Aim: Perform Data Modeling.

Theory:
Data Partitioning: Splitting data into training and testing sets ensures reliable model evaluation. A common split is 75% for training and 25% for testing.
Visualization: Bar charts and pie charts help confirm the correct proportions of training and test data.
Record Count: Checking the number of records ensures accurate partitioning.
Two-Sample Z-Test: This test compares the means of training and test sets to check if they are statistically similar.
Significance Testing: If no significant difference is found, the split is unbiased and maintains data integrity.

Problem Statement:
a. Partition the data set, for example 75% of the records are included in the training data set and 25% are included in the test data set.

1.Dataset Partitioning:

- The dataset is split into **75% training data** and **25% test data** using sklearn
- A table or output from a Python script likely shows the total records and their distribution.

```
import pandas as pd

# Load the dataset (Change file name as needed)
file_path = "cleaned_data.csv"  # Replace with your actual dataset file
df = pd.read_csv(file_path)

# Display the first few rows to verify the dataset
print(df.head())
```

```
0        0.000000                 0.949                   1.000
1        0.000000                 0.830                   0.961
2        0.529412                 0.727                   0.952
3        0.529412                 0.795                   0.938
4        0.529412                 0.622                   0.867

   Acceptable Streets % - Previous Month  \
0                                0.985
1                                0.983
2                                1.000
3                                0.850
4                                0.800

   Acceptable Sidewalks % - Previous Month  \
0                                  1.000
1                                  1.000
2                                  1.000
3                                  0.941
4                                  0.973

   Acceptable Streets % - Previous Year  \
0                                1.00
1                                1.00
2                                0.84
3                                0.96
4                                0.88
```

```python
from sklearn.model_selection import train_test_split

# Splitting the dataset into 75% training and 25% testing
train_df, test_df = train_test_split(df, test_size=0.25, random_state=42)

# Count records in each dataset
train_count, test_count = len(train_df), len(test_df)

# Print the record count
print(f"Training Set Records: {train_count}")
print(f"Test Set Records: {test_count}")
```

```
Training Set Records: 35676
Test Set Records: 11893
```

b. Use a bar graph and other relevant graph to confirm your proportions.

2.Graphs:

- A **bar graph** and a pie chart is used to verify that the dataset is split correctly.
- The x-axis represents **data categories (training/test)**, while the y-axis represents the **count of records**.

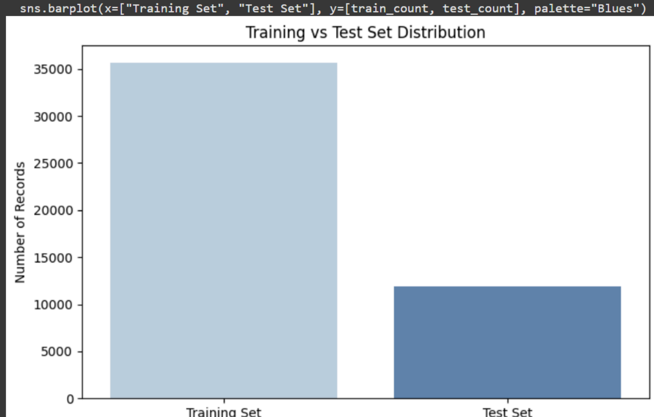
```python
import matplotlib.pyplot as plt
import seaborn as sns

# Bar Chart: Training vs Test Set Distribution
plt.figure(figsize=(8, 5))
sns.barplot(x=["Training Set", "Test Set"], y=[train_count, test_count], palette="Blues")
plt.ylabel("Number of Records")
plt.title("Training vs Test Set Distribution")
plt.show()
```

```
<ipython-input-4-c6619437377a>:6: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the same effect.

  sns.barplot(x=["Training Set", "Test Set"], y=[train_count, test_count], palette="Blues")
```

