

Midterm 1 2008

<Your Name>

<date when you took exam>

1 Instructions

Produce a \LaTeX document formatted like this one. You do not have to copy any of the questions into your document. Just make the sections and subsections with the same names that I have here. Use Sweave to insert your code and output. You must work in a Linux environment.

Submit your exam by uploading your `.Rnw` file and your final PDF file into ICON.

2 R for data analysis and graphics

See the documentation file `OECD.info` under datasets on the course web page.

1. Read the dataset `OECD.txt` into a dataframe in R.
2. Produce a numeric summary of all the variables in the dataset.
3. Produce a boxplot of the `beds` variable.

Your typeset document show show all the R code as well as the numeric output and the plot.

3 The bootstrap

Recall that the interquartile range, or IQR, is the difference between the 3rd quartile and the 1st quartile of a vector of numbers.

Suppose that the OECD data could be considered a sample of countries from around the world. We wish to use these data to estimate the IQR of beds per 1000 people in the population consisting of all countries.

1. Use R to calculate the IQR in the sample data.
2. Then use the `boot` function in the `boot` package to run a nonparametric bootstrap. Do at least 3 bootstrap runs, each with at least 999 replicate datasets. For each run, show

- (a) the bias in your point estimate
- (b) the standard error of your point estimate
- (c) 95% confidence intervals (basic, percentile, normal, and BCa) for the IQR in the population
- (d) a histogram of the statistics from the bootstrap samples (the $\hat{\theta}^*$ s)

Include in your document all R code and relevant output that you obtain. Write a sentence or two stating whether you observe any problems with this bootstrap analysis.

4 \LaTeX

Typeset the normal pdf in \LaTeX as a numbered equation:

$$f(x; \mu, \sigma^2) = \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{(x - \mu)^2}{2\sigma^2}\right), \quad -\infty < x < \infty \quad (1)$$