👋 Hi, I'm **Ashish Mishra**

📊 Internship in Data Science

🏢 at **ShadowFox**

Python Visualization Libraries: Matplotlib and Seaborn

🎨 Matplotlib

> **Matplotlib** is one of the most popular and powerful Python libraries for data visualization. It allows for creating a wide variety of static, animated, and interactive plots.

🔑 Key Features
✅ Highly customizable plots with detailed control
📁 Supports multiple file formats (PNG, PDF, SVG)
🛠️ Compatible with GUI toolkits (Tkinter, Qt, etc.)
📊 Ideal for both 2D and limited 3D plotting

📚 Typical Use Cases

- 📖 **Academic Research** – Create publication-quality plots.
- 📈 **Data Exploration** – Visualize trends and data distributions.
- 🧩 **Custom Visualizations** – Tailored plots for specific needs.

🌈 Seaborn

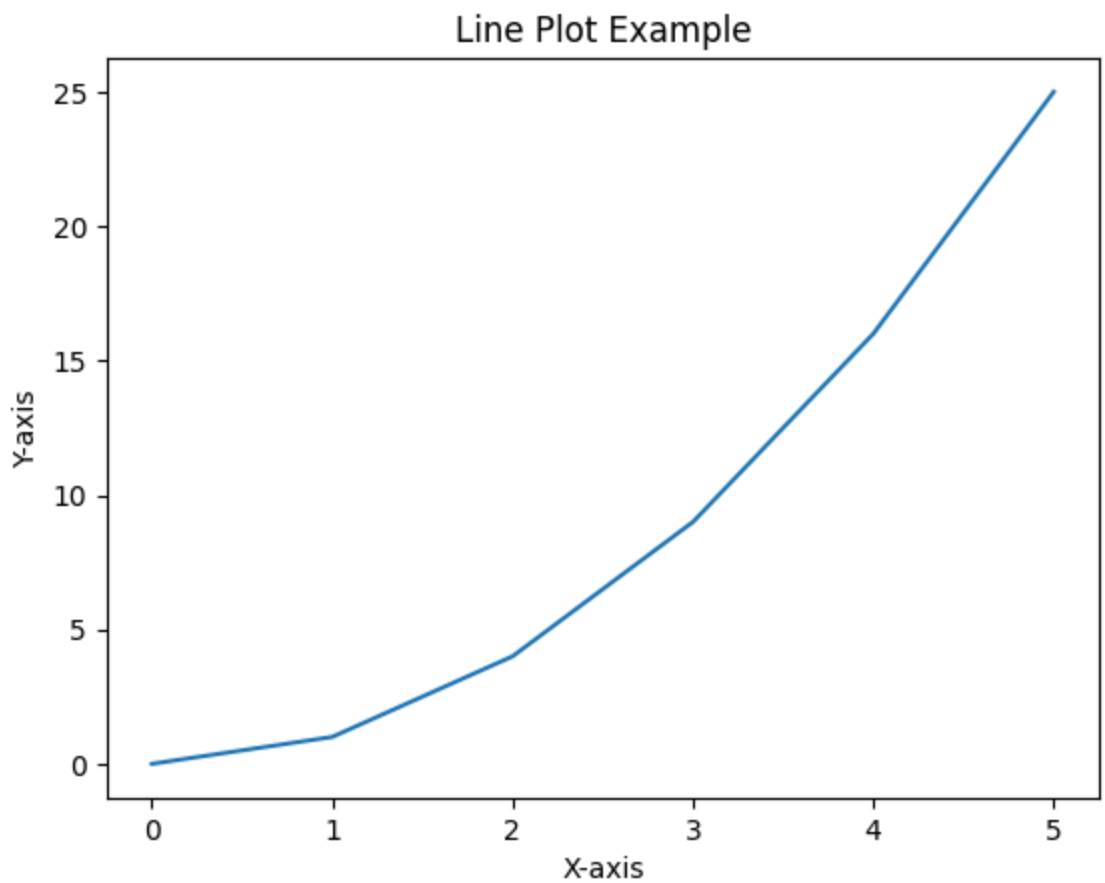
> **Seaborn** is a high-level API built on top of Matplotlib that simplifies the process of creating visually attractive and statistically meaningful graphics.

🌟 Key Features
🧠 Simplified syntax for quick and efficient plotting
🎨 Beautiful default themes and color palettes
📊 Built-in support for boxplots, violin plots, heatmaps
📉 Seamless integration with Pandas for EDA

📚 Typical Use Cases

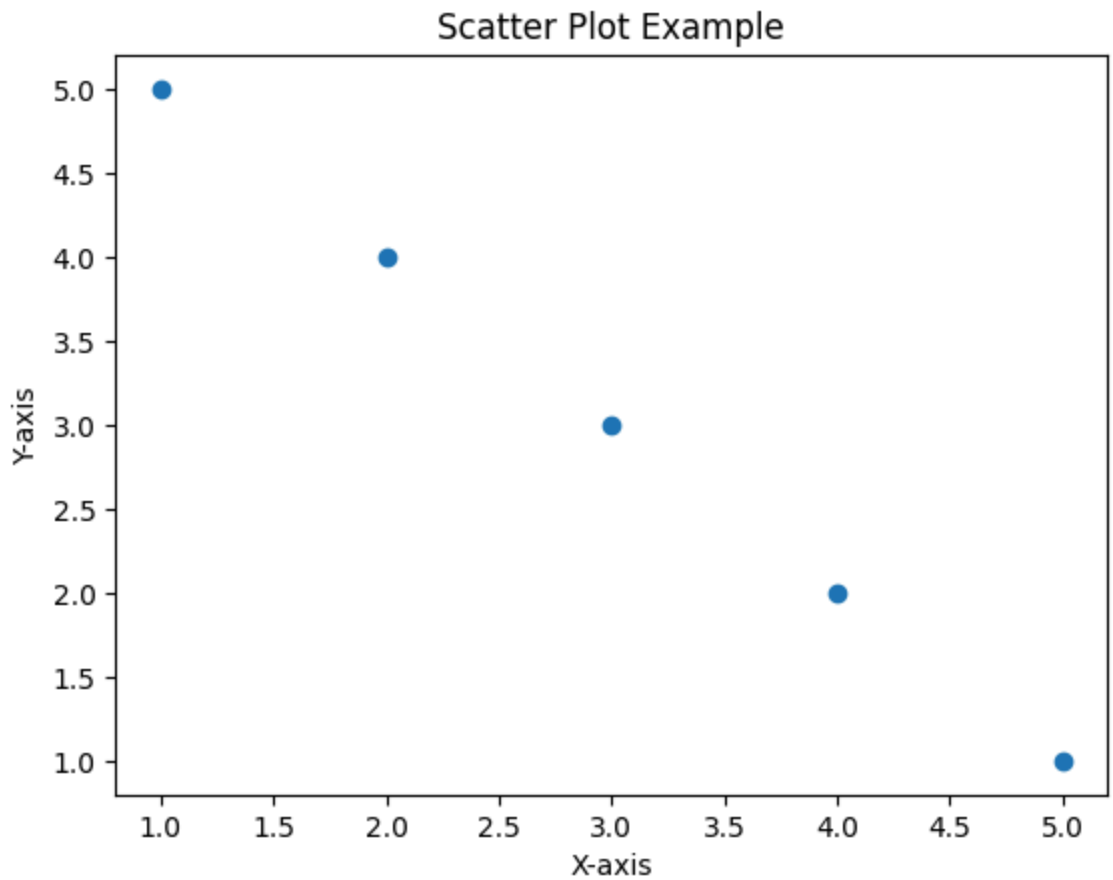
- 🔍 **Exploratory Data Analysis (EDA)** – Understand your data quickly.
- 📉 **Statistical Visualization** – Relationships and distributions.
- 🖼️ **Beautiful Plots** – Create insightful and presentable charts fast.

