1 . DATA PRE-PROCESSING

```
import pandas as pd
df = pd.read_csv('/content/drive/MyDrive/dataset/traindata.csv')
df.head()
```

	TripType	VisitNumber	Weekday	Upc	ScanCount	DepartmentDescription	FinelineNumber
0	7	20	Friday	7.192192e+09	1	FROZEN FOODS	9117.0
1	7	20	Friday	6.811311e+10	2	SERVICE DELI	4010.0
2	25	28	Friday	8.805520e+11	1	LADIESWEAR	313.0
3	25	28	Friday	8.085947e+10	1	LADIESWEAR	4447.0
4	25	28	Friday	4.900004e+09	1	DSD GROCERY	9538.0

```
# Finding NUlls
df.isnull().sum()
```

```
TripType                0
VisitNumber             0
Weekday                 0
Upc                     0
ScanCount               0
DepartmentDescription    0
FinelineNumber          0
dtype: int64
```

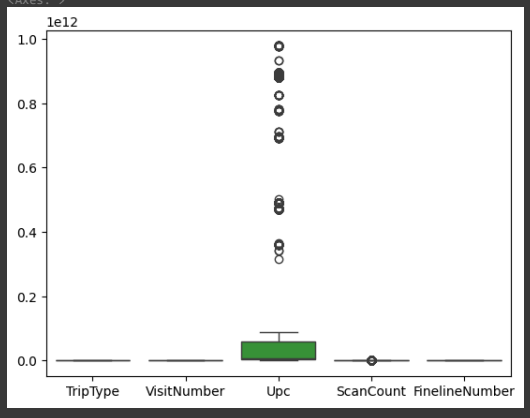
```
# Finding Duplicates
df[df.duplicated()]
```

	TripType	VisitNumber	Weekday	Upc	ScanCount	DepartmentDescription	FinelineNumber
173	25	604	Friday	8.398531e+09	1	HOME MANAGEMENT	8463.0
259	25	943	Friday	8.806320e+11	1	LADIESWEAR	313.0
533	25	1853	Friday	8.809400e+11	1	MENS WEAR	8506.0
557	25	1868	Friday	8.805520e+11	1	LADIESWEAR	3120.0
559	25	1868	Friday	8.806140e+11	1	LADIESWEAR	324.0
...	...	...	...	...	...	...	...
76579	25	190270	Sunday	1.326263e+09	1	GIRLS WEAR, 4-6X AND 7-14	800.0
76605	25	190281	Sunday	8.806160e+11	1	GIRLS WEAR, 4-6X AND 7-14	449.0
76732	38	190406	Sunday	1.600044e+09	1	GROCERY DRY GOODS	3555.0
76871	38	190766	Sunday	8.265756e+09	1	DSD GROCERY	2352.0
76974	25	191015	Sunday	8.806320e+11	1	LADIESWEAR	313.0

1082 rows × 7 columns

```
# Finding outliers --
outliers = ['TripType', 'VisitNumber', 'Upc', 'ScanCount', 'FinelineNumber' ]
import seaborn as sns
sns.boxplot(data = df[outliers])
# Just performed the step of Pre-processing but here outliers can be seen in UPC which will not be insightfull for any EDA or ML. Hence we can remove
```

```
<Axes: >
```




```
df.drop(columns = ['Upc'], inplace = True)
```

```
df
```

	TripType	VisitNumber	Weekday	ScanCount	DepartmentDescription	FinelineNumber
0	7	20	Friday	1	FROZEN FOODS	9117.0
1	7	20	Friday	2	SERVICE DELI	4010.0
2	25	28	Friday	1	LADIESWEAR	313.0
3	25	28	Friday	1	LADIESWEAR	4447.0
4	25	28	Friday	1	DSD GROCERY	9538.0
...	...	...	...	...	...	...
77181	25	191343	Sunday	2	MENS WEAR	5701.0
77182	25	191343	Sunday	2	DSD GROCERY	9211.0
77183	25	191343	Sunday	1	IMPULSE MERCHANDISE	100.0
77184	25	191343	Sunday	1	MENS WEAR	2828.0
77185	25	191343	Sunday	1	MENS WEAR	5225.0

77186 rows × 6 columns

```
df.dtypes
```

```
TripType                 int64
VisitNumber              int64
Weekday                 object
ScanCount                int64
DepartmentDescription   object
FinelineNumber         float64
dtype: object
```

```
# EXPLORATORY DATA ANALYSIS
import matplotlib.pyplot as plt
```

```
df.head(3)
```

