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DSA 2 – Milestone Project 1

Scenario 1: Stars

**Part 1**

1. The goal for this data analysis is to find stars that are similar to the Sun. Scientists have theorized that stars that share properties to the Sun (e.g. size, temperature) could potentially support life on their surrounding planets. We are trying to determine the color, spectral classification, temperature, radius, absolute magnitude, and luminosity of stars and how those values compare to the Sun . How do the stars from the dataset compare to the Sun for those respective properties? At what point is a star considered a dwarf star? How close to the star would a planet have to be to sustain life?
2. Although it was not included, I would have removed the “is\_star” column from the dataset mentioned in the instructions. Presumably, all objects in the set would display a 1 to indicate they are stars since it is the data set’s title. Any objects that displayed a 0 would be deleted from the set since we are specifically trying to determine which stars are similar to the Sun. Any objects not classified as stars would be irrelevant for this analysis.
3. There were several errors in formatting for the “Color” column. All entries were capitalized, and hyphens were added to any two-worded colors. Any entries that ended with “ish” were changed the closest color (e.g. “yellowish” to “yellow”) strictly for convenience. The changes made in this section were done to standardize the format for color, they have no bearing on whether a star is correctly classified. The following is a list of corrections and the number of each correction that was made:
   1. “yellowish” to “Yellow”: 6
   2. “Blue White” to “Blue-White”: 14
   3. “Yellow White” to “Yellow-White”: 3
   4. “yellow-white” to “Yellow-White”: 11
   5. “Blue-white” to “Blue-White”: 41
   6. “white” to “White”: 66
   7. “Whitish” to “White”: 2
   8. “Pale yellow orange” to “Yellow-White”: 1 (spectral class F, temperature within 6000-7500K)
   9. “Orange-Red” to “Orange”: 1 (temperature within 3700-5200K)
4. While there were no null values in this dataset, there were several errors. None of the stars were named, so I created a column to name them. After correcting the colors, I ordered the data set from lowest to highest temperature. I named each star with the first letter of the correct color (e.g. R for red stars), then a number starting with 1. One of the most common errors besides the formatting in the “Color” column was the color and/or spectral class mismatching the temperature for a star. To fix these issues efficiently, I sorted the stars by lowest to highest temperature. The changes I made are as follows:
   1. Rows 108-113: Change color from “Red” to “Orange” because the temperature falls between 3700 K-5200 K
   2. Rows 107-112: Change class from “M” to “K” because temperature falls between 3700 K-5200 K
   3. Rows 114, 116, 117: Change color from “Yellow” to “Orange” because temperature falls between 3700 K-5200 K
   4. Rows 119-123: Change color to “Yellow” and class to “G” because temperature falls between 5200 K-6000 K
   5. Row 126: Change color from “Red” to “Yellow-White” and class to “F” because temperature falls between 6000 K-7500 K
   6. Row 128: Change color from “White” to “Yellow-White” because temperature falls between 6000 K-7500 K
   7. Row 130: Change color from “Blue” to “Yellow-White” and class from “O” to “F” because temperature falls between 6000 K-7500 K
   8. Rows 131, 132, 136: Change color from “Yellow-White” to “White” and class from “F” to “A” because temperature falls between 7500 K-10 000 K
   9. Rows 138, 140, 143, 144, 146, 149: Change color from “Blue-White” to “White” because temperature falls between 7500 K-10 000 K
   10. Rows 141, 147, 148, 151: Change color from “Blue” to “White” and class from “O” to “A” because temperature falls between 7500 K-10 000 K
   11. Row 150: Change class from “B” to “A” because temperature falls between 7500 K-10 000 K
   12. Rows 152, 158, 163, 171, 172, 176: Change class from “A” to “B” because temperature falls between 10 000 K-30 000K
   13. Rows 153, 175, 180: Change color from “White” to “Blue-White” and class from “F” to “B” because temperature falls between 10 000 K-30 000 K
   14. Rows 154, 157, 159, 165-167, 178, 186, 188, 191, 193, 196, 201, 204, 208, 210-212, 215, 217, 220, 223: Change color from “Blue” to “Blue-White” and class from “O” to “B” because temperature falls between 10 000 K-30 000 K
   15. Rows 160, 170: Change color from “Yellow-White” to “Blue-White” and class from “F” to “B” because temperature falls between 10 000 K-30 000 K
   16. Rows 173, 181, 183, 187, 192, 194, 195, 197, 199, 200, 203, 209, 213, 221: Change color from “Blue” to “Blue-White” because temperature falls between 10 000 K- 30 000 K
   17. Rows 231, 233: Change class from “B” to “O” because temperature is greater than 30 000 K