In [1]:
```
import matplotlib.pyplot as plt

# Sample data
x = [0, 1, 2, 3, 4, 5]
y = [0, 1, 4, 9, 16, 25]

# Create line plot
plt.plot(x, y)
plt.xlabel('X-axis')
plt.ylabel('Y-axis')
plt.title('Line Plot Example')
plt.show()
```

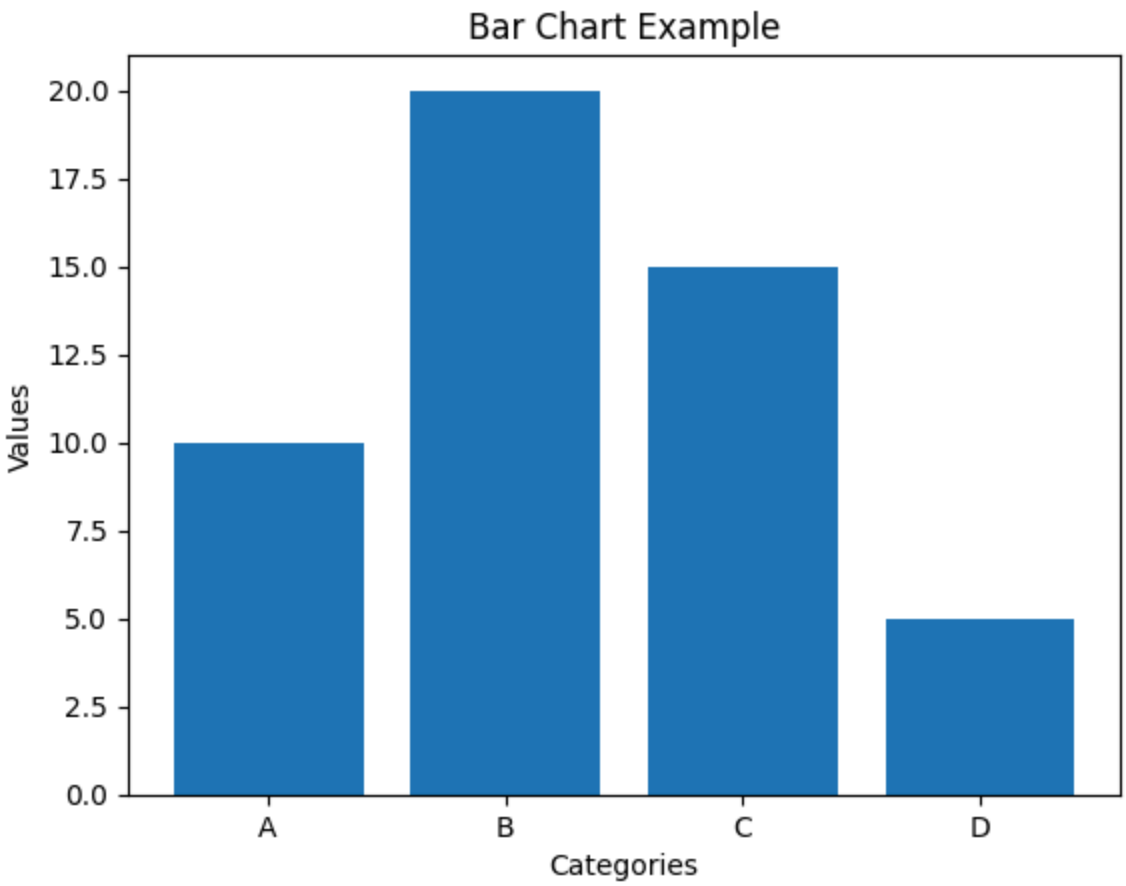


In [2]:
```
import matplotlib.pyplot as plt

# Sample data
x = [1, 2, 3, 4, 5]
y = [5, 4, 3, 2, 1]

# Create scatter plot
```

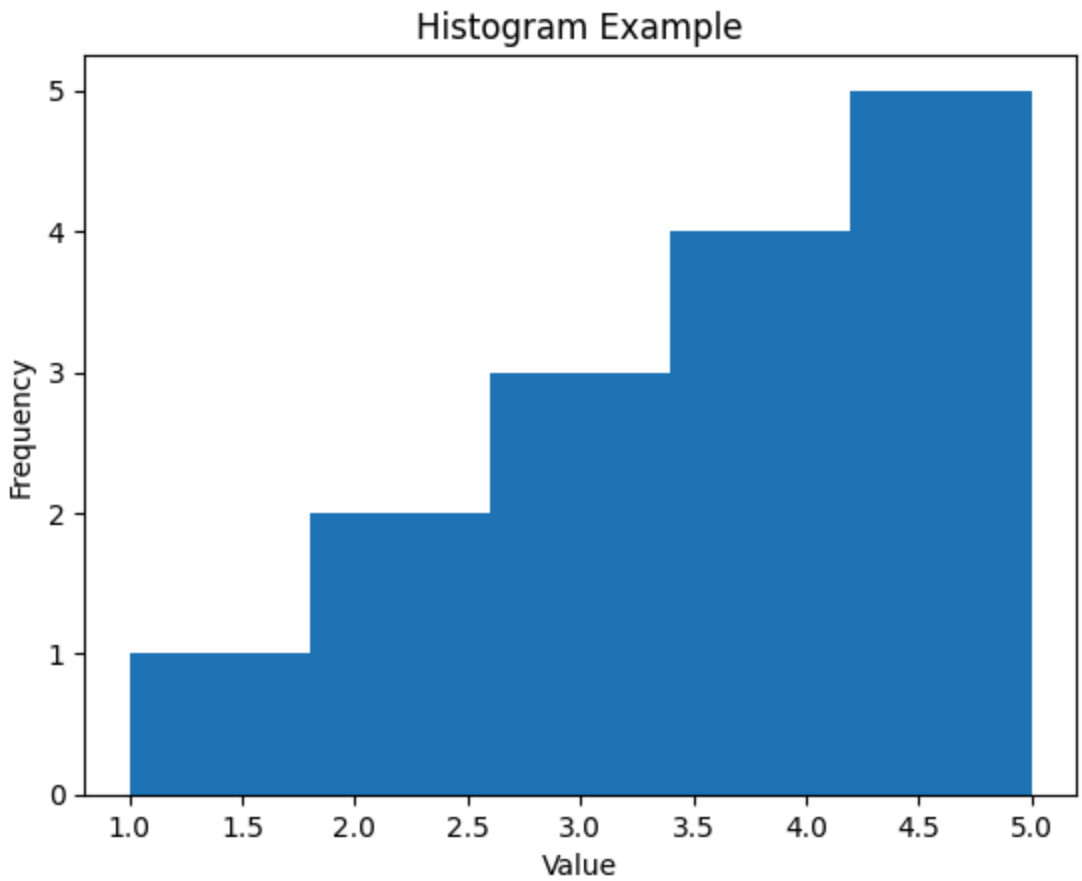
```
plt.scatter(x, y)
plt.xlabel('X-axis')
plt.ylabel('Y-axis')
plt.title('Scatter Plot Example')
plt.show()
```



