Define the necessary libraries

In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as  sns
import random
```

In [2]:
```
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error
from sklearn.preprocessing import MinMaxScaler, StandardScaler, MaxAbsScaler, Norma
```

Load the dataset into the dataframe

In [3]:
```
data=pd.read_csv('BigmartSales.csv')
df=pd.DataFrame(data)
df.head()
```

Out[3]:

	Item_Identifier	Item_Weight	Item_Fat_Content	Item_Visibility	Item_Type	Item_MRP	C
0	FDA15	9.30	Low Fat	0.016047	Dairy	249.8092	
1	DRC01	5.92	Regular	0.019278	Soft Drinks	48.2692	
2	FDN15	17.50	Low Fat	0.016760	Meat	141.6180	
3	FDX07	19.20	Regular	0.000000	Fruits and Vegetables	182.0950	
4	NCD19	8.93	Low Fat	0.000000	Household	53.8614	

Drop the "Item_Identifier" and "Outlet_Identifier" columns

In [4]:
```
columns_to_drop=["Item_Identifier","Outlet_Identifier"]
df=df.drop(columns_to_drop,axis=1)
#print(df.head())
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 8523 entries, 0 to 8522
Data columns (total 10 columns):
 #   Column                     Non-Null Count  Dtype
---  ------                     --------------  -----
 0   Item_Weight                7060 non-null   float64
 1   Item_Fat_Content           8523 non-null   object
 2   Item_Visibility            8523 non-null   float64
 3   Item_Type                  8523 non-null   object
 4   Item_MRP                   8523 non-null   float64
 5   Outlet_Establishment_Year  8523 non-null   int64
 6   Outlet_Size                6113 non-null   object
 7   Outlet_Location_Type       8523 non-null   object
 8   Outlet_Type                8523 non-null   object
 9   Item_Outlet_Sales          8523 non-null   float64
dtypes: float64(4), int64(1), object(5)
memory usage: 666.0+ KB
```

Extract the target labels

In [5]:
```
df.columns
```

Out[5]:
```
Index(['Item_Weight', 'Item_Fat_Content', 'Item_Visibility', 'Item_Type',
       'Item_MRP', 'Outlet_Establishment_Year', 'Outlet_Size',
       'Outlet_Location_Type', 'Outlet_Type', 'Item_Outlet_Sales'],
      dtype='object')
```

Replace the field "Item_Fat_Content" with numerical value

In [6]:
```
df['Item_Fat_Content']=df['Item_Fat_Content'].replace({'Low Fat':'0','Regular':'1'}
```

Perform ordinal encoding of the "Item_Type", "Outlet_Type", "Outlet_Location_Type" and "Outlet_Type" field

In [7]:
```
#Mapping Ordinal for 'Item_Type','Outlet_Type','Outlet_Location_Type'
ordinal_encoding=['Item_Type','Outlet_Type','Outlet_Location_Type']

for i in ordinal_encoding:
    list_data=df[i].unique()
    list_data_ordinal={value:index + 1 for index, value in enumerate(list_data)}
    df[i]=df[i].map(list_data_ordinal)
    #print(list_data)
```

Imputation of "Outlet_Size" field with mode value

In [8]:
```
outlet_size_mode_value = df['Outlet_Size'].mode()[0]
df['Outlet_Size'].fillna(outlet_size_mode_value, inplace=True)
#print(df['Outlet_Size'])
```

Check for null values

In [9]:
```
null_values=df.isnull().sum()
print(null_values)
```

