**Assignment-4**

9.7) Solution:

n = 100

= 37.7

σ = 9.2

1. Given confidence interval is 90%

α = 0.1

α / 2 = 0.05

Z α / 2 = 1.64485 (value taken from the z-distribution function in excel)

Formula for confidence interval when standard deviation is given

Z α / 2 σ/

= 37.7 (1.64485 \* (9.2 / ))

= [ 36.19 , 39.21 ]

1. Given significance level = 1%

Ho : 35

Ha : > 35

Using Z-test, calculation of Z-statistic

Z =

Z =

Z = 2.935

Z α = 2.326 (value taken from the z-distribution function in excel)

We use right tail test here, so

Z > Z α

So we can reject the hypothesis that the mean number of concurrent users is less than equal to 35. So, there is sufficient evidence that the mean of concurrent users is greater than 35.

9.9) Solution:

Given sample, 30 ,50 ,70

= 50

S2 = 400

σx = 20

1. Given confidence level to be calculated = 90%

α = 0.1

α / 2 = 0.05

t α / 2 σx /

Using Student T distribution here because sample size is small and the population has normal distribution.

Here, degree of freedom = n – 1 = 2

t α / 2 = 2.920

= 2.920 \* 20 /

= 50 33.717

= [ 16.3, 83.717 ]

1. Given level of significance = 10%

Ho : = 80

Ha : 80

Calculating t statistic,

t =

t =

t = -2.598

We have to do two sided test in this case

t α / 2 = -2.920

so, here the rejection region is [-] [ 2.920, ]

Here, t > t α / 2. In the left tail. t does not fall in the rejection region.

So, we can not reject the null hypothesis. There is not enough evidence to prove that the average salary of all entry-level computer engineers equals $80,000.

1. Given percentage for which confidence level has to be calculated = 90%

We use chi-square distribution for getting the confidence interval for standard deviation

α = 0.1

α / 2 = 0.05

= [ ]

= [ , ]

= [ 11.6 , 89.4 ]

9.10) Solution:

Sample size n = 200

defective items = 24

1. Proportion of defective items() = 24/200 = 0.12

We do not know the standard deviation of the population, so we estimate it by

s() =

=

= 0.02297

Given percentage of confidence interval to be calculated = 96%

α = 0.04

α / 2 = 0.02

Z α / 2 = 2.05375

Formula for confidence interval when proportion is given,

= Z α / 2 s()

=0.12 (2.05375 \* 0.02297)

= 0.12 ( 0.04717)

= [ 0.073 , 0.167 ]

Ho : <= 0.1

Ha : > 0.1

First significance level = 4%

α = 0.04

Z α = -1.75

We have to perform a left tail test,

s() =

s() = 0.02297

Calculating z statistic

Z =

Z =

Z = 0.8704

P(z) = 0.8273

Calculating P-value at 4% significance level,

P{z > Zobs} =

=1 - 0.807959

= 0.1920

Here P-value is greater than significance level. So, there is no sufficient data to reject the claim that at most one in 10 items in the shipment is defective at 4% level of significance.

Second significance level = 15%

α = 0.15

We calculated P value before which is 0.1920.

P > α

Here P-value is greater than significance level. So, there is no sufficient data to reject the claim that at most one in 10 items in the shipment is defective at 15% level of significance.

9.15) Solution:

n1 = 70

n2 = 100

= 42/70 = 0.6

= 59/100 = 0.59

Ho : =

Ha :

So, as we assume that that the null hypothesis is true by default, we calculate the pooled standard deviation

s() =

=

= 0.594

s() =

s() = 0.0765

Calculating z statistic,

Z =

Z =

Z = 0.1307

This is a two tailed test

Calculating p value :

P{ |z| |zobs| } = 2( 1 - )

= 2(1 - )

= 2 (1 - 0.551994)

= 0.896

Once we know the p value, we can test hypothesis at all significant levels. Usual significance α lie in the interval [ 0.01, 0.1 ]. Here the obtained P value is greater than 0.1.

Also, P value is the probability of observing a test statistic that is as extreme as or more extreme than the test statistic.

The obtained P value is very high, i.e, 0.896. The chance of observing that the two proportions are equal is almost 89% which is a very high value. So, there is no evidence to reject the null hypothesis at almost all the significant levels.

