NumPy Complete Summary

Step 1: Introduction to NumPy

- NumPy stands for 'Numerical Python'.

- It is a powerful library for numerical computations and working with arrays.

- Arrays are faster and more efficient than Python lists.

Step 2: NumPy Arrays

- Use np.array() to create arrays.

- Supports 1D, 2D, 3D arrays.

- Attributes: shape, ndim, size, dtype.

Step 3: Array Indexing & Slicing

- Indexing: arr[0], arr[1][2], etc.

- Slicing: arr[1:4], arr[:,1], arr[::2], etc.

Step 4: Data Types in NumPy

- Arrays have a uniform data type (dtype).

- Convert using arr.astype().

Step 5: Arithmetic Operations

- Element-wise operations: +, -, *, /, **

- Comparison: >, <, ==, etc.

- Supports broadcasting.

Step 6: Broadcasting

- Automatic expansion of arrays to match shapes for operations.

- Follows specific broadcasting rules.

Step 7: Mathematical & Statistical Functions

- sum(), mean(), median(), std(), var(), min(), max()

- Use axis=0 or axis=1 for multi-dimensional arrays.

Step 8: Reshaping & Resizing Arrays

- reshape(), ravel(), flatten(), resize()

- transpose() and T for transposing.

Step 9: Stacking & Splitting Arrays

- vstack(), hstack(), column_stack()

- vsplit(), hsplit()

Step 10: NumPy Random Module

- rand(), randn(), randint(), choice(), shuffle(), seed()

Step 11: Summary & Use Cases

- Used in Data Science, ML, Scientific Computing, Finance, Image Processing, etc.

- Forms the foundation for libraries like Pandas, Scikit-learn, TensorFlow.