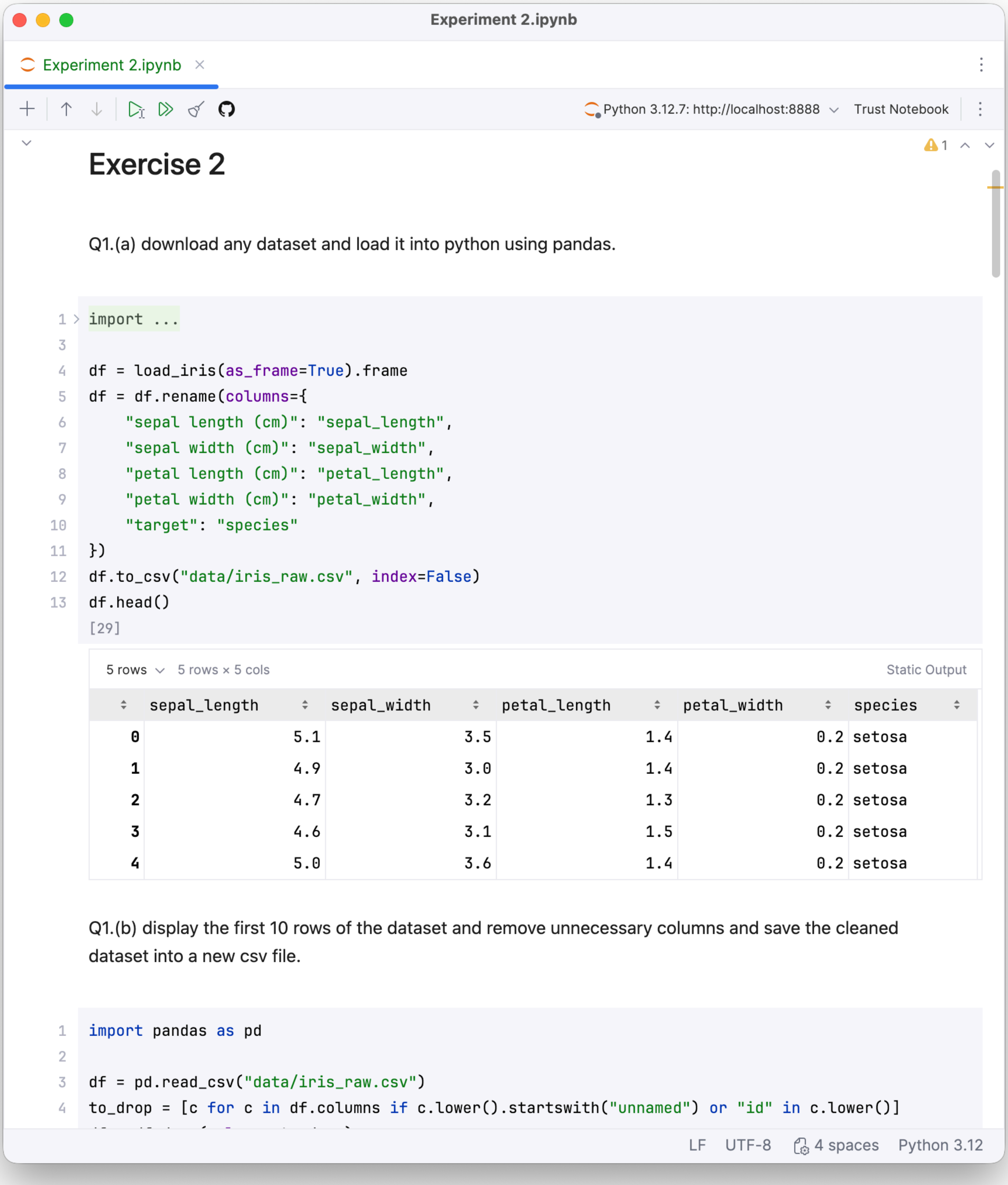


Exercise 2

Q1.(a) download any dataset and load it into python using pandas.

```python
import ...

df = load_iris(as_frame=True).frame
df = df.rename(columns={
    "sepal length (cm)": "sepal_length",
    "sepal width (cm)": "sepal_width",
    "petal length (cm)": "petal_length",
    "petal width (cm)": "petal_width",
    "target": "species"
})
df.to_csv("data/iris_raw.csv", index=False)
df.head()
```

