Homework 3 - Mangle

Don't forget to `svn up` *before you issue any other commands in SVN—this is to guard against you changing a document that someone else is working on in the same directory*[1].

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

Remember to comment your code carefully with your initials before every comment (as in `;ADM I just wrote a Python comment`*). 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.*

An astronomer is following up an imaging survey to obtain spectroscopy of targets in an area of the sky. The imaging survey consisted of a large "lat-lon rectangular" field limited in Right Ascension by $10^{\rm h}15^{\rm m} \leq \alpha < 11^{\rm h}15^{\rm m}$ and in declination by $30^\circ \leq \delta < 40^\circ$. Within this imaging, the astronomer places four spectroscopic plates. Each plate is a "spherical circle" on the sky of $\theta = 2^\circ$ in *radius*, and the centers of the plates are at $(\alpha, \delta) = (155^\circ, 34^\circ)$, $(\alpha, \delta) = (159^\circ, 36^\circ)$, $(\alpha, \delta) = (163^\circ, 34^\circ)$ and $(\alpha, \delta) = (167^\circ, 36^\circ)$.

1. Write Python code that constructs the *Mangle* mask that represents the spectroscopic survey that the astronomer conducts, remembering that it is impossible for her to observe data outside of the boundaries of the imaging survey. Your code should write the mask polygons out to a *.ply* file in the standard *Mangle* format.

2. By creating a random catalog of points over some or all of the sphere (in equal-area projection) and using *pymangle's* `contains` method, determine the area of your mask. Generate enough random points to determine the area of the mask to a precision of at least 0.5 deg^2.

In my `week6` directory in SVN, there is a list of quasars called *HW3quasarfile.dat*[2]. This is a list of 17,000 quasars that I've drawn from the Sloan Digital Sky Survey. Provided in the file are the coordinates of the quasars in base-60 ($hms.ss\circ\,'\,''$) format.

3. Plot the quasars from the file, plotting those quasars that lie within the mask in a different color from those that lie outside of the mask. Label your plot with the total area of the mask in square degrees[3] and with the number density[4] of the quasars in the mask.

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

[2] In general, it is **not** a good idea to store large data files in SVN as it slows down updates for all users, but this particular data file is quite small

[3] this is the total area of the astronomer's spectroscopic survey

[4] the total number of quasars in the mask per square degree