Homework 1 (EAS 8803: SEISMOLOGY II - SPRING SEMESTER 2008)
Total points: 100. Due 02/06/2008

Problem 1, 5, 6, 7, 10 of the Stein's textbook (pp 412-413). (10 point each)

Computer problem:
a) (Problem C-1 of the Stein's textbook: pp 413. 15 point): Using the Fourier series coefficients for the step function, derived in problem 1a, plot the first ten terms of the series and their sum. Also plot the sum of the first 20 and 30 terms.

b) (Modified from C-2 of the Stein's textbook: pp 413. 35 point): Write a subroutine to prepare the following time series for taking the fast Fourier transform (FFT) and take it. The subroutine should call a set of separate subroutines that perform the following operation:
    a. Cut the data between 300 and 1800 s;
    b. Remove the mean;
    c. Apply a cosine taper of length which you input;
    d. Extend the length of time series to the nearest power of 2;
    e. Take the FFT using the subroutine (COOLB) provided (Box 6C-2) or another subroutine (e.g., fft in Matlab);
    f. Plot the amplitude and phase spectrum.
    g. Invert the FFT back to the time domain and plot it.
    h. Write a subroutine to filter it in the frequency domain over the following two passband (low-pass-filtered at 30 s; band-pass-filtered at 2-8 Hz), and invert the FFT to yield two filtered time series. The subroutine should have the capability to taper in the frequency domain. Plot the original and filtered time series.

Note:
1.   Your code can be written in any scientific languages (e.g., Fortran, C, Matlab). Please make sure that the code can be compiled under standard Linux machine. Please submit your code electronically to zpeng@gatech.edu, and submit a write-up that includes all the figures.
2.   You can use the existing FFT subroutine in the Stein's book or in other languages (e.g., Fortran, C, Matlab). But you should write your own filter subroutine, instead of using any existing subroutine.
3.   The SAC binary format data can be downloaded from the following link: http://geophysics.eas.gatech.edu/people/zpeng/Teaching/EAS8803_S08/misc/BK. PKD.HHT.SAC.vel
4.   The ASCII format data can be downloaded from the following link: http://geophysics.eas.gatech.edu/people/zpeng/Teaching/EAS8803_S08/misc/BK _PKD_HHT_SAC_vel.dat
5.   The MatSAC package can be downloaded from the following link: http://geophysics.eas.gatech.edu/people/zpeng/Teaching/Sac_Tutorial_2006/MatS AC.tar.gz