Stat 571 Homework 6 Solutions

27 Goat Milk II

A) See the below R code. The solution should match what you found in "Goat Milk I" (to rounding error)

```
goats <- c(1209,1358,1380,1098,1241,1325,1008,1217,1487,1217,1269,1348,1139,1122)

#perform t-test and also get CI#
t.test(goats, mu = 1180)
```

```

    One Sample t-test

data:  goats
t = 1.8699, df = 13, p-value = 0.08418
alternative hypothesis: true mean is not equal to 1180
95 percent confidence interval:
 1170.036 1318.249
sample estimates:
mean of x
 1244.143
```

B) The CI is $(1140.81, 1347.47)$. We can interpret the interval by saying that we used a process that will result in an interval that covers the true population mean milk production in about 99% of samples of size $n = 14$ taken from the population. We had to assume the population distribution was normal. See R code below.

```
#change confidence level for CI#
t.test(goats, mu = 1180, conf.level=0.99)
```

```

    One Sample t-test

data:  goats
t = 1.8699, df = 13, p-value = 0.08418
alternative hypothesis: true mean is not equal to 1180
99 percent confidence interval:
 1140.813 1347.472
sample estimates:
mean of x
 1244.143
```

C) Since the interval includes 1180, we would not reject the null, and conclude that we do not have sufficient evidence to claim that the mean milk weight is different than 1180.

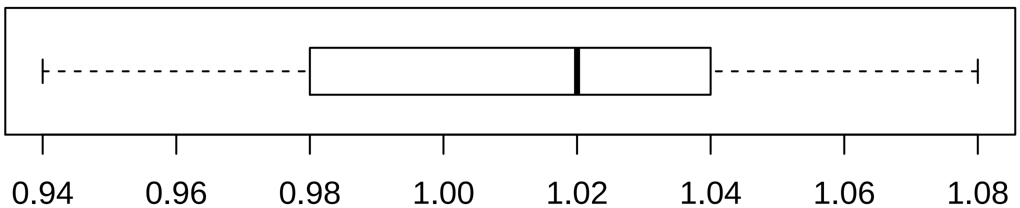
28 Syrup Swim

A) For this data we find $\bar{x} = 1.012$ and $s^2 = 0.0018$ $(s = 0.04232)$. Since the variance is unknown we use a T critical value. For a 95% interval the critical value is 2.110 (df = 17), so the CI is

$1.012 \pm 2.110\sqrt{\frac{0.0018}{18}} = 1.012 \pm 0.021$ or $(0.991, 1.033)$. We used a process that had a 95% success rate in covering the true μ, and this is the interval we got. Plausible values of μ range from 0.991 to 1.033. This seems to be evidence that adding syrup to the water doesn't change the swimming speed very much. For a 90% interval, the critical value is 1.740, so the CI is $1.012 \pm 1.740\sqrt{\frac{0.0018}{18}} = 1.012 \pm 0.017$ or $(0.995, 1.029)$. Interpretation is similar to above.

B)

```
boxplot(syrup, horizontal = T)
```



The boxplot can give you a rough sense of where the center of the interval will be (in this case slightly less than the median since there is a left skew). But without knowledge of the sample size, which isn't included in the boxplot, we can't get a sense of how wide or narrow the confidence interval will be.

29 Sample Size Calculations

A) Since we are assuming σ known, the critical value is a z. For a 90% CI, the critical value would be 1.645, so the width of the interval is $2(1.645)\sqrt{\frac{144}{n}}$. Set this equal to 0.5 and solve using algebra to find $n = 6235$. (Be sure to round up.)

B) Reducing σ would decrease the standard error of the estimate, so we could get the same confidence interval size with a smaller sample size. Our required n would be lower. If you work it out, you get $n = 3118$.