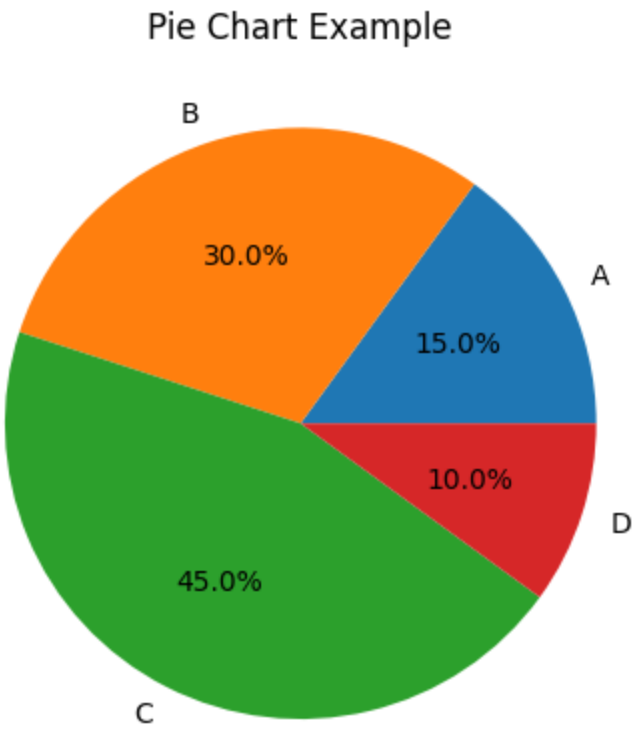
In [3]:
```
import matplotlib.pyplot as plt

# Sample data
categories = ['A', 'B', 'C', 'D']
values = [10, 20, 15, 5]

# Create bar chart
plt.bar(categories, values)
plt.xlabel('Categories')
plt.ylabel('Values')
plt.title('Bar Chart Example')
plt.show()
```



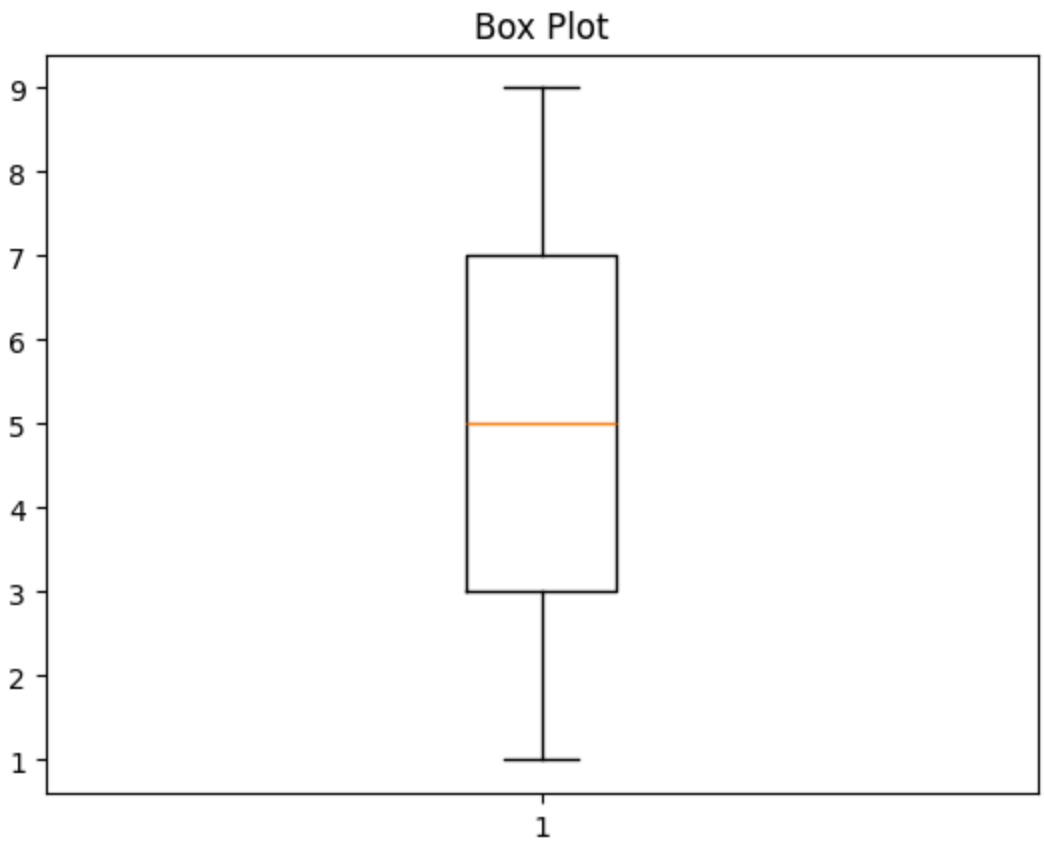
In [4]:
```
import matplotlib.pyplot as plt

# Sample data
data = [1, 2, 2, 3, 3, 3, 4, 4, 4, 4, 5, 5, 5, 5, 5]

# Create histogram
plt.hist(data, bins=5)
plt.xlabel('Value')
plt.ylabel('Frequency')
plt.title('Histogram Example')
plt.show()
```



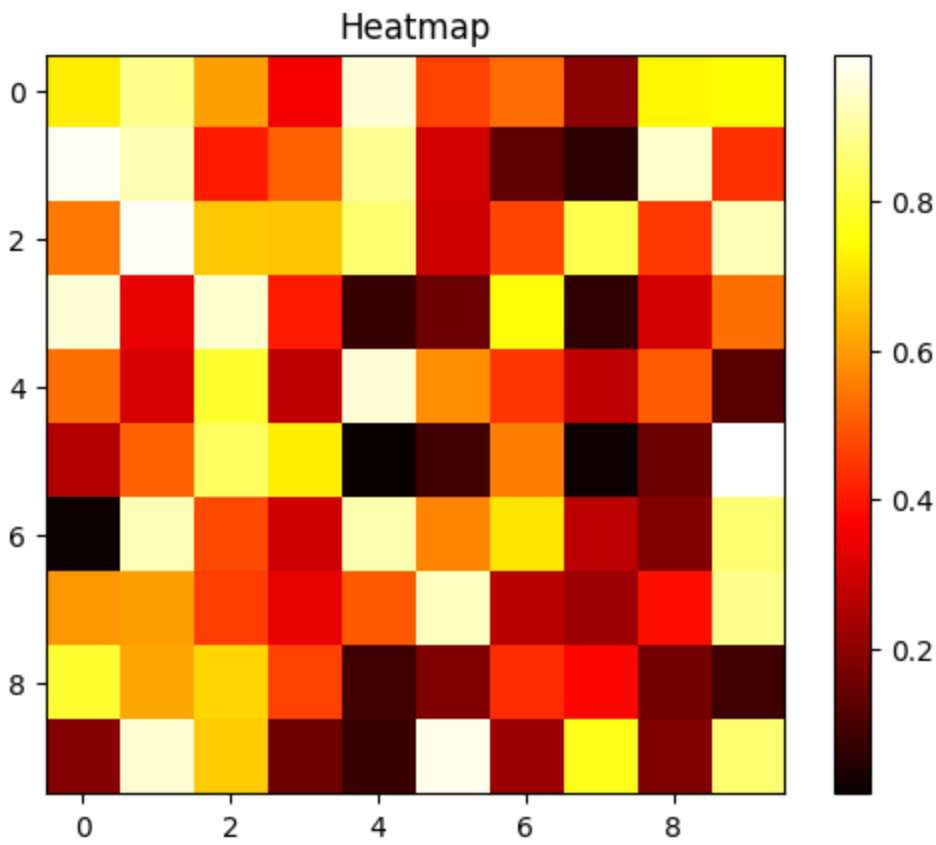
In [5]:
```
import matplotlib.pyplot as plt

# Sample data
labels = ['A', 'B', 'C', 'D']
sizes = [15, 30, 45, 10]

# Create pie chart
plt.pie(sizes, labels=labels, autopct='%1.1f%%')
plt.title('Pie Chart Example')
plt.show()
```



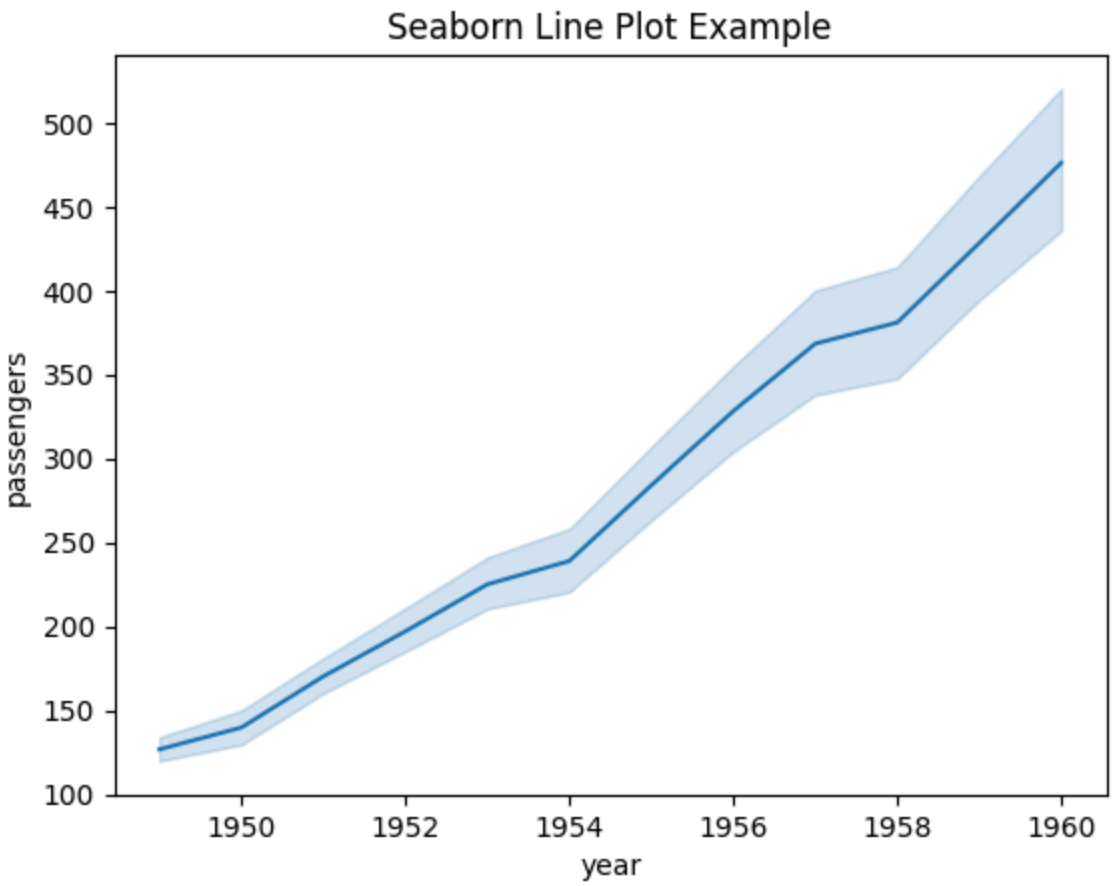
In [6]:
```
import matplotlib.pyplot as plt

data = [1, 2, 3, 4, 5, 6, 7, 8, 9]

plt.boxplot(data)
plt.title("Box Plot")
plt.show()
```



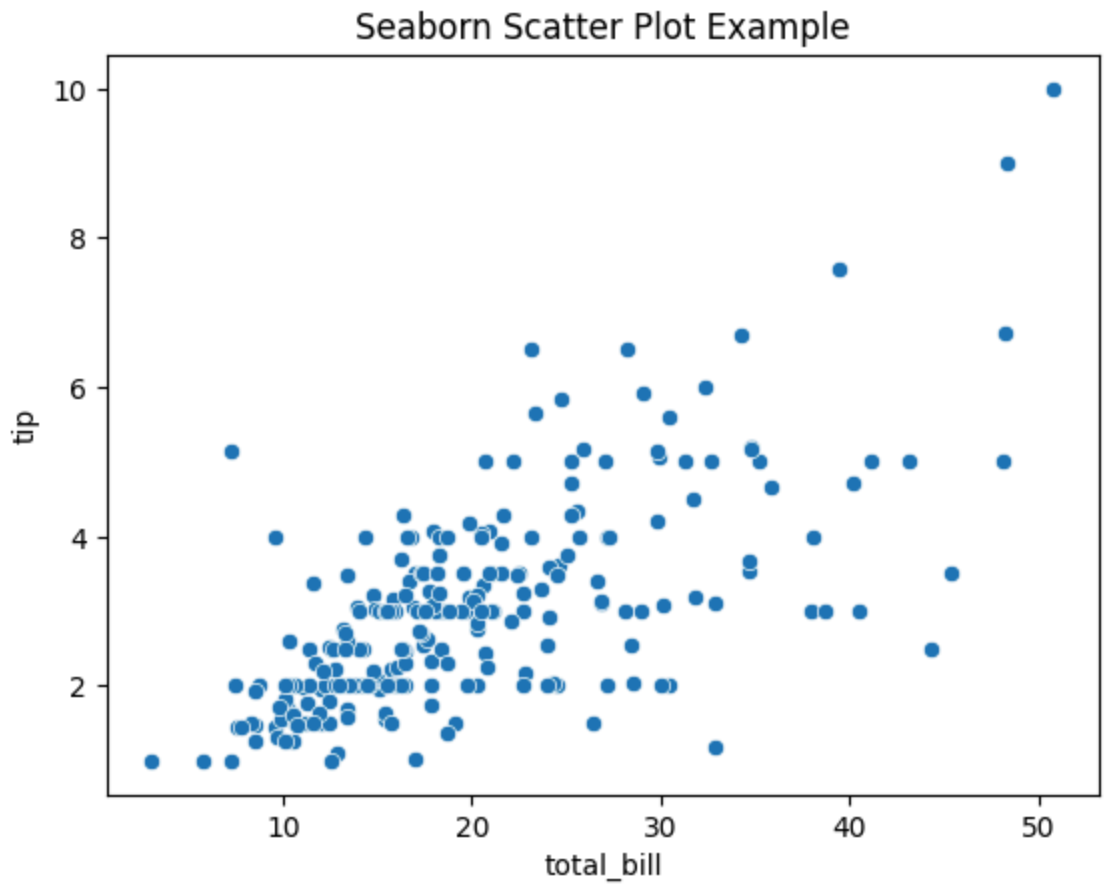
In [7]:
```
import matplotlib.pyplot as plt
import numpy as np

data = np.random.rand(10, 10)

plt.imshow(data, cmap='hot', interpolation='nearest')
plt.title("Heatmap")
plt.colorbar()
plt.show()
```



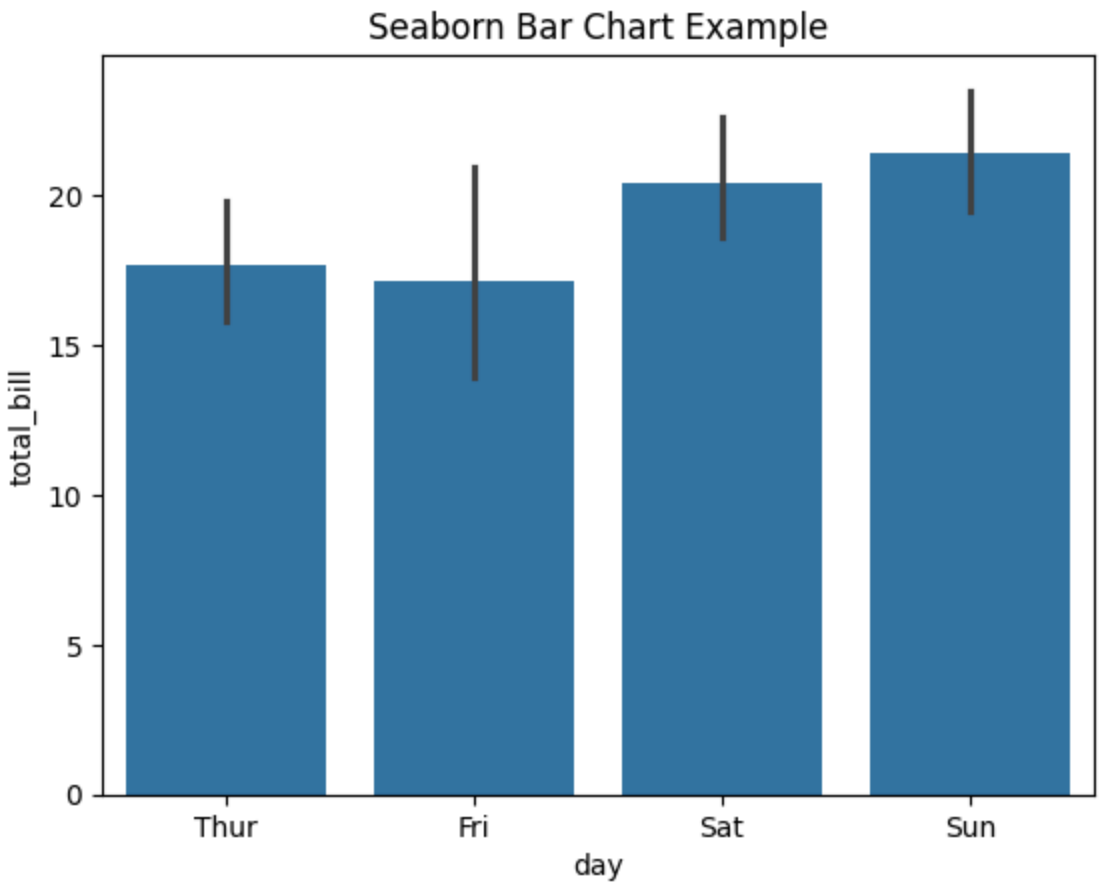
In [8]:
```
import seaborn as sns
import matplotlib.pyplot as plt

# Sample data
data = sns.load_dataset("flights")

# Create line plot
sns.lineplot(x="year", y="passengers", data=data)
plt.title('Seaborn Line Plot Example')
plt.show()
```



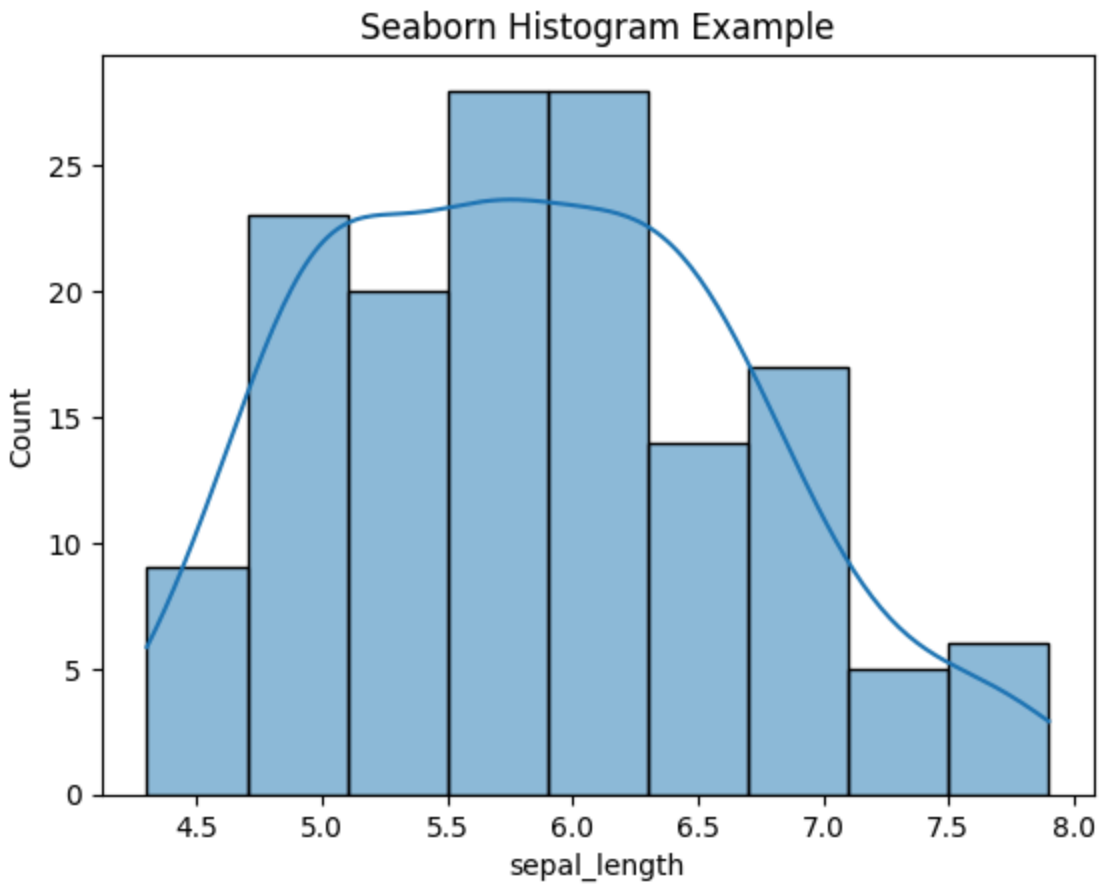
In [9]:
```
import seaborn as sns
import matplotlib.pyplot as plt

# Sample data
data = sns.load_dataset("tips")

# Create scatter plot
sns.scatterplot(x="total_bill", y="tip", data=data)
plt.title('Seaborn Scatter Plot Example')
plt.show()
```



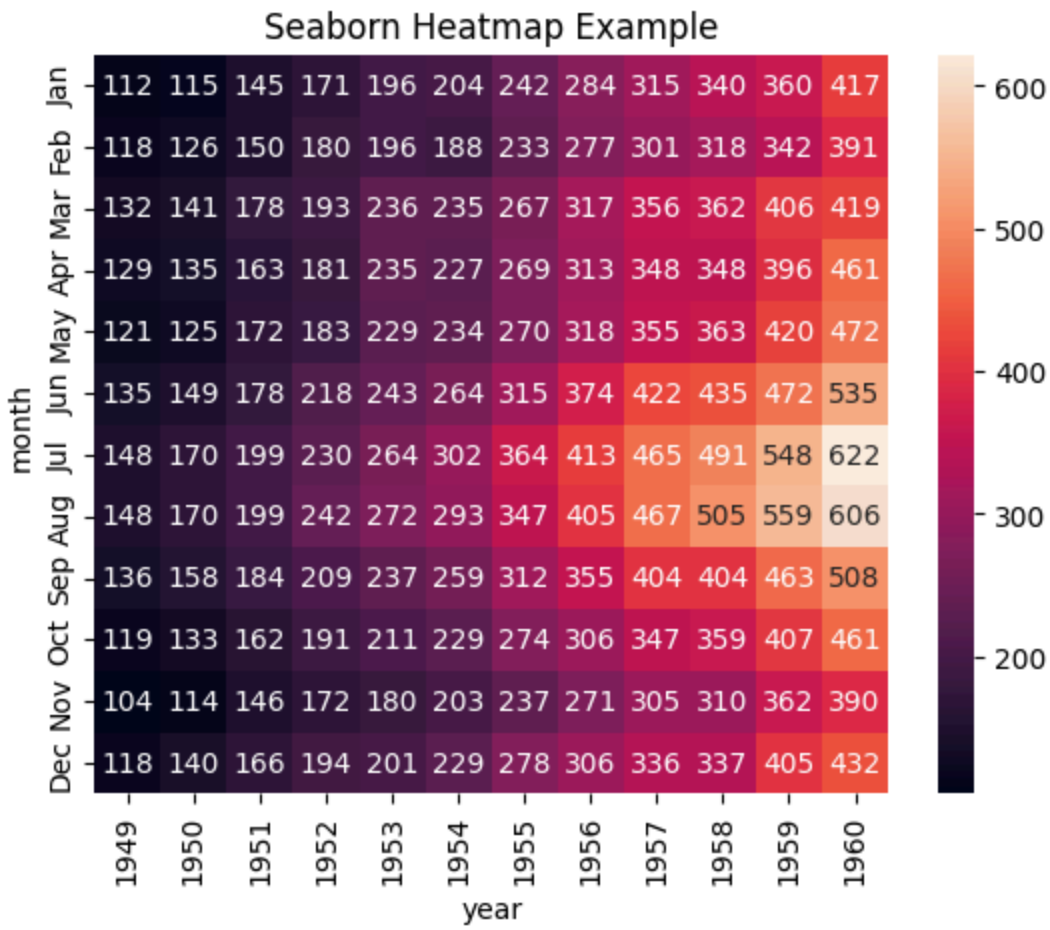
In [10]:
```
import seaborn as sns
import matplotlib.pyplot as plt

# Sample data
data = sns.load_dataset("tips")

# Create bar chart
sns.barplot(x="day", y="total_bill", data=data)
plt.title('Seaborn Bar Chart Example')
plt.show()
```



In [11]:
```
import seaborn as sns
import matplotlib.pyplot as plt

# Sample data
data = sns.load_dataset("iris")

# Create histogram
sns.histplot(data["sepal_length"], kde=True)
plt.title('Seaborn Histogram Example')
plt.show()
```

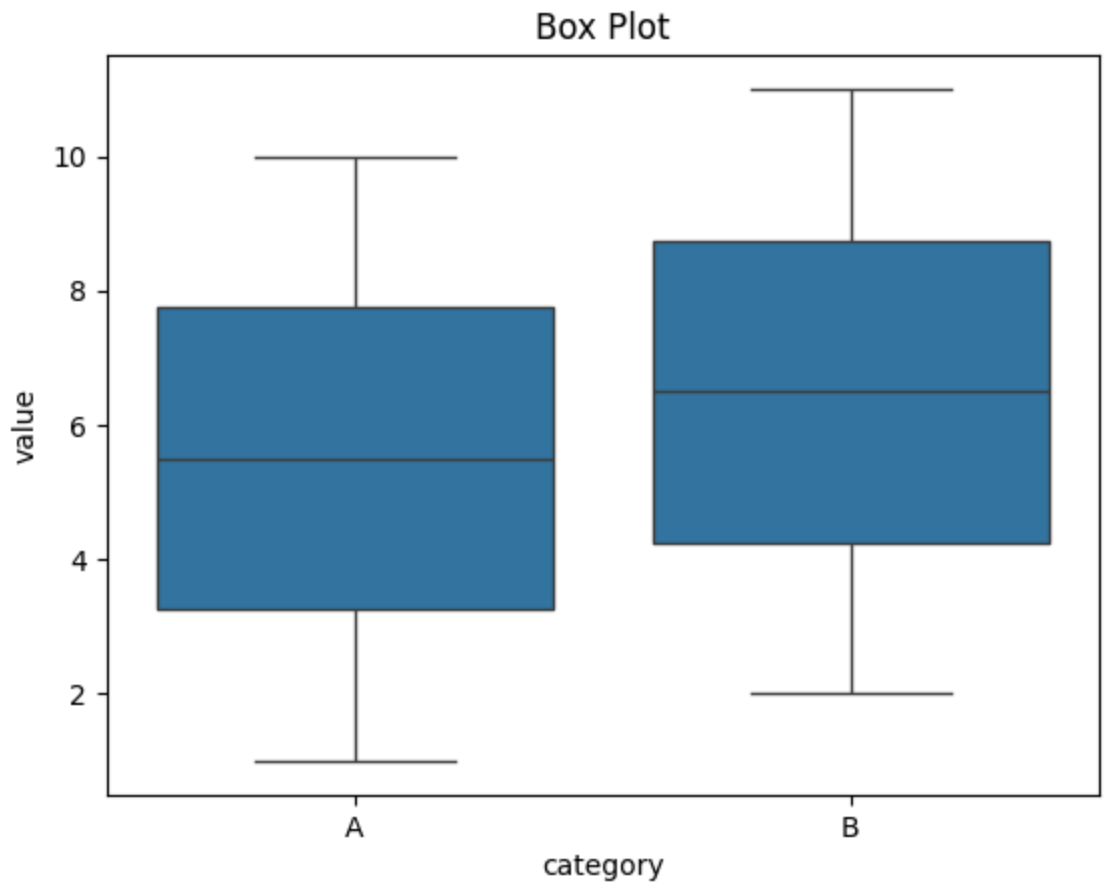


In [12]:
```
import seaborn as sns
import matplotlib.pyplot as plt

# Sample data
data = sns.load_dataset("flights")
pivot_data = data.pivot(index="month", columns="year", values="passengers")

# Create heatmap
sns.heatmap(pivot_data, annot=True, fmt="d")
plt.title('Seaborn Heatmap Example')
plt.show()
```