**Part 2**

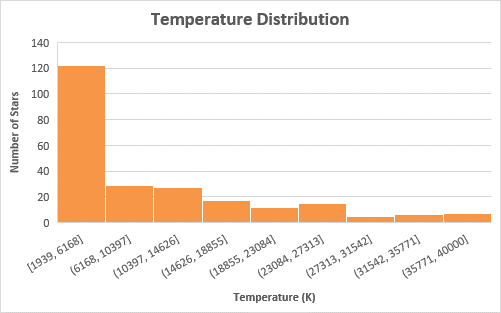
1. The average luminosity of a yellow-white star is 45000.51719
2. The temperature of the hottest star is blue with a temperature of 40 000 K

|  |  |  |
| --- | --- | --- |
| **Star** | **Temperature** | **Color** |
| 1 | 40000 K | Blue |
| 2 | 39000 K | Blue |
| 3 | 38940 K | Blue |
| 4 | 38234 K | Blue |
| 5 | 37882 K | Blue |

**Part 3**

|  |  |
| --- | --- |
| *Temperature Summary Stats* | |
|  |  |
| Mean | 10497.46 |
| Standard Error | 616.6064 |
| Median | 5776 |
| Mode | 3600 |
| Standard Deviation | 9552.425 |
| Sample Variance | 91248824 |
| Kurtosis | 0.877352 |
| Skewness | 1.321568 |
| Range | 38061 |
| Minimum | 1939 |
| Maximum | 40000 |
| Sum | 2519391 |
| Count | 240 |

The distribution of temperatures has a positive, right skew. The median value is greater than the mean and mode. The absolute value of the skewness statistic of 1.321568 is greater than 1, it indicates the distribution is strongly skewed. Kurtosis describes the “peakedness” of a distribution. A normal distribution has a kurtosis of 0. With this distribution, however, the kurtosis value of .877352, meaning the peak is higher than a normal distribution.

The histogram to the left shows a non-normal distribution of temperatures for the stars in the data set. The highest concentration of temperatures is in the bin ranging from 1939-6168 K, with a dramatic drop in the number of stars in the subsequent bins. With this distribution, the mode’s value is less than the mean and median. As a result, the distribution is positively skewed. The histogram has a mean value of 10497.46 K and a standard deviation of 9552.425. Using +/- 3 standard deviations to determine when a data point becomes an outlier, the threshold is 39154.735. With this standard, there are no obvious outliers with this distribution.

The scatter plot above shows the relationship between the temperature of a star and its luminosity. The correlation coefficient for these two variables is 0.393404076. This indicates that there is a positive correlation between a star’s temperature and its luminosity, but it is only a moderate one. A moderate correlation has a coefficient value between .3 and .7. An increase in temperature would likely result with an increase in luminosity. You would not be able to confidently predict the precise luminosity solely based on temperature or vice versa.

This combination bar-line graph illustrates a star’s luminosity compared to that of the Sun. The large range in luminosity values makes it impossible to see minor differences between the stars. To combat issues with scaling, the second graph comparing the stars in the data set to the Sun is zoomed in. This allows you to get a better look at which stars have a similar luminosity to the Sun.

The second graph shows stars in the data set that have the smallest diffence in luminosity from the Sun. By zooming in on these stars, you can see these differences much more clearly.

Here are the characteristics of the stars that have the closest luminosity to the Sun of 3.75E+28. The five stars included are the ones with the smallest difference in luminosity to the Sun and listed in order from smallest to largest difference within the set.

