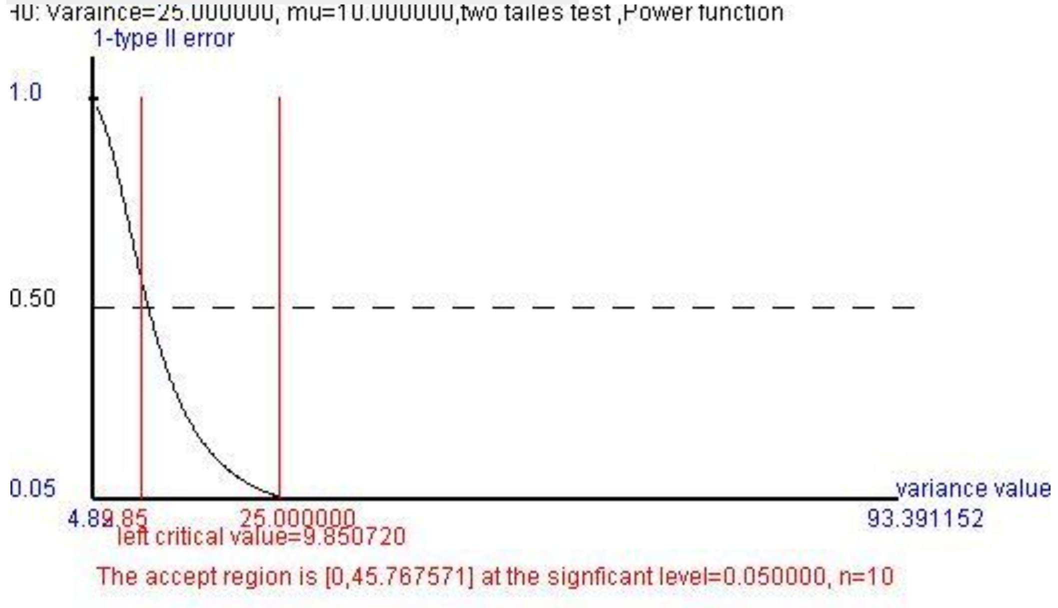
select 5:



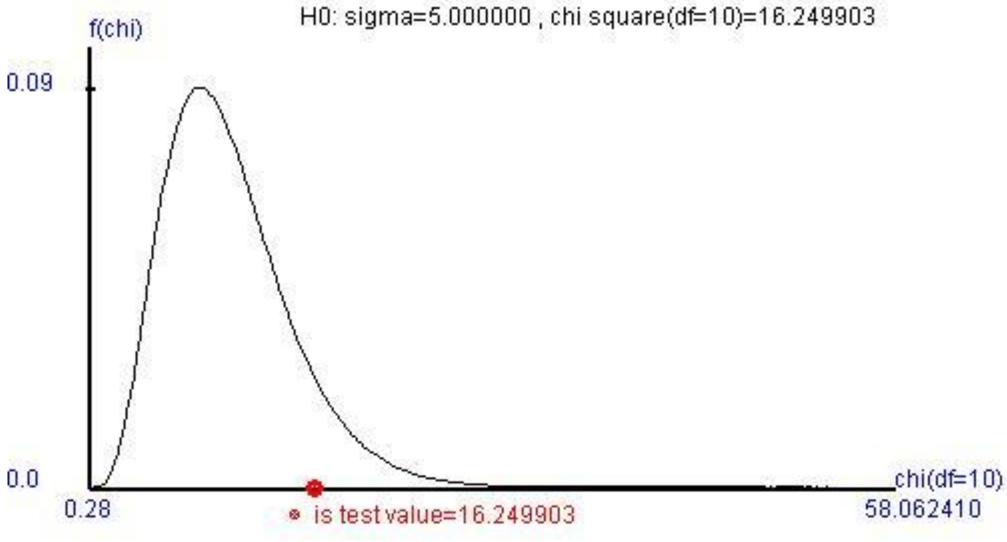


select 6:





select 7:



one population sigma test   when population mean is knwon
The sample variance=40.624758
H0: sigma=5.000000 , sigma is population standard deviation,population mean=10.000000
The test statistic chi-square(df=10)=   0.0025 ,
which formula is chi-square=n*(Sample Variance)/165037.098327
n is sample size=10
left tail test p-value=   0.0001
right tail test p-value=   0.9999
two tailes test p-value=   0.0002

The population standard deviation and variance confidence interval when mu is known
90% confidence interval for population variance
[22.190799 ,   103.100990]
90% confidence interval for population standard deviation
[4.710711 ,   10.153866]
95% confidence interval for population variance
[19.833296 ,   125.116932]
95% confidence interval for population standard deviation
[4.453459 ,   11.185568]
99% confidence interval for population variance
[16.128670 ,   188.442444]
99% confidence interval for population standard deviation
[4.016052 ,   13.727434]

4. One population sigma test , the population mu is unknown

there need input Ho sigma value

select 4:

