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Find the radius of a star

Final project due May 26, 2021 18:22 CEST

Final project: Find the radius of a star (External resource)

(10.0 points possible)



STATEMENT

SOLVE

Finding the radius of a star is not as easy as simply measuring it. In fact, the radius is calculated from a measured, namely the star's brightness (also called luminosity) and its surface temperature. More precisely, the surface temperature cannot be directly measured either but is itself computed, but let's not go there here.

You are given a file, stardata.txt, with star data: Each line of the file starts with the name of a star (a string), followed by the star's temperature (in Kelvin), followed by the star's luminosity (measured in terms of the Sun's luminosity).

Here are **two sample lines** from the file stardata.txt:

```
Vega 9600 50
Sirius_B 25000 0.0295
```

Your first task is to write a function which reads this data into an array of structures, with the structure type defined in the provided code. The function needs to return an integer, namely the number of stars read and stored in the array.

Your next task is to write a function that computes the radius of each star in this array (in terms of the Sun's radius). This radius is to be stored in the appropriate location in the array of structures. The formula to compute a star's radius (in terms of the Sun's radius) is

$$R = \left(\frac{T_S}{T} \right)^2 \cdot \sqrt{L},$$

where $T_S=3500$ is the temperature (in Kelvin) of the sun, T is the temperature of the star and L is the luminosity (in terms of the Sun's luminosity).

Your final task is to write a function which classifies each star in the array of structures as from the Main Sequence ('M'), a Giant ('G'), a Supergiant ('S'), or a White Dwarf ('W'). If a star does not fit into any of these categories, then the function should store an 'N' in the appropriate location.

Here are the classification rules (note that these are not exactly what astronomers use, but it's good enough for our purposes):

Main Sequence (M):

Luminosity between 10^{-2} and 10^6 times that of the sun;

Radius between 0.1 and 10 times that of the sun.

Giants (G):

Luminosity between 10^3 and 10^5 times that of the sun;

Radius between 10 and 100 times that of the sun.

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