Assignment 1: WIDS
Answers to Questions 1–5

Q1. Differentiate between Supervised and Unsupervised Learning

Supervised Learning	**Unsupervised Learning**
Uses labeled data	Uses unlabeled data
Input–output pairs are available	Only input data is available
Used for prediction tasks	Used for pattern discovery
Examples: Regression, Classification	Examples: Clustering, Dimensionality Reduction

Q2. NumPy Array vs Pandas Series and DataFrame

A NumPy array is a homogeneous, multi-dimensional data structure used for efficient numerical computation.

Feature	**NumPy Array**	**Pandas Series**	**Pandas DataFrame**
Data type	Homogeneous	Can be mixed	Can be mixed
Labels	No	Yes (index)	Yes (rows and columns)
Dimension	N-dimensional	1D	2D
Use case	Numerical computing	Labeled 1D data	Tabular data

A Pandas DataFrame is conceptually similar to a dictionary of Pandas Series.

Q3. Significance of Common Data Visualization Plots

- **Box Plot**: Displays data distribution using median, quartiles, and outliers.
- **Violin Plot**: Shows both summary statistics and the probability density of the data.

- **Histogram**: Represents frequency distribution of a numerical variable.
- **Scatter Plot**: Visualizes the relationship or correlation between two numerical variables.

Q4. Output of the Given Code Snippets

(a)

Reasoning followed

$$\begin{aligned} f(3) &= \text{“B”} + \text{“A”} = \text{“BA”} \\ f(4) &= \text{“BA”} + \text{“B”} = \text{“BAB”} \\ f(5) &= \text{“BAB”} + \text{“BA”} = \text{“BABBA”} \end{aligned}$$

Output:

```
BABBA
```

(b)

The function prints values before and after the recursive call.
Output:

```
3-2-1-1-2-3-
```

Q5. Hypothesis Testing and Statistical Distributions

Hypothesis testing is a statistical method used to make decisions about a population using sample data.

- **t-Distribution**: Used when sample size is small and population variance is unknown.
- **F-Distribution**: Used to compare variances and in Analysis of Variance (ANOVA).
- **Chi-square (χ^2) Distribution**: Used for categorical data to test independence or goodness of fit.