FORECSTING UNIT SALES

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Firstly, load the dataset from the given link. I have downloaded the datasets from the kaggle and loaded it using pandas.

In [1]:

```
import pandas as pd
import numpy as np
```

In [2]:

```
train_data=pd.read_csv("C:/Users/Ramini Varun Babu/Downloads/nap_queens assignment/sales_data/train.csv  ")
test_data=pd.read_csv("C:/Users/Ramini Varun Babu/Downloads/nap_queens assignment/sales_data/test.csv  ")
sample_data=pd.read_csv("C:/Users/Ramini Varun Babu/Downloads/nap_queens assignment/sales_data/sample_submission.csv
```

In [3]:

```
train_data.head(10)
```

Out[3]:

	ID	date	Item Id	Item Name	ad_spend	anarix_id	units	unit_price
0	2022-04-12_B09KDTS4DC	2022-04-12	B09KDTS4DC	NapQueen Elizabeth 8" Gel Memory Foam Mattress...	NaN	NAPQUEEN	0.0	0.0
1	2022-04-12_B09MR2MLZH	2022-04-12	B09MR2MLZH	NapQueen 12 Inch Bamboo Charcoal Queen Size Me...	NaN	NAPQUEEN	0.0	0.0
2	2022-04-12_B09KSYL73R	2022-04-12	B09KSYL73R	NapQueen Elsa 8" Innerspring Mattress, Twin XL	NaN	NAPQUEEN	0.0	0.0
3	2022-04-12_B09KT5HMNY	2022-04-12	B09KT5HMNY	NapQueen Elsa 6" Innerspring Mattress, Twin	NaN	NAPQUEEN	0.0	0.0
4	2022-04-12_B09KTF8ZDQ	2022-04-12	B09KTF8ZDQ	NapQueen Elsa 6" Innerspring Mattress, Twin XL	NaN	NAPQUEEN	0.0	0.0
5	2022-04-12_B09KTJRHC7	2022-04-12	B09KTJRHC7	NapQueen Elsa 6" Innerspring Mattress, Full	NaN	NAPQUEEN	0.0	0.0
6	2022-04-12_B09KTMKDKJ	2022-04-12	B09KTMKDKJ	NapQueen Elsa 8" Innerspring Mattress, Twin	NaN	NAPQUEEN	0.0	0.0
7	2022-04-12_B09KTMLQ1N	2022-04-12	B09KTMLQ1N	NapQueen Elsa 8" Innerspring Mattress, Full	NaN	NAPQUEEN	0.0	0.0
8	2022-04-12_B09MR5WS3Y	2022-04-12	B09MR5WS3Y	NapQueen Margaret 8" Charcoal Memory Foam Matt...	NaN	NAPQUEEN	0.0	0.0
9	2022-04-12_B09KSXP3HN	2022-04-12	B09KSXP3HN	NapQueen Elsa 8" Innerspring Mattress, Queen	NaN	NAPQUEEN	0.0	0.0

In [4]:

```
train_data.dtypes
```

Out[4]:

```
ID              object
date            object
Item Id         object
Item Name       object
ad_spend       float64
anarix_id       object
units          float64
unit_price     float64
dtype: object
```

In [5]:
```
train_data.shape
```

Out[5]:
```
(101490, 8)
```

PREPROCESSING THE DATA

In [6]:
```
train_data.isna().sum()
```

Out[6]:
```
ID                 0
date               0
Item Id            2
Item Name       1832
ad_spend       24187
anarix_id          0
units          17898
unit_price         0
dtype: int64
```

In [ ]:
```

```

In [7]:
```
train_data["Item Id"].nunique()
```

Out[7]:
```
217
```

In [8]:
```
train_data["Item Name"].nunique()
```

Out[8]:
```
199
```

In [9]:

```
train_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 101490 entries, 0 to 101489
Data columns (total 8 columns):
 #   Column      Non-Null Count   Dtype  
---  ------      --------------   -----  
 0   ID          101490 non-null  object 
 1   date        101490 non-null  object 
 2   Item Id     101488 non-null  object 
 3   Item Name   99658 non-null   object 
 4   ad_spend    77303 non-null   float64
 5   anarix_id   101490 non-null  object 
 6   units       83592 non-null   float64
 7   unit_price  101490 non-null  float64
dtypes: float64(3), object(5)
memory usage: 6.2+ MB
```

