STAT:5400
Homework 5

Due Mon. Oct. 17

You may submit your answers as a plain text file. LaTeX is not required for this assignment (although you may use it if you wish).

1 Bootstrap

1. Consider the airconditioning data listed below:

   ```
   hours
     3
     5
     7
    18
    43
    85
    91
    98
   100
   130
   230
   487
   ```

   Carry out a *nonparametric* bootstrap analysis concerning the log of the sample mean as an estimator of the log of the population mean. Use the `boot` function in the `boot` package to get the following:

   (a) Estimate the standard error of the log sample mean.
   (b) Estimate the bias, and produce an "unbiased" estimate.
   (c) Produce confidence intervals for the log population mean by the percentile method and the Bca method.

2. Using the same data, carry out a *parametric* bootstrap analysis concerning the log of the sample mean as an estimator of the log of the population mean. Assume that the population distribution of failure times of airconditioning equipment is exponential. Do the same three items as in question 1 above, except do only the percentile method confidence interval.

3. The bootstrap is not foolproof. To see this, consider analysis of a binomial model with "n" trials. You observe 0 successes. Discuss what would happen if you were to use the standard, non-parametric bootstrap in constructing a 95% C.I. for the binomial parameter p.

2 Jackknife

Carry out the same analysis of the airconditioning data, but use the jackknife to estimate the standard error, and bias. To produce a confidence interval, take your original estimate, plus or minus twice your estimated standard error. Write a few sentences comparing the jackknife results to those obtained with the bootstrap.

3 Rootfinding

The function
$$x^3 + 4x^2 - 10$$
has a real root in [0,3].

1. Use the built-in R function called `uniroot` to locate this root.

2. Write a function to carry out the bisection algorithm as we discussed in class. Use it to find the root of the function.