The one population sigma test ,H0 sigma value ,population mean value is unkown

H0: sigma= 5

one sample population sigma test when mu is unkown

H0: sigma=5.000000 mu is unknown, chi-square test value(df=9)=16.120097

[The sample data X1 O.C. curve, P.F. and test value image]

~~~~~~~~~~~~~~ choose one ~~~~~~~~~~~~~~~~~

1. two tailes Operation characteristic curve
2. two tailes Power function
3. right tail Operation characteristic curve
4. right tail Power function
5. left tail Operation characteristic curve
6. left tail Power function
7. test value image
8. return

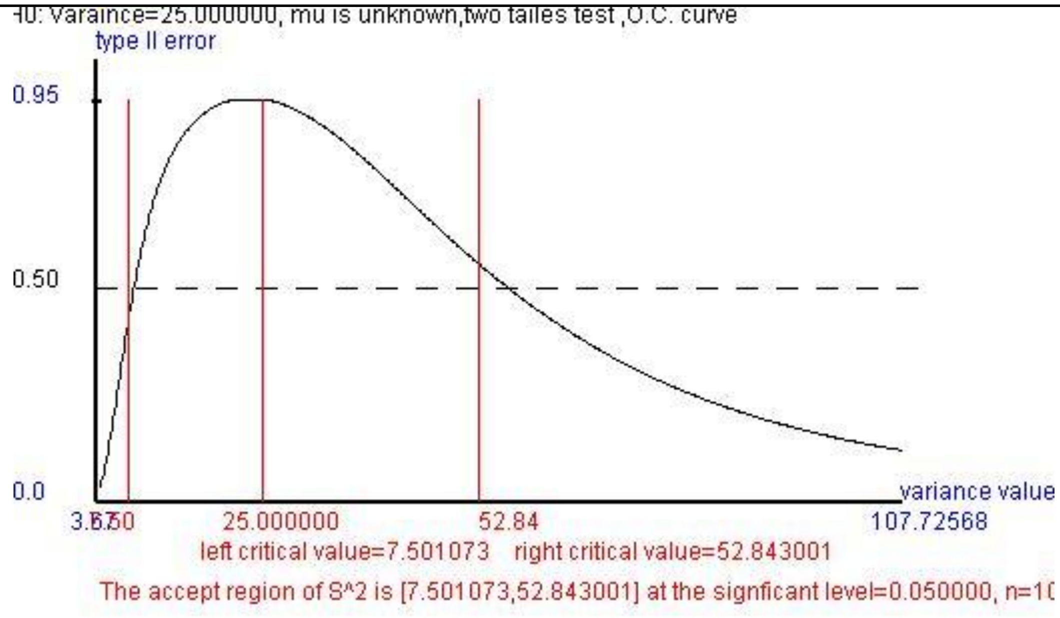
確定 取消

select 1:

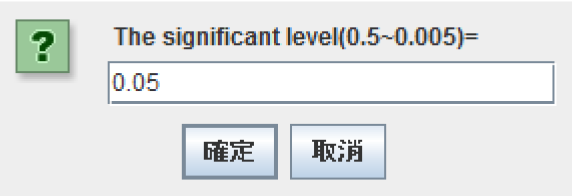
The significant level(0.5~0.005)=

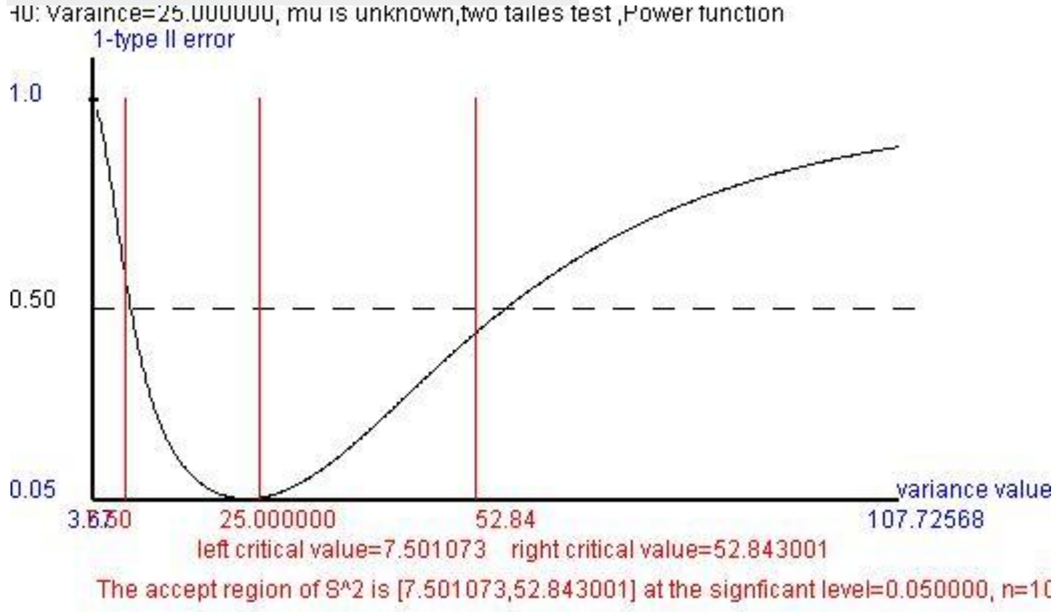
0.05

確定 取消
~~~~~~~~~~~~~~

