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Sleep vs GPA/Productivity

Introduction:

As college students who have very different sleeping patterns which affect how we go on with our daily lives, we were curious about whether other students here at Boston University would have similar sleeping patterns and how that affects them too. For this project, our primary purpose is to collect data on how much sleep BU students get weekly and how much productivity they achieve as a result. Also, whether the amount of sleep that a student gets has an effect on their GPA. The main problems or questions that we wanted to answer are: Is there a relationship between the number of hours you sleep and your GPA? and Is there a relationship between the number of hours you sleep and your productivity in general (number of hours you exercise, number of hours you take part in extracurricular activities, etc)? Our hypothesis for the first question is students who get around 49.7 hours (the average of the data we collected) of sleep per week tend to have a higher GPA. Our hypothesis for our second question is students who get around 49.7 hours of sleep per week tend to be more productive throughout the day.

Methodology:

Link: https://forms.gle/K4ifqjqXFGCWiFQ58

Our first step was to create a survey using google forms and send it out. We posted the survey on various Boston University Facebook groups, shared it with our friends that attend Boston University and also uploaded it onto the Piazza website to collect as much data as possible. Once we were done with the collection of the data, we wrote the code to create various visualizations. Our project includes the following visualizations and the methods used to create them:

- Histograms, created using matplotlib, to display the distribution of each variable (Hours of Exercise, GPA, etc).
- A density plot, created using matplotlib, to display the distribution of the hours of sleep.
- Scatterplots, created using matplotlib, highlighting the relationship between number of hours a student slept in a week and their GPA, The Hours they Exercised for, Hours Spent on Homework and Hours spent on Extracurriculars

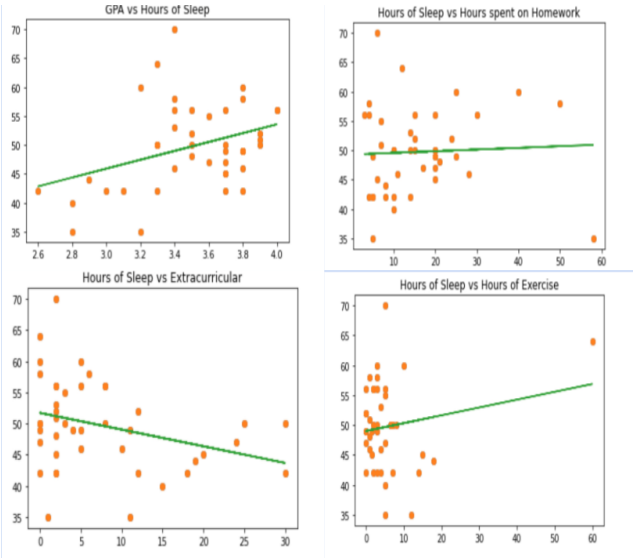
- Box plots, created using seaborn library, highlighting the hours spent on Homework, Extracurriculars, Exercise as well as a students GPA. (We multiplied the GPA by 10 to display distinct results)
- 2 Faceted Histograms, created using seaborn library, to display the values of hours of exercise, hours spent on homework, extracurricular activities and students gpa of students who sleep more than 50 hours a week and the students who sleep less than 50 hours a week. (We divided the data based on hours using the pandasql)
- A 4-Dimensional Scatterplot using seaborn Library

In addition, to be able to use seaborn, we also created a new data frame, data_df, using .melt() function putting in all the variable names (Hours spent on Homework, Exercise, Extracurriculars and GPA) into one column and their values into the other and then simply added their corresponding Hours of Sleep to another column.

Next, we conducted t-tests as well as chi square tests for each relationship (Hours of Sleep vs GPA, Hours of Sleep vs Hours spent on Extracurriculars, Hours of Sleep vs Hours spent on Exercise, Hours of Sleep vs Hours spent doing Homework) to check if we are able to reject our null hypothesis.

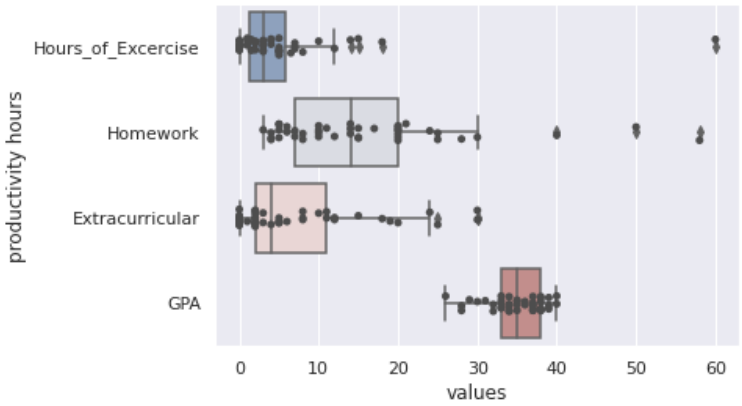
Results:

A Few Visualizations:



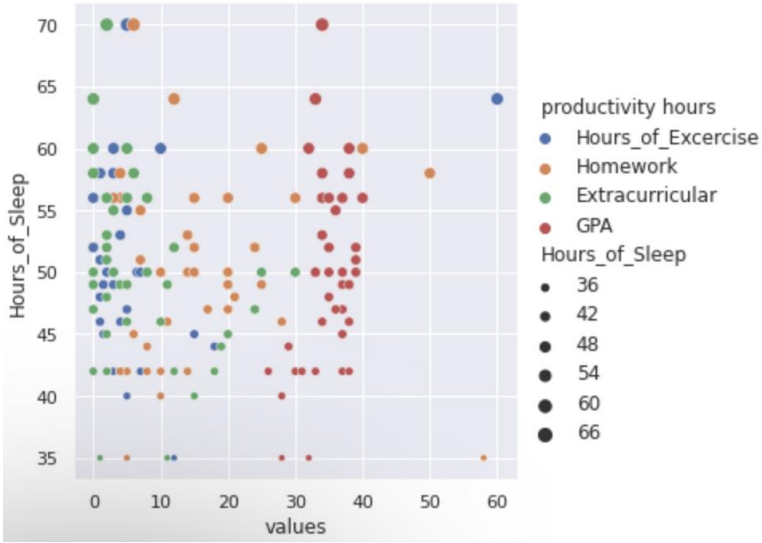
Scatterplots:

We visualized our data using python and created scatter plots with lines of best fit. As we can see on these plots, other than hours of sleep vs hours spent on extracurricular activities which has a negative correlation with each other, the number of hours of sleep vs the other variables all have positive correlations.



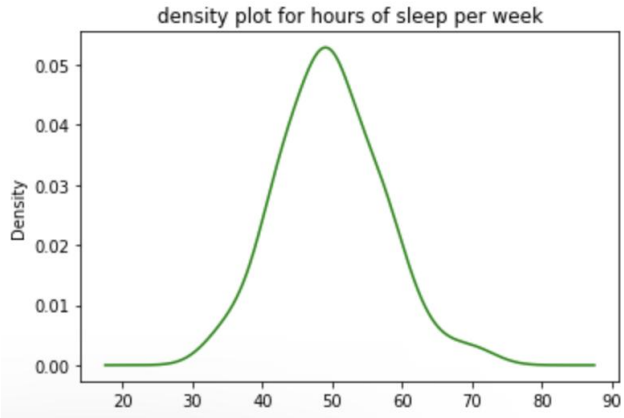
Box Plot:

This box plot shows the distribution of our data across Exercise, Homework, Extracurriculars, and GPA. We can observe that hours of exercise, extracurriculars and homework have a few outliers.



4-Dimensional Scatterplot:

From this scatterplot, we can see the relationship between the hours of sleep and productivity, gpa for each student on the data that we collected.



Density Plot:

This density plot, a smoothed version of a histogram, shows us the distribution of the amount of hours BU students sleep weekly. We notice that the peak is approximately 50 hours, with most of our data lying within the range of 40-60 hours.

Statistical Analysis:

Table 1: P-values from our T-tests and Chi-squared tests

	T-test P-Values	Chi-Squared P-Values
Sleep and GPA	0.10871289029983493	0.09113823465852292
Sleep and Exercise	0.6362474596433598	0.17062929238516952
Sleep and Extracurriculars	0.17598276547929337	0.35222314590969983
Sleep and Homework	0.7148144071101368	0.01160328483588961
Sleep and Productivity	0.8806846160121358	0.0861358389587382

For our t-tests, we separated students who had lower than the sample average in hours of sleep per week with students who had higher than average sleep. We then performed two-tailed t-tests to determine whether the students in each group had a significant difference in GPA, hours of exercise, hours of extracurriculars, hours of homework, and productivity. We also conducted chi-squared tests to determine whether each variable was independent of hours of sleep, or if they had some sort of relationship. Our results from the t-tests and chi-squared tests are shown in the table above. As you can see from the results from the chi-square test, other than sleep and homework, there is no significant relationship between sleep and the other variables and also overall productivity.

Conclusion:

Based on our data, this study found that there is no significant correlation between the number of hours a BU student sleeps and their GPA, providing evidence that there is no significant difference in the GPA between students that sleep more than average compared to students who sleep less than average. Our results also provide us with the finding that out of the three measures of productivity, only one which is the amount of hours a BU student does homework has a relationship with the amount of hours a student sleeps. Overall, the amount of sleep a BU student gets per week has no strong association with their general productivity. Our team believes that a larger sample size that covers a diverse range of students might produce better representative results of the whole BU population.