```
Item_Weight                  1463
Item_Fat_Content                0
Item_Visibility                 0
Item_Type                       0
Item_MRP                        0
Outlet_Establishment_Year       0
Outlet_Size                     0
Outlet_Location_Type            0
Outlet_Type                     0
Item_Outlet_Sales               0
dtype: int64
```

Imputation of "Item_Weight" field with mode value

In [10]:
```
item_weight_mode_value=df['Item_Weight'].mode()[0]
df['Item_Weight'].fillna(item_weight_mode_value,inplace=True)
#print(df['Item_Weight'])
```

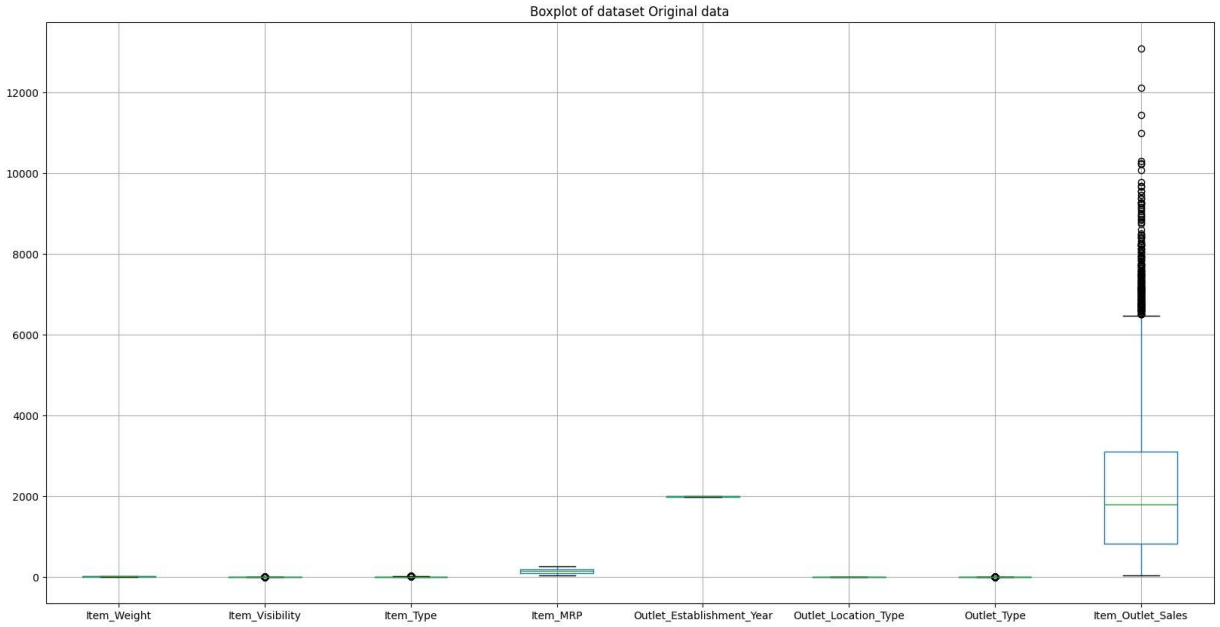
In [11]:
```
df.head()
```

Out[11]:

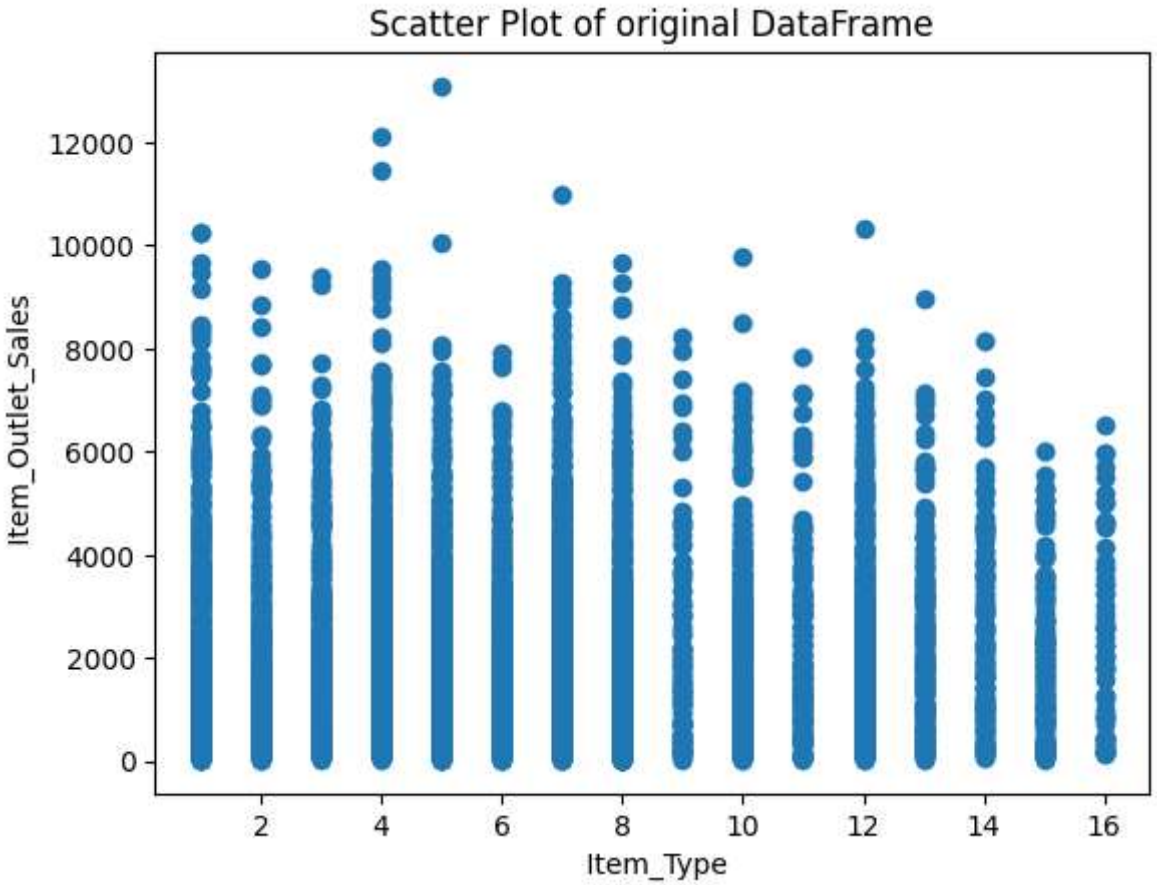
	Item_Weight	Item_Fat_Content	Item_Visibility	Item_Type	Item_MRP	Outlet_Establishm
0	9.30	0	0.016047	1	249.8092	
1	5.92	1	0.019278	2	48.2692	
2	17.50	0	0.016760	3	141.6180	
3	19.20	1	0.000000	4	182.0950	
4	8.93	0	0.000000	5	53.8614	

Display all field in the dataset using boxplot

In [12]:
```
#numeric_columns = df.select_dtypes(include=['int', 'float']).columns
df.boxplot(figsize=(20, 10))
plt.title("Boxplot of dataset Original data")
plt.show()
```



In [13]:
```
#Scatter plot
plt.scatter(df['Item_Type'], df['Item_Outlet_Sales'])
plt.title('Scatter Plot of original DataFrame')
plt.xlabel(' Item_Type')
plt.ylabel(' Item_Outlet_Sales')
plt.show()
```



In [14]:
```
#numeric_columns = df.select_dtypes(include=['int', 'float']).columns
X = df[['Item_Weight', 'Item_Visibility', 'Item_Type',
```