In [10]:

```
train_data["ad_spend"].nunique()
```

Out[10]:

```
19426
```

In [11]:

```
train_data["anarix_id"].nunique()
```

Out[11]:

```
1
```

In [12]:

```
#train_data=train_data.drop(["anarix_id","Item Id","Item Name","date","ID"],axis=1)
```

In [13]:
```
train_data
```

Out[13]:

	ID	date	Item Id	Item Name	ad_spend	anarix_id	units	unit_price
0	2022-04-12_B09KDTS4DC	2022-04-12	B09KDTS4DC	NapQueen Elizabeth 8" Gel Memory Foam Mattress...	NaN	NAPQUEEN	0.0	0.00
1	2022-04-12_B09MR2MLZH	2022-04-12	B09MR2MLZH	NapQueen 12 Inch Bamboo Charcoal Queen Size Me...	NaN	NAPQUEEN	0.0	0.00
2	2022-04-12_B09KSYL73R	2022-04-12	B09KSYL73R	NapQueen Elsa 8" Innerspring Mattress, Twin XL	NaN	NAPQUEEN	0.0	0.00
3	2022-04-12_B09KT5HMNY	2022-04-12	B09KT5HMNY	NapQueen Elsa 6" Innerspring Mattress, Twin	NaN	NAPQUEEN	0.0	0.00
4	2022-04-12_B09KTF8ZDQ	2022-04-12	B09KTF8ZDQ	NapQueen Elsa 6" Innerspring Mattress, Twin XL	NaN	NAPQUEEN	0.0	0.00
...	...	...	...	...	...	...	...	...
101485	2024-05-31_B0CR4BGLK5	2024-05-31	B0CR4BGLK5	NaN	604.73	NAPQUEEN	NaN	0.00
101486	2024-05-31_B0CR4BG4ZW	2024-05-31	B0CR4BG4ZW	NaN	261.21	NAPQUEEN	2.0	225.32
101487	2024-05-31_B0CR49NR3B	2024-05-31	B0CR49NR3B	NaN	0.00	NAPQUEEN	NaN	0.00
101488	2024-05-31_B0CR49N6MQ	2024-05-31	B0CR49N6MQ	NaN	0.00	NAPQUEEN	NaN	0.00
101489	2024-05-31_B0CR4BK4FW	2024-05-31	B0CR4BK4FW	NaN	0.00	NAPQUEEN	NaN	0.00

101490 rows × 8 columns

After finding the missing values. I have filled the null values of "ad_spend" column with 0. Since it is better to assume that they have not used any money for advertisement.

In [14]:

```
# Fill missing ad_spend with median
train_data['ad_spend'].fillna(0, inplace=True)
train_data['Item Id'].fillna(1,inplace=True)
```

In [15]:

```
#checking for the duplicate values.
print(train_data.duplicated().sum())
```

```
0
```

In [16]:

```
train_data.reset_index(drop=True, inplace=True)
```

Here, I have filled the null values of the "unit_price" and "units" column by the mean value of that particular item id

In [17]:

```
for column in [ 'unit_price', 'units']:
    train_data[column] = train_data.groupby('Item Id')[column].transform(lambda x: x.fillna(x.mean()))
```

In [18]:

```
train_data['units'].fillna(0, inplace=True)
```

In [19]:

```
train_data.isna().sum()
```

Out[19]:

```
ID                0
date              0
Item Id           0
Item Name      1832
ad_spend          0
anarix_id         0
units             0
unit_price        0
dtype: int64
```

EXPLORATORY DATA ANALYSIS

Removing the columns which have no correlation with the dependent variable.

In [20]:
```
df_encoded = pd.get_dummies(train_data, columns=['anarix_id','Item Id'])
```

In [21]:
```
train_data.corr()
```

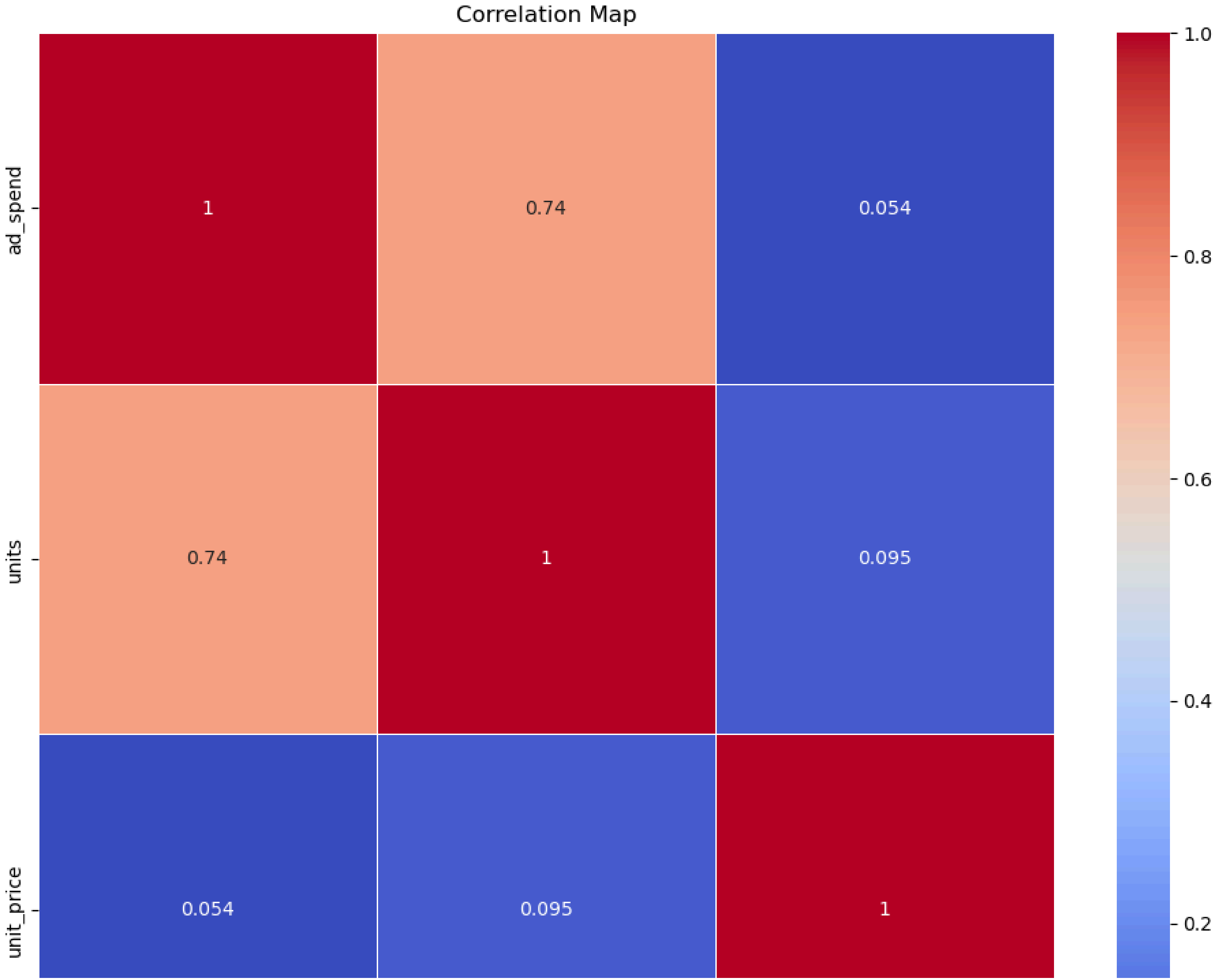
Out[21]:

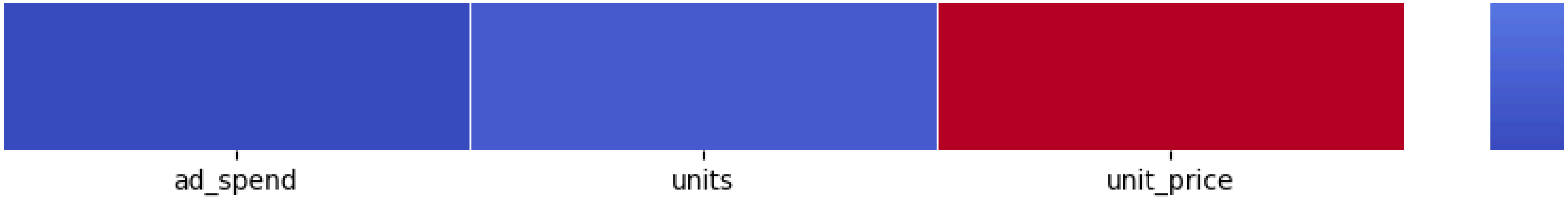
	ad_spend	units	unit_price
ad_spend	1.000000	0.744339	0.054472
units	0.744339	1.000000	0.094686
unit_price	0.054472	0.094686	1.000000

In [23]:

```
# Correlation Heatmap
import seaborn as sns
import matplotlib.pyplot as plt

corr_matrix = train_data.corr()
plt.figure(figsize=(12, 10))
sns.heatmap(corr_matrix, annot=True, cmap='coolwarm', linewidths=0.5)
plt.title('Correlation Map')
plt.show()
```


Correlation Map
ad_spend
units
unit_price
1
0.74
0.054
0.74
1
0.095
0.054
0.095
1
1.0
0.8
0.6
0.4
0.2



```
In [24]: X=train_data.drop(["units","anarix_id","Item Id","Item Name","date","ID"],axis=1)
         y=train_data["units"]
```

```
In [ ]:
```

```
In [25]: X.isna().sum()
```

```
Out[25]: ad_spend      0
         unit_price    0
         dtype: int64
```

```
In [ ]:
```

In [26]:
```
X
```

Out[26]:

	ad_spend	unit_price
0	0.00	0.00
1	0.00	0.00
2	0.00	0.00
3	0.00	0.00
4	0.00	0.00
...	...	...
101485	604.73	0.00
101486	261.21	225.32
101487	0.00	0.00
101488	0.00	0.00
101489	0.00	0.00

101490 rows × 2 columns

In [27]:
```
y.isna().sum()
```

Out[27]:
```
0
```

MODEL FITTING AND EVALUATION

In [28]:

```
from sklearn.model_selection import train_test_split
from sklearn.metrics import mean_squared_error



# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
```

LINEAR REGRESSION

In [29]:

```
from sklearn.linear_model import LinearRegression

model = LinearRegression()
model.fit(X_train, y_train)

# Making predictions
y_pred = model.predict(X_test)

# Evaluating the model
mse = mean_squared_error(y_test, y_pred)

print(f'Mean Squared Error: {mse}')
```

```
Mean Squared Error: 1407.4349721035123
```

In [30]:

```
from xgboost import XGBRegressor
model2 = XGBRegressor()
model2.fit(X_train, y_train)

# Make predictions
y_pred2 = model2.predict(X_test)

# Evaluate the model
mse2 = mean_squared_error(y_test, y_pred2)
print(f'Mean Squared Error: {mse2}')
```

```
Mean Squared Error: 1407.4349721035123
```

In [31]:

```
test_data=test_data.drop(["anarix_id","Item Id","Item Name","date"],axis=1)
```

In [32]:

```
test_data
```

Out[32]:

	ID	ad_spend	unit_price
0	2024-07-01_B09KDR64LT	NaN	0.0
1	2024-07-01_B09KDTS4DC	NaN	0.0
2	2024-07-01_B09KDTHJ6V	NaN	0.0
3	2024-07-01_B09KDQ2BWY	NaN	0.0
4	2024-07-01_B09KDYY3SB	101.72	1094.5
...	...	...	...
2828	2024-07-28_B0BRCW2B64	11.78	0.0
2829	2024-07-28_B0CFV6V981	1.17	0.0
2830	2024-07-28_B0BNL5BKMK	0.00	0.0
2831	2024-07-28_B0CR49BQRS	1.87	0.0
2832	2024-07-28_B0CY5QQ49F	1.45	0.0

