Quiz 2 Ans

Q1

(use Xr12-73)

With gasoline prices increasing, drivers are more concerned with their cars' gasoline consumption. For the past 5 years a driver has tracked the gas mileage of his car and found that the population variance from fill-up to fill-up was 25. Now that his car is 5 years old, he would like to know whether the variability of gas mileage from his last eight fill-ups; these are listed in the data.

Conduct a test at a 10% significance level to infer whether the variability has changed.

Q1 Ans

```
> #H0:σ^2 = 25 H1:σ^2=/=25
> mydata<-data.frame(Xr12_73)
> str(mydata)
'data.frame':	8 obs. of  1 variable:
 $ Mileage: num  28 25 29 25 32 36 27 24
> install.packages("EnvStats")
Error in install.packages : Updating loaded packages
> install.packages("EnvStats")
Installing package into ‘C:/Users/USER/Documents/R/win-library/3.5’
(as ‘lib’ is unspecified)
Warning in install.packages :
  package ‘EnvStats’ is in use and will not be installed
> require(EnvStats)
> varTest(mydata$Mileage,alternative = "two.sided",conf.level = 0.90,sigma.squared = 25,data.name = NULL)

        Chi-Squared Test on Variance

data:  mydata$Mileage
Chi-Squared = 4.62, df = 7, p-value = 0.5876
alternative hypothesis: true variance is not equal to 25
90 percent confidence interval:
  8.210624 53.290887
sample estimates:
variance
    16.5
```

Q2

(use Xr12-115)

According to the ACBL bridge hands that contain two 4-card suits, one 3-card suit and one 2-card suits(4-4-3-2) occur with 21.55% probability. Suppose that a bridge-playing statistic professor with time on his hands tracked the number of hands over a one-year period and recorded the following hands with 4-4-3-2 (code 2) and others (code 1). Test to determine whether the proportion of code2 differs from the theoretical probability at 1% significance level.

Q2 Ans

```
> #H0:p = 0.2155 H1:p =/= 0.2155
> mydata<-data.frame(Xr12_115)
> str(mydata)
'data.frame':   1040 obs. of  1 variable:
 $ Hands: num  1 2 1 2 1 2 1 2 1 1 ...
> table(mydata$Hands)

  1   2 
786 254 
> prop.test(254,1040,p = 0.2155,alternative = "two.sided",conf.level = 0.99,correct = FALSE)

        1-sample proportions test without continuity correction

data:  254 out of 1040, null probability 0.2155
X-squared = 5.0779, df = 1, p-value = 0.02423
alternative hypothesis: true p is not equal to 0.2155
99 percent confidence interval:
 0.2116068 0.2800975
sample estimates:
        p 
0.2442308 
```

Q3

(use Xr12-26)

A federal agency is responsible for enforcing laws governing weights and measures routinely inspects packages to determine whether the weight of the contents is the same as that advertised on the package. A random sample of containers whose packaging states that the contents weight 7.91 ounces was drawn. The contents were weighted and the results in Xr12-26. Can we conclude at the 10% significance level that on average the containers are mislabeled?

Q3 Ans

```
> #H0:µ = 7.91 H1:µ =/= 7.91
> mydata<-data.frame(Xr12_26)
> t.test(mydata$Weights,alternative = "two.sided",mu = 7.91,conf.level = 0.90)

	One Sample t-test

data:  mydata$Weights
t = 0.19474, df = 17, p-value = 0.8479
alternative hypothesis: true mean is not equal to 7.91
90 percent confidence interval:
 7.879150 7.948628
sample estimates:
mean of x 
 7.913889 
```

Q4

A principal at a school claims that the students in his school are above average intelligence. A random sample of thirty students' IQ scores have a mean score of 112.5. The average population IQ is known to be 100 and the standard deviation is 15. Is there sufficient evidence to support the principal's claim?(alpha = 0.05)

Q4 Ans

```
> #H0:µ<=100 H1:µ>100
> xbar<-112.5
> mu<-100
> sd<-15
> n<-30
> Alpha<-0.05
> z<-(xbar-mu)/(sd/sqrt(n))
> z
[1] 4.564355
> Pvalue<-pnorm(z,lower.tail = FALSE)
> Pvalue
[1] 2.505166e-06
> Pvalue<Alpha
[1] TRUE
```

Q5

Consider the hypotheses H0: $\sigma^2 = 20$ vs. H1: $\sigma^2 > 20$. Assume that Science scores on a 25-point quiz for a random sample of 5 students were drawn from a normal population. These were: 18, 16, 10, 13, and 23. Test the hypotheses at the 10% significance level. What is your conclusion?

Q5 Ans

```
> #H0:σ^2 = 20 H1:σ^2>20
> n<-5
> score<-c(18,16,10,13,23)
> svar<-var(score)
> pvar<-20
> Alpha<-0.1
> chi<-(n-1)*svar/pvar
> chi
[1] 4.9
> Pvalue<-pchisq(chi,df = n-1,lower.tail = FALSE)
> Pvalue
[1] 0.2977129
> Pvalue<Alpha
[1] FALSE
```

Q6

A union composed of several thousand pilots is preparing to vote on a new contract. A random sample of 500 pilots yielded 320 who planned to vote yes. It is believed that the new contract will receive more than 60% yes votes. State the appropriate null and alternative hypotheses. Can we infer at the 5% significance level that the new contract will receive more than 60% yes votes?

Q6 Ans

```
> #H0:p<=0.6 H1:p>0.6
> phat<-320/500
> p<-0.6
> n<-500
> Alpha<-0.05
> z<-(phat-p)/sqrt((p*(1-p)/n))
> z
[1] 1.825742
> Pvalue<-pnorm(z,lower.tail = FALSE)
> Pvalue
[1] 0.03394458
> Pvalue<Alpha
[1] TRUE
```

Q8

The Admissions officer for the graduate programs at the University of Pennsylvania believes that the average score on the LSAT exam at his university is significantly higher than the national average of 1,300. An accepted standard deviation σ for LSAT scores is 125. A random sample of 25 scores had an average of 1,375. Calculate the value of the test statistic and set up the rejection region at the 0.025 level. What is your conclusion?

Q8 Ans

```
> #H0:µ<=1300 H1:µ>1300
> xbar<-1375
> mu<-1300
> sd<-125
> n<-25
> Alpha<-0.025
> z<-(xbar-mu)/(sd/sqrt(n))
> z
[1] 3
> Pvalue<-pnorm(z,lower.tail = FALSE)
> Pvalue
[1] 0.001349898
> Pvalue<Alpha
[1] TRUE
```

Q9

A random sample of 10 single mothers was drawn from a Obstetrics Clinic. Their ages are 22, 17, 27, 20, 23, 19, 24, 18, 19, and 24 years.

1. Estimate the population mean with 90% confidence.

2. Test to determine if we can infer at the 5% significance level that the population mean is not equal to 20.

Q9 Ans

```
> #9.1
> Age<-c(22,17,27,20,23,19,24,18,19,24)
> xbar<-mean(Age)
> ssd<-sd(Age)
> n<-10
> tcv<-qt(0.10/2,df = n-1)
> se<-abs(tcv*ssd/sqrt(n))
> lcl<-xbar-se
> ucl<-xbar+se
> ci<-c(lcl,ucl)
> ci
[1] 19.44562 23.15438
```

```
> #9.2
> #H0:μ=20 H1:μ=/=20
> Age<-c(22, 17, 27, 20, 23, 19, 24, 18, 19,24)
> xbar<-mean(Age)
> mu<-20
> ssd<-sd(Age)
> n<-10
> Alpha<-0.05
> t<-(xbar-mu)/(ssd/sqrt(n))
> t
[1] 1.285094
> Pvalue<-2*pt(t,df = n-1,lower.tail = FALSE)
> Pvalue
[1] 0.2308441
> Pvalue < Alpha
[1] FALSE
```

Q10

The World Meteorological Organization has conducted statistical studies conducted by meteorological observatories around the world, indicating that the temperature increase of the earth's surface temperature over the past 100 years shows the existence of "global warming". In the global warming process, the direct impact is long-term climate variability. The following table shows the rainfall statistics of Tainan in the 12 months of 2013 (unit: mm):

7.5	1.5	5.5	111.7	286.0	233.5
148.9	806.5	60.2	0.0	6.1	21.1

Assuming that the rainfall is normally distributed, what is the 95% confidence interval for the average rainfall in Tainan?

Q10 Ans

```
> rain<-c(7.5,1.5,5.5,111.7,286.0,233.5,148.9,806.5,60.2,0.0,6.1,21.1)
> xbar<-mean(rain)
> ssd<-sd(rain)
> n<-12
> tcv<-qt(0.05/2,df = n-1)
> se<-abs(tcv*ssd/sqrt(n))
> lcl<-xbar-se
> ucl<-xbar+se
> ci<-c(lcl,ucl)
> ci
[1]  -6.192879 287.609546
```

Because the average rainfall is not negative, the best answer is 0~287.609546