```
                        'Item_MRP',
                        'Outlet_Location_Type', 'Outlet_Type']]
y = df[['Item_Outlet_Sales']]

print("\nX Variables :",X.columns)
print("\ny variable  :",y.columns)
```

```
X Variables : Index(['Item_Weight', 'Item_Visibility', 'Item_Type', 'Item_MRP',
       'Outlet_Location_Type', 'Outlet_Type'],
      dtype='object')

y variable  : Index(['Item_Outlet_Sales'], dtype='object')
```

Split the dataset into train and test(20%), apply Linear Regression and calculate RMSE value

In [15]:
```
# Splitting the dataset into training and testing sets (80% train, 20% test)
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_sta

##shape of test and train
print("\nX_train shape :",X_train.shape)
print("y_train shape :",y_train.shape)

print("\nX_test shape  :",X_test.shape)
print("y_test shape  :",y_test.shape)


# Applying Linear Regression
model = LinearRegression()
X_y_train=model.fit(X_train, y_train)

print("\nModel Name:",model,'\n')
print("Features of X_train, y_train is : "+model.feature_names_in_)

# Making predictions on the test set
y_pred = model.predict(X_test)
print("\ny_pred shape : ",y_pred.shape)

# Calculating RMSE
rmse = np.sqrt(mean_squared_error(y_test, y_pred))

# Displaying the RMSE value
print("\nRoot Mean Squared Error (RMSE) Linear Regression :", rmse)
```

```
X_train shape : (6818, 6)
y_train shape : (6818, 1)

X_test shape  : (1705, 6)
y_test shape  : (1705, 1)

Model Name: LinearRegression()

['Features of X_train, y_train is : Item_Weight'
 'Features of X_train, y_train is : Item_Visibility'
 'Features of X_train, y_train is : Item_Type'
 'Features of X_train, y_train is : Item_MRP'
 'Features of X_train, y_train is : Outlet_Location_Type'
 'Features of X_train, y_train is : Outlet_Type']

y_pred shape :  (1705, 1)

Root Mean Squared Error (RMSE) Linear Regression : 1330.3770710699025
```

Apply StandardScaller and split the dataset into train and test(20%)

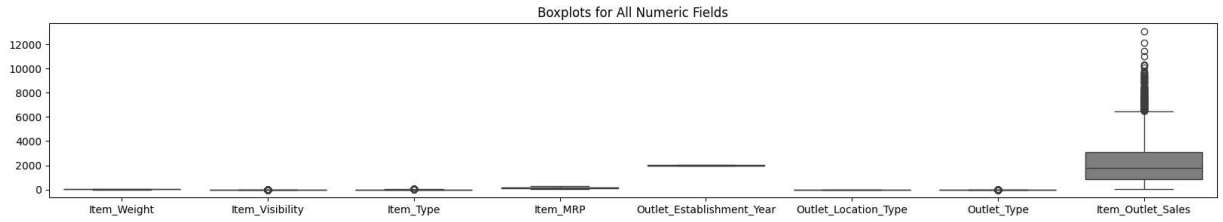
In [16]:
```
from sklearn.preprocessing import StandardScaler

# Apply StandardScaler
scaler = StandardScaler()
X_standardized = scaler.fit_transform(X)

# Split the dataset into train and test (80% train, 20% test)
X_train, X_test, y_train, y_test = train_test_split(X_standardized, y, test_size=0.
```

Display all field in the dataset using boxplot

In [17]:
```
# Display boxplots for all numeric fields
plt.figure(figsize=(20, 3))
sns.boxplot(data=df, orient='v')
plt.title('Boxplots for All Numeric Fields')
plt.show()
```



Apply Linear Regression and calculate RMSE value

In [18]:
```
# Apply Linear Regression
model = LinearRegression()
model.fit(X_train, y_train)

# Predict on the test set
y_pred = model.predict(X_test)
```

```
# Calculate RMSE
standard_scaler_rmse = np.sqrt(mean_squared_error(y_test, y_pred))
print(f'Root Mean Squared Error (RMSE) StandardScaller using Linear Regression: {st
```

```
Root Mean Squared Error (RMSE) StandardScaller using Linear Regression: 1330.3770710
699025
```

In [19]:
```
rmse_data={}
```

Apply MinMaxScaler, split the dataset into train and test(20%), apply LinearRegression and calculate RMSE

In [20]:
```
from sklearn.preprocessing import MinMaxScaler

# Apply MinMaxScaler
scaler = MinMaxScaler()
X_scaled = scaler.fit_transform(X)

# Split the dataset into train and test (80% train, 20% test)
X_train, X_test, y_train, y_test = train_test_split(X_scaled, y, test_size=0.2, ran

# Apply Linear Regression
model = LinearRegression()
model.fit(X_train, y_train)

# Predict on the test set
y_pred = model.predict(X_test)

# Calculate RMSE
rmse = np.sqrt(mean_squared_error(y_test, y_pred))
rmse_data[str(scaler)]=rmse
print(f'Root Mean Squared Error (RMSE) MinMaxScaler: {rmse}')
```

