STAT 308 – Homework 1

Solutions

For the problems in which calculations are needed, please include your `R` code with your answers, otherwise you will not be given full credit. Please upload your assignment by Thursday, September 8, 11:59 pm in a pdf file to Sakai.

- 1. Assume that Z is a random variable from the standard normal (i.e. $\mu = 0$, $\sigma = 1$).

– a. Calculate $P(Z \geq -1)$.

```
# Write your R code to answer the question here.
pnorm(-1,mean=0,sd=1,lower.tail=FALSE)
```

```
## [1] 0.8413447
```

OR

```
# Write your R code to answer the question here.
1 - pnorm(-1,mean=0,sd=1)
```

```
## [1] 0.8413447
```

– b. Determine the 0.2−quantile of Z.

```
# Write your R code to answer the question here.
qnorm(0.2,mean=0,sd=1)
```

```
## [1] -0.8416212
```

- 2. $F_{a,b}$ is a random variable from the F-distribution with $df1 = a$ and $df2 = b$.

– a. Calculate $P(F_{5,40} \leq 2.9)$

```
# Write your R code to answer the question here.
pf(2.9,df1=5,df2=40)
```

```
## [1] 0.9748583
```

– b. Find x such that $P(F_{6,24} \geq x) = 0.05$

```r
# Write your R code to answer the question here.
qf(0.05,df1=6,df2=24,lower.tail=FALSE)
```

```
## [1] 2.508189
```

OR

```r
# Write your R code to answer the question here.
qf(1-0.05,df1=6,df2=24)
```

```
## [1] 2.508189
```

- 3. Given a dataset of scores $\{0, 2, 5, 6, 3, 3, 3, 1, 4, 3\}$, calculate the

– a. mean,

```r
# Write your R code to answer the question here.
x <- c(0,2,5,6,3,3,3,1,4,3)
mean(x)
```

```
## [1] 3
```

– b. median,

```r
# Write your R code to answer the question here.
median(x)
```

```
## [1] 3
```

– c. variance.

```r
# Write your R code to answer the question here.
var(x)
```

```
## [1] 3.111111
```

- 4. A random sample of 32 persons attending a certain diet clinic was found to have lost an average of 30 pounds over a three week period, with a sample standard deviation of 11 pounds. For these data

– a. Calculate a 99% confidence interval for the given data.

```r
# Write your R code to answer the question here.
n <- 32
est <- 30
se <- 11/sqrt(n)
alpha <- 0.01
crit <- qt(1-alpha/2,df=n-1)
est + c(-1,1)*crit*se
```

```
## [1] 24.66409 35.33591
```

– b. Interpret the confidence interval in the context of the given problem.

We are 99% confident that the true mean weight loss over the last three weeks of all patients at the clinic is between 24.66 and 35.34 pounds.

– c. Suppose I wished to test my current belief that the average weight loss of the population is equal to 28 pounds. I come to the conclusion to reject $H_0 : \mu = 28$. Based on your answer to (b), does this make sense? Why or why not?

This does not make sense because 28 is inside our 99% confidence interval, which means that we would fail to reject H_0.

- 5. An outbreak of Salmonella-related illness was thought to be caused by pre-cut melons from a specific factory. Several samples were collected and can be found in the file `salmonella.csv` on the course webpage. A Salmonella level (in MPN/g) greater than 0.3 MPN/g is considered dangerous. To demonstrate that the levels are safe we want to show the mean level is less than 0.3 MPN/g.

– a. State the null and directional alternative hypothesis in symbols. Explicitly define μ.

$H_0 : \mu \leq 0.3$, $H_a : \mu > 0.3$. μ is the average salmonella level (in MPN/g) of all melons from this factory.

– b. Find the test statistic and p-value for the data below. Be sure to clearly identify them from your output. Note you are performing a one-sided test.

```
# Write your R code to answer the question here.
salmonella <- read.csv("../Data/salmonella.csv")
t.test(salmonella$Level,mu=0.3,alternative = "greater")
```

```
##
##  One Sample t-test
##
## data:  salmonella$Level
## t = -0.13098, df = 41, p-value = 0.5518
## alternative hypothesis: true mean is greater than 0.3
## 95 percent confidence interval:
##  0.2703245       Inf
## sample estimates:
## mean of x
## 0.2978571
```

$t = -0.1310$, $p - value = 0.5518$

– c. State your decision and conclusion for the given problem.

Because $p - value > 0.05$, we fail to reject H_0 and can say there is not significant evidence that the true mean salmonella levels of all the melons from the factory is greater than 0.3 MPN/g.