	TripType	VisitNumber	Weekday	ScanCount	DepartmentDescription	FinelineNumber
0	7	20	Friday	1	FROZEN FOODS	9117.0
1	7	20	Friday	2	SERVICE DELI	4010.0
2	25	28	Friday	1	LADIESWEAR	313.0

```
#1. EDA
# BARPLOT TO CHECK TRIP-TYPE HAVING MAX ORDER COUNTS
# Ans> As per analysis, TripType-38 had purchased max orders_qty of 33535 quantities,
# while TripType-7 has least puchase_QTY
```

```
Triptype_scan =  df.groupby('TripType')['ScanCount'].sum()
B = Triptype_scan.reset_index()
B
```

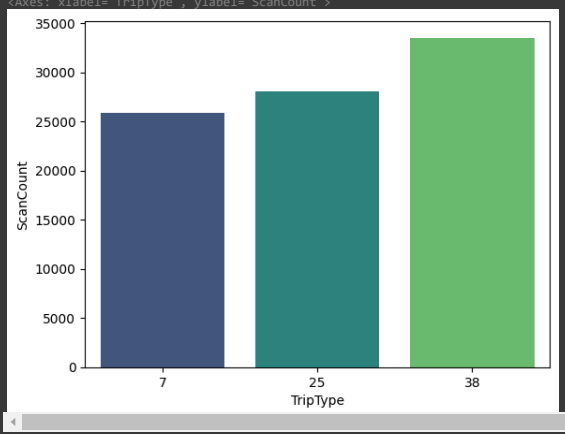
	TripType	ScanCount
0	7	25854
1	25	28049
2	38	33535

```
sns.barplot(x= B['TripType'], y= B['ScanCount'], palette = 'viridis')
```

```
<ipython-input-10-e863ed4641af>:1: 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

  sns.barplot(x= B['TripType'], y= B['ScanCount'], palette = 'viridis')
<Axes: xlabel='TripType', ylabel='ScanCount'>
```




```
# 2. EDA
# SUM OF ORDERED QTY BASED ON VISIT NUMBER
# Ans> We found that VisitNumber 84350 had purchased max quantities of products that was 89 QTY
```

```
QTY_BY_Visit = df.groupby('VisitNumber')['ScanCount'].sum()
A = QTY_BY_Visit.reset_index()
A.sort_values(by = 'ScanCount', ascending = False)
```

	VisitNumber	ScanCount
5299	84350	89
8040	127057	81
4430	71143	74
12135	188905	68
1725	27356	66
...	...	...
8876	140036	0
7326	116544	0
8660	136530	-1
4686	75132	-1
10562	164446	-1

12309 rows × 2 columns

```
A[['ScanCount', 'VisitNumber']].max()
```

```
ScanCount          89
VisitNumber    191343
dtype: int64
```

```
#3. EDA
# TO check Average Ordered QTY on each Visitnumber based on each TripType
# Ans> Per visit avg purchased orders are max for TripType-38 with 11-12 quantites and least for TripType-7 with 4-5 orders per visit.
```

```
df_a=df.groupby(['TripType', 'VisitNumber'])['ScanCount'].sum()
C =df_a.reset_index()
C
```

	TripType	VisitNumber	ScanCount
0	7	20	3
1	7	72	3
2	7	76	4
3	7	137	2
4	7	199	4
...	...	...	...
12304	38	191231	9
12305	38	191273	5
12306	38	191322	15
12307	38	191326	11
12308	38	191337	26

12309 rows × 3 columns

```
C.groupby('TripType')['ScanCount'].mean()
```

```
TripType
7      4.536585
25     7.584911
38    11.516140
Name: ScanCount, dtype: float64
```

```
#4. EDA
# Analyze Sum of orderQTY based on weekdays for each TripType
# Ans> Sunday has the most ordered Qty for all the TripTypes, while Thrusday has the least order counts for each TripType
```

```
df.head(2)
```