```
Root Mean Squared Error (RMSE) MinMaxScaler: 1330.3770710699025
```

Apply RobustScaler,Split the dataset into train and test(20%), apply LinearRegression and calculate RMSE

In [21]:
```
from sklearn.preprocessing import RobustScaler

# Apply RobustScaler
scaler = RobustScaler()
X_scaled = scaler.fit_transform(X)

# Split the dataset into train and test (80% train, 20% test)
X_train, X_test, y_train, y_test = train_test_split(X_scaled, y, test_size=0.2, ran

# Apply Linear Regression
model = LinearRegression()
model.fit(X_train, y_train)

# Predict on the test set
y_pred = model.predict(X_test)

# Calculate RMSE
```

```
rmse = np.sqrt(mean_squared_error(y_test, y_pred))
rmse_data[str(scaler)]=rmse
print(f'Root Mean Squared Error (RMSE) RobustScaler: {rmse}')
```

```
Root Mean Squared Error (RMSE) RobustScaler: 1330.3770710699025
```

Apply MaxAbsScaler, split the dataset into train and test(20%), apply LinearRegression and calculate RMSE

In [22]:
```
from sklearn.preprocessing import MaxAbsScaler

# Apply MaxAbsScaler
scaler = MaxAbsScaler()
X_scaled = scaler.fit_transform(X)

# Split the dataset into train and test (80% train, 20% test)
X_train, X_test, y_train, y_test = train_test_split(X_scaled, y, test_size=0.2, ran

# Apply Linear Regression
model = LinearRegression()
model.fit(X_train, y_train)

# Predict on the test set
y_pred = model.predict(X_test)

# Calculate RMSE
rmse = np.sqrt(mean_squared_error(y_test, y_pred))
rmse_data[str(scaler)]=rmse
print(f'Root Mean Squared Error (RMSE) RobustScaler: {rmse}')
```

```
Root Mean Squared Error (RMSE) RobustScaler: 1330.3770710699025
```

Apply Normalizer, split the dataset into train and test(20%), apply LinearRegression and calculate RMSE

In [23]:
```
from sklearn.preprocessing import Normalizer

# Apply Normalizer
normalizer = Normalizer()
X_normalized = normalizer.fit_transform(X)

# Split the dataset into train and test (80% train, 20% test)
X_train, X_test, y_train, y_test = train_test_split(X_normalized, y, test_size=0.2,

# Apply Linear Regression
model = LinearRegression()
model.fit(X_train, y_train)

# Predict on the test set
y_pred = model.predict(X_test)

# Calculate RMSE
rmse = np.sqrt(mean_squared_error(y_test, y_pred))
rmse_data[str(normalizer)]=rmse
print(f'Root Mean Squared Error (RMSE) Normalizer: {rmse}')
```

