

SLEEP HEALTH INFLUENCED BY LIFESTYLE FACTORS

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**Research Methods - Project
IMBA, 2nd Year, 2023-2024**

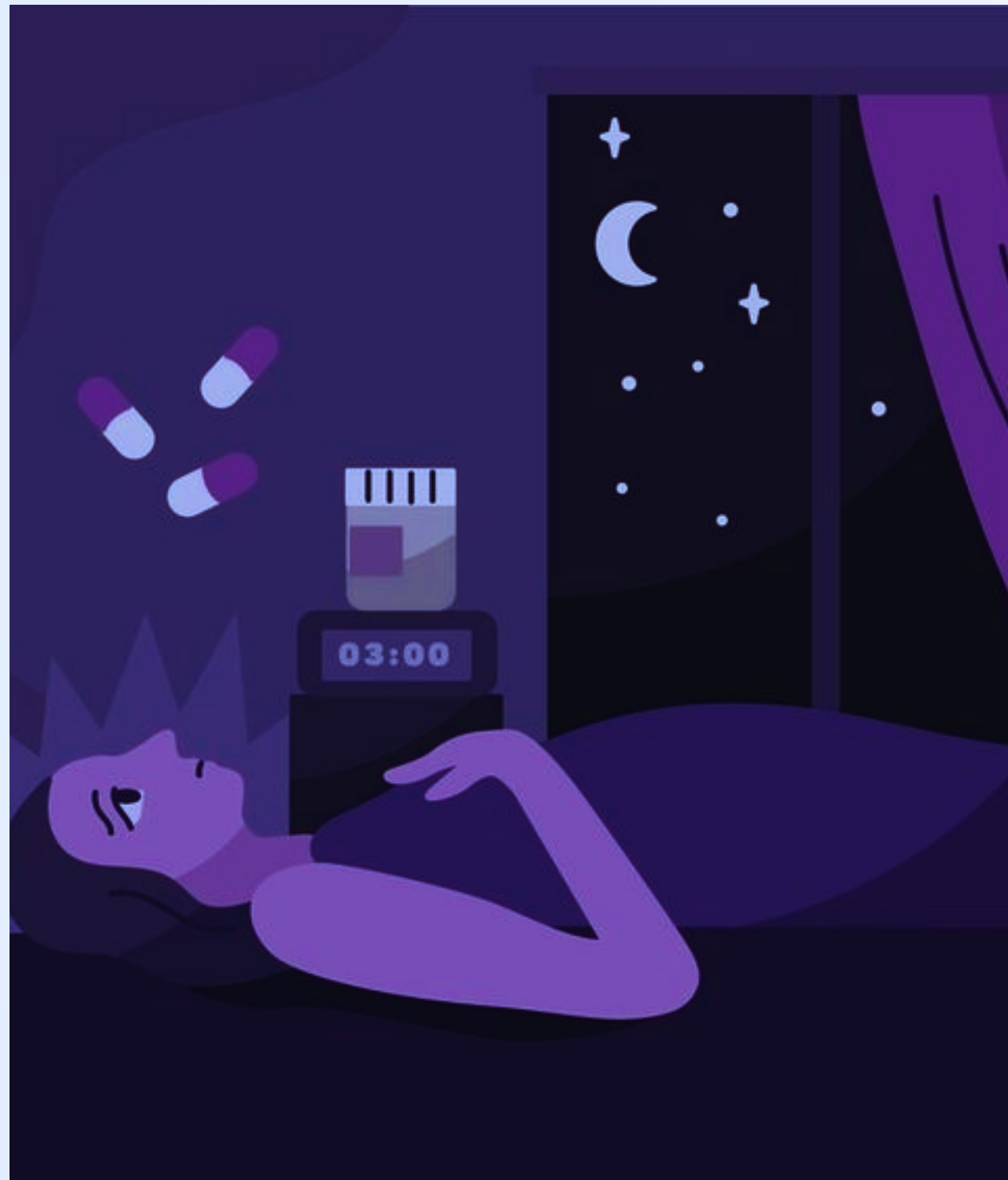
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INTRODUCTION

*Sleep is a fundamental determinant of health, yet its quality is often compromised by lifestyle factors. **This study aimed to investigate the relationship between sleep health and lifestyle factors, specifically sleep duration, physical activity level, and stress.***

*Using a **dataset of a sample of 374** , we employed descriptive analytics, visualized through **scatterplots, to explore initial associations between the variables.** Moreover, an OLS regression model was developed to quantify these relationships and predict the quality of sleep from the selected lifestyle factors.*



DATASET

The Sleep Health and Lifestyle Dataset comprises 374 rows and 13 columns, covering a wide range of **variables related to sleep and daily habits**:

- Details such as: gender, age, occupation, sleep duration, quality of sleep, physical activity level, stress levels, BMI category, blood pressure, heart rate, daily steps, and the presence or absence of sleep disorder.

Main Sleep Metrics:

1. **Sleep Duration,**

2. **Quality, and**

3. **Factors influencing Sleep Patterns:**

- **Lifestyle factors**(physical activity levels, stress levels, and BMI)
- **Cardiovascular factors** (blood pressure and heart rate)
- **Sleep disorder factors** (insomnia and sleep apnea).

RESEARCH QUESTIONS

Based on these data, **four research questions** have been developed:

- **What is the correlation between the main factors of the dataset?**
- **What is the relationship/correlation between Sleep - Physical Activity Level? What about Sleep Duration and Stress Level?**
- **What is the linear regression between quality of sleep and sleep duration and to what extent the predicted values differ from actual values?**
- **To what extent does the data analyzed represent “a good fit” for the model?**

1) IMPORTING DATA

```
[ ] import pandas as pd

df = pd.read_csv("sleep-health-and-lifestyle-dataset/Sleep_health_and_lifestyle_dataset.csv")
```

DataFrame information display

```
[ ] df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 374 entries, 0 to 373
Data columns (total 13 columns):
#   Column                                Non-Null Count  Dtype  
---  -
0   Person ID                            374 non-null   int64  
1   Gender                                374 non-null   object  
2   Age                                    374 non-null   int64  
3   Occupation                            374 non-null   object  
4   Sleep Duration                        374 non-null   float64 
5   Quality of Sleep                      374 non-null   int64  
6   Physical Activity Level                374 non-null   int64  
7   Stress Level                          374 non-null   int64  
8   BMI Category                          374 non-null   object  
9   Blood Pressure                        374 non-null   object  
10  Heart Rate                            374 non-null   int64  
11  Daily Steps                           374 non-null   int64  
12  Sleep Disorder                        374 non-null   object  
dtypes: float64(1), int64(7), object(5)
memory usage: 38.1+ KB
```

1) DATA

Display the first 5 rows of the dataframe. You can display more by giving a number as an argument to the function `head()`.

```
[ ] df.head()
```

	Person ID	Gender	Age	Occupation	Sleep Duration	Quality of Sleep	Physical Activity Level	Stress Level	BMI Category	Blood Pressure	Heart Rate	Daily Steps	Sleep Disorder
0	1	Male	27	Software Engineer	6.1	6	42	6	Overweight	126/83	77	4200	None
1	2	Male	28	Doctor	6.2	6	60	8	Normal	125/80	75	10000	None
2	3	Male	28	Doctor	6.2	6	60	8	Normal	125/80	75	10000	None
3	4	Male	28	Sales Representative	5.9	4	30	8	Obese	140/90	85	3000	Sleep Apnea
4	5	Male	28	Sales Representative	5.9	4	30	8	Obese	140/90	85	3000	Sleep Apnea

```
[ ] df = df.drop(columns=["Blood Pressure"])
df.head()
```

	Gender	Age	Occupation	Sleep Duration	Quality of Sleep	Physical Activity Level	Stress Level	BMI Category	Heart Rate	Daily Steps	Sleep Disorder	Systolic BP	Diastolic BP
0	Male	27	Software Engineer	6.1	6	42	6	Overweight	77	4200	None	126.0	83.0
1	Male	28	Doctor	6.2	6	60	8	Normal	75	10000	None	125.0	80.0
2	Male	28	Doctor	6.2	6	60	8	Normal	75	10000	None	125.0	80.0
3	Male	28	Sales Representative	5.9	4	30	8	Obese	85	3000	Sleep Apnea	140.0	90.0
4	Male	28	Sales Representative	5.9	4	30	8	Obese	85	3000	Sleep Apnea	140.0	90.0

2) CORRELATION MATRIX

```
[ ] corr_mat = df.corr()  
display(corr_mat)
```

<ipython-input-10-2528a9142a7f>:1: FutureWarning: The default value of numeric_only in DataFrame.corr is deprecated. In a future version, it will default to False.
corr_mat = df.corr()

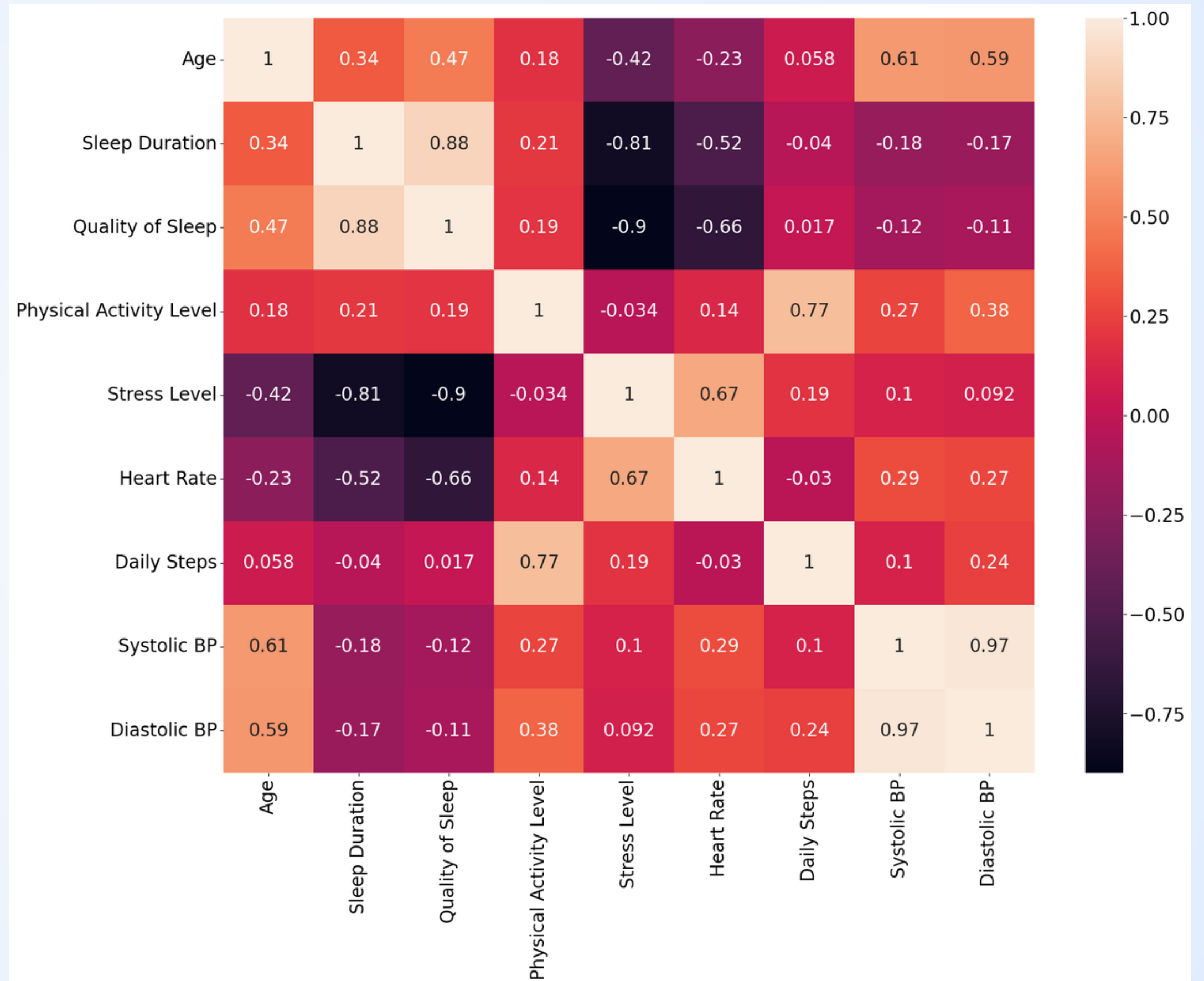
	Age	Sleep Duration	Quality of Sleep	Physical Activity Level	Stress Level	Heart Rate	Daily Steps	Systolic BP	Diastolic BP
Age	1.000000	0.344709	0.473734	0.178993	-0.422344	-0.225606	0.057973	0.605878	0.593839
Sleep Duration	0.344709	1.000000	0.883213	0.212360	-0.811023	-0.516455	-0.039533	-0.180406	-0.166570
Quality of Sleep	0.473734	0.883213	1.000000	0.192896	-0.898752	-0.659865	0.016791	-0.121632	-0.110151
Physical Activity Level	0.178993	0.212360	0.192896	1.000000	-0.034134	0.136971	0.772723	0.265416	0.382651
Stress Level	-0.422344	-0.811023	-0.898752	-0.034134	1.000000	0.670026	0.186829	0.102818	0.091811
Heart Rate	-0.225606	-0.516455	-0.659865	0.136971	0.670026	1.000000	-0.030309	0.294143	0.271092
Daily Steps	0.057973	-0.039533	0.016791	0.772723	0.186829	-0.030309	1.000000	0.103342	0.241986
Systolic BP	0.605878	-0.180406	-0.121632	0.265416	0.102818	0.294143	0.103342	1.000000	0.972885
Diastolic BP	0.593839	-0.166570	-0.110151	0.382651	0.091811	0.271092	0.241986	0.972885	1.000000



3) CORRELATION HEAT MAP

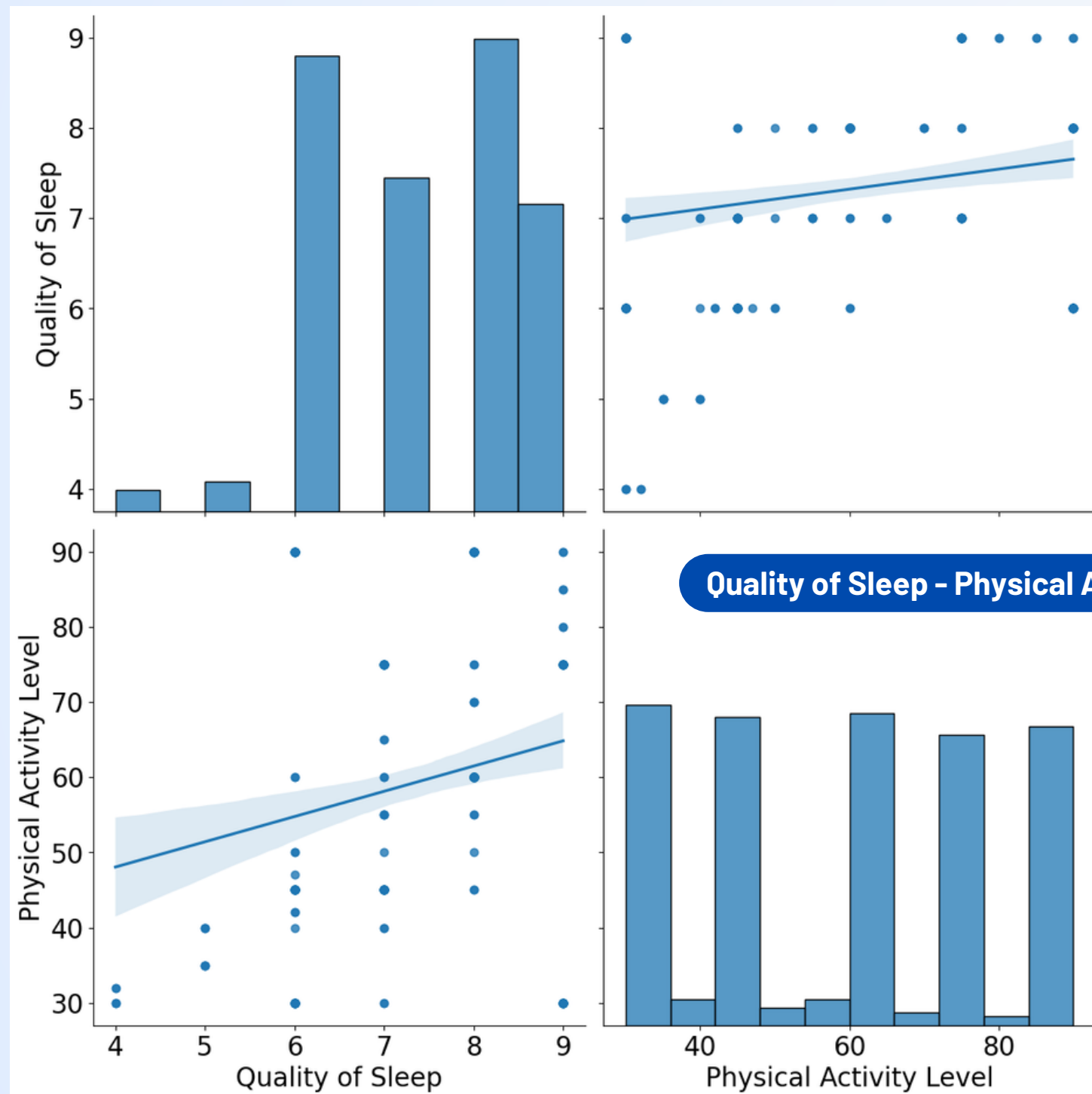
```
[ ] import seaborn as sns
import matplotlib.pyplot as plt

plt.rcParams.update({"font.size": 20})
plt.figure(figsize=(20, 15))
sns.heatmap(corr_mat, annot=True)
```

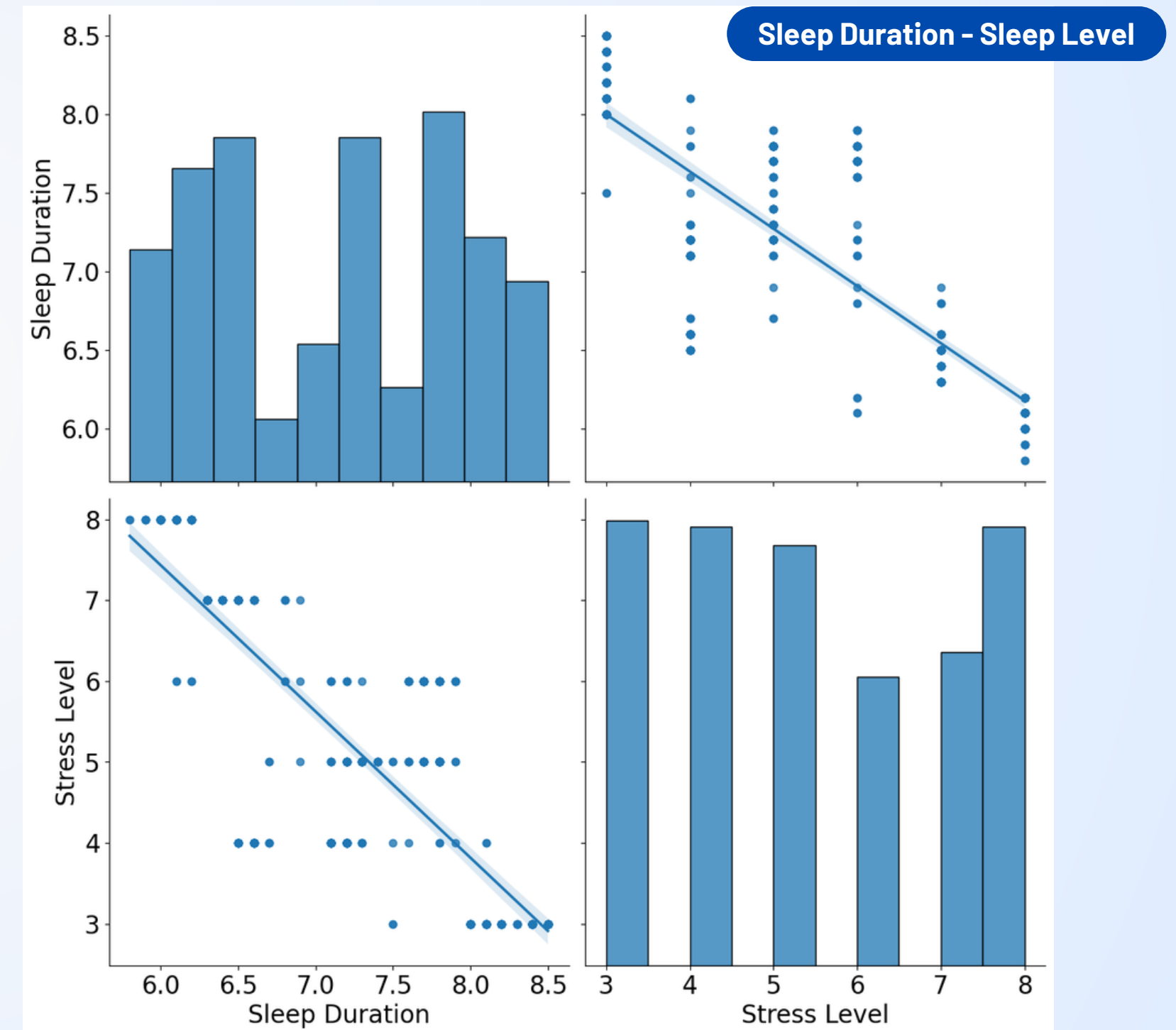


4) PAIR PLOTS

```
sns.pairplot(df[['Quality of Sleep', 'Physical Activity Level']], kind='reg', height=6)
```



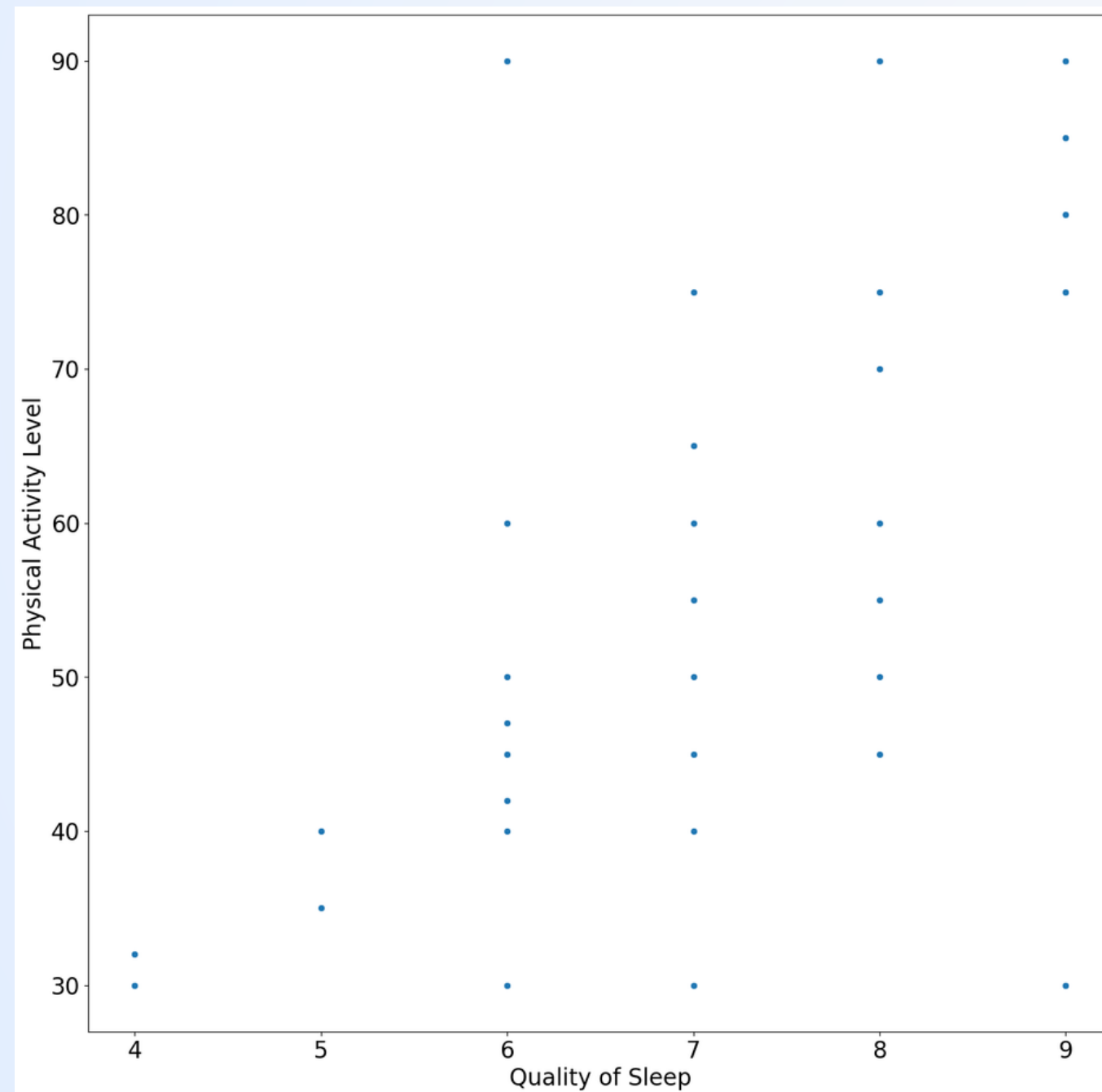
```
[ ] sns.pairplot(df[['Sleep Duration', 'Stress Level']], kind='reg', height=6)
```



5) SCATTERPLOTS

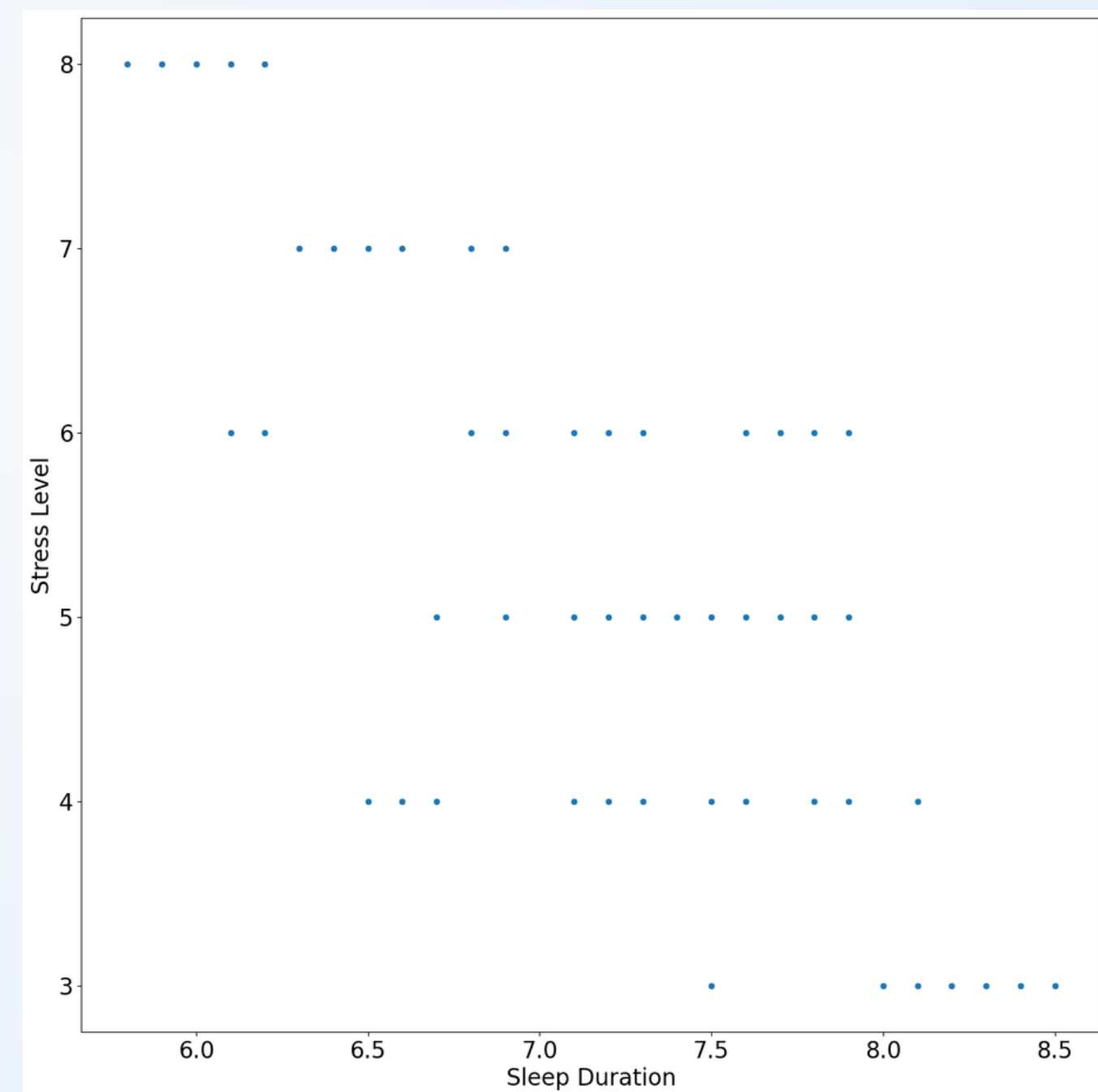
Generate Scatterplot Quality of Sleep - Physical Activity Level

```
[ ] plt.figure(figsize=(16,16))
    sns.scatterplot(x=df['Quality of Sleep'], y = df['Physical Activity Level'])
```



Generate Scatterplot Sleep Duration - Stress Level

```
[ ] plt.figure(figsize=(16,16))
    sns.scatterplot(x=df['Sleep Duration'], y = df['Stress Level'])
```



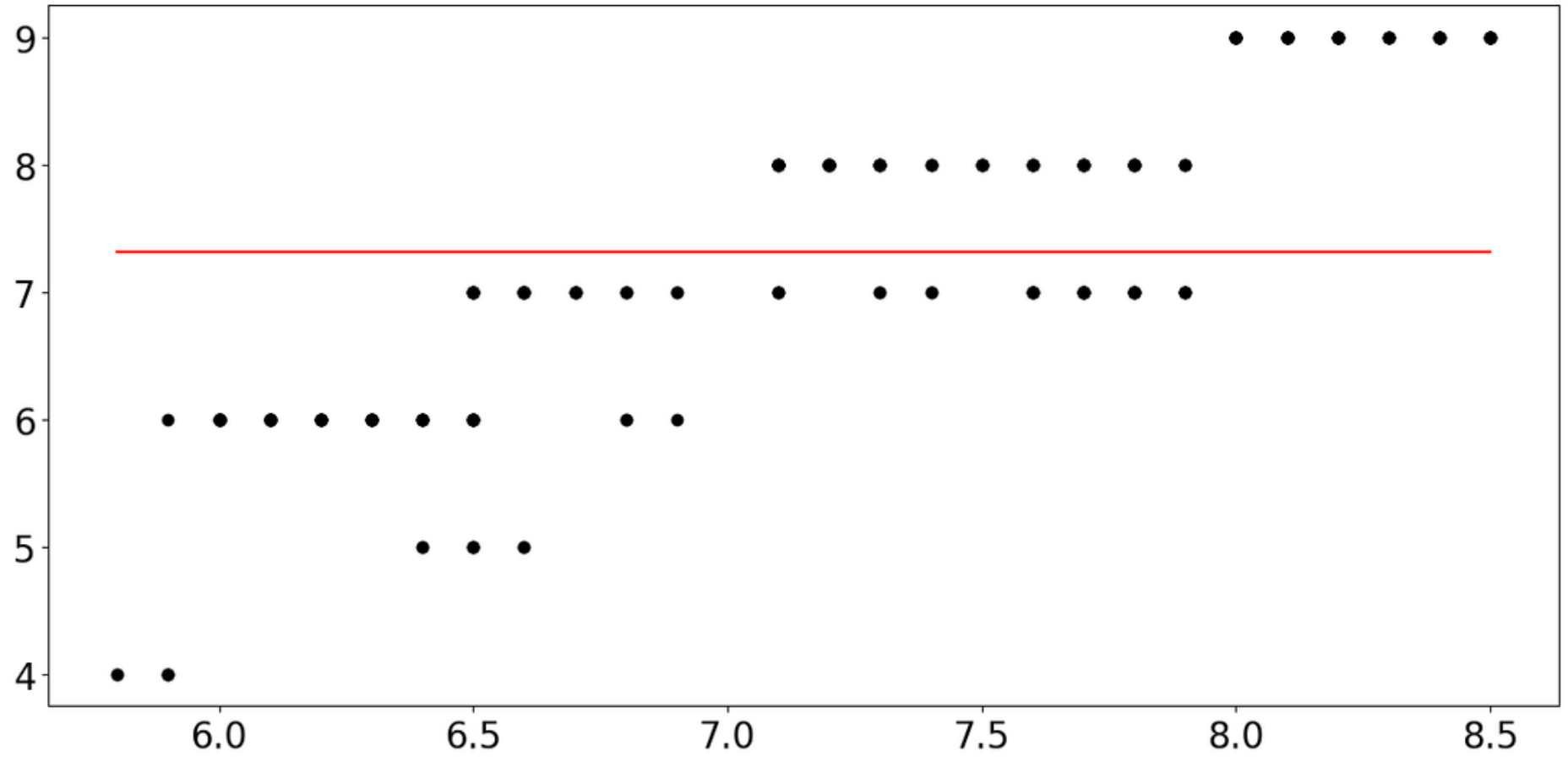
```
[ ] import numpy as np

reg_df = df[['Sleep Duration', 'Quality of Sleep']]
reg_df.head()
```

	Sleep Duration	Quality of Sleep
0	6.1	6
1	6.2	6
2	6.2	6
3	5.9	4
4	5.9	4

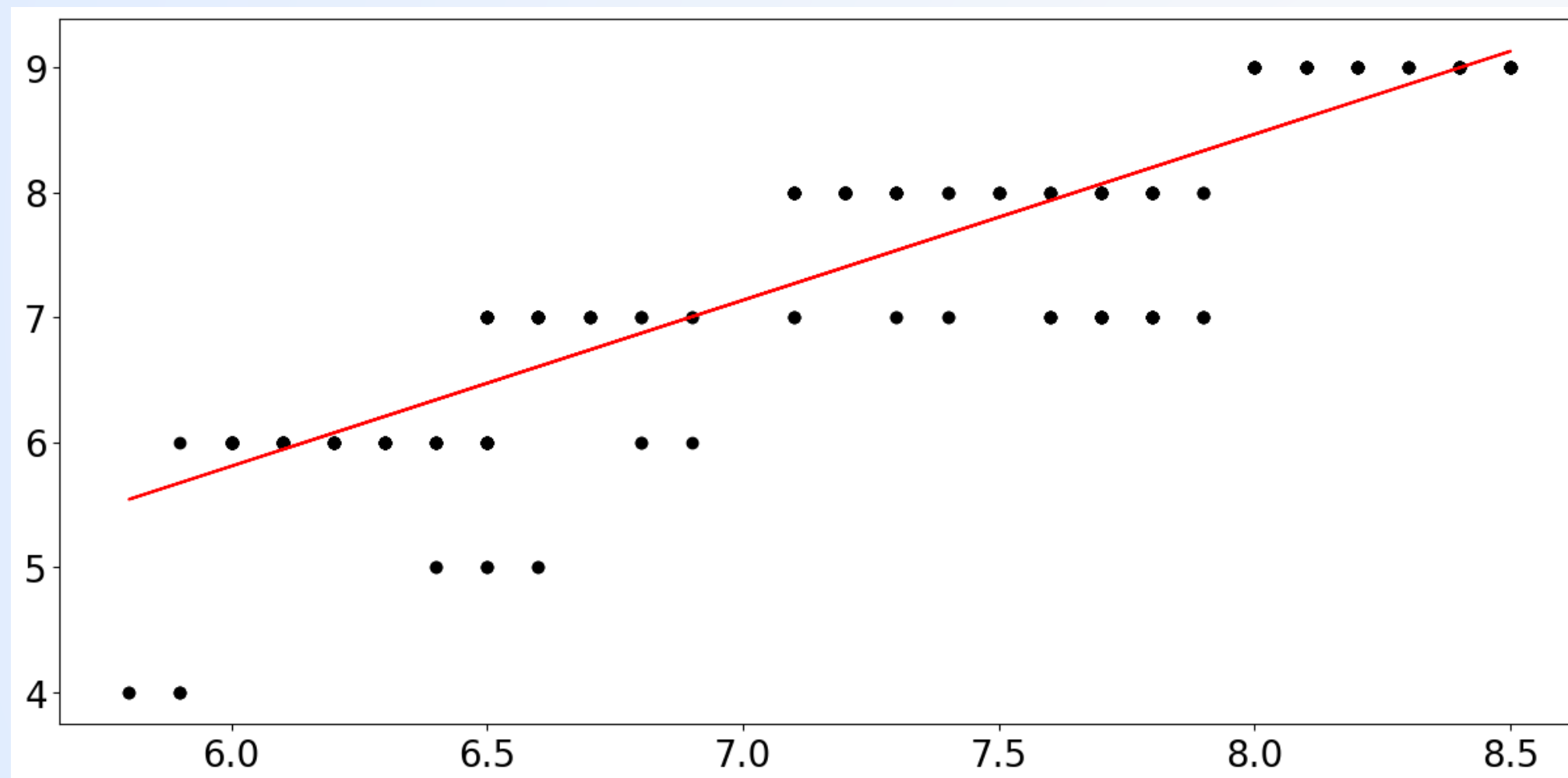
Sleep Duration - Quality of Sleep.

```
[ ] fig = plt.figure(figsize=(15,7))
ax = plt.gca()
ax.scatter(reg_df['Sleep Duration'], reg_df['Quality of Sleep'], c='k')
ax.plot((reg_df['Sleep Duration'].min(), reg_df['Sleep Duration'].max()),(np.mean(reg_df['Quality of Sleep']), np.mean(reg_df['Quality of Sleep'])), color='r');
```



6) BASELINE PREDICTOR

7) SIMPLE LINEAR REGRESSION MODEL



```
[ ] reg_df['Mean_Yhat'] = reg_df['Quality of Sleep'].mean()
```

```
[ ] y_bar = df['Quality of Sleep'].mean()
    x_bar = df['Sleep Duration'].mean()
    std_y = np.std(df['Quality of Sleep'], ddof = 1)
    std_x = np.std(df['Sleep Duration'], ddof = 1)
    r_xy = df.corr().loc['Sleep Duration', 'Quality of Sleep']
    beta_1 = r_xy*(std_y/std_x)
    beta_0 = y_bar - beta_1*x_bar
```

```
[ ] reg_df['Linear_Yhat'] = beta_0 + beta_1 * reg_df['Sleep Duration']
```

```
[ ] fig = plt.figure(figsize=(15,7))

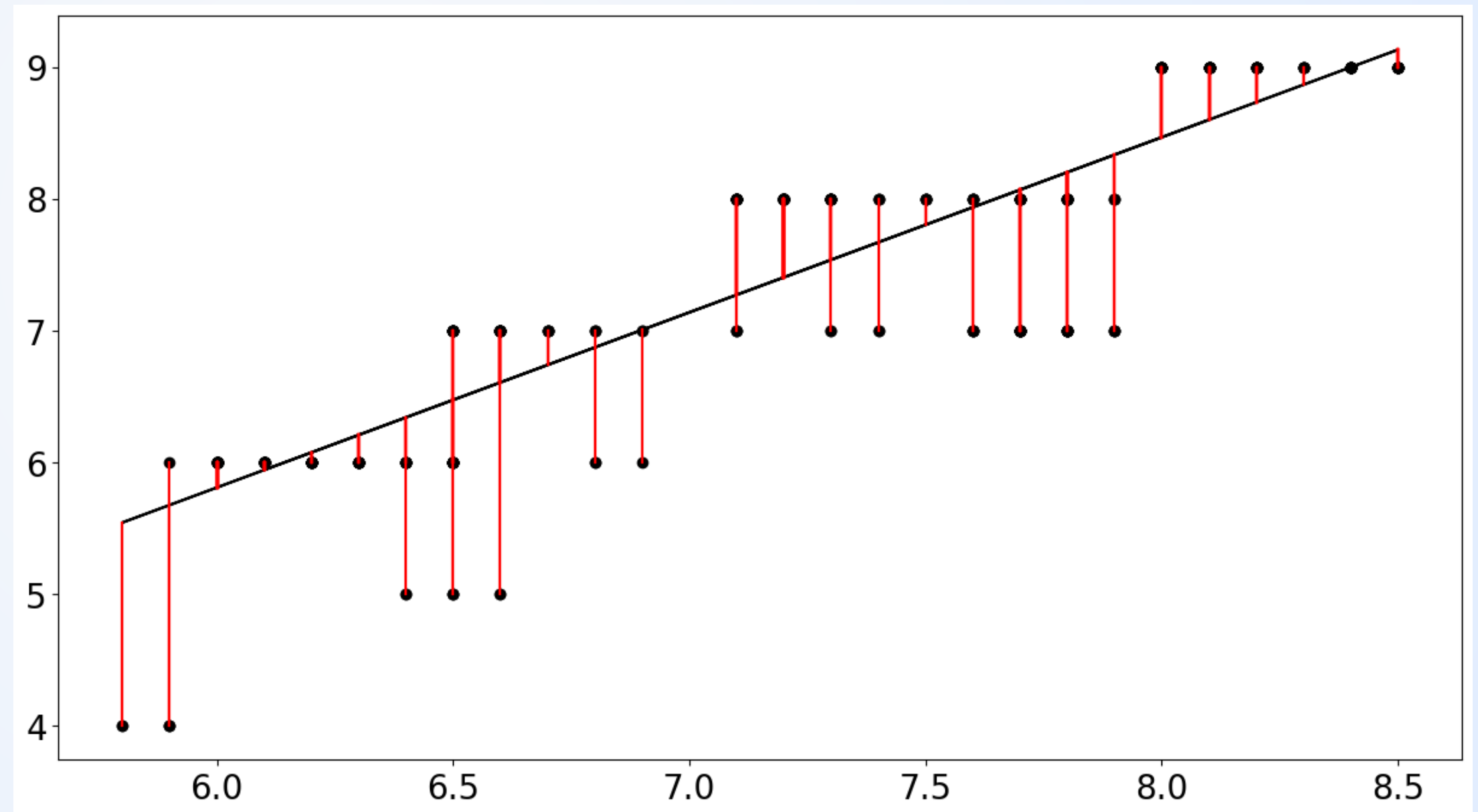
    ax = plt.gca()
    ax.scatter(reg_df['Sleep Duration'], reg_df['Quality of Sleep'], c='k')
    ax.plot(reg_df['Sleep Duration'], reg_df['Linear_Yhat'], color='r');
```

7) SIMPLE LINEAR REGRESSION MODEL

```
[ ] fig = plt.figure(figsize=(15,7))
    fig.set_figheight(8)
    fig.set_figwidth(15)
    ax = fig.gca()

    ax.scatter(x=reg_df['Sleep Duration'], y=reg_df['Quality of Sleep'], c='k')
    ax.plot(reg_df['Sleep Duration'], reg_df['Linear_Yhat'], color='k');

    for _, row in reg_df.iterrows():
        plt.plot((row['Sleep Duration'], row['Sleep Duration']), (row['Quality of Sleep'], row['Linear_Yhat']), 'r-')
```



8) OLS REGRESSION MODEL

```
[ ] import statsmodels.api as sm

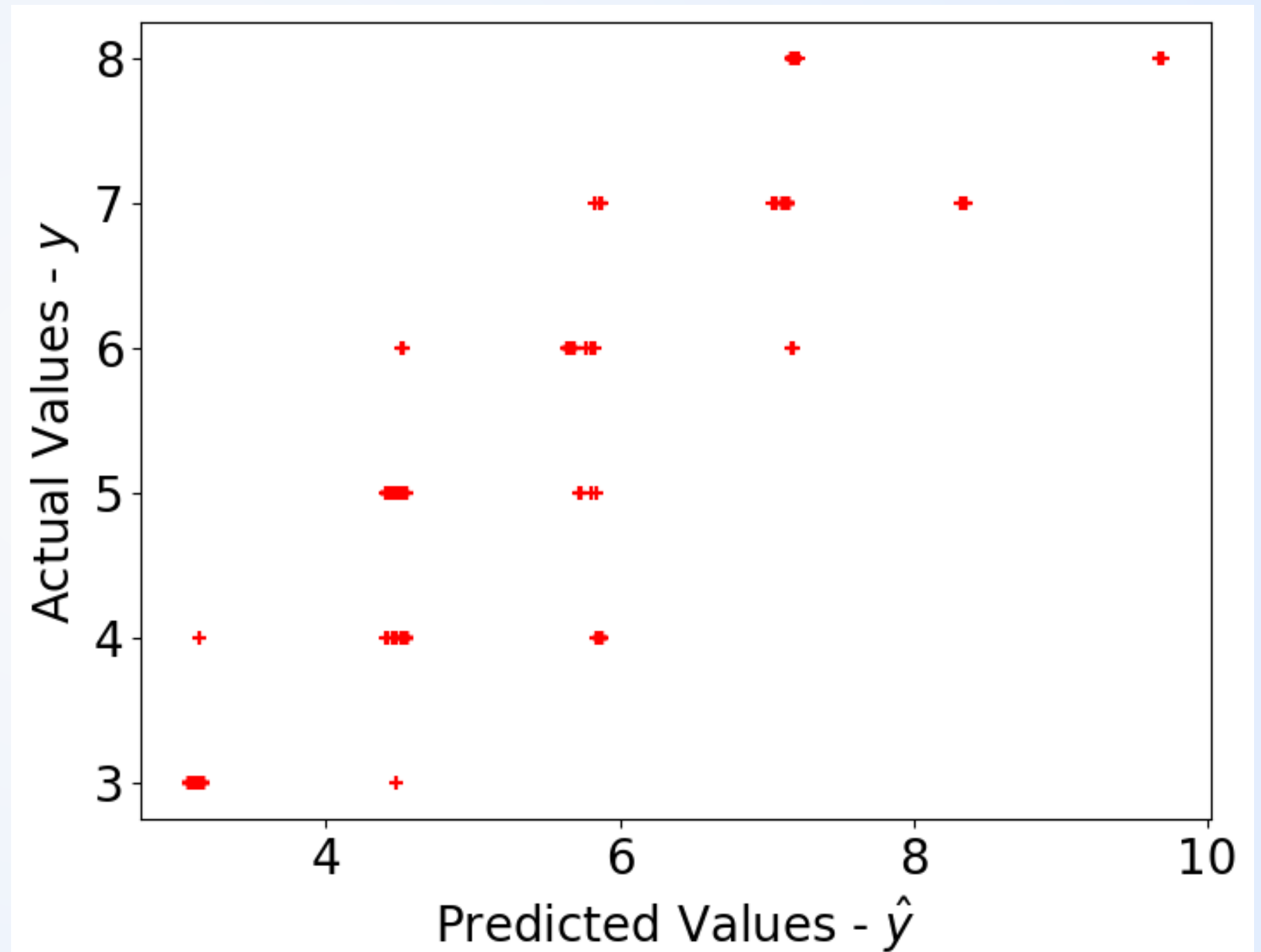
[ ] stress = df['Stress Level'].values
target = pd.DataFrame(stress)
print(target.shape)

(374, 1)

[ ] X = df[['Sleep Duration','Quality of Sleep']].values
X = sm.add_constant(X)
y = target

model = sm.OLS(y, X)
model = model.fit()
predictions = model.predict(X)

plt.figure(figsize=(8,6))
plt.scatter(predictions, y, s=30, c='r', marker='+', zorder=10)
plt.xlabel("Predicted Values -  $\hat{y}$ ")
plt.ylabel("Actual Values -  $y$ ")
plt.show()
```



8) OLS REGRESSION MODEL SUMMARY

```
[ ] model.summary()
```

OLS Regression Results

Dep. Variable:	0	R-squared:	0.809
Model:	OLS	Adj. R-squared:	0.808
Method:	Least Squares	F-statistic:	786.2
Date:	Wed, 24 Jan 2024	Prob (F-statistic):	3.86e-134
Time:	12:44:44	Log-Likelihood:	-435.01
No. Observations:	374	AIC:	876.0
Df Residuals:	371	BIC:	887.8
Df Model:	2		

Covariance Type: nonrobust

	coef	std err	t	P> t	[0.025	0.975]
const	15.6250	0.395	39.577	0.000	14.849	16.401
x1	-0.1748	0.108	-1.620	0.106	-0.387	0.037
x2	-1.2298	0.072	-17.151	0.000	-1.371	-1.089

Omnibus:	41.654	Durbin-Watson:	0.966
Prob(Omnibus):	0.000	Jarque-Bera (JB):	52.436
Skew:	-0.897	Prob(JB):	4.11e-12
Kurtosis:	3.381	Cond. No.	104.

Notes:

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

RESULTS & FINDINGS



Main Findings

*The main findings suggest that **the model demonstrated that approximately 80.9% of the variance in sleep quality could be explained by sleep duration and stress level.** Stress level was found to be a significant predictor of sleep quality.*

*This study's findings underscore the significant impact of stress on sleep quality, highlighting the **need for stress management interventions as part of a healthy lifestyle.***

The pairplot indicates that sleep quality and physical activity level are generally positively correlated, with higher sleep quality being linked to higher levels of physical activity

RESULTS & FINDINGS

Limitations

Despite the strong model fit, **the lack of normality in the residuals suggests that future research should incorporate a broader range of variables** to fully capture the determinants of sleep quality.

The limitations of the research are mainly on the limited access to data and the lack of previous numerous researches on this topic, which needs to be further investigated due to the fact that human nature, behavior and lifestyle is changing due to the rapid changes in the environment.



THANK YOU!

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