Period04 – Periodicities in Light Curves and Fourier Transforms

1) On the class website, follow the link to the Period04 homepage. The link can be found either on the class website homepage, or on the CCD data page.
2) You will also need the tutorial data files found on the Period04 homepage. Download either tutorial.zip or tutorials.tar.gz.
3) Follow the instructions to download and install Period04 on your computer.
4) Start Period04. Click on "Help" and follow the instructions for the two tutorials. Record your results in your notebook.
5) If we are using in-class data, you will probably need to load the output of AIP4WIN into Excel and delete extra columns. Leave only the time (usually in Julian days) and V-C1, C1-C2, and SKY. Save the results.
6) If we don't have any in class data, go to the class observations webpage at http://www.physics.udel.edu/~jlp/classweb/ccddata.htm, find the GD358 1990 or 1994 light curves, and download them to your computer.
   a. Background: GD358 is a pulsating white dwarf.
   b. These observations record its brightness variations over time.
      i. These observations are each about a month in length.
      ii. The observations were taken with a network of telescopes positioned around the globe to try to observe 24 hrs a day.
7) Start Period04.
8) Import either our class data the 1990 or the 1994 light curve into Period04. If you are using the 1990 or the 1994 light curve, please note that these data are in intensities, not magnitudes, so make sure that the "Time string is in magnitudes" box is NOT checked.
9) Also note, the data for the tutorials is given in days. The authors of Period04 are long-period variable observers, and they think in days. If you are using the 1990 or 1994 light curves, the data is given in SECONDS.
10) Plot the light curve (click Display graph) and describe what you see. Explain any gaps. You can use your mouse to zoom in.
11) Click on the Fourier tab. If you are using the in class data, calculate the Fourier Transform (FT) from 0 to 3000 cycles per day. If you are using the 1990 or 1994 data, calculate the Fourier Transform (FT) from 0 to 0.006 Hz (Hz is an abbreviation for Hertz, or cycles per second). Leave the step rate at the default of "High", and do the calculations based on the "Original data".
12) Period04 will select the highest amplitude frequency it finds and ask you if you want to use it. Say yes.
13) When the FT is finished, display the graph and describe what you find. Using the cursor, estimate the frequency and amplitude of the largest peak. Does this agree with what Period04 found?
14) Click on the Fit tab. You will find the first line filled with information about the frequency Period04 found. Check the box to the left of F1. Then click "Calculate". Period04 will now do fit a single sinusoid to the original light curve to determine the absolute best period, amplitude, and phase for this frequency.
15) Go back to the Fourier window. Now select "Residuals at original". This tells Period04 to subtract the sinusoid from the original light curve and calculate the

FT of what's left over. It will select the highest amplitude peak, and ask you if you want to use it. Say "yes".

16) Repeat steps 13-14 until you have identified all significant peaks.
17) If you are using the 1990 or 1994 data sets, continue until you have identified 20 peaks.
18) Examine your last FT. Do you think any remaining peaks are noise, or are they real?
19) Record your peaks in your notebook, and save your project. Bring your project to class.