ANALYTICS VIDHYA-JOB-A-THON

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Importing Libraries

In [82]:
```
import matplotlib.pyplot as plt
import pandas as pd
import numpy as np
import seaborn as sns

from sklearn.preprocessing import LabelEncoder
from sklearn.model_selection import train_test_split
from sklearn import metrics
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error,r2_score
from sklearn.tree import DecisionTreeRegressor
from sklearn.ensemble import RandomForestRegressor
from xgboost import XGBRegressor

import warnings
warnings.filterwarnings('always')
warnings.filterwarnings('ignore')
```

Basic Information on the data

In [2]:
```
path=r'C:\Users\JAYADEVA JAVALI\Desktop\AV\TRAIN.csv'
path1=r'C:\Users\JAYADEVA JAVALI\Desktop\AV\TEST_FINAL.csv'
train=pd.read_csv(path)
test=pd.read_csv(path1)
```

In [3]:
```
train.head()
```

Out[3]:

	ID	Store_id	Store_Type	Location_Type	Region_Code	Date	Holiday	Discount	#Order
0	T1000001	1	S1	L3	R1	2018-01-01	1	Yes	9
1	T1000002	253	S4	L2	R1	2018-01-01	1	Yes	60
2	T1000003	252	S3	L2	R1	2018-01-01	1	Yes	42
3	T1000004	251	S2	L3	R1	2018-01-01	1	Yes	23
4	T1000005	250	S2	L3	R4	2018-01-01	1	Yes	62

In [4]:
```
test.head()
```

Out[4]:

	ID	Store_id	Store_Type	Location_Type	Region_Code	Date	Holiday	Discount

	ID	Store_id	Store_Type	Location_Type	Region_Code	Date	Holiday	Discount
0	T1188341	171	S4	L2	R3	2019-06-01	0	No
1	T1188342	172	S1	L1	R1	2019-06-01	0	No
2	T1188343	173	S4	L2	R1	2019-06-01	0	No
3	T1188344	174	S1	L1	R4	2019-06-01	0	No
4	T1188345	170	S1	L1	R2	2019-06-01	0	No

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

Out[5]: (188340, 10)

In [6]:
```
test.shape
```

Out[6]: (22265, 8)

In [9]:
```
train.info(),test.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 188340 entries, 0 to 188339
Data columns (total 10 columns):
 #   Column         Non-Null Count   Dtype  
---  ------         --------------   -----  
 0   ID             188340 non-null  object 
 1   Store_id       188340 non-null  int64  
 2   Store_Type     188340 non-null  object 
 3   Location_Type  188340 non-null  object 
 4   Region_Code    188340 non-null  object 
 5   Date           188340 non-null  object 
 6   Holiday        188340 non-null  int64  
 7   Discount       188340 non-null  object 
 8   #Order         188340 non-null  int64  
 9   Sales          188340 non-null  float64
dtypes: float64(1), int64(3), object(6)
memory usage: 14.4+ MB
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 22265 entries, 0 to 22264
Data columns (total 8 columns):
 #   Column         Non-Null Count  Dtype 
---  ------         --------------  ----- 
 0   ID             22265 non-null  object
 1   Store_id       22265 non-null  int64 
 2   Store_Type     22265 non-null  object
 3   Location_Type  22265 non-null  object
 4   Region_Code    22265 non-null  object
 5   Date           22265 non-null  object
 6   Holiday        22265 non-null  int64 
 7   Discount       22265 non-null  object
dtypes: int64(2), object(6)
memory usage: 1.4+ MB
```

Out[9]: (None, None)

In [14]:
```
train.describe()
```

Out[14]:

	Store_id	Holiday	#Order	Sales
count	188340.000000	188340.000000	188340.000000	188340.000000
mean	183.000000	0.131783	68.205692	42784.327982
std	105.366308	0.338256	30.467415	18456.708302

	Store_id	Holiday	#Order	Sales
min	1.000000	0.000000	0.000000	0.000000
25%	92.000000	0.000000	48.000000	30426.000000
50%	183.000000	0.000000	63.000000	39678.000000
75%	274.000000	0.000000	82.000000	51909.000000
max	365.000000	1.000000	371.000000	247215.000000

In [32]:
```
train.describe(include='O')
```

Out[32]:

	ID	Store_Type	Location_Type	Region_Code	Date	Discount
count	188340	188340	188340	188340	188340	188340
unique	188340	4	5	4	516	2
top	T1051393	S1	L1	R1	2018-10-28	No
freq	1	88752	85140	63984	365	104051

In [31]:
```
test.describe()
```

Out[31]:

	Store_id	Holiday
count	22265.000000	22265.000000
mean	183.000000	0.032787
std	105.368395	0.178082
min	1.000000	0.000000
25%	92.000000	0.000000
50%	183.000000	0.000000
75%	274.000000	0.000000
max	365.000000	1.000000

In [33]:
```
test.describe(include='O')
```

Out[33]:

	ID	Store_Type	Location_Type	Region_Code	Date	Discount
count	22265	22265	22265	22265	22265	22265
unique	22265	4	5	4	61	2
top	T1202786	S1	L1	R1	2019-07-12	No
freq	1	10492	10065	7564	365	12773

High Level Information on the data

In [16]:
```
train.isnull().sum()
```

Out[16]:
```
ID              0
Store_id        0
Store_Type      0
Location_Type   0
```

```
Region_Code      0
Date             0
Holiday          0
Discount         0
#Order           0
Sales            0
dtype: int64
```

In [21]:
```
if train.isnull().sum().any() == False:
    print("There are no missing values")
else:
    print("There are missing values")
```

```
There are no missing values
```

In [17]:
```
test.isnull().sum()
```

Out[17]:
```
ID               0
Store_id         0
Store_Type       0
Location_Type    0
Region_Code      0
Date             0
Holiday          0
Discount         0
dtype: int64
```

In [22]:
```
if test.isnull().sum().any() == False:
    print("There are no missing values")
else:
    print("There are missing values")
```

```
There are no missing values
```

In [18]:
```
#categorical features
categorical = train.select_dtypes(include =[np.object])
print("Categorical Features in Train Set:",categorical.shape[1])

#numerical features
numerical= train.select_dtypes(include =[np.float64,np.int64])
print("Numerical Features in Train Set:",numerical.shape[1])
```

```
Categorical Features in Train Set: 6
Numerical Features in Train Set: 4
```

In [19]:
```
#categorical features
categorical = test.select_dtypes(include =[np.object])
print("Categorical Features in Test Set:",categorical.shape[1])

#numerical features
numerical= test.select_dtypes(include =[np.float64,np.int64])
print("Numerical Features in Test Set:",numerical.shape[1])
```

```
Categorical Features in Test Set: 6
Numerical Features in Test Set: 2
```

In [25]:
```
# Checking for duplicate rows
print("number of duplicate rows in train set: ", train.duplicated().sum())
```

```
number of duplicate rows in train set:  0
```

In [24]:
```
# Checking for duplicate rows
print("number of duplicate rows in test set: ", test.duplicated().sum())
```

```
number of duplicate rows in test set:  0
```

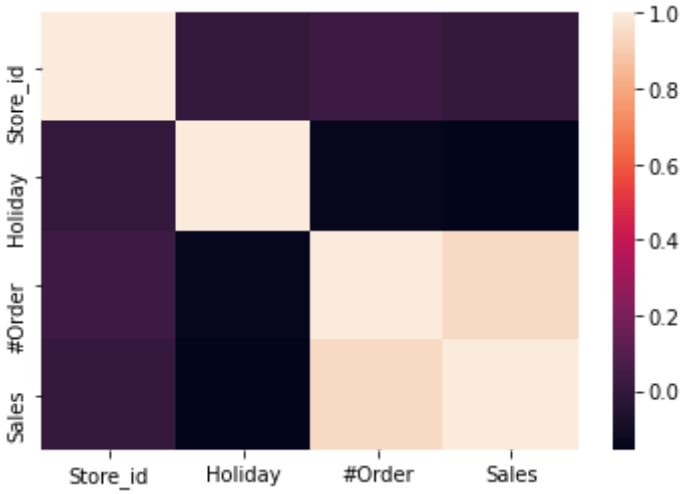
In [26]:
```
train.corr()
```

Out[26]:

	Store_id	Holiday	#Order	Sales
Store_id	1.000000e+00	-4.477583e-19	0.028290	0.004377
Holiday	-4.477583e-19	1.000000e+00	-0.140496	-0.154779
#Order	2.828985e-02	-1.404963e-01	1.000000	0.941601
Sales	4.376631e-03	-1.547788e-01	0.941601	1.000000