**Sun vs. Star - Luminosity**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Star Name** | **Temperature** | **Luminosity (E+28)** | **Radius (E+5)** | **Absolute Magnitude (A\_M)** | **Color** |
| **Sun** | **5778 K** | **3.75** | **4.33** | **4.83** | **Yellow** |
| YW2 | 6757 K | **1.43** | 1.12 | 2.41 | Yellow-White |
| Y5 | 5936 K | **1.357** | 1.106 | 4.46 | Yellow |
| YW1 | 6380 K | **1.35** | .98 | 2.93 | Yellow-White |
| Y2 | 5587 K | **.819** | .99 | 5.03 | Yellow |
| Y4 | 5800 k | **.81** | .9 | 5.05 | Yellow |

As wiith luminosity, there is also a large range for the stars’ radii. It is very difficult to see how different stars compare to the Sun when all the stars are included on the graph. When you zoom in, you able to see the stars that have the most similar radius measurements to the Sun. Of those stars, all of them have significantly higher temperatures than the Sun. Other than radius, none of the variabless are similar to the Sun in this smaller sample.

The stars below have the most similar radii to the Sun of 4.33E+5. The five stars included in the table have the smallest difference in radius measurements from the Sun and are listed in order from smallest to largest difference within the set.

**Sun vs. Star - Radius**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Star Name** | **Temperature** | **Luminosity (E+28)** | **Radius (E+5)** | **Absolute Magnitude (A\_M)** | **Color** |
| **Sun** | **5778 K** | **3.75** | **4.33** | **4.86** | **Yellow** |
| BW25 | 26140 K | 14520 | **5.49** | -3.8 | Blue-White |
| BW33 | 17140 K | 883 | **5.653** | -2.64 | Blue-White |
| BW78 | 16390 K | 1278 | **5.68** | -3.32 | Blue-White |
| BW71 | 14060 K | 1092 | **5.745** | -2.04 | Blue-White |
| W20 | 9700 K | 74 | **2.89** | .16 | White |

Like the previous sets of graphs, this pair compares the stars in the data set to the Sun. Rather than illustrating the differences in luminosity or radius, however, these graphs show absolute magnitude. The first graph shows all of the stars included in the set while the second graph specifically shows the stars that have an absolute magnitude that is similar to the Sun’s. Although the range in absolute magnitude is not as large as with luminosity or radius, it is still difficult to differentiate between the all 240 points in the full data set. By zooming in, we can more clearly see how the other stars compare to the Sun.

Below are the stars that have absolute magnitudes that are most similar to the Sun at +4.83. The five stars included in the table have the smallest difference in absolute magnitude to the Sun. They are ordered from smallest to largest difference within the set.

**Sun vs. Star – Absolute Magnitude**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Star Name** | **Temperature** | **Luminosity (E+28)** | **Radius (E+5)** | **Absolute Magnitude (A\_M)** | **Color** |
| **Sun** | **5778 K** | **3.75** | **4.33** | **4.86** | **Yellow** |
| O11 | 4980 K | .357 | 1.13 | **4.78** | Orange |
| O12 | 5112 K | .63 | .876 | **4.68** | Orange |
| Y2 | 5587 K | .819 | .99 | **5.03** | Yellow |
| Y4 | 5800 | .81 | .9 | **5.08** | Yellow |
| Y5 | 5936 K | 1.357 | 1.106 | **4.46** | Yellow |

ŷ = 1.1861x + 10216 R² = 0.0041 R = .06403

ŷ = 1.1861 (.319) + 10216 = 10216.3784

The star has a predicted temperature of 10216 K. At this temperature, the star would fall into the B star class and have a blue-white color. The R value is incredibly low, which indicates there is a very weak positive correlation between radius and temperature. While we could predict the temperature based on the radius, it would by no means be reliable.

The correlation coefficient for radius vs luminosity is .5265. This indicates there is a moderate positive correlation between radius and luminosity. As radius increases, luminosity will likely increase as well.

**Part 4**

The space research company AWAY (Aliens Where Are You) is looking for stars that share similar properties to the Sun. The goal of the company is to find planets other than Earth that can support life. We already know that the Sun is capabable of sustaining life on a planet and should therefore look for stars that are similar in its temperature, luminosity, size, and absolute magnitude. In order to focus on finding other stars that share the Sun’s properties, I would create a feasibility report. This type of report focuses on the likelihood of finding another yellow-dwarf star capable of sustaining life on its surrounding planets. AWAY would use its resources most effectively by focusing on a list of stars that share specific traits with the Sun. Given the information in the data set, there is potentially one star that has multiple similar properties to the Sun that AWAY should examine further.