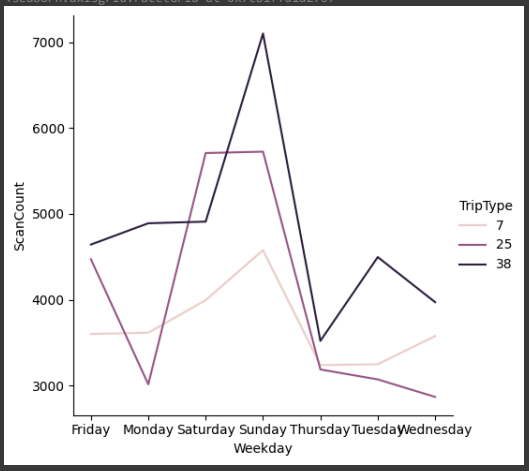
	TripType	VisitNumber	Weekday	ScanCount	DepartmentDescription	FinelineNumber
0	7	20	Friday	1	FROZEN FOODS	9117.0
1	7	20	Friday	2	SERVICE DELI	4010.0

```
df_b=df.groupby(['TripType', 'Weekday'])['ScanCount'].sum()
d = pd.DataFrame(df_b)
d.sort_values(by = ['TripType', 'ScanCount'], ascending =[True,False] )
```

TripType	Weekday	ScanCount
7	Sunday	4578
	Saturday	3995
	Monday	3616
	Friday	3601
	Wednesday	3577
	Tuesday	3248
	Thursday	3239
25	Sunday	5725
	Saturday	5709
	Friday	4472
	Thursday	3188
	Tuesday	3072
	Monday	3015
	Wednesday	2868
38	Sunday	7101
	Saturday	4910
	Monday	4891
	Friday	4643
	Tuesday	4497
	Wednesday	3972
	Thursday	3521

```
sns.relplot(x='Weekday', y = 'ScanCount' , kind = 'line' , hue = 'TripType', data = d)
```

```
<seaborn.axisgrid.FacetGrid at 0x7cb1ffd1d270>
```

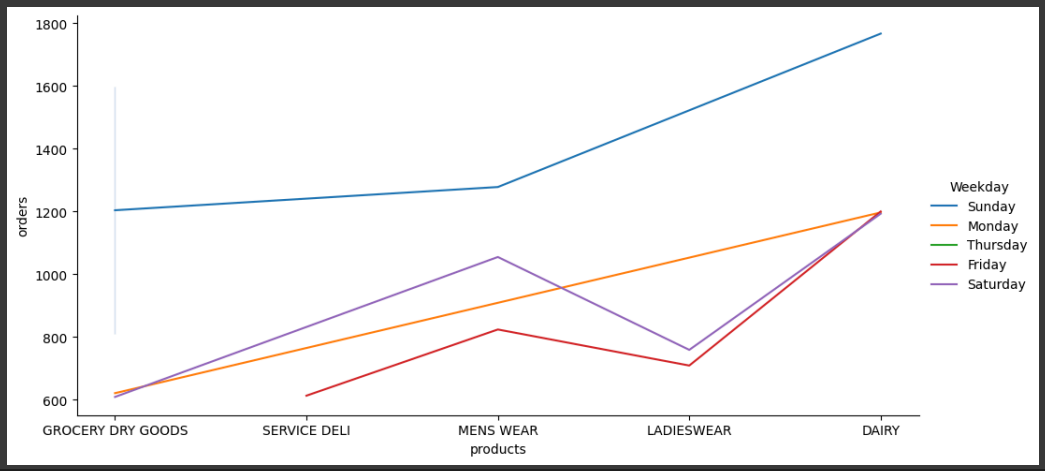



```
#5. EDA
# Analyze the DepartmentDescription that can help in Inventory Management
# Ans> Dairy demands at highest on all weekdays, Men wear products demand seems good on all days, Grocery dry products has least demand
```

```
df_e = df.groupby(['TripType', 'Weekday', 'DepartmentDescription'])['ScanCount'].sum()
E = pd.DataFrame(df_e)
EE=E.sort_values(by = ['TripType', 'ScanCount'], ascending=[True,False])
EEE = EE.groupby('TripType').head(5)
EEE
```