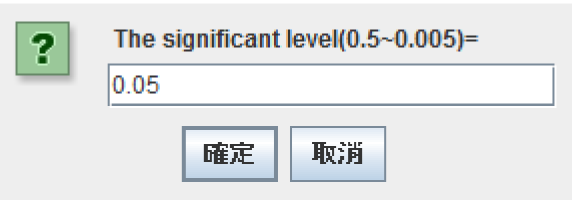


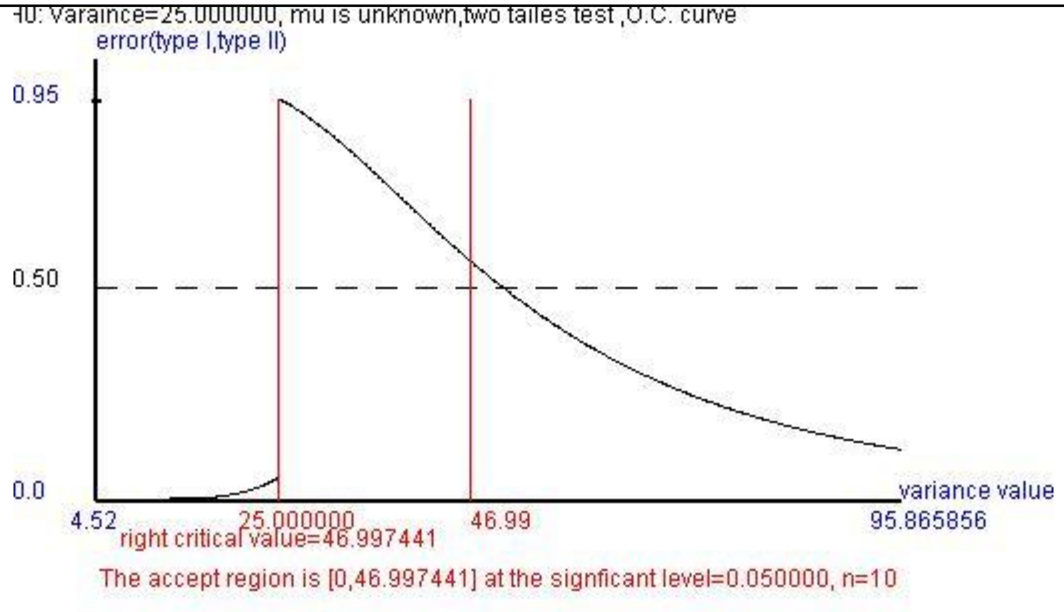
select 2:



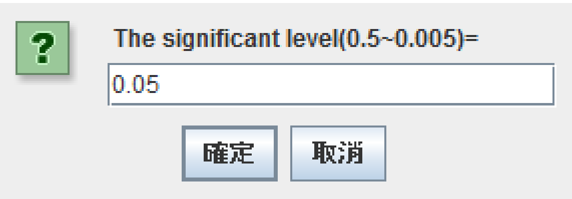


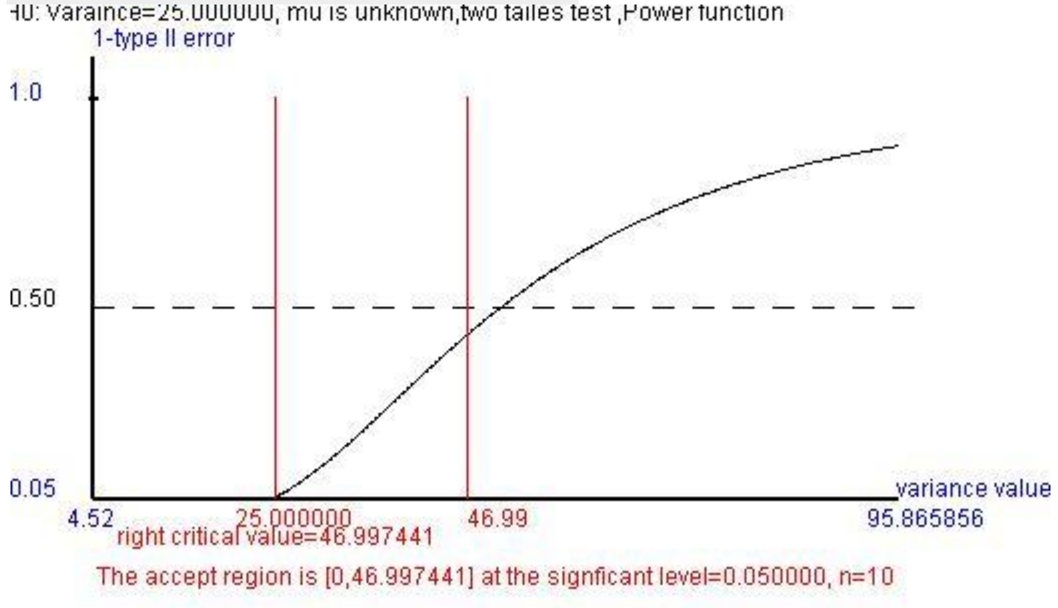
select 3:



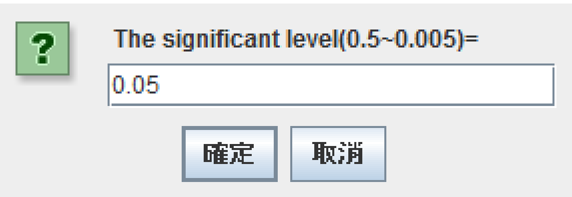


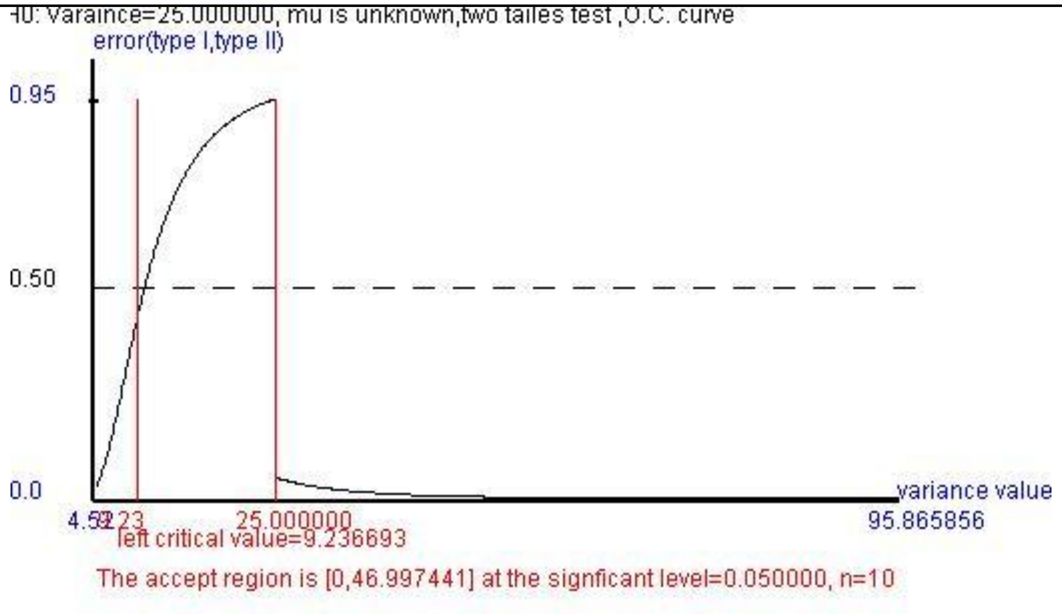
select 4:



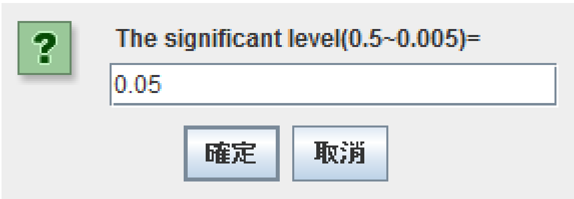


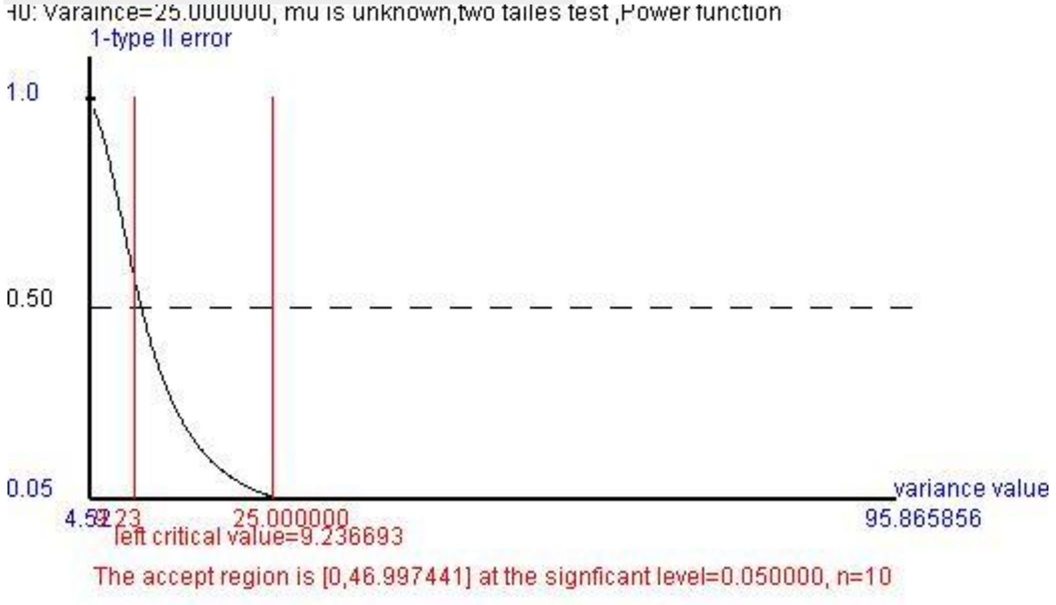
select 5:



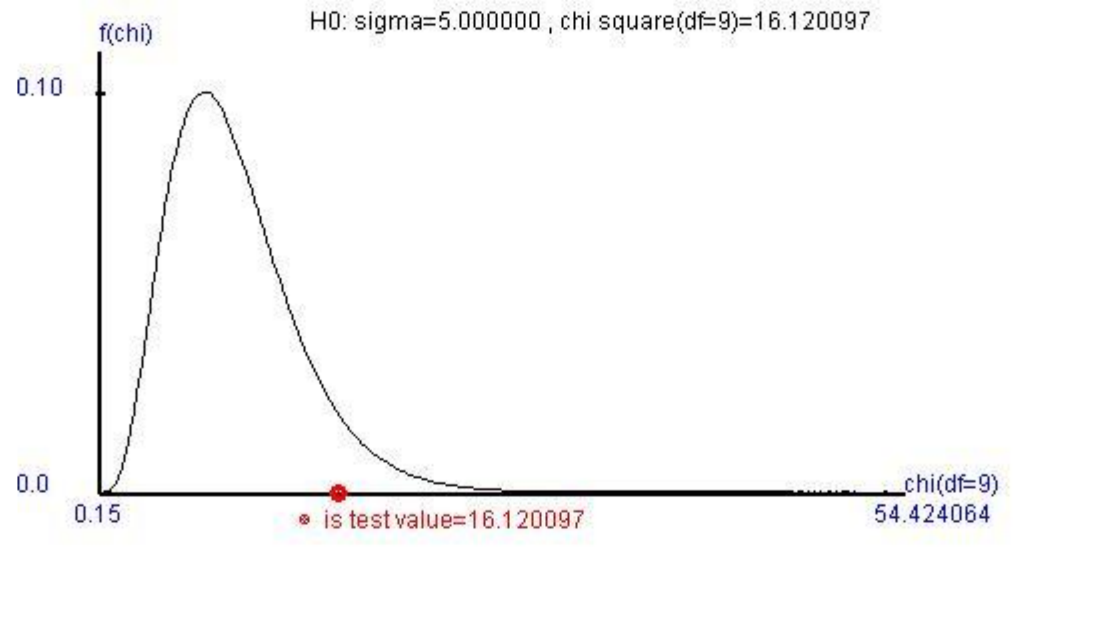


select 6:





select 7:

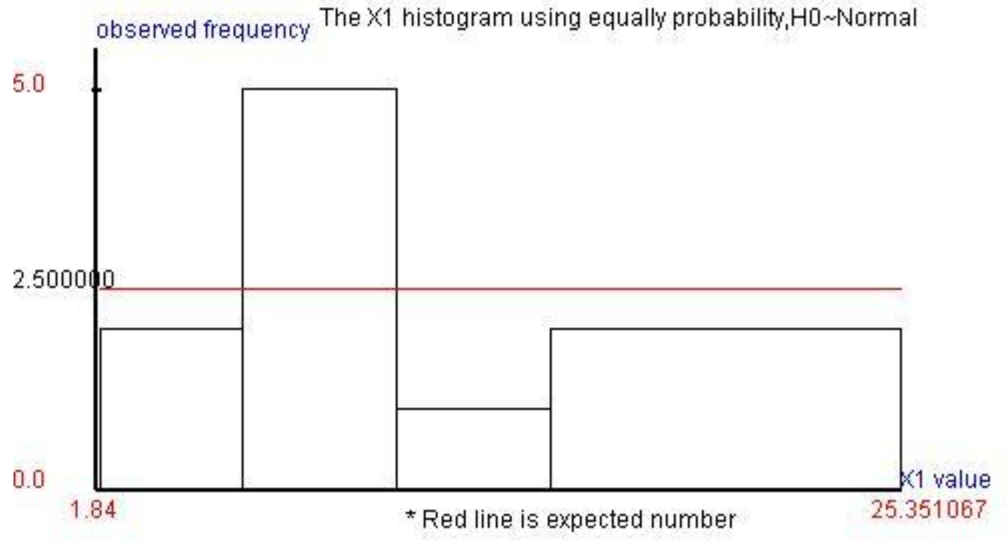


one population sigma test when population mean is unknown
H0: sigma=5.000000 , sigma is population standard deviation ,sample mean=10.569664
The sample variance=44.778046
The test static chi-square(df=9)= 16.1201 ,
which formula is chi-square=(n-1)*(Sample Variance)/25.000000
n is sample size=10
left tail test p-value= 0.9356
right tail test p-value= 0.0644
two tailes test p-value= 0.1288