2833 rows × 3 columns

In [33]:
```
# Fill missing ad_spend with median
test_data['ad_spend'].fillna(0, inplace=True)

# Fill missing units with median
test_data['unit_price'].fillna(0, inplace=True)
```

In [34]:
```
test_data=test_data.drop(["ID"],axis=1)
```

In [35]:
```
y_pred1 = model.predict(test_data)
```

In [36]:
```
y_pred1
```

Out[36]:
```
array([-1.11898259, -1.11898259, -1.11898259, ..., -1.11898259,
       -0.92423433, -0.96797459])
```

In [37]:
```
sample_data
```

Out[37]:

	ID	TARGET
0	2024-07-01_B09KDR64LT	0
1	2024-07-01_B09KDTS4DC	0
2	2024-07-01_B09KDTHJ6V	0
3	2024-07-01_B09KDQ2BWY	0
4	2024-07-01_B09KDYY3SB	0
...	...	...
2828	2024-07-28_B0BRCW2B64	0
2829	2024-07-28_B0CFV6V981	0
2830	2024-07-28_B0BNL5BKMK	0
2831	2024-07-28_B0CR49BQRS	0
2832	2024-07-28_B0CY5QQ49F	0

2833 rows × 2 columns

Saving the results from linear regression model into the submission file

```
In [38]: sub=pd.read_csv("C:/Users/Ramini Varun Babu/Downloads/nap_queens assignment/sales_data/test.csv  ")
```

```
In [39]: sub["Target"]=y_pred1
```

```
In [40]: sub
```

Out[40]:

	ID	date	Item Id	Item Name	ad_spend	anarix_id	unit_price	Target
0	2024-07-01_B09KDR64LT	2024-07-01	B09KDR64LT	NapQueen Elizabeth 10" Gel Memory Foam Mattres...	NaN	NAPQUEEN	0.0	-1.118983
1	2024-07-01_B09KDTS4DC	2024-07-01	B09KDTS4DC	NapQueen Elizabeth 8" Gel Memory Foam Mattress...	NaN	NAPQUEEN	0.0	-1.118983
2	2024-07-01_B09KDTHJ6V	2024-07-01	B09KDTHJ6V	NapQueen Elizabeth 12" Gel Memory Foam Mattres...	NaN	NAPQUEEN	0.0	-1.118983
3	2024-07-01_B09KDQ2BWY	2024-07-01	B09KDQ2BWY	NapQueen Elizabeth 12" Gel Memory Foam Mattres...	NaN	NAPQUEEN	0.0	-1.118983
4	2024-07-01_B09KDYY3SB	2024-07-01	B09KDYY3SB	NapQueen Elizabeth 10" Gel Memory Foam Mattres...	101.72	NAPQUEEN	1094.5	18.072919
...	...	...	...	...	...	...	...	...
2828	2024-07-28_B0BRCW2B64	2024-07-28	B0BRCW2B64	NapQueen Anula Green Tea 12", Queen	11.78	NAPQUEEN	0.0	0.107827
2829	2024-07-28_B0CFV6V981	2024-07-28	B0CFV6V981	NaN	1.17	NAPQUEEN	0.0	-0.997135
2830	2024-07-28_B0BNL5BKMK	2024-07-28	B0BNL5BKMK	NapQueen 2" Bamboo Charcoal Mattress Topper, ...	0.00	NAPQUEEN	0.0	-1.118983
2831	2024-07-28_B0CR49BQRS	2024-07-28	B0CR49BQRS	NaN	1.87	NAPQUEEN	0.0	-0.924234
2832	2024-07-28_B0CY5QQ49F	2024-07-28	B0CY5QQ49F	NaN	1.45	NAPQUEEN	0.0	-0.967975