TripType	Weekday	DepartmentDescription	ScanCount
7	Sunday	GROCERY DRY GOODS	811
	Monday	GROCERY DRY GOODS	621
	Thursday	GROCERY DRY GOODS	620
	Friday	SERVICE DELI	613
	Saturday	GROCERY DRY GOODS	609
25	Sunday	MENS WEAR	1278
	Saturday	MENS WEAR	1055
	Friday	MENS WEAR	824
	Saturday	LADIESWEAR	759
	Friday	LADIESWEAR	709
38	Sunday	DAIRY	1767
		GROCERY DRY GOODS	1597
	Friday	DAIRY	1200
	Monday	DAIRY	1197
	Saturday	DAIRY	1193

```
import matplotlib.pyplot as plt
sns.relplot(x = 'DepartmentDescription', y ='ScanCount', kind = 'line', hue ='Weekday', data = EEE, height =5, aspect = 2 )
plt.xlabel('products')
plt.ylabel('orders')
plt.show()
```




```
df.head(2)
```

	TripType	VisitNumber	Weekday	ScanCount	DepartmentDescription
0	7	20	Friday	1	FROZEN FOODS
1	7	20	Friday	2	SERVICE DELI

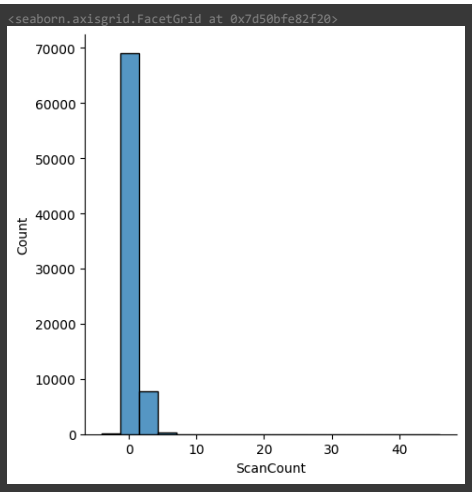
```
# checking Skewness (-1 to +1) and we want to remove skewness above 0.5 between (-0.5)
df_s = df[['TripType', 'VisitNumber', 'ScanCount']]
df_s.skew()
```

```
TripType       -0.357663
VisitNumber    -0.027284
ScanCount      10.730222
dtype: float64
```

```
df.drop(columns = ['FinelineNumber'], inplace = True )
```

```
# SCANCOUNT SKEWNESS
import seaborn as sns
sns.displot(df['ScanCount'])
```

```
<seaborn.axisgrid.FacetGrid at 0x7d50bfe82f20>
```



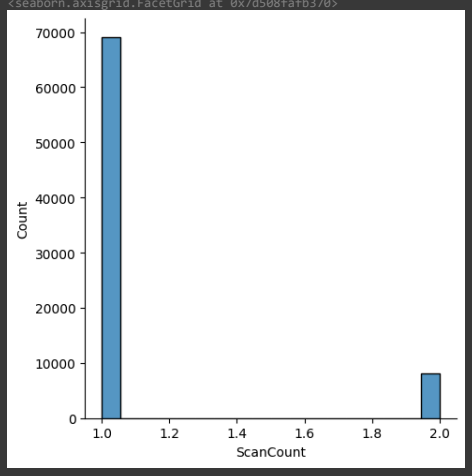

```
from scipy.stats import mstats
df_s['ScanCount'] = pd.Series(mstats.winsorize(df_s['ScanCount'], limits=[0.1, 0.1]))
df_s['ScanCount'].skew()
```

```
<ipython-input-14-294cd6ffa3e3>:2: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  df_s['ScanCount'] = pd.Series(mstats.winsorize(df_s['ScanCount'], limits=[0.1, 0.1]))
2.5657863085170285
```

```
sns.displot(df_s['ScanCount'])
```

```
<seaborn.axisgrid.FacetGrid at 0x7d508fafb370>
```




```
df_s.skew()
```

```
TripType      -0.357663
VisitNumber   -0.027284
ScanCount      2.565786
dtype: float64
```

```
df['ScanCount'] = df_s['ScanCount']
df['ScanCount'].skew()
```

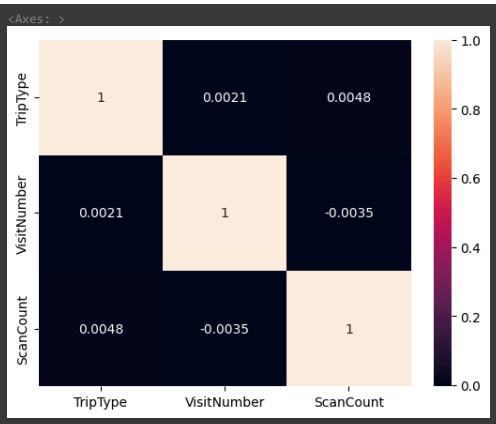
```
2.5657863085170285
```

```
# CORRELATION
cor = df[['TripType','VisitNumber', 'ScanCount' ]]
cor.corr()
```

	TripType	VisitNumber	ScanCount
TripType	1.000000	0.002086	0.004786
VisitNumber	0.002086	1.000000	-0.003500
ScanCount	0.004786	-0.003500	1.000000

```
sns.heatmap(cor.corr(), annot = True)
```

<Axes: >



2. TRANSFORMATION AND STANDARDIZATION

```
# Tranforming all the categorical to numberical values - 'Weekday' and 'DepartmentDescription'
```

```
from sklearn.preprocessing import LabelEncoder
cols = ['Weekday', 'DepartmentDescription']
for c in cols:
  le = LabelEncoder()
  df[c] = le.fit_transform(df[c])
```

```
df.head(5)
```

	TripType	VisitNumber	Weekday	ScanCount	DepartmentDescription
0	7	20	0	1	20
1	7	20	0	2	56
2	25	28	0	1	35
3	25	28	0	1	35
4	25	28	0	1	16

```
# Standardizing all the values using Standard Scaler
      # splitting dataframe into X and Y
```

```
X = df.iloc[:,1:]
Y = df['TripType']
```

```
from sklearn.preprocessing import StandardScaler
ss = StandardScaler()
X_SS = ss.fit_transform(X)
x = pd.DataFrame(X_SS)
y = Y
```

3. MODEL DEVELOPMENT

```
# Splitting into Test and Train from the dataset
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test = train_test_split(x,y,test_size = 0.2, random_state = 42)
x_train.shape,x_test.shape,      y_train.shape,y_test.shape
```

```
((61748, 4), (15438, 4), (61748,), (15438,))
```

```
# Data Balacing for classifier problem --> On Train dataset
df['TripType'].value_counts()
```

```
TripType
38    28525
25    26493
7     22168
Name: count, dtype: int64
```

```
from imblearn.over_sampling import RandomOverSampler
ros = RandomOverSampler()
x_train_re, y_train_re = ros.fit_resample(x_train, y_train)
```

```
# Model training : As this is multiclass classification ->
# Decesion Tree and Random Forest Classifier can be used
from sklearn.tree import DecisionTreeClassifier
model1 = DecisionTreeClassifier()
model1.fit(x_train_re, y_train_re)
```

```
▾ DecisionTreeClassifier
DecisionTreeClassifier()
```

```
# Predictions
y_train_pred = model1.predict(x_train_re)
y_test_pred = model1.predict(x_test)
```