The population standard deviation and variance confidence interval
90% confidence interval for population variance
[23.819406 , 121.196100]
90% confidence interval for population standard deviation
[4.880513 , 11.008910]
95% confidence interval for population variance
[21.184474 , 149.238799]
95% confidence interval for population standard deviation
[4.602659 , 12.216333]
99% confidence interval for population variance
[17.083562 , 232.379957]
99% confidence interval for population standard deviation
[4.133227 , 15.244014]

5. The population disitribution whether normal distribution test

select 5:



pearson goodness of fit

class	[1]	[2]	[3]	[4]
lower limit		6.05638	10.56983	15.08268
upper limit	6.05638	10.56983	15.08268	
observed no	2.00000	5.00000	1.00000	2.00000
probability	0.25000	0.25000	0.25000	0.25000
expected no	2.50000	2.50000	2.50000	2.50000
chi square	0.10000	2.50000	0.90000	0.10000

degree of freedom=1

H0: X1~Normal(mu,sigma*sigma) mu,sigma are unknown

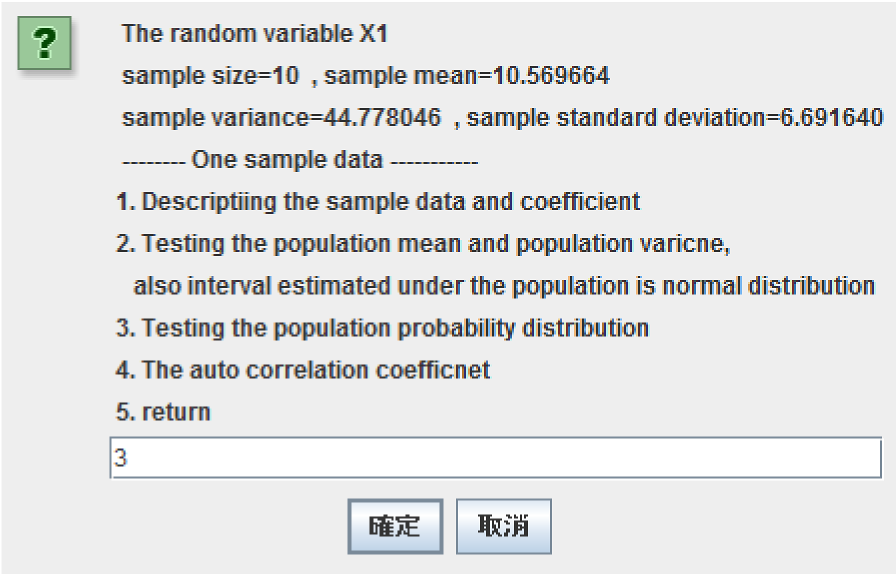
population mean(mu) point estimated value=10.569664 (MLE,UMVUE)

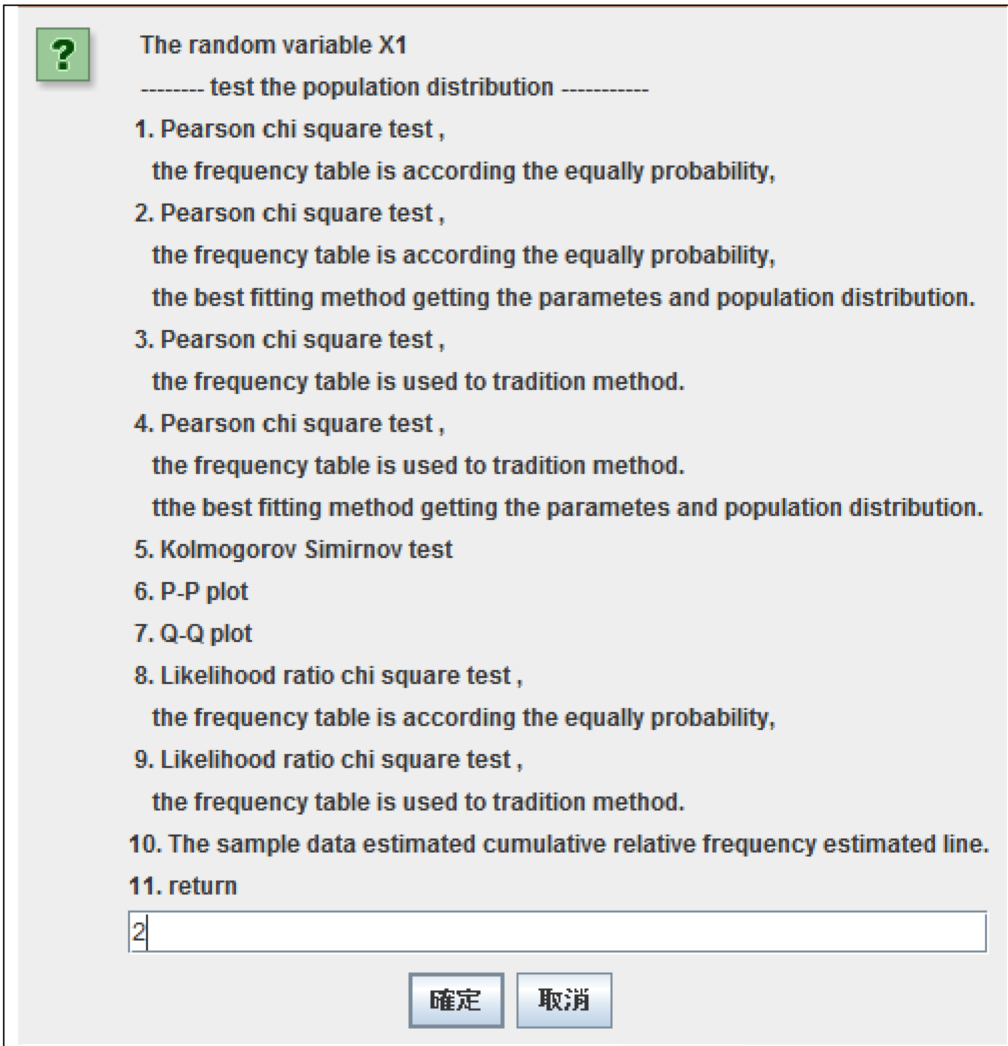
population variance(sigma*sigma) which point estimated value=44.778046 (UMVUE)

