Homework 4 - Basic Data Mining

When preparing your homework submissions, don't forget to `git fetch, git status, git pull` *before you issue any other commands in Git – this is to guard against you changing a document that someone else is working on in the same directory*[1].

Don't forget to `git add` *and* `git commit` *(with* `-m` *comments) frequently as you work. This allows other users to see how your work progressed and it automatically backs up your work as you produce. Thus, you're less likely to lose any of your work and/or so you can revert to earlier versions of your work as needed.*

Remember to comment your code carefully with your initials before every comment (as in `# JCR I just wrote a Python comment to document a change.` *Remember to provide an informative header for* **every** *function that you write. Also provide a README file to inform people how to run your code.*

Homework

An astronomer wants to study the WISE (IR) properties of SDSS optical point sources that are detected by the FIRST radio survey (*remember from my lecture notes that FIRST, WISE, and SDSS data are all stored on tomservo*). As an initial test, she chooses to limit her study to a specific region of the sky – two overlapping circular regions of $\theta = 2^\circ$ in radius centered at $(\alpha, \delta) = (163^\circ, 50^\circ)$ and $(\alpha, \delta) = (167^\circ, 50^\circ)$.

1. Determine which FIRST sources lie in the astronomer's survey and write them out to a FITS file.

2. Use my `sdss_sweep_data_index.py` code to determine SDSS `PSFFLUXES` and WISE `W1` and `W2` magnitudes for *primary*[2] point sources in SDSS that are within $1''$ of the FIRST sources in the astronomer's survey.
   Retain the SDSS RA and DEC for these sources to help answer question 4, below. Note that only $\sim$5% of the FIRST sources will match an SDSS primary point source in the astronomer's field.

3. Determine which of the FIRST sources in the astronomer's survey is brightest (has the largest flux) in WISE W1. Let us refer to this source as IR 1. Plot the 7 fluxes (5 SDSS and 2 WISE) of IR 1 in Jy[3] as a function of wavelength [4] and save to a png.

4. Use the SDSS Navigate Tool and the SDSS RA and DEC of IR 1 to retrieve it's optical image. Click Explore to see the spectrum and identifying information of IR 1. As part of your code for question 3, print out a few brief comments indicating why, given how it was selected in the astronomer's survey, the spectrum and identification of IR 1 is as might be expected.

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[1] This shouldn't be a big deal unless we're working collaboratively, but you should get into the habit *now*.

[2] "primary" in this context means the best observation in the SDSS, given that the SDSS scanned some parts of the sky multiple times.

[3] For PSFFLUX, 1nmgy is 3631×10^{-9}Jy, for W1 it is 309.54×10^{-9}Jy, and for W2 it is 171.787×10^{-9}Jy

[4] PSFLUX represents SDSS ugriz bands at 3543Å, 4770Å, 6231Å, 7625Å and 9134Å, respectively. WISE W1 and W2 are at 3.4μm and 4.6μm, respectively