BSTT 565- Computational Statistics-Homework 4

November 7, 2020

Due: November 30, 2020

1) Download "nerve firings" data from $http://www.stat.cmu.edu/\sim larry/all-of-statistics/index.html$. Construct a 95% normal, pivotal and percentile confidence intervals for estimating the skewness and the median of the nerve data by bootstrapping.

2) This example is from Efron and Tibshirani (1993). When drug companies introduce new medications, they are sometimes required to show bioequivalence. This means that the new drug is not substantially different from the current treatment. Here are data on eight subjects who used medical patches to infuse hormone into the blood. Each subject received three treatments: placebo, old-patch, new-patch.

Let $Z = Old - Placebo$ and $Y = New - Old$. The Food and Drug Administration (FDA) requirement of bioequivalence is that $|\theta| \leq 0.20$, where $\theta = \frac{E_F(Y)}{E_F(Z)}$. What can you say about the bioequivalence?

3) Let $X_1, ..., X_n \sim N(\mu, 1)$. Let $\theta = e^{\mu}$ and let $\hat{\theta} = e^{\bar{X}}$. Create a dataset using $\mu = 5$ consisting of $n = 100$ observations. Use the bootstrap to get the standard error and 95 percent confidence interval for

Subject	Placebo	Old	New	Old-Placebo	New-Old
1	9243	17649	16449	8406	-1200
2	9671	12013	14614	2342	2601
3	11792	19979	17274	8187	-2705
4	13357	21816	23798	8459	1982
5	9055	13850	12560	4795	-1290
6	6290	9806	10157	3516	351
7	12412	17208	16570	4796	-638
8	18806	29044	26325	10238	-2719

θ. Plot a histogram of the bootstrap replications. This is an estimate of the distribution of $\hat{\theta}$. Compare this to the true sampling distribution of $\hat{\theta}$.

4) Let $X_1, ..., X_n \sim Uniform(0, \theta)$. Let $\hat{\theta} = X_{max} = max(X_1, ..., X_n)$. Generate a dataset of size 50 with $\theta = 1$. Find the distribution of $\hat{\theta}$. Compare the true distribution of $\hat{\theta}$ to the histograms from the bootstrap. Are you happy with the performance of the bootstrap? What is going on here? See Problem 9.6 in the textbook.

5) This problem is about the correlation between GPA and LSAT scored for entrance to law school. Admission officers in the law school are interested in the correlation between these two measures. Find normal, pivotal and percentile 95 percent confidence intervals for the correlation parameter for 100, 1000 and 10000 bootstrap samples. What did you get out of this problem? Explain. Data are below: (First applicant has 3.39 GPA and 576 LSAT score, and so on.)

LSAT: 576, 635, 558, 578, 666, 580, 555, 661, 651, 605, 653, 575, 545, 572, 594.

GPA: 3.39, 3.30, 2.81, 3.03, 3.44, 3.07, 3.00, 3.43, 3.36, 3.13, 3.12, 2.74, 2.76, 2.88, 3.96.