Title***: Finding Another Sun: The Search For A Star That Could Potentially Support Life***

We know that the Sun is capable of supporting life because we are all here on Earth. The question remains, however, if there are any other stars in the universe that are capable of supporting life. In an effort to narrow down the search, we will look at stars that share similar attributes to the Sun, specifically examining temperature, luminosity, radius, and absolute magnitude.

The primary graphic is a simple table that shows all of the characteristics of the yellow stars in the data set. It is simple, easy to read, and is the most efficient way to present the data.

**Sun vs. Yellow Stars**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Temperature (K)** | **Luminosity** | **Radius** | **Absolute Magnitude** | **Color** | **Spectral Class** | **Type** |
| Y1 | 5300 | .59 | .91 | 5.49 | Yellow | G | 3 |
| Y2 | 5587 | .819 | .99 | 5.03 | Yellow | G | 3 |
| Y3 | 5752 | 245000 | 97 | -6.63 | Yellow | G | 4 |
| **Sun** | **5778** | **3.75** | **4.33** | **4.83** | **Yellow** | **G** | **3** |
| Y4 | 5800 | .81 | .9 | 5.05 | Yellow | G | 3 |
| Y5 | 5936 | 1.37 | 1.106 | 4.46 | Yellow | G | 3 |

I would also include the zoomed in graphs of luminosity, radius, and absolute magnitude vs. Sun. These more clearly show the stars that have similar traits to the Sun rather than the charts that graph out the entire data set. It is significantly more difficult to differentiate the individual stars and minor differences with the large ranges within the full data set.

I would include the following two images in my presentation. The first shows the different types of stars. This gives the audience a better picture of what a yellow dwarf star would look like compared to a red giant or a white dwarf. The second image is strictly a close up of a yellow dwarf. Since the AWAY company is specifically looking for yellow dwarfs like the Sun, it is important to give a clear picture of the stars we are looking for. Because the audience is a group of scientists, I would not need to rely heavily on outside visuals. I would depend most heavily on the graphs and tables derived from the provided data set.