```
Root Mean Squared Error (RMSE) Normalizer: 1433.2135040375158
```

Define a function valuelabel to place the legend of each bar in the histogram

In [24]:
```
def valuelabel(ax):
    # Function to add value labels on top of each bar in a histogram
    for p in ax.patches:
        ax.annotate(f'{p.get_height():.2f}', (p.get_x() + p.get_width() / 2., p.get
                    ha='center', va='center', xytext=(0, 10), textcoords='offset po
```

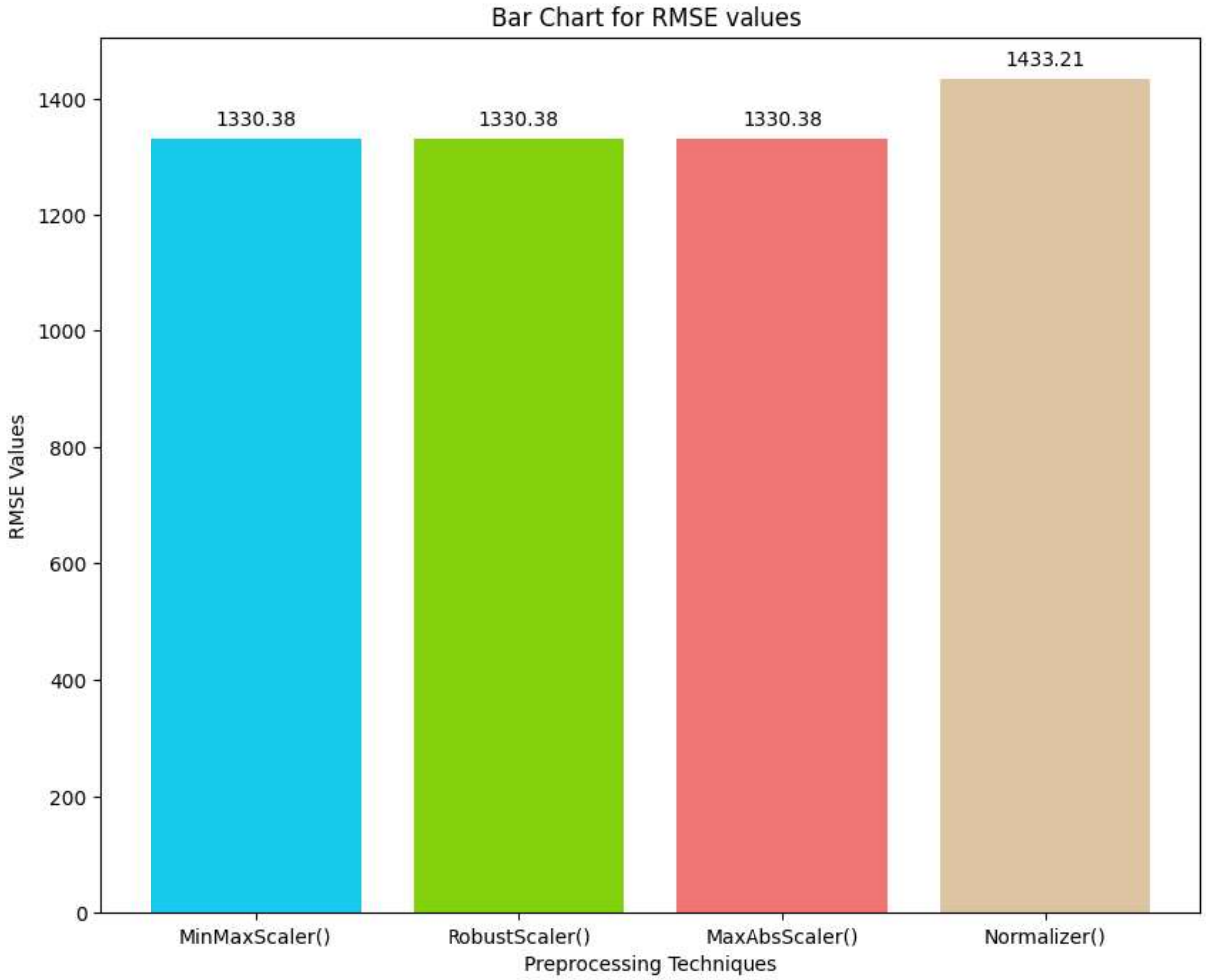
Plot a histogram to display the RMSE value of each scaler

In [25]:
```
# Generate random colors for each bar
colors = [f'#{random.randint(0, 0xFFFFFF):06x}' for _ in rmse_data]

# Plotting a bar chart
fig, ax = plt.subplots(figsize=(10, 8))
bars = ax.bar(rmse_data.keys(), rmse_data.values(),color=colors)
ax.set_xlabel('Preprocessing Techniques')
ax.set_ylabel('RMSE Values')
ax.set_title('Bar Chart for RMSE values ')

# Call the valuelabel function to add value labels on top of each bar
valuelabel(ax)

# Display the plot
plt.show()
```


Bar Chart for RMSE values
1330.38
1330.38
1330.38
1433.21
RMSE Values
0
200
400
600
800
1000
1200
1400
MinMaxScaler()
RobustScaler()
MaxAbsScaler()
Normalizer()
Preprocessing Techniques

In [ ]: