STAT 215: ANALYTIC INTERVALS AND TESTS ABOUT MEANS

(1) A supermarket chain is interested in discovering how much arsenic is in the chicken they buy from a particular supplier. They plan to break off their relationship with this supplier if there is sufficient evidence that the average arsenic concentration is more than 80 parts per billion (ppb). A random sample of six chickens from the supplier contains the following concentrations in ppb:

68 75 81 93 95 134

The sample mean, $\bar{x}$, is 91 ppb. The sample standard deviation, s, is 23.47 ppb. Suppose we can safely assume that the population distribution is Normal.

Note that if desired you can build the data frame in R as follows:

```
ChickenData <- data.frame(Arsenic = c(68, 75, 81, 93, 95, 134))
```

(a) Calculate the critical values, $\pm t^*$, that surround a 90% confidence interval; convert them back to the original scale; and construct the interval.

(b) Conduct the relevant hypothesis test, using a significance level that corresponds to the confidence level above, to determine whether or the grocery store will continue buying from this supplier. Use whatever computational tool you like to compute the P-value.

(c) Check your results by using the "built-in" R function to get a t-based P-value and confidence interval:

```
library("mosaic")  #if you haven't already done this
t.test(~Arsenic, data = ChickenData, mu = 80, conf.level = 0.90)
```

(d) For comparison, build the interval and do the test the wrong way, without accounting for the fact that we have only an estimate of the population standard deviation (that is, treat the sample standard deviation as though it were the population standard deviation, and use a Standard Normal in place of a t-distribution). How do the results differ? What risks might we run by failing to properly model our uncertainty?

(2) Use the `RestaurantTips` data in `Lock5Data` and test whether the percent tip (`PctTip`) differs according to whether or not the customer used a credit card `Credit`. Construct a 99% confidence interval for the difference in means. Then check your results using the `t.test()` function:

```
t.test(Response ~ Explanatory, data = DataSet, conf.level = ...)
```