![Graphical user interface, website

Description automatically generated](data:image/jpeg;base64,/9j/4AAQSkZJRgABAQEASABIAAD/4SQsRXhpZgAATU0AKgAAAAgABgALAAIAAAAmAAAIYgESAAMAAAABAAEAAAExAAIAAAAmAAAIiAEyAAIAAAAUAAAIrodpAAQAAAABAAAIwuocAAcAAAgMAAAAVgAAEUYc6gAAAAgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAFdpbmRvd3MgUGhvdG8gRWRpdG9yIDEwLjAuMTAwMTEuMTYzODQAV2luZG93cyBQaG90byBFZGl0b3IgMTAuMC4xMDAxMS4xNjM4NAAyMDIyOjAyOjI3IDA5OjQ5OjI4AAAGkAMAAgAAABQAABEckAQAAgAAABQAABEwkpEAAgAAAAM1MgAAkpIAAgAAAAM1MgAAoAEAAwAAAAEAAQAA6hwABwAACAwAAAkQAAAAABzqAAAACAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA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QgdHlwZXMgb2Ygc3RhcnMcAhkAB3NjaWVuY2UcAhkACWVkdWNhdGlvbhwCGQAHZGlhZ3JhbRwCGQAFY2hhcnQcAhkABm5hdHVyZRwCGQAGcG9zdGVyHAIZABF5ZWxsb3cgZHdhcmYgc3RhchwCGQAEc3RhchwCGQAGcGxhbmV0HAIZAA5yZWQgZHdhcmYgc3RhchwCGQAPc3VwZXJnaWFudCBzdGFyHAIZAA5yZWQgZ2lhbnQgc3RhchwCGQAPYmx1ZSBnaWFudCBzdGFyHAIZABB3aGl0ZSBkd2FyZiBzdGFyHAIZAAh1bml2ZXJzZRwCGQAGZ2FsYXh5HAIZAAVzcGFjZRwCGQAJYXN0cm9ub215HAIZAAVuaWdodBwCGQAFc3RhcnMcAhkAA3NreRwCGQAKc2NpZW50aWZpYxwCGQAIc2NpZW5jZXMcAhkAC2VkdWNhdGlvbmFsHAIZAAhsZWFybmluZxwCGQAFbGVhcm4cAhkAB2RyYXdpbmccAhkAB25hdHVyYWwcAhkAC2Vudmlyb25tZW50HAIZAAZkZXNpZ24cAhkABXdvcmxkHAIZAAtvdXRlciBzcGFjZRwCGQAMc29sYXIgc3lzdGVtHAIZAAZjb3Ntb3McAhkADGFzdHJvbm9taWNhbBwCGQAKYXN0cm9ub21lchwCGQAJY29zbW9sb2d5HAIZAAlwbGFuZXRhcnkcAhkABGRhcmscAhkADGlsbHVzdHJhdGlvbhwCGQAGdmVjdG9yHAIZAANFUFMcAhkAB2NhcnRvb24cAhkAB2dyYXBoaWMcAhkAB2NsaXBhcnQcAhkACGNsaXAgYXJ0HAIZAAVpbWFnZRwCGQAHcGljdHVyZRwCGQAIY2xpcC1hcnQcAngANURpYWdyYW0gc2hvd2luZyBkaWZmZXJlbnQgdHlwZXMgb2Ygc3RhcnMgaWxsdXN0cmF0aW9uHAIAAAIABBwCNwAIMjAyMjAyMjccAjwACzA5NDcyOSswMDAwADhCSU0EJQAAAAAAEERwPLdN3rs1oKPTFlzIgIz/7AARRHVja3kAAQAEAAAAZAAA/9sAQwADAgIDAgIDAwMDBAMDBAUIBQUEBAUKBwcGCAwKDAwLCgsLDQ4SEA0OEQ4LCxAWEBETFBUVFQwPFxgWFBgSFBUU/9sAQwEDBAQFBAUJBQUJFA0LDRQUFBQUFBQUFBQUFBQUFBQUFBQUFBQUFBQUFBQUFBQUFBQUFBQUFBQUFBQUFBQUFBQU/8AAEQgCIwPLAwEiAAIRAQMRAf/EAB8AAAEFAQEBAQEBAAAAAAAAAAABAgMEBQYHCAkKC//EALUQAAIBAwMCBAMFBQQEAAABfQECAwAEEQUSITFBBhNRYQcicRQygZGhCCNCscEVUtHwJDNicoIJChYXGBkaJSYnKCkqNDU2Nzg5OkNERUZHSElKU1RVVldYWVpjZGVmZ2hpanN0dXZ3eHl6g4SFhoeIiYqSk5SVlpeYmZqio6Slpqeoqaqys7S1tre4ubrCw8TFxsfIycrS09TV1tfY2drh4uPk5ebn6Onq8fLz9PX29/j5+v/EAB8BAAMBAQEBAQEBAQEAAAAAAAABAgMEBQYHCAkKC//EALURAAIBAgQEAwQHBQQEAAECdwABAgMRBAUhMQYSQVEHYXETIjKBCBRCkaGxwQkjM1LwFWJy0QoWJDThJfEXGBkaJicoKSo1Njc4OTpDREVGR0hJSlNUVVZXWFlaY2RlZmdoaWpzdHV2d3h5eoKDhIWGh4iJipKTlJWWl5iZmqKjpKWmp6ipqrKztLW2t7i5usLDxMXGx8jJytLT1NXW19jZ2uLj5OXm5+jp6vLz9PX29/j5+v/aAAwDAQACEQMRAD8A/KqiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKXaaSvtX9g/9iv4fftQeD/E+q+MfGV/4au9Mv47SCGzuLaMSo0e8sRKpJ5444oA+Kqd5Zr9ho/+CMnwimsPtyfETxQ9lsMn2hZLIx7R1O7ysY68+1fNn7bX7Bfw0/Zt+DkHizwj451LxHqsmqwWRs7q4tZEETpKxfEShsgxrz0+agD4Kopdpp3lN+Hr/n60AMop3lmk2HvxQAlFLt70bTQAlFLtPsKPLb0oASil2mjaaAEopdh9P0o2mgA2Hp39KCpFfrH+yz+wV8GPh5+zTZfF/wCOsH9pNfaamszLezTJaadaygGFRHEQ0kjKyZBydzhVXu3wB+1pf/C7Uvjdq9x8HLdbXwG0Ft9ljWO4j/eeSvnHbP8AOP3m7244oA8b20bTxX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RQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFAH/9k=)

