The python script generates the written "Student Performance Analysis Report" and 10 charts shown below

=== Student Performance Analysis Report ===

1. STUDY HOURS AND QUIZ PERFORMANCE ANALYSIS

Correlation coefficient between study hours and quiz scores: -0.07

Interpretation: Weak correlation

2. SLEEP PATTERN IMPACT ANALYSIS

Performance Statistics by Sleep Duration:

Sleep Category	Average Quiz Score	Standard Deviation	Number of Students
Insufficient (<6h)	80.04	12.46	28
Optimal (6-8h)	76.52	14.73	50
Extended (>8h)	73.20	17.02	22

3. ATTENDANCE AND PROJECT PERFORMANCE ANALYSIS

Correlation between attendance and project scores: -0.06

4. STRESS LEVEL IMPACT ANALYSIS

Correlation between stress and performance metrics:

- Stress vs Quiz Average: 0.02
- Stress vs Project Score: -0.07
- Stress vs Participation Score: -0.05

5. TIME MANAGEMENT ANALYSIS

Time allocation statistics:

Average weekly study hours: 15.0

Average extracurricular hours: 4.9

Average total activity hours: 19.9

6. STUDENT PERFORMANCE CLUSTER ANALYSIS

Cluster Profiles (Average Scores):

Quiz Average	Project Score	Participation Score	Performance Cluster
0	76.42	90.86	50.20
1	91.43	77.83	75.07
2	62.90	82.04	75.46

7. ASSIGNMENT COMPLETION ANALYSIS

Assignment Completion Statistics by Performance Level

Performance Quartile	Mean	Min	Max
Bottom 25%	11.72	8	14
Lower Mid 25%	10.80	8	14
Upper Mid 25%	10.60	8	14
Top 25%	10.84	8	14

8. PARTICIPATION AND ATTENDANCE ANALYSIS

Participation Statistics by Attendance Level:

Attendance Level	Count	MEAN	STD	Min	25%	50%	75%	Max
Low	25.0	67.89	18.13	15.18	58.82	67.54	80.57	97.91
Medium-Low	25.0	69.07	21.56	19.94	60.49	68.30	88.21	100.00
Medium-High	25.0	66.71	18.29	20.87	54.77	63.61	75.47	100.00
High	25.0	64.31	19.20	24.34	53.43	62.98	76.61	100.00

9. STUDY EFFICIENCY ANALYSIS

Study Efficiency Statistics:

Average score per study hour: 5.75

Most efficient student: 13.82 points per hour

Least efficient student: 2.62 points per hour

10. TOP VS BOTTOM PERFORMERS COMPARISON

Top vs Bottom Performers Comparison:

	Top 10% Average	Bottom 10% Average
Attendance Rate	0.85	0.86
Study Hours Per Week	13.26	14.86
Assignments Completed	11.20	11.70
Project Score	83.32	84.30
Participation Score	72.02	66.28
Sleep Hours	7.44	7.75

Key Differences (Top - Bottom):

Attendance Rate: -0.02

Study Hours Per Week: -1.61

Assignments Completed: -0.50

Project Score: -0.99

Participation Score: +5.73

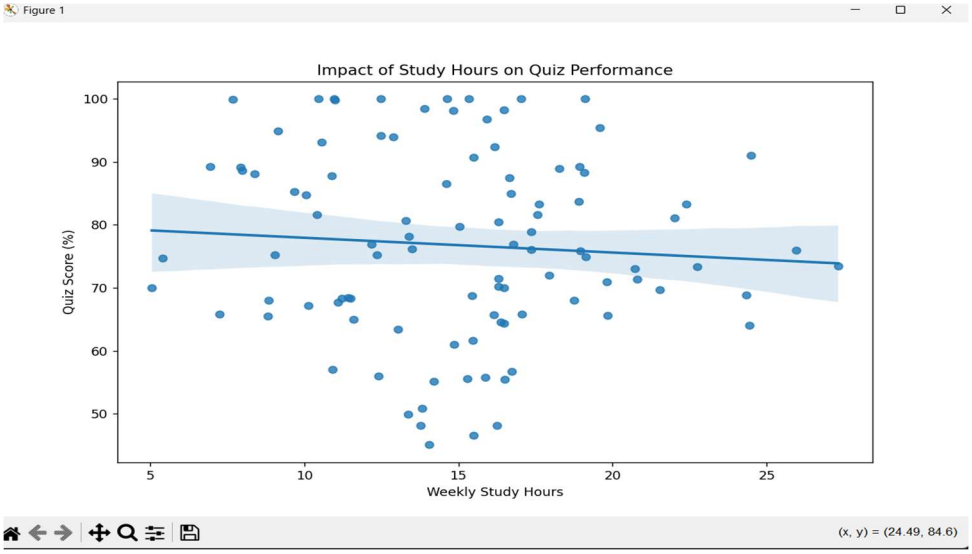
Sleep Hours: -0.31

Charts:

1. Study Hours vs Quiz Performance

Type: Scatter Plot with Regression Line

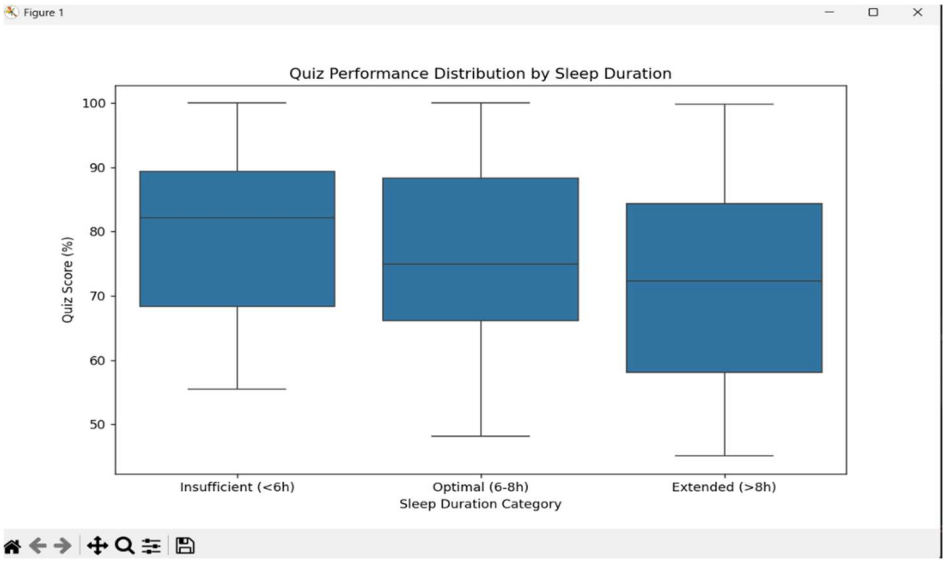
→ Uses sns.regplot(...) to show linear correlation between study hours and quiz scores.



2. Quiz Performance by Sleep Category

Type: Boxplot

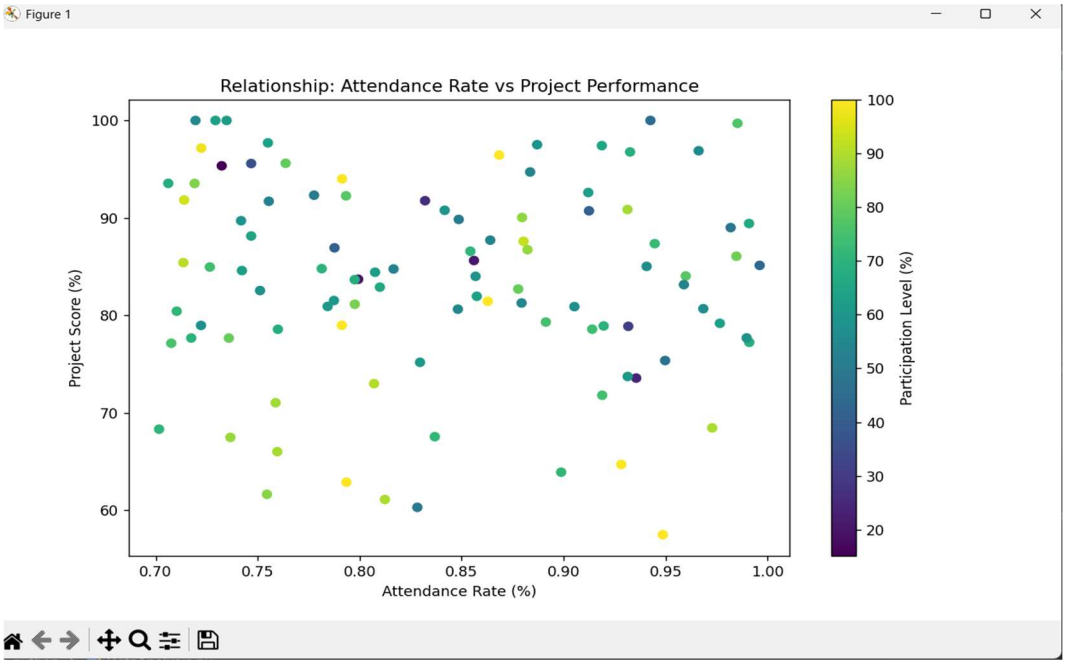
→ Visualizes score distribution across sleep categories using sns.boxplot(...).



3. Attendance Rate vs Project Performance

Type: Scatter Plot with Color Mapping

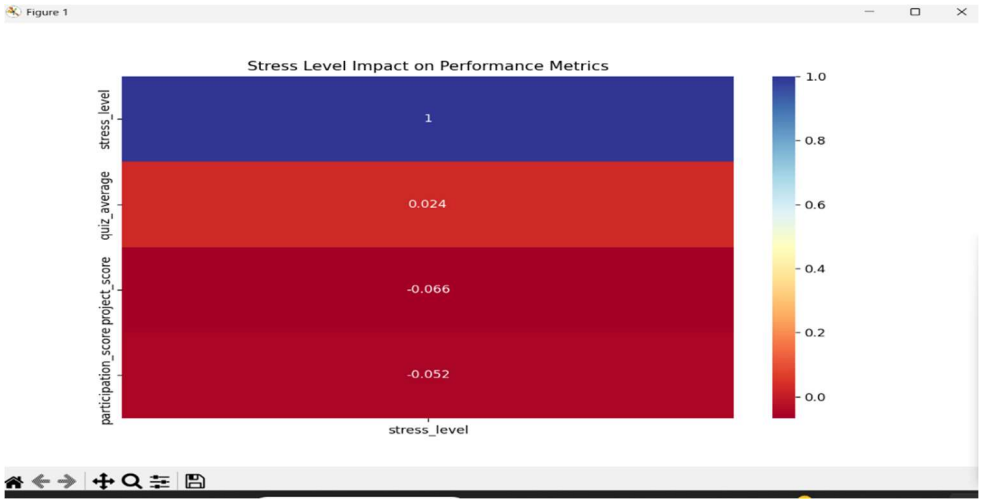
→ Uses plt.scatter(...), with c=participation_score and cmap='viridis' to add a 3rd variable via color intensity.



4. Stress Impact on Performance Metrics

Type: Heatmap

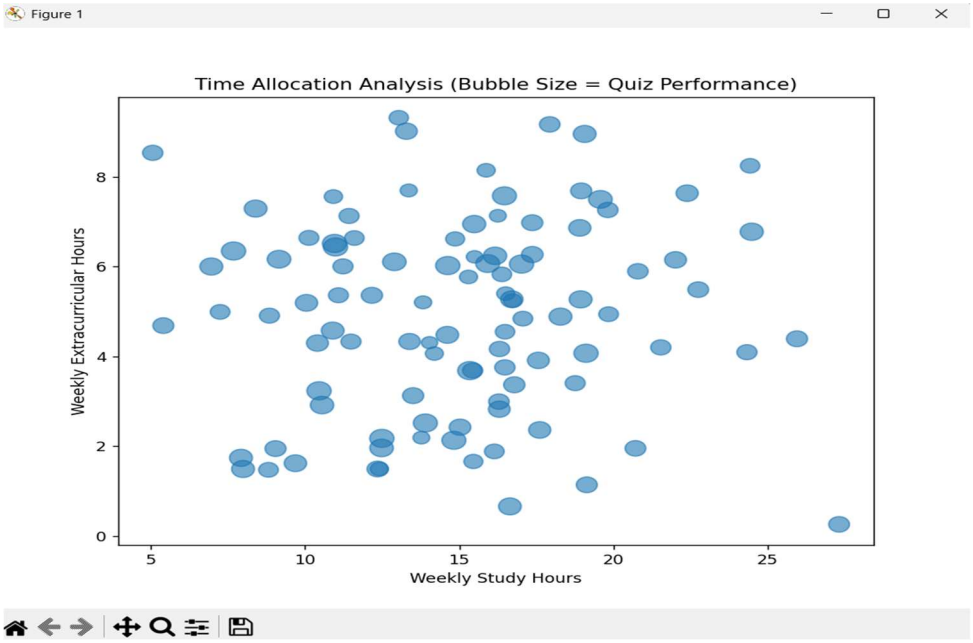
→ Uses sns.heatmap(...) on correlation values between stress level and multiple performance metrics.



5. Time Allocation: Study vs Extracurricular

Type: Bubble Chart (Scatter Plot with variable size)

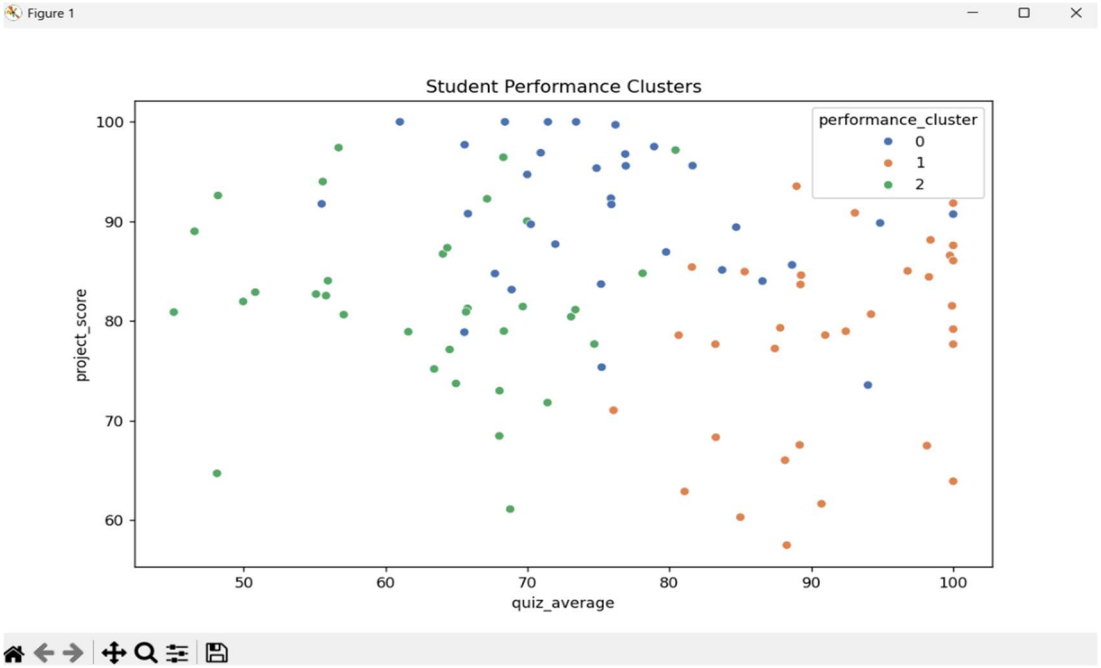
→ Plot uses plt.scatter(...) with s=quiz_average * 2 for bubble sizing — combines study, extracurricular, and performance in one view.



6. Student Performance Clusters

Type: Scatter Plot with Hue (Cluster Labels)

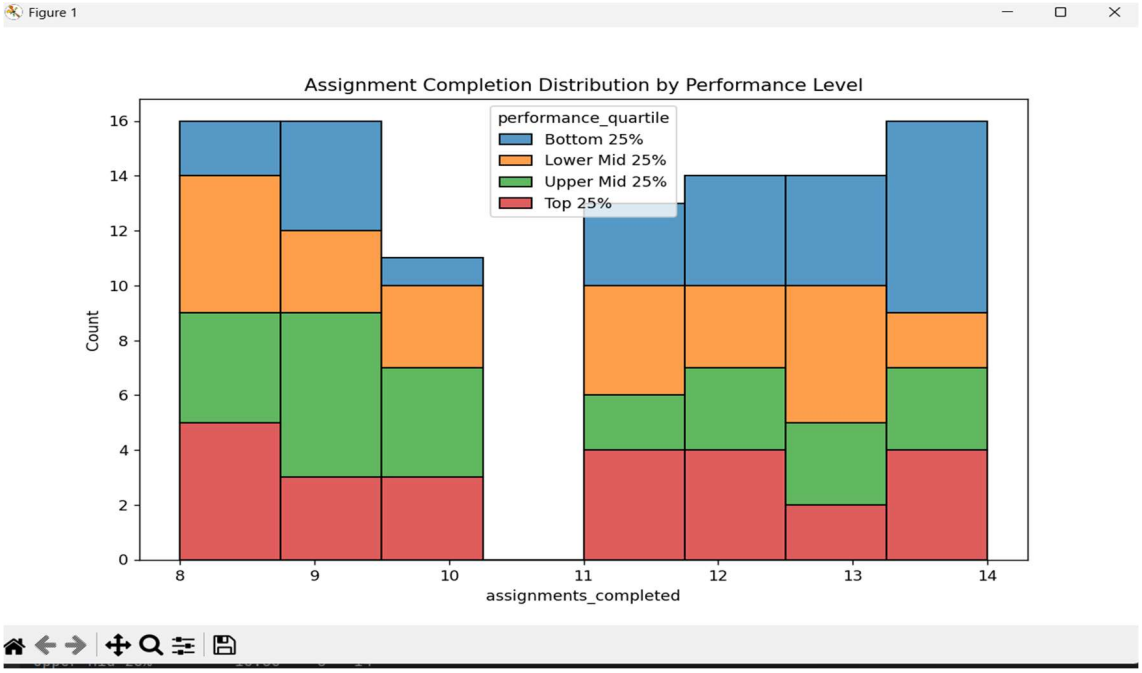
→ Uses sns.scatterplot(...) with hue='performance_cluster' from KMeans clustering.



7. Assignment Completion by Performance Quartile

Type: Histogram (Stacked by Hue)

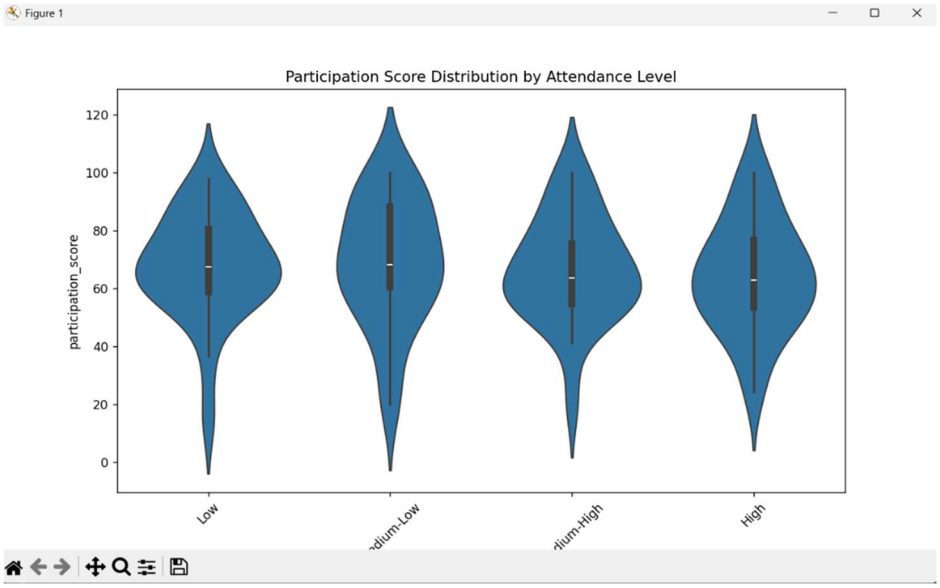
→ Uses sns.histplot(..., multiple="stack") to show how assignment completion varies across performance quartiles.



8. Participation Score by Attendance Level

Type: Violin Plot

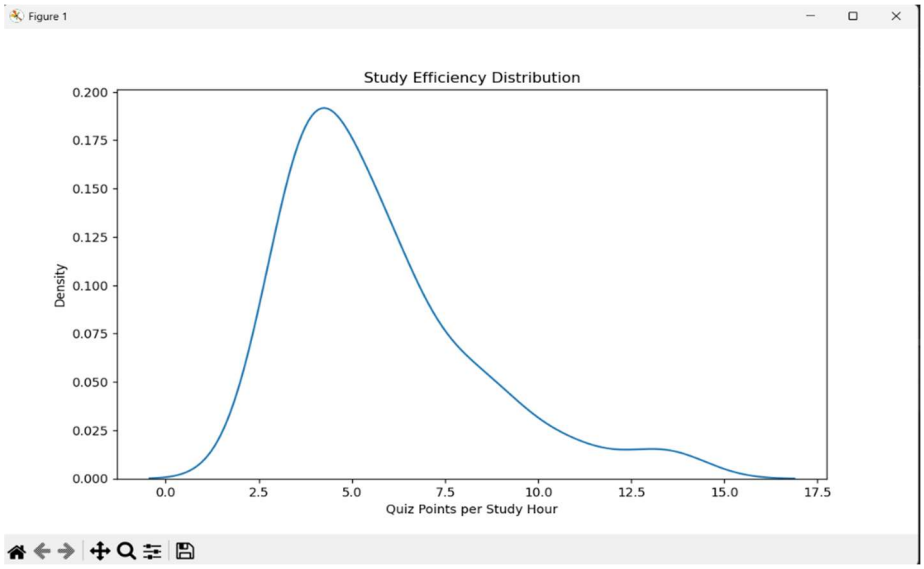
→ Uses sns.violinplot(...) to show distribution shape and density of participation scores across attendance tiers.



9. Study Efficiency Distribution

Type: KDE Plot (Density Plot)

→ Uses sns.kdeplot(...) to show the distribution of quiz points earned per study hour.



10. Performance Profile Comparison: Top vs Bottom Students

Type: Radar Chart (Polar Line Plot)

→ Uses plt.subplot(..., projection="polar") to plot multivariate differences between top and bottom performers.