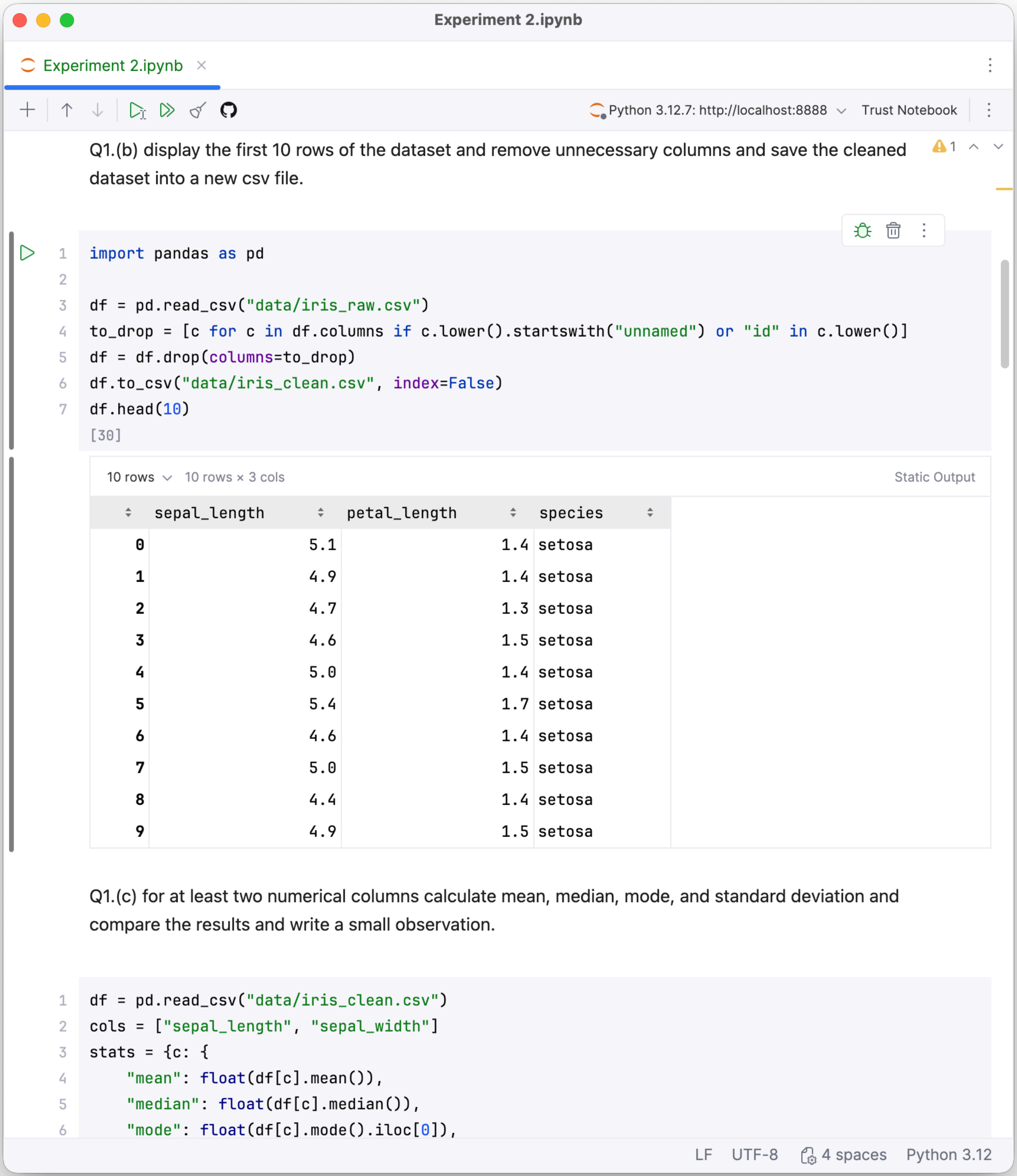
[29]

5 rows 5 rows × 5 cols Static Output

	sepal_length	sepal_width	petal_length	petal_width	species
0	5.1	3.5	1.4	0.2	setosa
1	4.9	3.0	1.4	0.2	setosa
2	4.7	3.2	1.3	0.2	setosa
3	4.6	3.1	1.5	0.2	setosa
4	5.0	3.6	1.4	0.2	setosa

Q1.(b) display the first 10 rows of the dataset and remove unnecessary columns and save the cleaned dataset into a new csv file.

```python
import pandas as pd

df = pd.read_csv("data/iris_raw.csv")
to_drop = [c for c in df.columns if c.lower().startswith("unnamed") or "id" in c.lower()]
```



Q1.(b) display the first 10 rows of the dataset and remove unnecessary columns and save the cleaned dataset into a new csv file.

