Midterm 3: Takehome

Problem 6

This problem refers to the garbage weight data set, available on Moodle. This set represents a random sample of garbage from 62 suburban homes.

Loading the dataset (garbage weight):

```
library(readxl)
garbage_weight <- read_excel("/Users/sepehrakbari/Documents/LFC/Semester 2/MATH 150/DSs/garba
#View(garbage_weight)
```

(a) Construct a level 99 confidence interval for the average amount of glass waste by direct calculation. Identify the point estimate, margin of error, and interval endpoints. Make sure your work is clear.

```
mean <- mean(garbage_weight$GLASS)
standard_deviation <- sd(garbage_weight$GLASS)
cofidence_level <- 0.995
size <- length(garbage_weight$GLASS)
degree_of_freedom <- size - 1

t_star <- qt(cofidence_level, degree_of_freedom)
margin_of_error <- t_star * standard_deviation / sqrt(size)

lower_endpoint <- mean - margin_of_error
upper_endpoint <- mean + margin_of_error

cat("Point Estimate (Mean):",mean,"\n")
```

```
Point Estimate (Mean): 3.752097
```

```
cat("Margin of Error:",margin_of_error,"\n")
```

```
Margin of Error: 1.049602
```

```
cat("The Confidence Interval will be from",lower_endpoint,"to",upper_endpoint,"pound. \n")
```

```
The Confidence Interval will be from 2.702495 to 4.801699 pound.
```

(b) Confirm the results of part (a) with a single line of R code. Include both code and output.

```
t.test(garbage_weight$GLASS, conf.level=0.99)
```

```
    One Sample t-test

data:  garbage_weight$GLASS
t = 9.5048, df = 61, p-value = 1.199e-13
alternative hypothesis: true mean is not equal to 0
99 percent confidence interval:
 2.702495 4.801699
sample estimates:
mean of x
 3.752097
```

(c) Carefully interpret your answer using the language developed in class.

Based on the data given, about 99% of suburbon households throw away about 2.7 to 4.8 pounds of garbage.

Problem 7

Does the garbage weight set provide evidence that the average food waste per household is more than 3.5 pounds? Follow all best practices from class and test at significance level $\alpha = 0.05$.

```
cat("Null Hypothesis (H0): H0 = 3.5 \n")
```

```
Null Hypothesis (H0): H0 = 3.5
```

```
cat("Alternative Hypothesis (H1): H1 > 3.5 (one-sided)\n\n")
```

```
Alternative Hypothesis (H1): H1 > 3.5 (one-sided)
```

```r
population_mean <- mean(garbage_weight$FOOD)
standard_deviation <- sd(garbage_weight$FOOD)
size <- length(garbage_weight$FOOD)
degree_of_freedom <- size - 1
sample_mean <- 3.5
alpha <- 0.05

t_score <- (population_mean - sample_mean) / (standard_deviation / sqrt(size))
p_value <- 1 - pt(t_score, degree_of_freedom)

cat("t-score is:",t_score,"\n")
```

```
t-score is: 3.142544
```

```r
cat("p-value is:",p_value,"\n\n")
```

```
p-value is: 0.001292524
```

```r
if(p_value < alpha) {
  cat("There is sufficient evidance to show that
the average food waste per household is greater than 3.5 pounds.")
}else{
  cat("There is insufficient evidance to show that
the average food waste per household is greater than 3.5 pounds.")
}
```

```
There is sufficient evidance to show that
the average food waste per household is greater than 3.5 pounds.
```

```r
cat(" We draw no conclusions however.")
```

```
 We draw no conclusions however.
```

Or we can use R's t.test() function to calculate or justify our answer:

```r
t.test(garbage_weight$FOOD, mu = 3.5, alternative = "greater")
```

```
    One Sample t-test

data:  garbage_weight$FOOD
t = 3.1425, df = 61, p-value = 0.001293
alternative hypothesis: true mean is greater than 3.5
95 percent confidence interval:
 4.116549      Inf
sample estimates:
mean of x
 4.815968
```