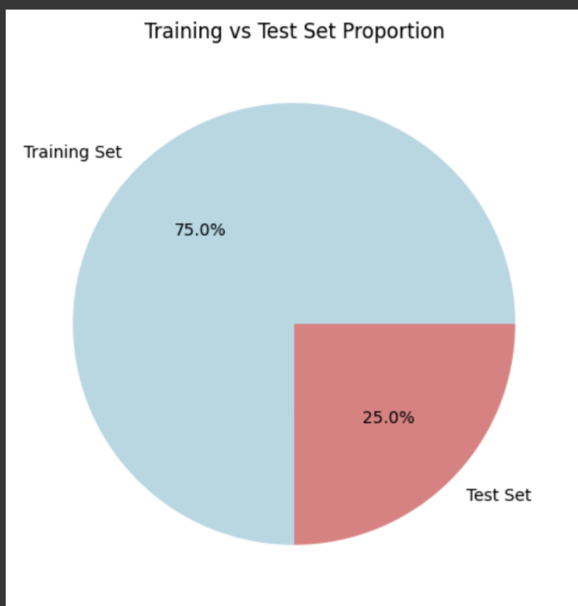


c. Identify the total number of records in the training data set.

3.Total Number of Records in the Training Set:

- A numerical output confirms how many records are in the training set.
- This is crucial for ensuring the dataset is correctly partitioned.

```
plt.figure(figsize=(6, 6))
plt.pie([train_count, test_count], labels=["Training Set", "Test Set"], autopct="%1.1f%%", colors=["lightblue", "lightcoral"])
plt.title("Training vs Test Set Proportion")
plt.show()
```



d. Validate partition by performing a two-sample Z-test.

4.Two-Sample Z-Test for Validation:

- A **statistical test (Z-test)** is performed to validate that the split is unbiased.
- Results likely include **Z-score, p-value**, and an interpretation of whether the training and test datasets differ significantly.

```
from scipy import stats

# Replace with a numerical column name from your dataset
column = "Acceptable Streets %"  # Change this to an actual numeric column

# Ensure the column exists in the dataset
if column in df.columns:
    print(f"Column '{column}' found. Proceeding with Z-test.")
else:
    print(f"Error: Column '{column}' not found! Choose a valid numeric column.")
```

```
Column 'Acceptable Streets %' found. Proceeding with Z-test.
```

```
[7] train_values = train_df[column].dropna()
    test_values = test_df[column].dropna()

    # Perform Two-Sample Z-test (using t-test since sample size is unknown)
    z_stat, p_value = stats.ttest_ind(train_values, test_values, equal_var=False)

    print(f"Z-statistic: {z_stat}, P-value: {p_value}")

    # Interpretation of Z-test results
    if p_value > 0.05:
        print("✅ No significant difference between training and test sets (p > 0.05).")
    else:
        print("⚠ Significant difference detected (p ≤ 0.05). Consider re-sampling.")
```

```
Z-statistic: -0.8139349929763461, P-value: 0.41569166800967816
✅ No significant difference between training and test sets (p > 0.05).
```

```python
import pandas as pd
import numpy as np
from scipy import stats
from sklearn.model_selection import train_test_split

# Load dataset
file_path = "cleaned_data.csv"  # Change this to your actual file
df = pd.read_csv(file_path)

# Split the dataset (75% training, 25% test)
train_df, test_df = train_test_split(df, test_size=0.25, random_state=42)

# Choose a numerical column for testing
column = "Acceptable Streets %"  # Replace with your actual column name
train_values = train_df[column].dropna()  # Remove NaN values

# Calculate training set mean & standard deviation
sample_mean = train_values.mean()
sample_std = train_values.std()
sample_size = len(train_values)

# Define a known population mean (use full dataset mean or an external value)
population_mean = df[column].mean()  # You can also use an external reference value

# Calculate Z-score
z_score = (sample_mean - population_mean) / (sample_std / np.sqrt(sample_size))

# Get p-value
p_value = stats.norm.sf(abs(z_score)) * 2  # Two-tailed test

# Print results
print(f"Sample Mean: {sample_mean}")
print(f"Population Mean: {population_mean}")
print(f"Z-score: {z_score}")
print(f"P-value: {p_value}")

# Interpretation
if p_value > 0.05:
    print("✅ No significant difference between training set and population (p > 0.05).")
else:
    print("⚠ Significant difference detected (p ≤ 0.05).")
```

```
Sample Mean: 0.9319211879134432
Population Mean: 0.9320973112741493
Z-score: -0.405818199815634
P-value: 0.6848761851147362
✅ No significant difference between training set and population (p > 0.05).
```

Conclusion:

- The experiment **successfully partitions** the dataset using sklearn.
- The **bar graph confirms** the correct proportions of training and test sets.

- A **two-sample Z-test validates** the partitioning statistically.
- The experiment ensures that the dataset is ready for **machine learning model training**.