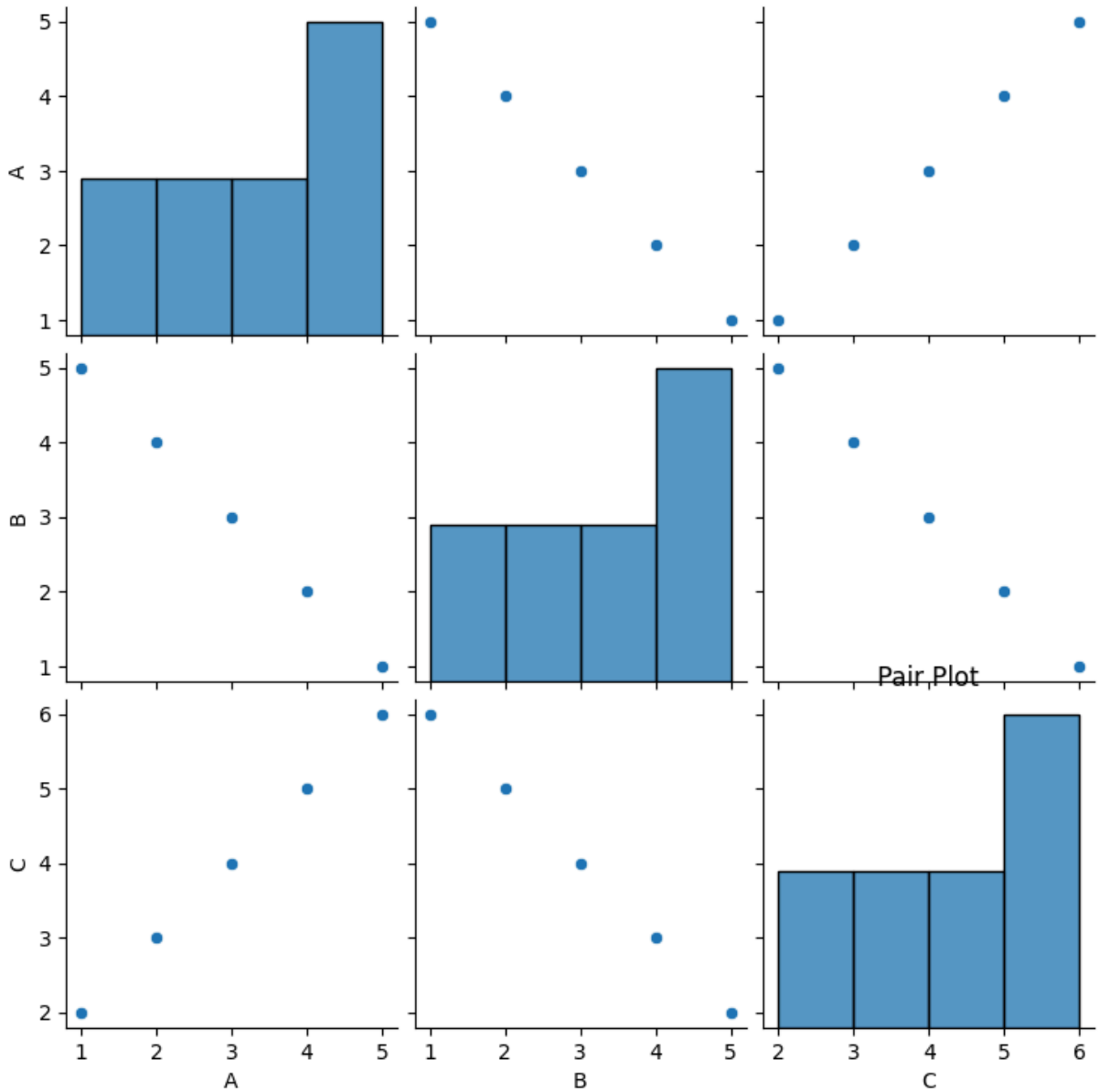


In [13]:

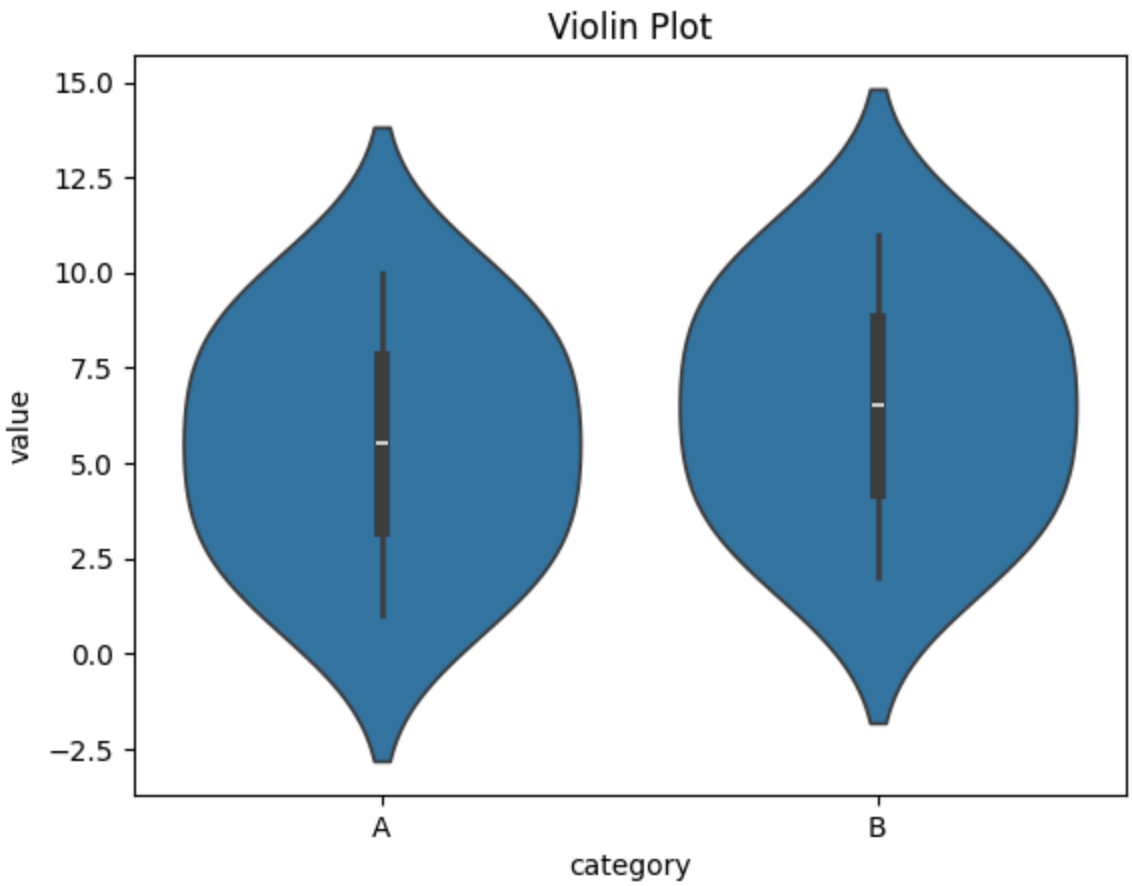
```
import seaborn as sns
import pandas as pd

data = pd.DataFrame({
    "category": ['A']*10 + ['B']*10,
    "value": [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11]
})

sns.boxplot(data=data, x="category", y="value")
plt.title("Box Plot")
plt.show()
```