4. MODEL METRICS

```
# METRCIS --> Model Accuracy -- Accuracy score , Precesion score , Recall score , F1_score
# >>>
# Accuracy score ->>>>>>>> 81% for Decision Tree Classifier

from sklearn.metrics import accuracy_score, precision_score,recall_score, classification_report
accuracy_test = accuracy_score(y_test, y_test_pred)
cs_test = classification_report(y_test, y_test_pred)
accuracy_test
```

```
0.8089130716414044
```

```
precison_test = precision_score(y_test, y_test_pred, average = 'micro')
recall_test = recall_score(y_test, y_test_pred, average = 'micro')
precison_test , recall_test
```

```
(0.8089130716414044, 0.8089130716414044)
```

```
# USING BAGGING to improve accuracy with DecisionTree
# Accuracy remains similar with Bagging_DT =>>>>>> 80%
```

```
from sklearn.ensemble import BaggingClassifier
from sklearn.tree import DecisionTreeClassifier
dt = DecisionTreeClassifier()
bg = BaggingClassifier(base_estimator = dt, n_estimators = 10, random_state = 42)
bg.fit(x_train_re, y_train_re)
y_test_bg= bg.predict(x_test)
```

```
/usr/local/lib/python3.10/dist-packages/sklearn/ensemble/_base.py:166: FutureWarning: `base_estimator` was renamed to `estimator` in version 1.2 and will be removed in 1.4.
  warnings.warn(
```

```
accuracy_test_bg = accuracy_score(y_test, y_test_bg)
accuracy_test_bg
```

```
0.8010752688172043
```

```
# USING BAGGING to improve accuracy with RandomForestClassifier
# Accuracy decreased with Bagging_RandomForestClassifier =>>>>>>> 78%
    # ------
# Used For-Loop to find the max accuracy by altering n_estimator(1~30)
# Max accuracy received ->>>>>> 78% which again the same as above Bagging_RandomForestClassifier
```

```
from sklearn.ensemble import RandomForestClassifier
rfc = RandomForestClassifier()
nest=[]
acc =[]
for i in range(1,30):
  bg_rf = BaggingClassifier(base_estimator = rfc, n_estimators = i, random_state = 42)
  bg_rf.fit(x_train_re, y_train_re)
  y_test_bg_rf= bg_rf.predict(x_test)
  accuracy_test_bg_rf = accuracy_score(y_test, y_test_bg_rf)
  nest.append(i)
  acc.append(accuracy_test_bg_rf)
```

```
Show hidden output
```

```
acc
```

```
[0.7623396813058686,
 0.7593600207280736,
 0.7653193418836637,
 0.7722502914885347,
 0.7737401217774323,
 0.7760720300557067,
 0.7747117502267133,
 0.7767197823552273,
 0.7777561860344604,
 0.7775618603446042,
 0.7787278144837414,
 0.7778209612644125,
 0.7788573649436455,
 0.7789221401735976,
 0.7790516906335018,
 0.780217644772639,
 0.7798289933929266,
 0.780282420002591,
 0.7805415209223993,
 0.779246016323358,
 0.7795698924731183,
 0.7796994429330224,
 0.7800880943127348,
 0.7796346677030703,
 0.7794403420132141,
 0.7800880943127348,
 0.7800880943127348,
 0.7791164658634538,
 0.7807358466122555]
```

```
accuracy_test_bg_rf
```

```
0.7811244979919679
```

```
# DecisionTree            = 81% Accuracy : y_test_pred = model1.predict(x_test)
# DecisionTree + Bagging = 80% Accuracy : y_test_bg= bg.predict(x_test)
# RandomForest+ Bagging  = 78% Accuracy : y_test_bg_rf= bg_rf.predict(x_test)

# --> We can select "DecisionTree model" to make predictions for other dataset.
```

5 .Making Predictions on new dataset

```
df_new = pd.read_csv('/content/drive/MyDrive/dataset/testdata.csv')
df_new.head()
```

	VisitNumber	Weekday	Upc	ScanCount	DepartmentDescription	FinelineNumber
0	87	Friday	7.106841e+09	1	FROZEN FOODS	4063
1	361	Friday	6.727878e+10	1	MENS WEAR	1605
2	385	Friday	2.840007e+09	1	DSD GROCERY	4551
3	413	Friday	2.200000e+09	1	IMPULSE MERCHANDISE	135
4	462	Friday	7.282133e+10	1	PLUS AND MATERNITY	744

```
#Dropped colums as per MODEL BUILT
df_new.drop(columns = ['Upc','FinelineNumber'], inplace = True)
```

```
#Transformed
from sklearn.preprocessing import LabelEncoder
cat_col = ['Weekday', 'DepartmentDescription']
for colm in cat_col:
  lee = LabelEncoder()
  df_new[colm]=lee.fit_transform(df_new[colm])
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
<ipython-input-1-6843b95fd5f8> in <cell line: 4>()
      4 for colm in cat_col:
      5   lee = LabelEncoder()
----> 6   df_new[colm]=lee.fit_transform(df_new[colm])
      7
      8 df_new.head(5)

NameError: name 'df_new' is not defined
```

```
X_new = df_new.iloc[:,:]
X_new
```

	VisitNumber	Weekday	ScanCount	DepartmentDescription
0	87	0	1	18
1	361	0	1	37
2	385	0	1	14
3	413	0	1	27
4	462	0	1	45
...	...	...	...	...
2995	191158	3	5	18
2996	191164	3	1	13
2997	191225	3	1	13
2998	191256	3	1	37
2999	191337	3	1	35

3000 rows × 4 columns

```
#Standardize
from sklearn.preprocessing import StandardScaler
ss_new = StandardScaler()
X_std = ss_new.fit_transform(X_new)
x_n = pd.DataFrame(X_std)
x_n
```

	0	1	2	3
0	-1.747144	-1.430756	-0.241391	-0.547027

```
predict_new = model1.predict(x_n)
predict_new
```

```
array([ 7, 25,  7, ...,  7, 25, 25])
```