Image from <https://www.freepik.com/premium-vector/different-types-stars_6911858.htm#query=yellow%20dwarf%20star&position=20&from_view=keyword>

A close up of a planet

Description automatically generated with low confidence

Image from <http://www.astronoo.com/en/news/yellow-dwarf.html>

Main insights:

* + Most stars temperature falls below 6500 K (123 out of 240; 51.25%)
  + There are a number of stars that share L, R, or A\_M; but none share similar measurements in all categories as the Sun
  + Of the 240 stars listed, only 5 fall into the same class as the Sun (2% of data set)
  + One star (Y5) shares similar temp, L, and A\_M, but R is approx. 25% of the Sun’s
  + Y3 only shares temperature range with Sun, varies significantly in other categories (much larger, more luminous, and has vastly different A\_M)
  + Of the five yellow stars in the data set, 1 is a Super Giant and 4 are in the Main Sequence like the Sun

More than anything, the AWAY company needs more data. Of the 240 stars listed in the data set, only five of them were in the same color and class as the Sun (Yellow, Class G). That is only 2% of the data set. Of the five yellow stars, one of them is completely dissimilar to the Sun in every category except temperature. It is significantly larger, more luminous, and has a vastly lower absolute magnitude value. Because of these traits, it would not be an effective use of time or resources to explore this star more thoroughly. There is one star that is close in temperature, luminosity, and absolute magnitude, but its radius is about 25% of the Sun’s. If the AWAY company is looking to explore one star, it should be Y5. It is in the best interest of the compan, , however, to get more information on this star and to expand its data set to include more yellow stars to compare to the Sun.

**Part 5**

While a goal of any report is to inform the audience, in this instance it is secondary to the goal help the AWAY company make business decisions. The company is looking to explore stars that are similar to the Sun. The information presented should help AWAY narrow down which stars could have surrounding planets that support life. AWAY should also determine whether they need more information, both for expanding their data set and for examining specific stars more closely.

My audience is comprised of scientists at the AWAY company. They will have a strong background in astronomy and a working knowledge of what luminosity, radius, and absolute magnitude are and how they relate to stars. My audience’s baseline assumption is that I am a top-tiered expert in the field of astronomy. It is my duty to inform them that I am not, in fact, an expert in astronomy early on in the presentation.

I want my audience to make a decision based on the data, whether it is to examine specific stars from the data set further or to go out and gather information on a new grouping of stars.

Below are the three story points I plan to focus on for my data story:

* + Relationship between two metrics:
    - The radius has a very weak correlation with temperature so it is not a good predictor of what temperature or star color. The correlation coefficient is .06403, well below the .3 to .7 range to be considered a moderate correlation.
    - There is a moderate positive correlation between temperature and luminosity.
  + Drill Down: looking at overall comparison of Sun’s stats to a sample of stars, but zoom in to get a closer look at the ones who share the most similar properties
    - There are 240 stars in the data set. Because there are so many stars, it becomes difficult to see the individual points and how they compare to the Sun. By zooming in, it is much easier for the audience to view the presented information for each data point
    - Both luminosity and radius have a large value ranges. These large ranges make it nearly impossible to clearly show the data on graphs without. By zooming in, the audience is better able to see the individual stars and how their luminosity and radius directly relate to the Sun.
  + Compare & contrast:
    - AWAY is looking for stars that have similar characteritics to the Sun, specifically yellow-dwarfs.The only way to determine if a star and Sun are similar is to directly compare the values for each variable. Both the tables and zoomed in graphs presented earlier are visual aids that help illustrate those points.
    - The Sun’s traits are as follows:
      * Temp: 5778 K, L: 3.75E+28, R: 4.33E+05, A\_M: +4.83, type: 3
    - Star Y3 traits are as follows:
      * Temp: 5752 K, L: 245000, R: 97, A\_M: -6.63, type: 4
    - Star Y5 traits are as follows:
      * Temp: 5936 K, L: 1.37, R: 1.106, A\_M: 4.46, type: 3
    - While Y3 is close in temperature to the Sun, that is where the similarities end. It is significantly larger, more luminous, and has a much much lower absolute magnitude. In addition, AWAY is specifically looking for yellow dwarf stars which fall into the Main Sequence star type. Star Y3 is a type 4 Super Giant and would not meet the specifications for AWAY. Contrastingly, Star Y5 shares a number of similar measurements to the Sun.

