

University of Colorado
Department of Civil, Environmental and Architectural Engineering
CVEN 5454 Quantitative Methods
Homework #3

Due March 1st, 2005

TOPICS: CONTINUOUS AND DISCRETE RVs, PARAMETER ESTIMATION, MONTE CARLO,
KERNEL DENSITY ESTIMATORS – CHAPTERS 5 AND 6.

1. Problem 9, page 131
2. Problem 4, page 140
3. Problem 13, page 141

4. Problem 10, page 157
5. Problem 14, page 175
6. From the monthly flow (or rainfall) data that you used in Homework #1, select a month with highly skewed distribution (hint: you can pick this by looking at the histograms that you plotted in the first homework). To this monthly values fit a Gamma distribution, Log Normal and Weibull distribution.
 - (a) Plot all the three fitted PDFs along with the histogram
 - (b) Test the goodness of fit of each of the fitted PDFs
 - (c) For the PDF that you decided as the best fit (based on (a) and (b) above) estimate the exceedence probability of the 85th percentile. Estimate this by integrating the PDF (you can use the numerical integration routines that I showed in the lab session) and also from using the in-built R commands and compare the two.
7. Monthly streamflows during the month of May at Lees Ferry on the Colorado River, exhibit a bimodal distribution. Clearly no traditional PDFs capture the distribution satisfactorily. Therefore, you resort to nonparametric methods. Fit a 'nonparametric' PDF using kernel density estimators and overlay this on the histogram.
Lees Ferry streamflow data can be obtained on the class webpage.

8. Using the method of Maximum Likelihood Estimation (MLE) what are the parameters of the Log Normal distribution?

9. Using the best fit PDF (from 3(a and b) above) generate 100 Monte Carlo samples, each of the same size as the observed data. Estimate the mean, standard deviation, skew and IQR for each Monte Carlo sample and boxplot them along with the statistics of the observed data. [Bonus points for writing your own Monte Carlo code from first principles, rather than using the in-built R functions]
10. Repeat 9 from the nonparametric PDF.