pearson chi-square test statistic =3.600000

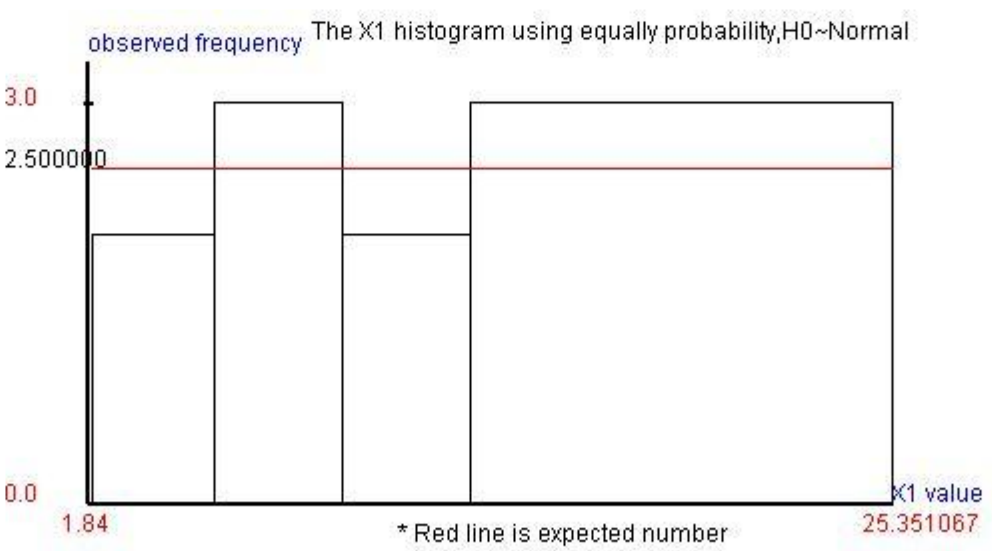
p-value=0.057700

Note:


The random variable X1
sample size=10 , sample mean=10.569664
sample variance=44.778046 , sample standard deviation=6.691640
-------- One sample data -----------
1. Descriptiing the sample data and coefficient
2. Testing the population mean and population varicne,
also interval estimated under the population is normal distribution
3. Testing the population probability distribution
4. The auto correlation coefficnet
5. return
3
確定
取消



Are you sure to select " 2.H0:Normal distribution "



mu point estimated value=10.569664 (MLE)

sigma point estimated value=6.691640 (MLE)
mu value from 9.231336 to 11.907992
sigma value from 5.576367 to 8.364550