2833 rows × 8 columns

```
In [41]: sub=sub.drop(["Item Id","Item Name","ad_spend","anarix_id","unit_price"],axis=1)
```

```
In [42]: sub
```

```
Out[42]:
                            ID        date     Target
   0    2024-07-01_B09KDR64LT  2024-07-01  -1.118983
   1    2024-07-01_B09KDTS4DC  2024-07-01  -1.118983
   2    2024-07-01_B09KDTHJ6V  2024-07-01  -1.118983
   3    2024-07-01_B09KDQ2BWY  2024-07-01  -1.118983
   4    2024-07-01_B09KDYY3SB  2024-07-01  18.072919
 ...                      ...         ...        ...
2828    2024-07-28_B0BRCW2B64  2024-07-28   0.107827
2829    2024-07-28_B0CFV6V981  2024-07-28  -0.997135
2830    2024-07-28_B0BNL5BKMK  2024-07-28  -1.118983
2831    2024-07-28_B0CR49BQRS  2024-07-28  -0.924234
2832    2024-07-28_B0CY5QQ49F  2024-07-28  -0.967975

2833 rows × 3 columns
```

```
In [43]: sub=sub.drop(["date"],axis=1)
```

```
In [44]: sub.to_csv('C:/Users/Ramini Varun Babu/Downloads/nap_queens assignment/sales_data/submission.csv', index=False)
```

RANDOM FOREST REGRESSOR

In [45]:

```
from sklearn.ensemble import RandomForestRegressor
from sklearn.metrics import mean_squared_error

model3 = RandomForestRegressor(n_estimators=100, random_state=42)
model3.fit(X_train, y_train)
```

Out[45]:

```
RandomForestRegressor(random_state=42)
```

In [46]:

```
y_pred3 = model3.predict(X_test)

# Evaluate model performance
mse = mean_squared_error(y_test, y_pred3)
print(f'Mean Squared Error: {mse}')
```

```
Mean Squared Error: 1167.4556172184161
```

LINEAR REGRESSION WITH LASSO AND RIDGE REGULARIZATION

In [47]:

```
from sklearn.linear_model import LinearRegression, Lasso, Ridge

lasso=Lasso(alpha=0.1)
Ridge= Ridge(alpha=1.0)

lasso.fit(X_train, y_train)
Ridge.fit(X_train, y_train)
```

Out[47]:

```
Ridge()
```

In [48]:

```
lasso_pred=lasso.predict(X_test)
mse = mean_squared_error(y_test, lasso_pred)
print(f'Mean Squared Error: {mse}')
```

```
Mean Squared Error: 1407.4313434008466
```

In [49]:
```
Ridge_pred=Ridge.predict(X_test)
mse = mean_squared_error(y_test, Ridge_pred)
print(f'Mean Squared Error: {mse}')
```

```
Mean Squared Error: 1407.4349720552063
```

Saving the result from the random forest regressor into the submission1 csv file

In [50]:
```
rand = model3.predict(test_data)
```

In [51]:
```
sub1=pd.read_csv("C:/Users/Ramini Varun Babu/Downloads/nap_queens assignment/sales_data/test.csv  ")
```

In [52]:
```
sub1["Target"]=rand
```

In [53]:
```
sub1=sub1.drop(["Item Id","Item Name","ad_spend","anarix_id","unit_price","date"],axis=1)
```

In [54]:
```
sub1
```

Out[54]:
```
                         ID     Target
   0   2024-07-01_B09KDR64LT   4.135729
   1   2024-07-01_B09KDTS4DC   4.135729
   2   2024-07-01_B09KDTHJ6V   4.135729
   3  2024-07-01_B09KDQ2BWY   4.135729
   4   2024-07-01_B09KDYY3SB  10.640000
 ...                     ...        ...
2828  2024-07-28_B0BRCW2B64   1.435701
2829   2024-07-28_B0CFV6V981  70.570990
2830  2024-07-28_B0BNL5BKMK   4.135729
2831  2024-07-28_B0CR49BQRS   0.765791
2832   2024-07-28_B0CY5QQ49F   0.989624

2833 rows × 2 columns
```

In [55]:
```
sub1.to_csv('C:/Users/Ramini Varun Babu/Downloads/nap_queens assignment/sales_data/submission1.csv', index=False)
```

In [ ]:

In [ ]: