#One Sample Chi-square Test of Variance for a Normal Distribution

#Prototyped by Justin Mann

#2/17/2016

#This test tests hypotheses about whether the variance of a population is statistically equivalent to a specified SigmaSquared\_naught.

#Assumptions:

#1. Observed values, X1...Xn, are a random sample from a normal distribution.

#2. Variance of the population is unknown.

#Hypotheses:

#Null: SigmaSquared is equal to SigmaSquared-naught

#Alternative: SigmaSquared is not equal to SigmaSquared\_naught

#assign "x" to data subset

x <- iris$Sepal.Length[iris$Species=="setosa"]

x

#assign population variance to "sigmsq\_naught"

sigma\_naught <- sqrt(0.1)

sigma\_naught

#verify length and assign to "n"

n <- length(x)

n

#assign "xbar" to the mean of "x"

xbar <- mean(x)

xbar

#assign "s" to standard deviation

s <- sqrt(var(x))

s

#assign "s\_sq" to variance

s\_sq <-var(x)

s\_sq

**[1] 0.124249**

#assign "degf" to n-1

degf <- n-1

degf

#\*\*\*\*\*Test Statistic\*\*\*\*\*

Xsq <- (degf\*s\_sq)/sigma\_naught^2

Xsq

**[1] 60.882**

#Critical Value of the Test:

alpha <- 0.05

C1 <- qchisq(alpha/2,degf) #Two sided Lower

C1

[**1] 31.55492**

C2 <- qchisq(1-alpha/2,degf) #Two sided Upper

C2

**[1] 70.22241**

C3 <- qchisq(alpha,degf) #One sided lower

C3

**[1] 33.93031**

C4 <- qchisq(1-alpha,degf)

C4

**[1] 66.33865**

#Decision Rules:

#1. If chisq<C1 or chisq>C2, then reject the Null (two sided case)

#2. If chisq<C3, then reject Null (one sided lower tail)

#3. If chisq>C4, then reject Null (one sided upper lower)

#Probablility Values:

P <- 2\*(1-pchisq(Xsq,degf))

P

**[1] 0.2375398**

PL <- pchisq(Xsq,degf)

PL

PU <- 1-(pchisq(Xsq,degf))

PU

#Confidence Intervals for Population Variance:

CI1 <- (degf\*s\_sq/C1) #two sided

CI1

**[1] 0.1929398**

CI2 <- (degf\*s\_sq/C2) #two sided

CI2

**[1] 0.08669881**

CI3 <- (degf\*s\_sq/C3) #one sided

CI3

CI4 <- (degf\*s\_sq/C4) #one sided

CI4

#Now text the R function

library(EnvStats)

varTest(x,sigma.squared = 0.1, alternative = "two.sided", conf.level = 0.95)

**Results of Hypothesis Test**

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**Null Hypothesis: variance = 0.1**

**Alternative Hypothesis: True variance is not equal to 0.1**

**Test Name: Chi-Squared Test on Variance**

**Estimated Parameter(s): variance = 0.124249**

**Data: x**

**Test Statistic: Chi-Squared = 60.882**

**Test Statistic Parameter: df = 49**

**P-value: 0.2375398**

**95% Confidence Interval: LCL = 0.08669881**

**UCL = 0.19293982**