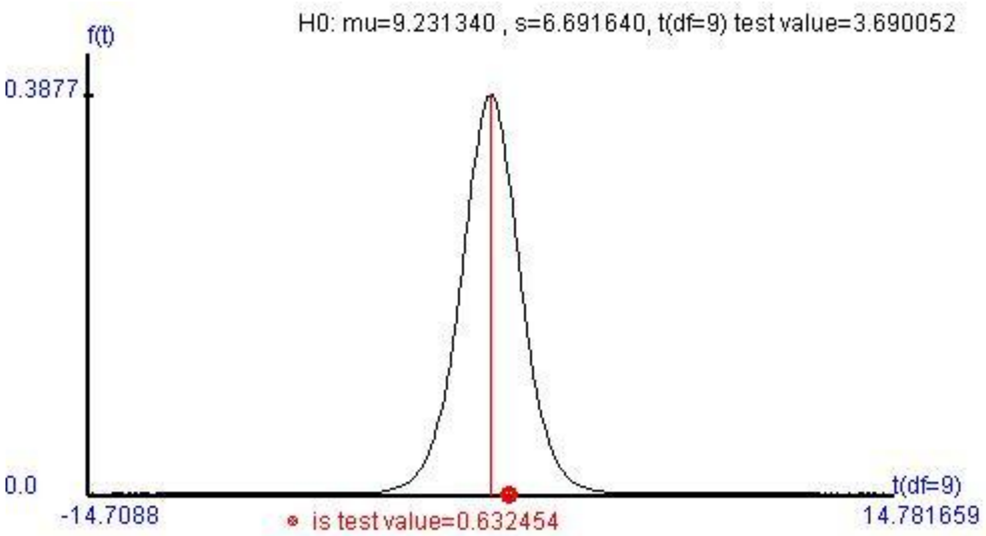
pearson goodness of fit

class	[1]	[2]	[3]	[4]
lower limit		5.47027	9.23148	12.99218
upper limit	5.47027	9.23148	12.99218	
observed no	2.00000	3.00000	2.00000	3.00000
probability	0.25000	0.25000	0.25000	0.25000
expected no	2.50000	2.50000	2.50000	2.50000
chi square	0.10000	0.10000	0.10000	0.10000

degree of freedom=1
H0: X1~Normal(mu=9.231336,sigma*sigma=31.095865), sigma=5.576367
pearson chi-square test statistic =0.400000
p-value=0.527000

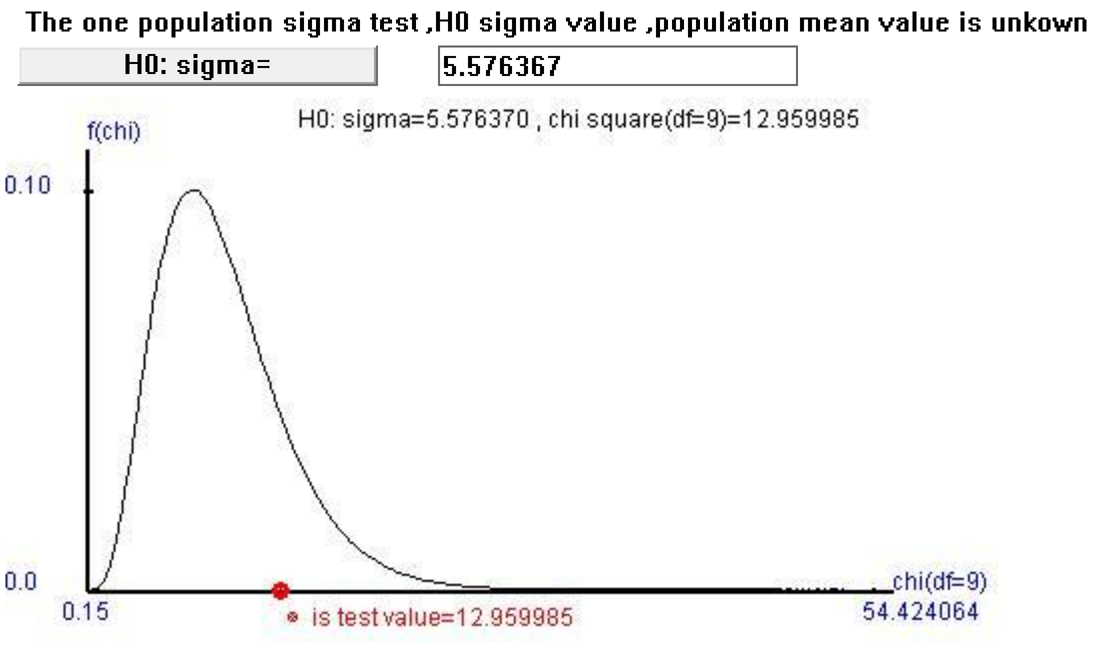
The one population mu test when sigma unkown,H0 mu value

H0: mu= 9.231336



One population mean test , the population standard deviation is unknown
H0: mu=9.231340 , mu is population mean , the sample standard deviation=6.691640
The sample mean=10.569664

the test statistic t(df=9)=0.632454 ,
which formula is t=(X1 sample mean-0)/standard error
the standard error =sample stand deviation/(n-1)^0.5, n is sample size=10
left tail test p-value= 0.7286
right tail test p-value= 0.2714
two tailes test p-value= 0.5428
90% confidence interval for mu
[6.691079 , 14.448249]
95% confidence interval for mu
[5.783340 , 15.355987]
99% confidence interval for mu
[3.690052 , 17.449275]



one population sigma test when population mean is unknown
H0: sigma=5.576370 , sigma is population standard deviation ,sample mean=10.569664
The sample variance=44.778046
The test static chi-square(df=9)= 12.9600 ,
which formula is chi-square=(n-1)*(Sample Variance)/31.095902
n is sample size=10
left tail test p-value= 0.8356
right tail test p-value= 0.1644
two tailes test p-value= 0.3288

```
The population standard deviation and variance confidence interval
  90% confidence interval for population variance
  [23.819406 ,    121.196100]
  90% confidence interval for population standard deviation
  [4.880513 ,    11.008910]
  95% confidence interval for population variance
  [21.184474 ,    149.238799]
  95% confidence interval for population standard deviation
  [4.602659 ,    12.216333]
  99% confidence interval for population variance
  [17.083562 ,    232.379957]
  99% confidence interval for population standard deviation
  [4.133227 ,    15.244014]
```