***Finding Another Sun: The Search For A Star That Could Potentially Support Life***

In February 2022, I was asked to assist the AWAY company (Aliens Where Are You) find stars that could possibly support life on surrounding planets. We know that the Sun is capable of supporting life because you and I are here on Earth. Some might debate you on whether it is *intelligent* life, but that is certainly a philosophical question for another day. There are an infinite number of stars in the Universe, so how should AWAY narrow their search for life on another planet? Can we find the next Sun? The simplest approach, it seems, is to examine stars that share characteristics to it.

My name is Leanna Wisnefske. While I am not an expert in Astronomy, I am a student of data and statistical analysis. Not only will I be able to tell you which stars you should examine more closely in the data set, I will be able to provide statistical insisghts as to why.

In working with the data set, I decided to examine the information with a broad scope then focus in to points related to the Sun. The first characteristic I examined was luminosity. The range in luminosities for the data set is quite large. When graphing the luminosities from the data set compared to the Sun, it became incredibly difficult to see the data points both because of the large range for luminosity and because there are 240 stars included in the data set.. In order to more closely examine the stars that had a similar luminosity to the Sun, I zoomed in on the graph and created a table with the variables for the stars. I included five stars that had the smallest difference in luminosity with the Sun. The temperatures of the stars in this smaller sample were pretty inconsistent, with the color ranging from yellow to yellow-white (5587K – 6757 K). All of the stars that had a similar luminosity to the Sun also shared similar radii with each other (.98-1.93).

Upon further examination, I determined that there is a moderate positive correlation between the two measures. With a correlation coefficient of .5265, when there one variable changes (i.e. radius increases), the other will likely follow suit (i.e. luminosity would also increase).

**Sun vs. Star - Luminosity**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Star Name** | **Temperature** | **Luminosity (E+28)** | **Radius (E+5)** | **Absolute Magnitude (A\_M)** | **Color** |
| **Sun** | **5778 K** | **3.75** | **4.33** | **4.83** | **Yellow** |
| YW2 | 6757 K | **1.43** | 1.12 | 2.41 | Yellow-White |
| Y5 | 5936 K | **1.357** | 1.106 | 4.46 | Yellow |
| YW1 | 6380 K | **1.35** | .98 | 2.93 | Yellow-White |
| Y2 | 5587 K | **.819** | .99 | 5.03 | Yellow |
| Y4 | 5800 k | **.81** | .9 | 5.05 | Yellow |

After examining the luminosity, I decided to look at the radius of the stars. Like luminosity, there is a wide range of values. With such a large, it is difficult to see the difference in radii, particularly since more than half of the data points have a radius that is less than 1. I once again zoomed in on the graph and created a table with the appropriate measurements In order to more closely examine the stars that shared a radius similar to the Sun. Again, I used the five stars that had the smallest difference in the variable I was examining. Of the five stars with the most similar radii to the Sun, one is a white star and four are blue-white in color. The temperatures range from 9700 K to 26140 K, much hotter than the Sun’s temperture of 5778 K. Luminosities range from 74 to 14520, once again much larger values than the Sun at 3.75. Lastly, the absolute magnitude of the stars with a similar radius to the Sun range from -3.8 to .16. In comparison, the largest absolute magnitude value of those stars is less than half of the Sun’s. In trying to determine if luminosity is a strong predictor of temperature, I found it is decidedly not. With a correlation coefficient of .06403, it indicates there is a very, very weak positive correlation. A moderate correlation would have a coefficient between .3 and .7. By looking at the luminosity, you cannot reliably predict a star’s temperature.

**Sun vs. Star - Radius**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Star Name** | **Temperature** | **Luminosity (E+28)** | **Radius (E+5)** | **Absolute Magnitude (A\_M)** | **Color** |
| **Sun** | **5778 K** | **3.75** | **4.33** | **4.86** | **Yellow** |
| BW25 | 26140 K | 14520 | **5.49** | -3.8 | Blue-White |
| BW33 | 17140 K | 883 | **5.653** | -2.64 | Blue-White |
| BW78 | 16390 K | 1278 | **5.68** | -3.32 | Blue-White |
| BW71 | 14060 K | 1092 | **5.745** | -2.04 | Blue-White |
| W20 | 9700 K | 74 | **2.89** | .16 | White |

Beyond examining luminosity and radius, I also analyzed the stars’ absolute magnitude in relation to the Sun. Unlike luminosity and radius, there is not a large range for absolute magnitude. The number of data points, however, is still 240 and it was still difficult to separate one point from another on the graph. The five stars included in the smaller sample had the five smallest differences in absolute magnitude with the Sun. The temperatures of the five stars with absolute magnitudes that most closely resembled the Sun’s range from 4980 K to 5936 K, including two orange and three yellow stars. These temperatures are similar to the Sun at 5778 K. The luminosities range from .63 to 1.357, or roughly 14.55% to 31.34% of the value of the Sun’s luminosity. The radii of the stars are between .876 and 1.13. The largest of the stars had a radius roughly 26% of the Sun’s, so the stars are quite a bit smaller.

**Sun vs. Star – Absolute Magnitude**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Star Name** | **Temperature** | **Luminosity (E+28)** | **Radius (E+5)** | **Absolute Magnitude (A\_M)** | **Color** |
| **Sun** | **5778 K** | **3.75** | **4.33** | **4.86** | **Yellow** |
| O11 | 4980 K | .357 | 1.13 | **4.78** | Orange |
| O12 | 5112 K | .63 | .876 | **4.68** | Orange |
| Y2 | 5587 K | .819 | .99 | **5.03** | Yellow |
| Y4 | 5800 K | .81 | .9 | **5.08** | Yellow |
| Y5 | 5936 K | 1.357 | 1.106 | **4.46** | Yellow |

Lastly, I examined the temperature of the stars. AWAY is specifically looking for yellow-dwarf stars. A star’s temperature must fall between 5200 K and 6000 K to be classified as a yellow star. In the data set of 240 stars, 123 (51.25%) of them had temperatures below 6500 K. Of those, only five were classified as yellow stars. Since there were only five stars, I created a table to easily compare the values of them to the Sun. The star that was closest to the Sun in temperature (5752 K), was completely dissimilar in every category. It had a significantly higher luminosity and radius, while having a much smaller absolute magnitude. This star is also considered a Super Giant. As such, it would not be an efficient use of money, time, or resources to explore this star further. Of the remaining four yellow stars, Y5 similar properties to the Sun. Its measurements are as follows: temp: 5936 K, L: 1.37, R: 1.106, A\_M: 4.46, type: 3 (Main Sequence).

**Sun vs. Yellow Stars**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Temperature (K)** | **Luminosity** | **Radius** | **Absolute Magnitude** | **Color** | **Spectral Class** | **Type** |
| Y1 | 5300 | .59 | .91 | 5.49 | Yellow | G | 3 |
| Y2 | 5587 | .819 | .99 | 5.03 | Yellow | G | 3 |
| ~~Y3~~ | ~~5752~~ | ~~245000~~ | ~~97~~ | ~~-6.63~~ | ~~Yellow~~ | ~~G~~ | ~~4~~ |
| **Sun** | **5778** | **3.75** | **4.33** | **4.83** | **Yellow** | **G** | **3** |
| Y4 | 5800 | .81 | .9 | 5.05 | Yellow | G | 3 |
| Y5 | 5936 | 1.37 | 1.106 | 4.46 | Yellow | G | 3 |

Y3 is the star that has the closest overall values to the Sun should be examined further. Its luminosity value is 36.5% of the Sun’s and its radius is approximately 25.5% of the Sun’s. These values are substantially lower than the Sun’s. We need more information to determine if those differences effect the star’s ability to support life on a surrounding planet. More importantly, AWAY is looking for yellow-dwarf stars. In AWAY’s data set, only five stars are yellow and one of them is a Super Giant. In looking for stars that share characteristics to the Sun and could possibly support life on orbiting planets, you simply cannot limit the search to four yellow stars. There are an infinite number of stars in the Universe. In order to find the next Sun, AWAY needs to expand its data set to include more stars, particularly yellow ones.