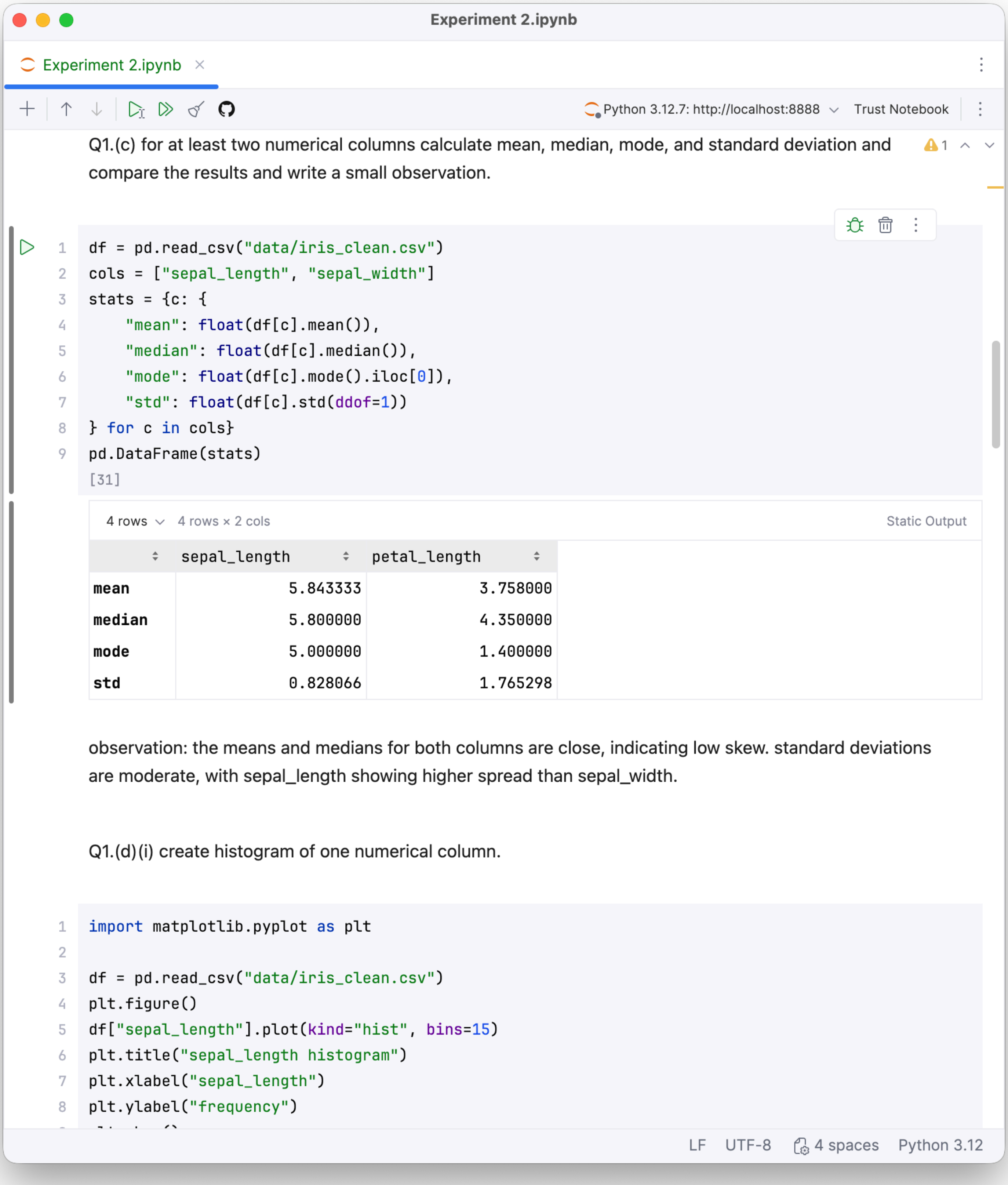
```python
import pandas as pd

df = pd.read_csv("data/iris_raw.csv")
to_drop = [c for c in df.columns if c.lower().startswith("unnamed") or "id" in c.lower()]
df = df.drop(columns=to_drop)
df.to_csv("data/iris_clean.csv", index=False)
df.head(10)
```

[30]

	sepal_length	petal_length	species
0	5.1	1.4	setosa
1	4.9	1.4	setosa
2	4.7	1.3	setosa
3	4.6	1.5	setosa
4	5.0	1.4	setosa
5	5.4	1.7	setosa
6	4.6	1.4	setosa
7	5.0	1.5	setosa
8	4.4	1.4	setosa
9	4.9	1.5	setosa

Q1.(c) for at least two numerical columns calculate mean, median, mode, and standard deviation and compare the results and write a small observation.

```python
df = pd.read_csv("data/iris_clean.csv")
cols = ["sepal_length", "sepal_width"]
stats = {c: {
    "mean": float(df[c].mean()),
    "median": float(df[c].median()),
    "mode": float(df[c].mode().iloc[0]),
```



Q1.(c) for at least two numerical columns calculate mean, median, mode, and standard deviation and compare the results and write a small observation.

```python
df = pd.read_csv("data/iris_clean.csv")
cols = ["sepal_length", "sepal_width"]
stats = {c: {
    "mean": float(df[c].mean()),
    "median": float(df[c].median()),
    "mode": float(df[c].mode().iloc[0]),
    "std": float(df[c].std(ddof=1))
} for c in cols}
pd.DataFrame(stats)
```

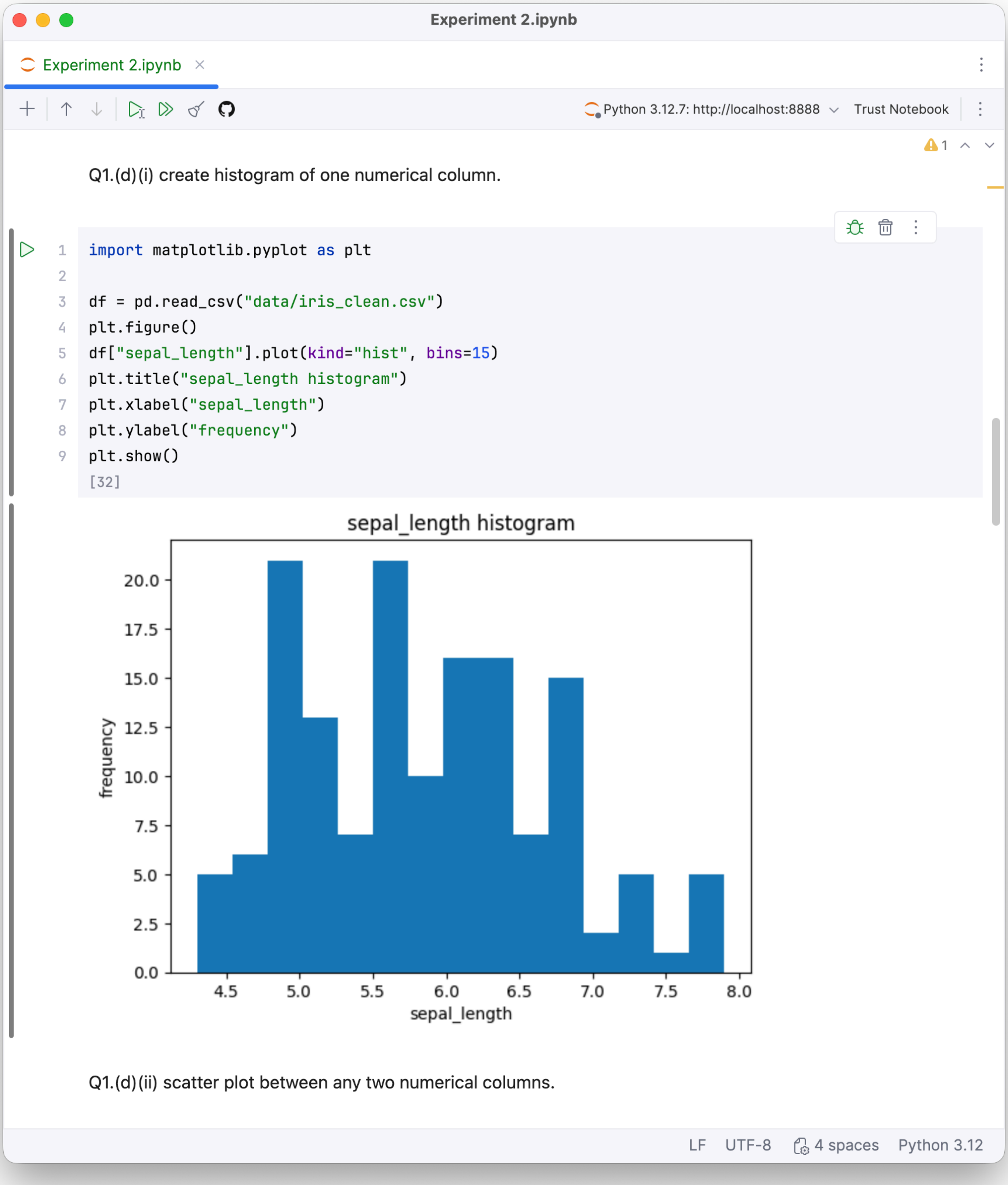
[31]

	sepal_length	petal_length
mean	5.843333	3.758000
median	5.800000	4.350000
mode	5.000000	1.400000
std	0.828066	1.765298

observation: the means and medians for both columns are close, indicating low skew. standard deviations are moderate, with sepal_length showing higher spread than sepal_width.

Q1.(d)(i) create histogram of one numerical column.

```python
import matplotlib.pyplot as plt

df = pd.read_csv("data/iris_clean.csv")
plt.figure()
df["sepal_length"].plot(kind="hist", bins=15)
plt.title("sepal_length histogram")
plt.xlabel("sepal_length")
plt.ylabel("frequency")
```

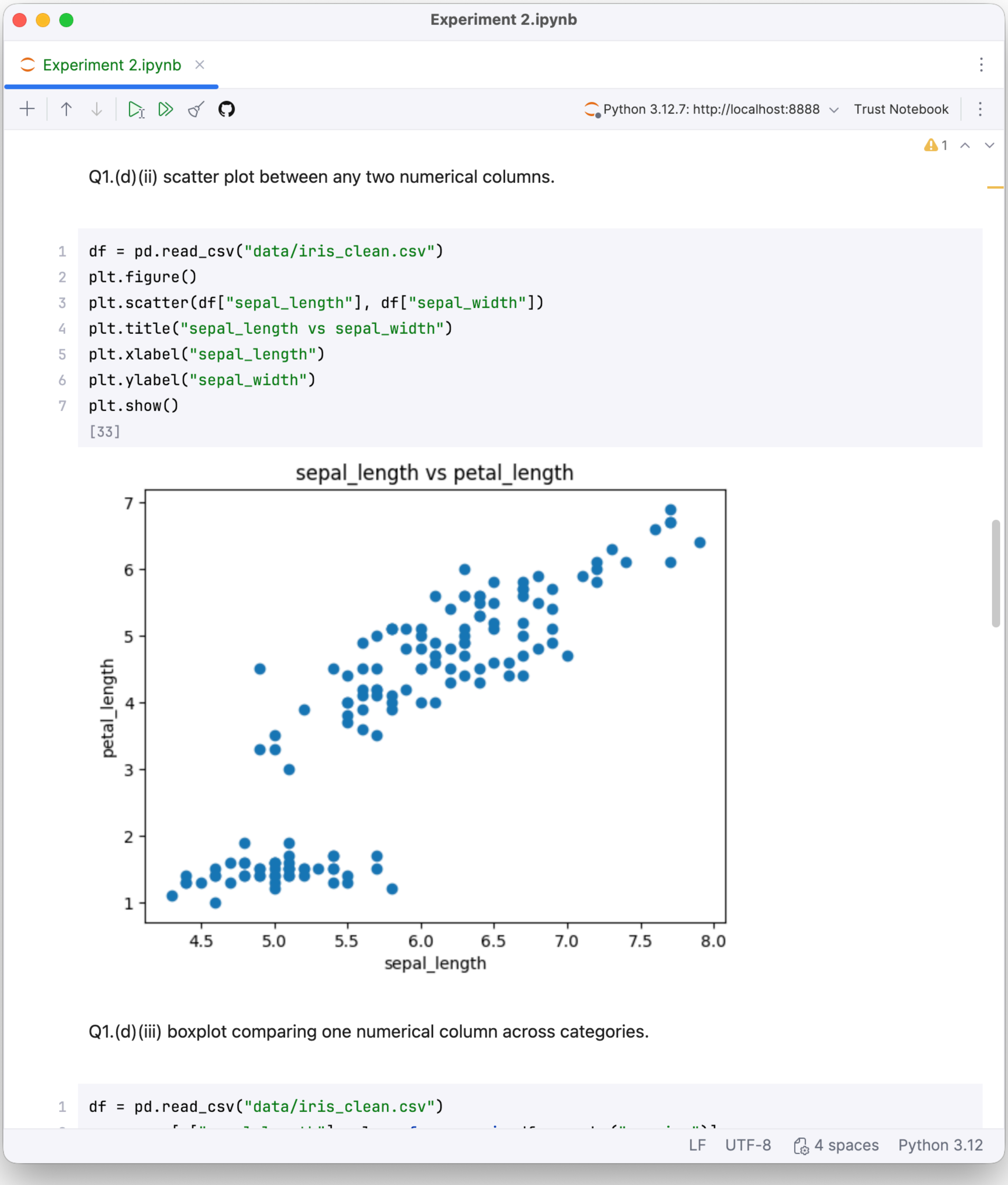


Q1.(d)(i) create histogram of one numerical column.

```python
import matplotlib.pyplot as plt

df = pd.read_csv("data/iris_clean.csv")
plt.figure()
df["sepal_length"].plot(kind="hist", bins=15)
plt.title("sepal_length histogram")
plt.xlabel("sepal_length")
plt.ylabel("frequency")
plt.show()
```

[32]

Q1.(d)(ii) scatter plot between any two numerical columns.

