Homework 3. Stat 202a. Due Tue, Nov 8, 10:30am. version1.0 Wed Oct 19 11am

You must work on the homework INDEPENDENTLY! Collaborating on this homework will be considered cheating. Submit your homework by email to stat202a@stat.ucla.edu. **Late homeworks will not be accepted!** Your homework solution should be a single PDF document. The first pages should be your *output* from the problems above. After that, on subsequent pages, include all your *code* for these problems.

1. Approximation of an infinite series in C.

It is well known that 1 - 1/2 + 1/3 - 1/4 + 1/5 - 1/6 +/- ... = ln(2).

Write a C function called *alt2(n)* that computes the first *n* terms in this series, as a function of *n*. Call your C function from *R* to evaluate *alt2(n)* for various *n*. Using *R*, plot *alt2(n)* vs. *n*, for *n* ranging from some small number up to 1 million. You may set up your range of the y-axis in a way that you feel is appropriate; you do not need to show alt2(n) for very small values of n, if these are off the plot.

2. Kernel density estimates in C.

Write a C function to compute a Gaussian kernel density estimate for univariate data. The inputs to the function should be two integers, m and n, a vector g of m gridpoints at which to calculate the estimates, a vector x consisting of the n observed data points, and a vector y of length m which will contain the resulting density estimates.

Gather data on all earthquakes of magnitude at least 3.0 in the longitude range -118.0 to -117.0 and latitude range 34.0 to 35.0, from Jan 1, 1960 to Jan 1, 2011, from http://www.data.scec.org/eq-catalogs/date_mag_loc.php. Input the data into *R*. (Use maximum magnitude = 9.0, min depth = 0, max depth = 100km, event type = local.)

Take this vector of earthquake magnitudes, and use your C function to make a kernel density estimate of the earthquake magnitudes, using a Gaussian kernel with bandwidth selected using the rule of thumb suggested by Scott (1992). You may calculate this bandwidth in *R*. Let $\{m_1, m_2, ..., m_{100}\}$ = a vector of 100 equally spaced magnitudes spanning the observed range of magnitudes in your dataset, compute your kernel estimates on this grid using the C function, and plot your kernel density estimates $\hat{f}(m_1)$, $\hat{f}(m_2)$, ..., $\hat{f}(m_{100})$.

Output: Your output for this assignment should be a pdf document containing the following, in this order.

Figure 1. A plot of alt2(n) versus n, for n ranging up to 1 million.

Figure 2. A plot of your kernel density estimates $\hat{f}(m_1)$, $\hat{f}(m_2)$, ..., $\hat{f}(m_{100})$ versus m.

After these 2 figures, include all of your C code, followed by all of your *R* code.