# Data Cleaning

Adjust Column Width: To have a comprehensive view on the data

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Figure 3.1.1 Adjust column width

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Figure 3.1.2 Adjust column width

Spelling Check: To ensure that the data analysis can be done correctly

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Figure 3.2.1 Spell checking

Sorting: Sort to ascending based on the ‘Study Hours’ to make it easier to analyze patterns and correlations between study time and other variables

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Figure 3.3.1 Sorting with ‘Hours Studies’

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Figure 3.3.2 Sorting with ‘Hours Studies’

Create Table: Converting the dataset into table format allows for easier visualization, comparison, and analysis of the data

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Figure 3.4.1 Insert as a table format

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Figure 3.4.2 Insert as a table format

# Data Process

## Data Attributes

|  |  |  |
| --- | --- | --- |
| **Attributes** | **Description** | **Data Types** |
| Hours Study | Collect the number of hours students are spending on study each day | Ratio | Integer |
| Previous Scores | List scores of students obtains in previous test / exam | Ratio | Integer |
| Extracurricular Activities | Whether the student is participating in any extracurricular activities | Categorical (Nominal) |  Boolean |
| Numeric representation for Extracurricular Activities | Show ‘1’ if the student is taking part in extracurricular activities; ‘0’ vice versa | Interval | Integer |
| Sleep Hours | The number of hours student sleep in a day | Interval | Integer |
| Sample Question Papers Practiced | Number of practices done by the student | Interval | Integer |
| Performance Index | Student’s overall performance in current test / exam | Interval | Integer |
| High Performer | Whether a student is a high performer based on their performance index | Interval | Integer |

Table 4.1 Data attributes included

## Data Processing

The data are pre-processed before being used for data analysis. For better analyze, some columns were added into this dataset. The first one is ‘Numeric representation for Extracurricular Activities’, it is used to represent the ‘Extracurricular Activities’ in numeric format (‘1’ and ‘0’). By doing this, it will reduce the complexity and increase the evenness of the dataset.

|  |  |
| --- | --- |
| **Extracurricular Activities** | **Numeric representation for Extracurricular Activities** |
| Yes | 1 |
| No | 0 |
| Yes | 1 |
| Yes | 1 |
| No | 0 |

Table 4.2 Sample of ‘Numeric representation for Extracurricular Activities

In addition, ‘High Performer’ show ‘1’ when the student’s ‘Performance Index’ is greater than 81; ‘0’ when less or equal to 81, which is high performance threshold. The threshold is calculated by using ` =PERCENTILE.EXC(‘Performance Index’, 0.9)`, to calculate the top 10% of performance index.

|  |  |
| --- | --- |
| **Performance Index** | **High Performer** |
| 91 | 1 |
| 65 | 0 |
| 45 | 0 |
| 36 | 0 |

Table 4.3 Sample of ‘High Performer’

In conclusion, steps above are executed to present a neatly, completely and easier to understand dataset to make it better to use and analyze after.

## Screenshot of dataset

|  |  |  |  |
| --- | --- | --- | --- |
| Hours Studied | Previous Scores | Extracurricular Activities | Numeric representation for Extracurricular Activities |
| 7 | 99 | Yes | 1 |
| 4 | 82 | No | 0 |
| 8 | 51 | Yes | 1 |
| 5 | 52 | Yes | 1 |
| 7 | 75 | No | 0 |
| 3 | 78 | No | 0 |
| 7 | 73 | Yes | 1 |
| 8 | 45 | Yes | 1 |
| 5 | 77 | No | 0 |

Figure 4.1 Screenshot of dataset

|  |  |  |  |
| --- | --- | --- | --- |
| Sleep Hours | Sample Question Papers Practiced | Performance Index | High Performer |
| 9 | 1 | 91 | 1 |
| 4 | 2 | 65 | 0 |
| 7 | 2 | 45 | 0 |
| 5 | 2 | 36 | 0 |
| 8 | 5 | 66 | 0 |
| 9 | 6 | 61 | 0 |
| 5 | 6 | 63 | 0 |
| 4 | 6 | 42 | 0 |
| 8 | 2 | 61 | 0 |

Figure 4.2 Screenshot of dataset (cont.)

# Data Analysis and Result Discussion

## Descriptive Statistics

Result:

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Measure of central tendency | | | Measures of variability | | | | | | |
| Mean | Medina | Mode | Range | | Variance | Standard Deviation | Quartile | | |
| Min | Max | Q1 | Q3 | IQR |
| Hours Studies | 4.99 | 5 | 1 | 1 | 9 | 6.70 | 2.59 | 3 | 7 | 4 |
| Previous Scores | 69.4 | 69 | 54 | 40 | 99 | 300.78 | 17.34 | 54 | 85 | 31 |
| Sleep Hours | 6.53 | 7 | 8 | 4 | 9 | 2.88 | 1.70 | 5 | 8 | 3 |
| Sample Question Paper Practiced | 4.58 | 5 | 6 | 0 | 9 | 8.22 | 2.87 | 2 | 7 | 5 |
| Performance Index | 55.2 | 55 | 67 | 10 | 100 | 369.12 | 19.2 | 40 | 71 | 31 |

Table 5.1 Statistic table of dataset

Discussion:

This insight offers a deep understanding into all aspects of student life, including study hours, academic performance etc. By analyzing the measures of central tendency and variability, we can fully understand the student behaviour and performance.

In terms of study hours, student average study for 5 hours in a day, and the median was also 5 hours, indicating that the distribution of study hours is relatively symmetrical. However, the mode represents that most students only study for 1 hour a day. There was a significant variance in the study habits as shown by the 8-hour study time range and 2.59-hours standard deviation.

The attribute with the prior scores had a mean of 69.4 and a median of 69. The mode, which is 54, is noteworthy because it is lower than the mean and median. There was a substantial variation in academic achievement, as seen by the range of 59 and the standard deviation of 17.34. The mean and median of the students' performance index were 55.2 and 55, respectively. While the mode of this attribute was 67, which was higher than the mean and median, show a right-skewed distribution. The range of it is 90 with a standard deviation of 19.2, which shows a significant difference in student performance level.

In terms of sleep hours, students sleep about 6.53 hours per day, and most of them sleep for 8 hours. Sleep duration ranged from 4 to 9 hours with a standard deviation of 1.70 hours. Some students may be sleep deprived while others are better rested.

Students practiced an average of 4.58 sample papers, with a median of 5. The mode is 6, indicating that many students practiced a slightly higher number of papers. The range and standard deviation showed significant differences in how students practiced the sample papers, with some students not practicing and some practicing as many as 9 papers.

Overall, the data revealed significant differences in students' study time, previous grades, sleep time, practice sample papers, and performance indexes. These results reflect the diversity of student behavior and performance:

The study time shows that the students' study habits are diverse; Previous grades and performance indices indicate large differences in academic performance and performance levels; Sleep time showed that most students had enough sleep, but there were some variations. The number of sample practice papers shows that students' preparation strategies are diverse.

This data can help educators understand a wide range of differences in student behavior and performance, which can identify areas that need support. For example, disparities in grades can be reduced through targeted academic support, and sleep problems can be addressed through wellness programs.

## Sampling and estimation

Result:

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Figure 5.7.1 Estimation of the proportion of high-performance students

Discussion:

Based on the results, about 10% of the students obtain a high-performance index (score greater than 81). The genuine percentage of top performers in the population is assessed to be between 9% and 10.1% with a 95% confidence level. This result suggests that approximately one in ten students is a high performer. A standard error of 0.003 indicates that the margin of error between the sample proportion and the overall proportion is small. The margin of error is 0.006, so we have a high level of confidence in the forecast for this.

Getting 8 to 10 hours of sleep every night has a major impact on academic achievement, according to the National Sleep Foundation. High performers might have improved sleeping and study techniques. Furthermore, B. Lovato and M. Lack's (2010) study discovered a strong relationship between enhanced cognitive function and academic achievement and good sleep.

Result:

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Figure 5.7.2 Prediction intervals

Discussion:

A new student's performance index has a prediction interval of [54.848, 55.601], which means that we have a 95% confidence interval in which their performance will fall. The sample means deviate slightly from the population means. With a 0.377 margin of error, the estimate appears to be rather accurate. Credé, Roch, and Kieszczynka's (2010) study found a strong correlation between academic achievement and attendance in class. Increased attendance rates have the potential to improve students' overall performance by boosting their grasp of the course material. In addition, T. J. Cleary and B. Platten (2013) discovered that self-regulation techniques and goal setting greatly enhance academic achievement.

Result:

A graph with numbers and points

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Figure 5.7.3 Sampling error

Discussion:

The graph indicates that the standard error falls with increasing sample size. This indicates that higher sample numbers increase the estimate's accuracy. The Central Limit Theorem states that as sample size increases, the sample means approaches the population mean and the standard error decreases, improving the accuracy and dependability of our estimations. Sample size has a major impact on statistical analysis, particularly when estimating population parameters, as Sirin (2005) pointed out. Greater findings confidence and effective error reduction are achieved with larger sample numbers.

Discussion:

Through these three analyses, we can effectively help educational institutions, educators and administrators in making decisions. First of all, the application of high-performance proportion can be used to develop targeted support programs. By identifying and assisting students who are about to achieve at a high level, more resources and tutoring can be made available to raise academic standards more broadly. Additionally, Prediction intervals give educators and administrators a realistic expectation for the academic achievement of incoming pupils. To guarantee that the majority of students fulfil the required academic requirements, this can be used to inform course design, modifications to teaching strategies, and resource allocation.

In conclusion, educational administrators can use the data from these findings to gain a better understanding of and ability to enhance student academic performance. Through a comprehensive understanding of the variables that impact high performance, like sleep patterns, study habits, and socioeconomic status, educational institutions may design and execute focused interventions that improve overall student outcomes. A wider framework for understanding these results is provided by comparisons with other studies and real-world data, emphasizing the significance of helping high-achieving students to uphold and raise academic standards.