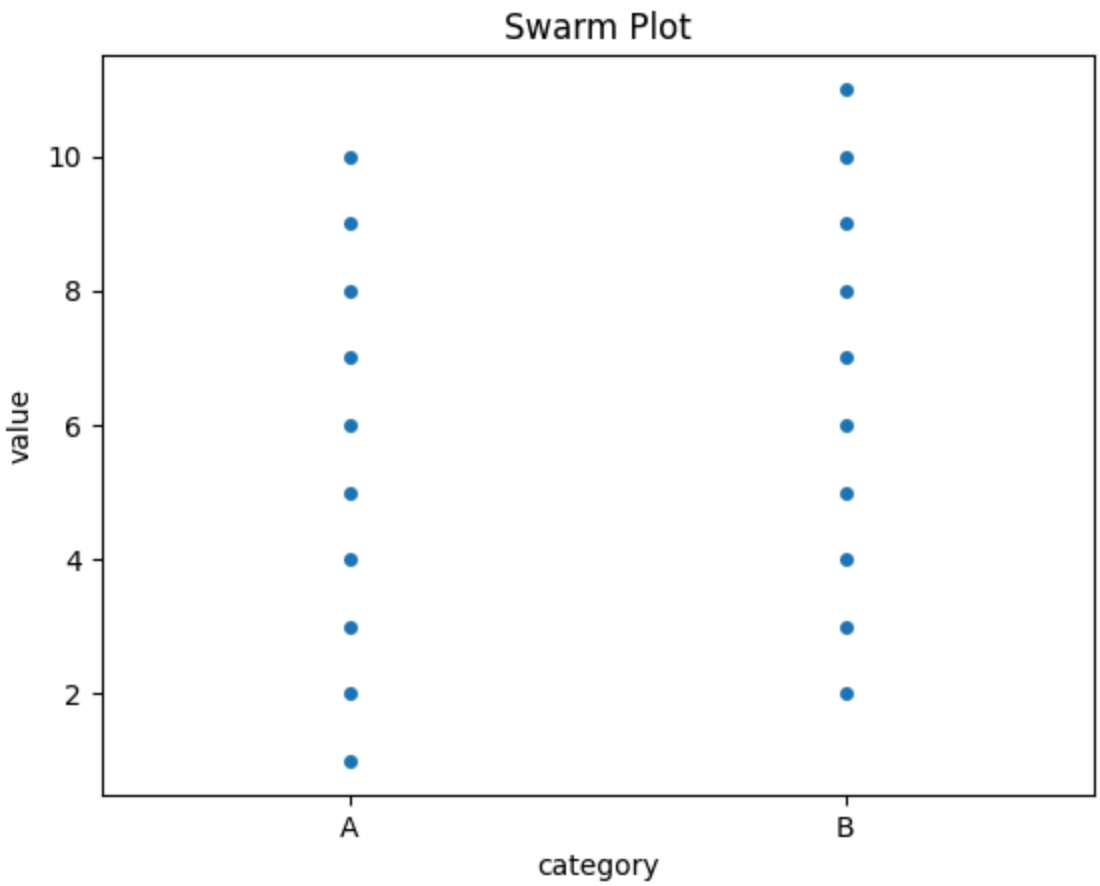
In [14]:
```
import seaborn as sns
import pandas as pd

data = pd.DataFrame({
    "A": [1, 2, 3, 4, 5],
    "B": [5, 4, 3, 2, 1],
    "C": [2, 3, 4, 5, 6]
})

sns.pairplot(data)
plt.title("Pair Plot")
plt.show()
```



In [15]:
```
import seaborn as sns
import pandas as pd

data = pd.DataFrame({
    "category": ['A']*10 + ['B']*10,
    "value": [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11]
})

sns.violinplot(data=data, x="category", y="value")
plt.title("Violin Plot")
plt.show()
```



In [16]:
```
import seaborn as sns
import pandas as pd

data = pd.DataFrame({
    "category": ['A']*10 + ['B']*10,
    "value": [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11]
})

sns.swarmplot(data=data, x="category", y="value")
plt.title("Swarm Plot")
plt.show()
```



👩‍💻 Strengths and Weaknesses of Matplotlib and Seaborn

🎨 Matplotlib

Strengths

🔑 Strength	📊 Details
Flexibility and Control	🔧 Matplotlib offers complete control over every aspect of a plot, allowing highly customized visualizations.
Versatility	🔄 Supports a wide variety of plots, including line, scatter, bar, histograms, 3D plots, and more. Also supports animations and interactive plots.
Integration	🔗 Works seamlessly with libraries like NumPy, Pandas, SciPy, and GUI toolkits such as Tkinter, wxPython, and Qt.
Large Community & Documentation	📚 Extensive resources, tutorials, and support from a large user community.

Weaknesses

❌ Weakness	💬 Details
Complexity	🧠 Requires more code for simple plots and can become verbose due to its extensive customization options.
Default Styles	💻 The default aesthetic of plots can appear outdated and less attractive compared to more modern libraries like Seaborn.
Interactivity	🖱️ Basic interactivity is supported, but it lacks the advanced interactive capabilities of libraries like Plotly or Bokeh.
Performance with Large Datasets	📉 Can be slow with very large datasets, particularly for interactive visualizations.

🌈 Seaborn

Strengths

🔑 Strength	📊 Details
Ease of Use	✨ Simplifies the creation of complex statistical plots with minimal code, ideal for quick data visualization and exploration.
Aesthetics	🌟 Beautiful default styles and color palettes enhance visual appeal without needing customization.
Integration with Pandas	🐼 Works seamlessly with Pandas DataFrames, making it easy to create visualizations directly from structured data.
Statistical Visualization	📉 Specialized in statistical plots like violin plots, box plots, and heatmaps.

Weaknesses

❌ Weakness	💬 Details
Limited Customization	⚙️ Provides fewer customization options compared to Matplotlib, limiting detailed adjustments for complex visualizations.
Dependency on Matplotlib	🔗 Built on top of Matplotlib, so advanced customization requires understanding Matplotlib's features.
Performance with Large Datasets	📉 Struggles with very large datasets due to high-level statistical computations that can be resource-intensive.
Interactivity	🖱️ Primarily focused on static plots, requiring additional tools for interactivity.

⚖️ Comparison

🏷️ Aspect	🎨 Matplotlib	🌈 Seaborn
Ease of Use	👷 Highly customizable but requires more code for basic plots.	👩‍🏫 Simplifies the process of creating beautiful, informative plots with minimal code.
Customization Options	⚙️ Extensive customization options for detailed visual adjustments.	🎨 Provides fewer customization options, but with beautiful defaults.
Interactivity	🖱️ Basic interactivity; needs additional libraries like Plotly or Bokeh for advanced features.	🔒 Primarily static plots, but can integrate with Matplotlib's interactive capabilities.
Performance with Large Datasets	📊 Handles large datasets well but can slow down with very large data.	📉 Struggles with very large datasets due to its high-level nature and statistical features.

📝 Summary

- **Matplotlib** is ideal for users who need **full control** over their plots and want to create **publication-quality** figures. It is best suited for complex, highly customized visualizations, and integration with other Python libraries.
- **Seaborn** is best for users who need **quick, beautiful visualizations** and **statistical analysis** with **minimal code**. It excels in **exploratory data analysis (EDA)** and works seamlessly with Pandas.
