MTH 290B Homework #7 - November 21, 2019

Instructions: Please follow the instructions in Section 1.9 for how this homework should be completed and turned in. You should have multiple files once this is completed where each file is similar to the example shown on page 42. Include any output as a commented block at the end of your file, this includes any test cases. Save each file as the filename given in the respective problem. Please compress the files into one file (either zip, tar, tgz, etc.) and email it to me before class on the due date.

1. The file `stars.dat` contains a list of the nearest stars and some of their properties. The list elements are 4-tuples containing the name of the star, the distance from the sun in light years, the apparent brightness, and the luminosity. The apparent brightness is how bright the stars look in our sky compared to the brightness of Sirius A. The luminosity, or the true brightness, is how bright the stars would look if all were at the same distance compared to the Sun.

   (a) Make function that reads in the data file and returns a dictionary that contains the data as 4-tuples. Filename: `stars_data_dict1`

   (b) Make function that reads in the data file and returns a nested dictionary that contains the data. You can use `distance`, `apparent brightness`, and `luminosity` as the keys corresponding to the stars. Filename: `stars_data_dict2`

2. The viscosity of gases depends on the temperature. For some gases the following formula is relevant:

$$\mu(T) = \mu_0 \frac{T_0 - C}{T + C} \left(\frac{T}{T_0}\right)^{1.5}$$

   where the values of the constants C,T_0, and μ_0 are found in the file `viscosity_of_gases.dat`. The temperature is measured in Kelvin.

   (a) Load the file into a nested dictionary `mu_data` such that we can look up C , T_0 , and μ_0 for a gas with name `name` by `mu_data[name][X]`, where `X` is `'C'` for C , `'T_0'` for T_0, and `'mu_0'` for μ_0.

   (b) Make a function `mu(T, gas, mu_data)` for computing $\mu(T)$ for a gas with name `gas` (according to the file) and information about constants C, T_0 , and μ_0 in `mu_data`.

   (c) Plot $\mu(T)$ for air, carbon dioxide, and hydrogen with $T \in [223, 373]$.

   Filename: `viscosity_of_gases`