1. Consider Exercise 23 on page 56 of your text (but do not answer any of the questions posed by your textbook).
   (a) To determine a 90% confidence interval of the mean percent change in fatalities just among states that increased the speed limit, which t-tool is appropriate? Choose one of: A. 1-sample, B. 2-sample paired, C. 2-sample unpooled, D. 2-sample pooled. Justify your answer.
   (b) Load in the data for this problem and plot side-by-side boxplots. Cut and paste this into R:
   ```r
   library(Sleuth3)
   s=ex0223
   boxplot(s$PctChange ~ s$SpeedLimit,
           names=c("increased","retained"),xlab="speed limit",
           ylab="Percent change in fatalities",
           main="Investigating the effect of increasing the speed limit over 55mph")
   ```
   Do the boxplots suggest that there is a difference between the states that increased the speed limit and states that did not?
   (c) Use R’s `t.test()` function to construct a two-sided 90% CI for the true mean percent change in fatalities just among the states that increased the speed limit from 55mph. Use this 90% CI to test whether the percent of fatalities increased just among the states that increased the speed limit from 55mph? That is, just consider the data `s[s$SpeedLimit=="Inc",]`. This is a different question than what your book asks! Report on all 6 steps of the hypothesis test although instead of reporting a p-value to make a decision regarding $H_0$, use the two-sided 90% CI. Put all R-code and R-output, including the boxplot, into the Appendix.
   (d) Write a conclusion in terms of the problem.
   (e) What is the scope of inference for this problem?

2. Consider Exercise 22 on page 55 of your text (but do not answer any of the questions posed by your textbook).
   (a) Load in the data for this problem and plot side-by-side boxplots. Cut and paste this into R:
   ```r
   library(Sleuth3)
   d=ex0222
   boxplot(d$Math,d$Word,d$Arith,d$Parag,
           names=c("math","word","arithmetic","paragraph"),ylab="score",
           main="Results from AFQT")
   ```
   Do the boxplots suggest that there is a difference between the mean “word knowledge” scores and the mean “math knowledge” scores?
   (b) To compare the mean “word knowledge” scores to the mean “math knowledge” scores, explain why a t-test is more appropriate than a z-test.
   (c) To compare the mean “word knowledge” scores to the mean “math knowledge” scores, which t-test is appropriate for this problem? Choose one of: A. 1-sample, B. 2-sample paired, C. 2-sample unpooled, D. 2-sample pooled. Justify your answer.
   (d) A researcher wants to test whether military recruits’ math knowledge is less than their word knowledge on the average. Use R’s `t.test()` function to test this hypothesis. Put the R-code and R-output, including the boxplot, in the Appendix.
   (e) Report on all 6 steps of the hypothesis test at $\alpha = 0.01$.
   (f) Write a conclusion in terms of the problem.
   (g) What is the scope of inference for this problem?
3. (a) In problem #2, the boxplot shows that the “word knowledge” scores are left skewed with some small outliers. Does this suggest that the \(t\)-test that you applied is not appropriate? Explain. 

*Hint: this question is asking about the robustness of the \(t\)-test.*

(b) In an attempt to transform the “word knowledge” scores to a more symmetric distribution, try log-transforming the data as your book suggests and plot it:

```r
boxplot(log(d$Math), log(d$Word), log(d$Arith), log(d$Parag),
        names=c("math", "word", "arithmetic", "paragraph"), xlab = "AFQT categories",
        ylab="log(score)", main="Results from AFQT")
```

You will get some warnings from R because there are some zero scores. Do the log-transformed scores for “word knowledge” look more normal than the original scores? Justify your answer. Use Display 3.8 on page 71 to explain why or why not the transformation worked.

(c) Find the Box Cox transform for the “word knowledge” scores by implementing the following code:

```r
library(MASS)
boxcox(d$Word[d$Word>0]~1, lambda=seq(1, 3, .1))
```

Which transform does Box Cox suggest? Include your R-code and R-output in an Appendix including the Box Cox plot.

(d) Transform the data as suggested by Box Cox and generate a boxplot. Do the Box Cox transformed scores for “word knowledge” look more normal than the original scores? Justify your answer.