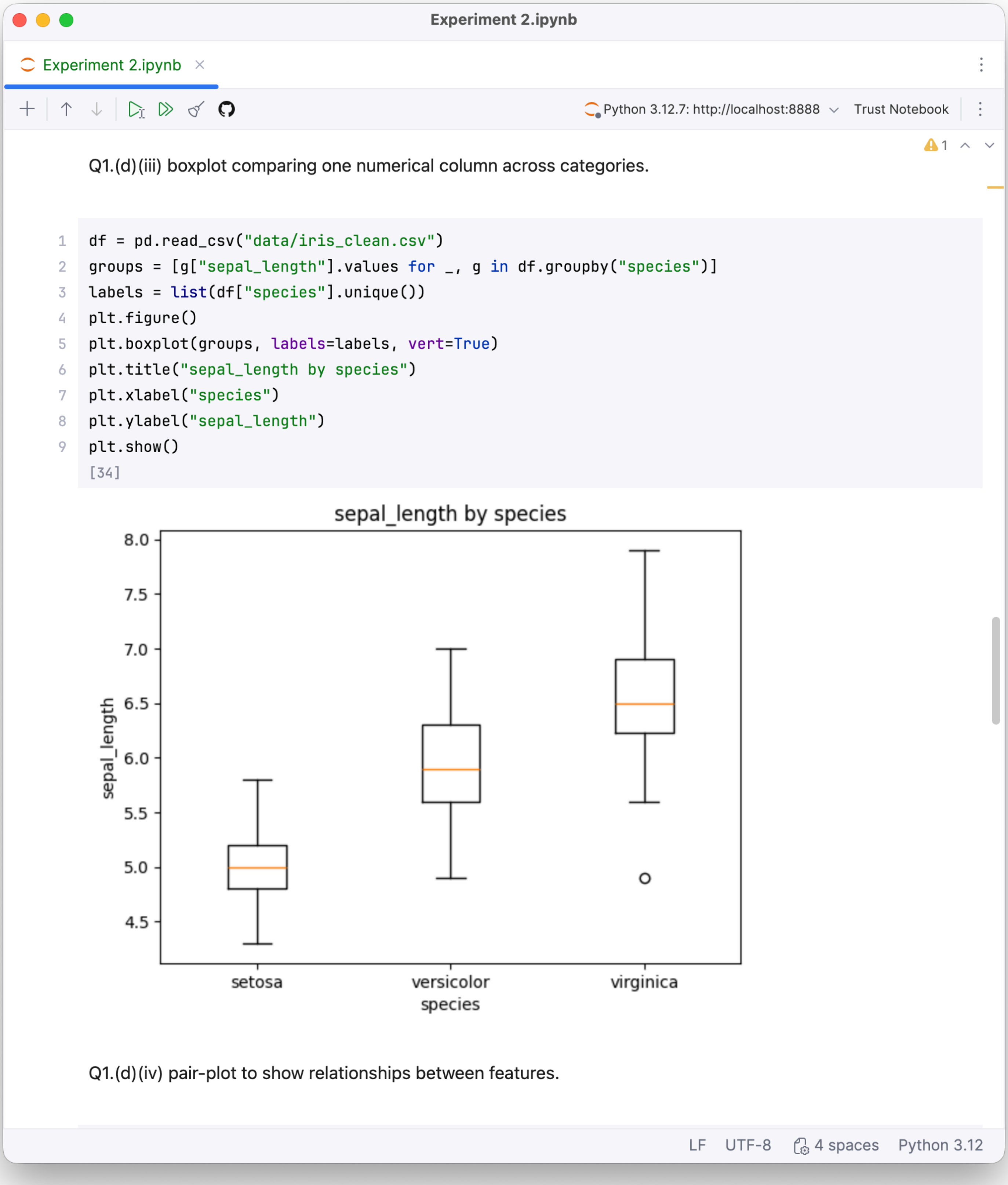


Q1.(d)(ii) scatter plot between any two numerical columns.

```python
df = pd.read_csv("data/iris_clean.csv")
plt.figure()
plt.scatter(df["sepal_length"], df["sepal_width"])
plt.title("sepal_length vs sepal_width")
plt.xlabel("sepal_length")
plt.ylabel("sepal_width")
plt.show()
[33]
```

Q1.(d)(iii) boxplot comparing one numerical column across categories.

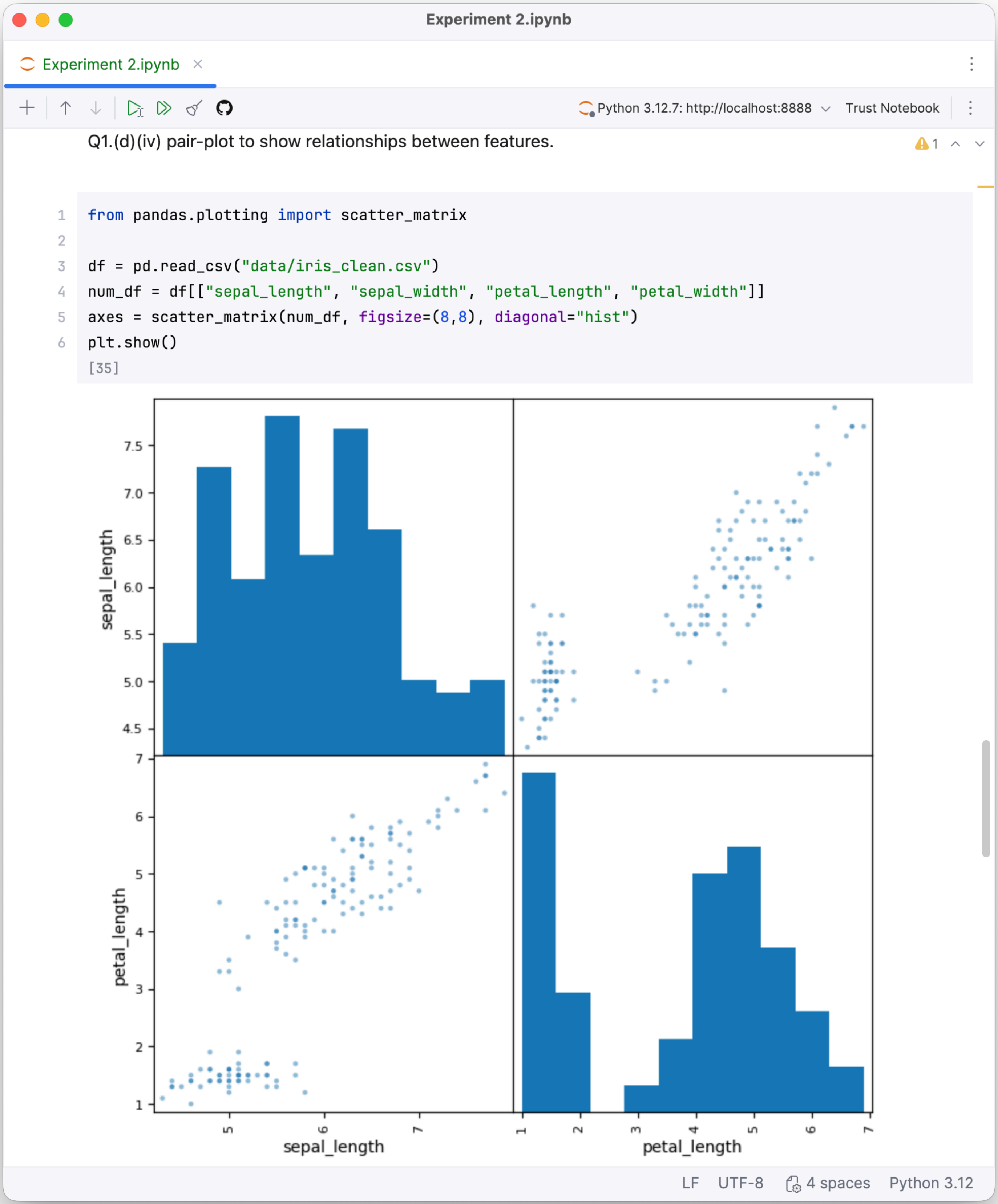
```python
df = pd.read_csv("data/iris_clean.csv")
```



Q1.(d)(iii) boxplot comparing one numerical column across categories.

