Here's a clear and beginner-friendly overview of the four popular Python libraries you mentioned: NumPy, Pandas, Matplotlib, and NetworkX.

🐍 **Python Libraries Overview**

🔷 **1. NumPy (Numerical Python)**

✅ **Purpose:**

- **Used for scientific computing and numerical operations.**

- **Provides support for large, multi-dimensional arrays and matrices.**

✅ **Key Features:**

- **Efficient array operations**

- **Broadcasting and vectorization**

- **Linear algebra, statistics, and random number generation**

✅ **Example:**

```
import numpy as np


a = np.array([1, 2, 3])
b = np.array([4, 5, 6])


print(a + b)  # Output: [5 7 9]
```

🔷 **2. Pandas**

✅ **Purpose:**

- **Used for data analysis and data manipulation.**

- **Provides two main data structures: DataFrame (table) and Series (column).**

✅ **Key Features:**

- **Reading/writing CSV, Excel, SQL files**

- **Filtering, grouping, merging data**

- **Time series handling**

✅ **Example:**

```
import pandas as pd
```

```
data = {'Name': ['Ali', 'Sara'], 'Age': [22, 25]}
df = pd.DataFrame(data)


print(df)
```

Output:

```
  Name  Age
0  Ali   22
1  Sara   25
```

🔷 3. Matplotlib

✅ **Purpose:**

- **Used for data visualization.**
- **Create graphs like line charts, bar graphs, histograms, etc.**

✅ **Key Features:**

- **Plot customization (titles, labels, legends)**
- **Supports 2D plots and basic 3D plots**

✅ **Example:**

```
import matplotlib.pyplot as plt


x = [1, 2, 3, 4]
y = [10, 20, 25, 30]


plt.plot(x, y)
plt.title("Simple Line Plot")
plt.xlabel("X-axis")
plt.ylabel("Y-axis")
plt.show()
```

🔷 4. NetworkX

✅ **Purpose:**

- **Used for network and graph analysis.**
- **Represent complex networks: nodes and edges (e.g., social networks, road maps).**

✅ **Key Features:**

- **Create and visualize graphs**
- **Find shortest paths, degree, centrality**
- **Analyze connectivity**

✅ **Example:**

```
import networkx as nx
import matplotlib.pyplot as plt


G = nx.Graph()
G.add_edges_from([(1, 2), (2, 3), (3, 4), (4, 1)])


nx.draw(G, with_labels=True)
plt.show()
```

✅ **Summary Table**

Library	Use Case	Data Structure	Common Use
NumPy	Numerical computing	ndarray	Math, arrays
Pandas	Data analysis	DataFrame, Series	Tables, CSV
Matplotlib	Data visualization	N/A	Graphs, charts
NetworkX	Graph/network analysis	Graph, DiGraph	Nodes and edges

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Let me know if you'd like a mini project using all four libraries together!