IDL/Python Programming Assignment

For every figure made below, make a caption for it in a file called `README.txt`. The figure that each caption belongs to should be clearly marked. Make your explanations clear and concise. They should include what the plot is showing (e.g. what are the axes and what was the data used?) as well as a short (1-2 sentence) statement about something interesting to take away from the plot. Pretend you are writing a paper and you want to tell the reader something they should take away from each plot. Remember, this is what YOU think is important. Don't be afraid about being right or wrong. Assume that the reader looks at your figures in the order that you make them, so feel free to refer to previous figures and not re-explain axis for similar figures. You can refer to them as figures 1,2,3,etc as long as you have written somewhere a key for which figure number is which.

For example, I might type:

```
Figure 1: HRDiagram_BrightStars.eps

<caption goes here>

Figure 2: HRDiagram_AllStars.eps

<second caption goes here>

etc...
```

1) Clean up the BrightStars file.

Go into the StarData directory. **Copy into this directory** the file
`~premapta/StarData/WriteNewFile.pro` (for IDL users)
`~premapta/StarData/WriteNewFile.py` (for python users)

Go through these files and explain what each part of the code does. Do this by leaving comments.

For IDL users: "comment" lines start with a semi-colon (;)
For Python users: "comment" lines start with a hash (#)
Commented lines should look blue in the emacs window.

When you are done with your comments, copy the file to
`/astro/users/premapta/Assignments/CodeComments/<your name>.pro`
(python users use a .py)

Edit the code so that the output file is called `BrightStars_NEW.dat` (that's an underscore, not a space). Run the code! You should now see a new file called `BrightStars_NEW.dat`.

Open up a new file called `StarHeader_NEW.txt`. In this file, explain what each column of `BrightStars_NEW.dat` represents, like what is in `StarHeader.txt`. Don't forget units!

Now, Edit the code again so that the input file is `NearStars.dat` and the output file is `NearStars_NEW.dat`. Run the code again. Now you should see a file called `NearStars_NEW.dat` in your directory.

2) Make a directory called `<yourname>_CodingAssignment`. For example, I would call it `Michael_CodingAssignment`. Go into that directory. *Everything following here should be done in this directory.* Move `StarHeader_NEW.txt`, `NearStars_NEW.dat`, and `BrightStars_NEW.dat` into this directory.

3) Make a scatter plot of Absolute V-band magnitude versus color for the stars in BrightStars_NEW.dat. Make it such that the y-axis goes from dim to bright and the x-axis goes from blue to red (remember how magnitudes work!). *Don't forget to label the axes!*

   Save the figure to the file `HRDiagram_BrightStars.eps` in the CodingAssignment directory you made above.
   Don't forget the caption!

4) Make another plot that is the same as above, but with data from *both* BrightStars_NEW *and* NearStars_NEW. Make these data points different colors and shapes (e.g. BrightStars data can be blue X's and NearStars can be red diamonds). Make a legend on your plot.

   Save the figure to the file `HRDiagram_AllStars.eps` in the CodingAssignment directory.

5) Make a histogram (include both BrightStars and NearStars) of the stars' distance from us. Normalize it into a *probability distribution*.

   Save the figure to the file `DistPDF.eps`

6) Make a *probability distribution* (again, including both samples) of the total speed of the stars (u = sqrt(uDec^2+uRA^2); sqrt = square root)

   Save the figure to the file `VelPDF.eps`

7) Make a histogram of the absolute magnitude of all the stars (BrightStars + NearStars). Normalize it such that the y-axis represents the *fraction of stars*.

Save the figure to the file `MagHist.eps`

8)Make a histogram of the color of the total sample of stars. Normalize it such that the y-axis represents the *fraction of stars*.

Save the figure to `ColorHist.eps`

10) Look at the `HRDiagram_AllStars.eps` file. Split up this data into two groups based on color and magnitude. Pick any grouping you want, but *explain why you split the data up in this way*. Put your explanation in the caption for this figure in `README.txt`

Plot all the stars again in a scatter plot similar to questions 3 and 4, but now color the stars based on their group.
Make a legend.
Save your figure to `HRDiagramCustom.eps`

11) Using the grouping you made in question 7, plot histograms of the magnitude, color, and distance of the stars in each group. Each plot should be placed vertically on a single figure. Each figure should have a separate curve for each of the two groups, so don't forget the legend! (**Hint**: make the lines the same colors and style in each plot, so you only need one legend!) Each histogram should be normalized to give the *fraction of stars* in the respective groups.

Save the figure to `NewGroupPlots.eps`

12) We haven't used the velocity yet. Pick at *least four* interesting plots to make using velocity. Make your plots be in the *same figure*, but make it look presentable. At least *two* of these plots should be histograms.

Hint: Think about grouping the stars, either by velocity or by other things and comparing velocities.

Name your figure `VelocityPlots.eps`.

Explain each of these figures in the caption in `README.txt`.