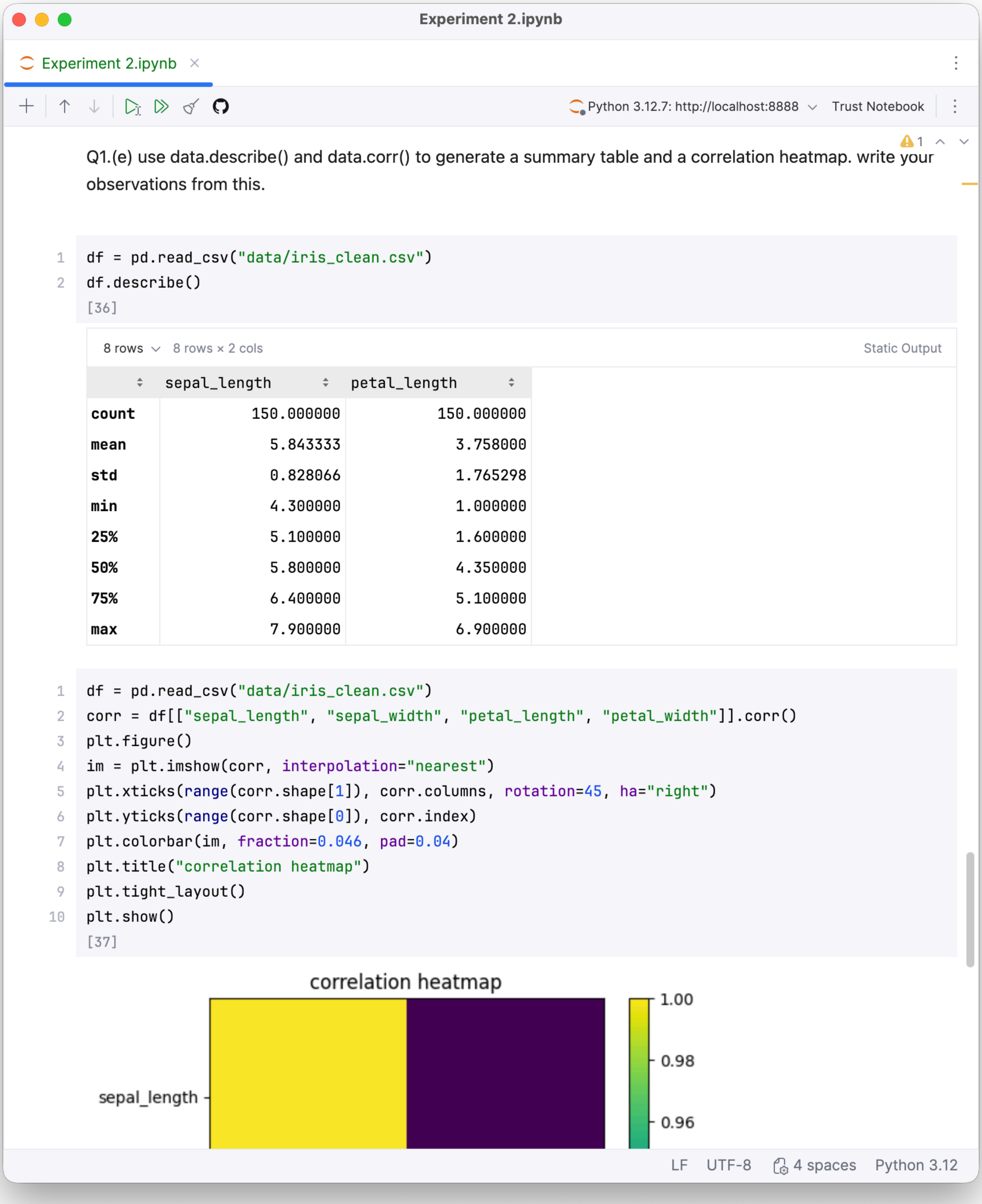
```python
df = pd.read_csv("data/iris_clean.csv")
groups = [g["sepal_length"].values for _, g in df.groupby("species")]
labels = list(df["species"].unique())
plt.figure()
plt.boxplot(groups, labels=labels, vert=True)
plt.title("sepal_length by species")
plt.xlabel("species")
plt.ylabel("sepal_length")
plt.show()
[34]
```

Q1.(d)(iv) pair-plot to show relationships between features.