9.18) Solution:

The number of days for which blocked intrusion attempts are sampled (n) = 14

Average of the blocked intrusion before the change of the firewall () = 50

Variance before the change of the firewall () = 58

The number of days for which blocked intrusion attempts after the change of firewall are sampled(m) = 20

Average of the blocked intrusion after the change of firewall () = 40.2

Variance after the change of the firewall () = 63.33

Given the percentage for which confidence interval to be calculated = 95%

Here, the assumption is the variances are equal before and after the change

So, calculating the pooled standard deviation,

Sp =

Sp =

Sp = 7.8207

Degrees of freedom = n + m -2 = 14 + 20 -2 = 32

α = 0.05

α / 2 = 0.025

t α / 2 = 2.037 (Here, we are using t-distribution because sample sizes are less than 30)

Formula for confidence interval when two population means are compared,

= – t α / 2  \* Sp

= 50 – 40.2 2.037\*7.8207 \*

= 9.8 5.5513

= [ 4.25,15.35 ]

1. Ho : =

Ha :

t statistic under the assumption that variances are equal,

tobs =

tobs =

tobs = 3.596

Calculating P value under the assumption that variances are equal:

P(t > tobs) = P(t > 3.596) where degrees of freedom is 32

= 0.000537 (value taken from the F-distribution function in excel)

Standard deviation when variances are not equal,

Sp =

Sp =

Sp = 2.7035

Degree of freedom =

= 28.910

t statistic under the assumption that variances are not equal,

tobs =

tobs =

tobs = 3.624

Calculating P value under the assumption that variances are equal:

P(t > tobs) = P(t > 3.624) where degrees of freedom is 28.910

= 0.00057 (value taken from the F-distribution function in excel)

In both the cases, the value of P is very LOW.

There is no significant difference in the p values for both the cases. There is a significant reduction in the rate of intrusion attempts.

9.20) Solution:

Sample size, n = 40

Sample standard deviation = 6.2min

Assumed standard deviation of the population = 5min

Ho : σ = 5

Ha : 5

Here, we are comparing the standard deviations. We use chi-square for this purpose

Calculating chi-square statistic:

obs =

obs =

obs = 59.9664

Degrees of freedom = n-1 = 39

This is a two sided test.

Calculating P value: P = 2min(P{obs}, P{obs})

P{obs} = P( > 59.9664)

= 0.017043 (calculated from the chi square function in excel)

P{obs} = P{}

= 1-0.017043

= 0.9829

Here, the area of P{obs} is less compared to the area of P{obs}

So, P value = 2 \* 0.017043

= 0.034

The value of P is very low in this case. The probability of above case occurring is just 3.4% which is very less. So, there is significant evidence against the null hypothesis for α 0.034.

9.22) solution:

Size of sample1, n = 30

Size of sample2, m = 20

= 0.6min

= 1.2min

1. Ho : =

Ha :

Fobs = = 0.25

Here, = 1

This is a two-sided test, so the P-value is

P = 2 min (P{F 0.25} , P{F 0.25})

Here, n – 1 = 29, m – 1 = 19

P{F 0.25} = 0.9987

P{F 0.25} = 0.0013

Here the area of P{F 0.25} is less than P{F 0.25})

P = 2\*0.0013 = 0.0026

The value of P is very low. The chance of population variances being equal is almost 0.0082% which is a very low value. Therefore, there is significant evidence against the population variances not being equal.

1. Given the percentage for which the confidence level to be calculated = 95%

α = 0.05

α / 2 = 0.025

Confidence interval for the ratio of variances,

[ ]

F α / 2(n-1,m-1) = 2.401943 (calculated from F-distribution excel functions)

F α / 2(m-1,n-1) = 2.231274 (calculated from F-distribution excel functions)

[ ]

[ 0.11, 0.6 ]

9.23) Solution:

Variance of Anthony’s grade, = 162.8

Variance of Eric’s grade, = 10.4

n = 6

m = 6

= 85

= 80

Given level of significance = 5%

= 0.05

Ho : =

Ha :

t statistic under the assumption that variances are equal,

Sp =

Sp =

Sp = 9.3059

tobs =

tobs =

tobs = 0.93062

Calculating P value under the assumption that variances are equal:

P(t > tobs) = P(t > 0.9548) where degrees of freedom is 10

= 0.373971

Standard deviation when variances are not equal,

Sp =

Sp =

Sp = 5.3728

Degree of freedom =

= 5.63622

t statistic under the assumption that variances are not equal,

tobs =

tobs =

tobs = 0.9306

Calculating P value under the assumption that variances are equal:

P(t > tobs) = P(t > 0.9306) where degrees of freedom is 5.63622

= 0.394765

The value of P is greater than α when variances are equal and not equal. So, there is no enough evidence that the average grade of Anthony is greater then the average grade of Eric.

Ho : =

Ha :

Fobs = = 15.6538

Here, = 1

This is a Right tail test, so the P-value is

P = P{F 15.6538}

Here, n – 1 = 5, m – 1 = 5

P{F 15.6538} = 0.004495

The value of P is less than the α. So, we can reject the null hypothesis and there is enough evidence to prove that the variance of grades of Eric is less than the variance of grades of Anthony.