Q1.(d)(iv) pair-plot to show relationships between features.

```python
from pandas.plotting import scatter_matrix

df = pd.read_csv("data/iris_clean.csv")
num_df = df[["sepal_length", "sepal_width", "petal_length", "petal_width"]]
axes = scatter_matrix(num_df, figsize=(8,8), diagonal="hist")
plt.show()
[35]
```

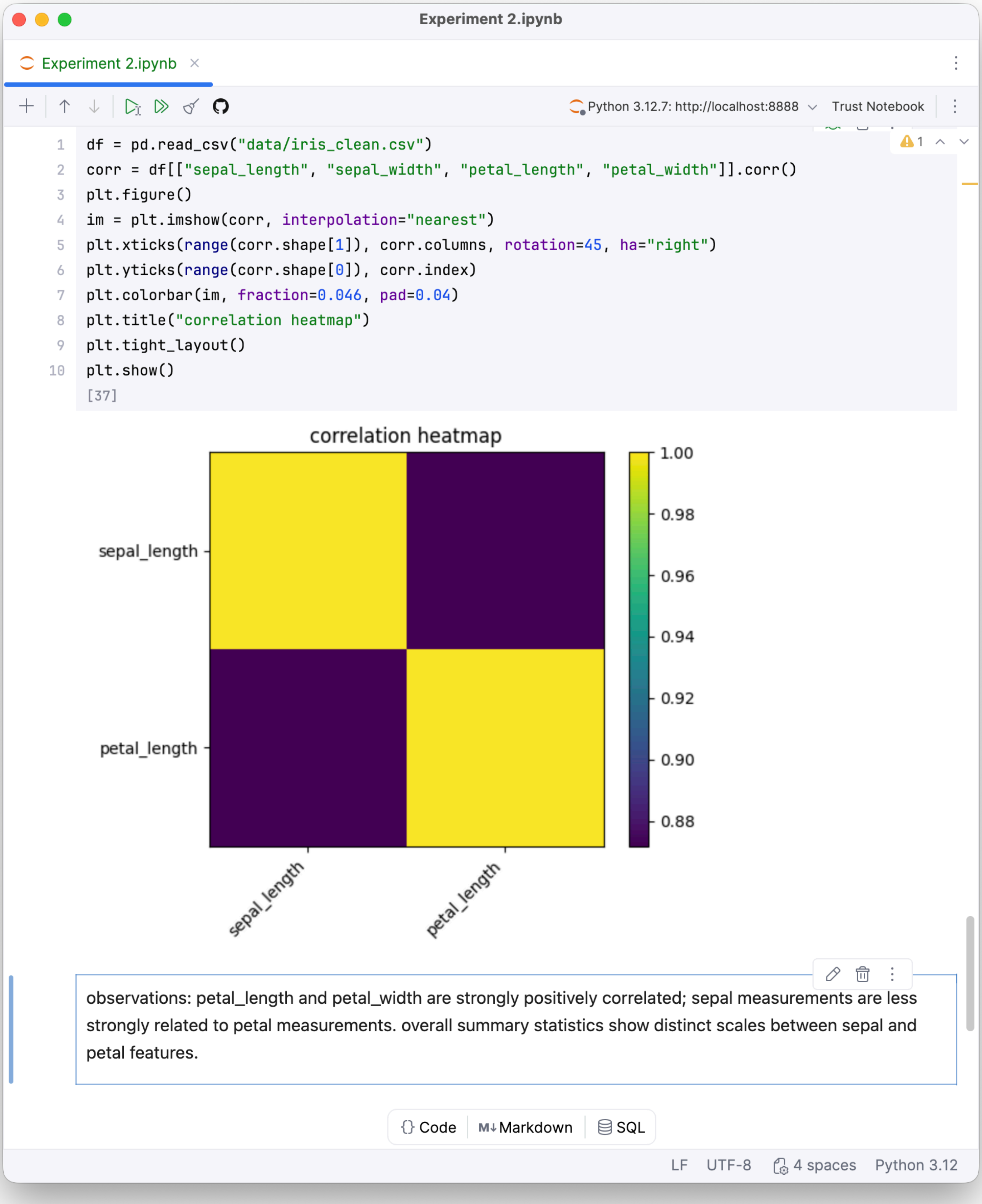


Q1.(e) use data.describe() and data.corr() to generate a summary table and a correlation heatmap. write your observations from this.

```
df = pd.read_csv("data/iris_clean.csv")
df.describe()
[36]
```

	sepal_length	petal_length
count	150.000000	150.000000
mean	5.843333	3.758000
std	0.828066	1.765298
min	4.300000	1.000000
25%	5.100000	1.600000
50%	5.800000	4.350000
75%	6.400000	5.100000
max	7.900000	6.900000

```
df = pd.read_csv("data/iris_clean.csv")
corr = df[["sepal_length", "sepal_width", "petal_length", "petal_width"]].corr()
plt.figure()
im = plt.imshow(corr, interpolation="nearest")
plt.xticks(range(corr.shape[1]), corr.columns, rotation=45, ha="right")
plt.yticks(range(corr.shape[0]), corr.index)
plt.colorbar(im, fraction=0.046, pad=0.04)
plt.title("correlation heatmap")
plt.tight_layout()
plt.show()
[37]
```



```python
df = pd.read_csv("data/iris_clean.csv")
corr = df[["sepal_length", "sepal_width", "petal_length", "petal_width"]].corr()
plt.figure()
im = plt.imshow(corr, interpolation="nearest")
plt.xticks(range(corr.shape[1]), corr.columns, rotation=45, ha="right")
plt.yticks(range(corr.shape[0]), corr.index)
plt.colorbar(im, fraction=0.046, pad=0.04)
plt.title("correlation heatmap")
plt.tight_layout()
plt.show()
```

[37]

observations: petal_length and petal_width are strongly positively correlated; sepal measurements are less strongly related to petal measurements. overall summary statistics show distinct scales between sepal and petal features.