In [34]:
```
sns.heatmap(train.corr())
```

Out[34]: <AxesSubplot:>



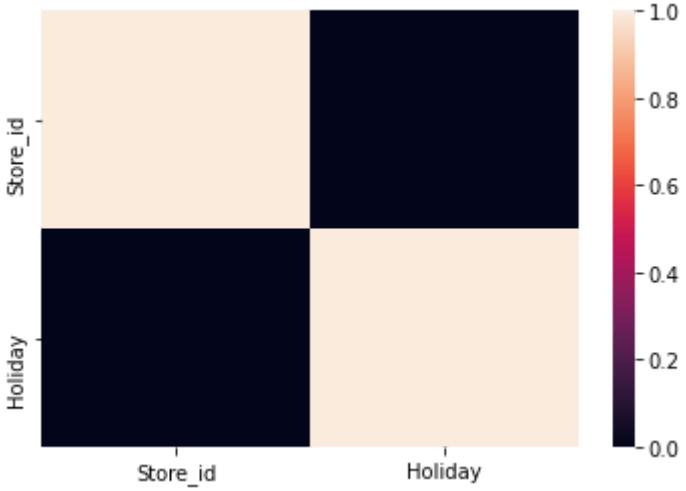
In [27]:
```
test.corr()
```

Out[27]:

	Store_id	Holiday
Store_id	1.000000e+00	-5.400071e-19
Holiday	-5.400071e-19	1.000000e+00

In [35]:
```
sns.heatmap(test.corr())
```

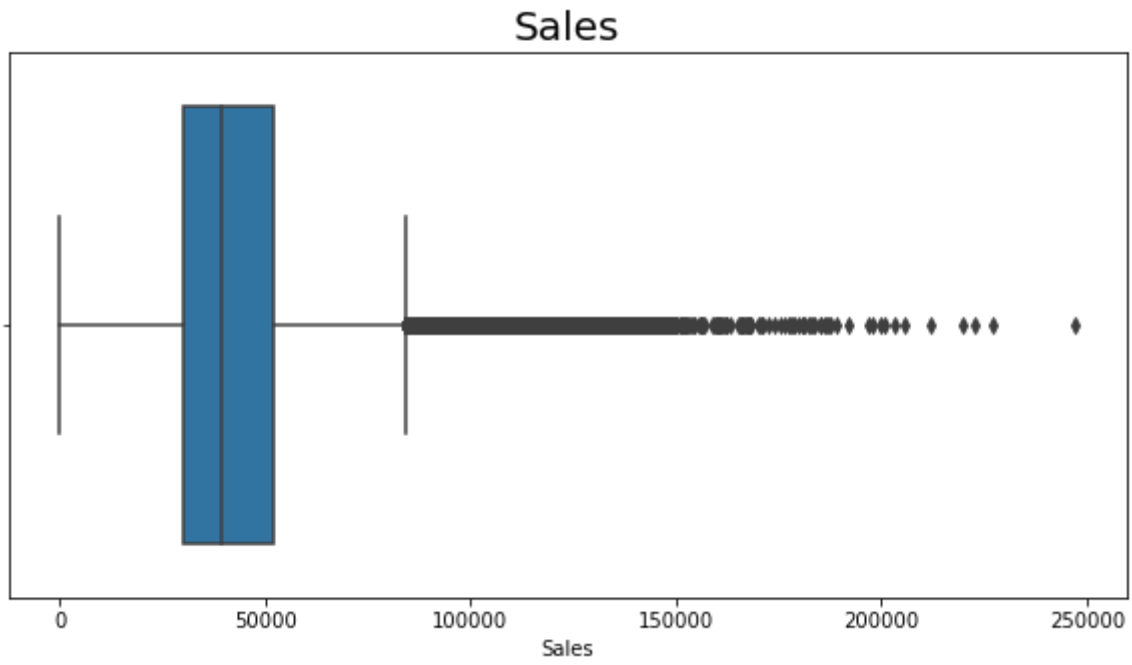
Out[35]: <AxesSubplot:>



Checking for Outliers

In [39]:
```
for c in ['Sales']:
```

```
    plt.figure(figsize=(10, 5))
    sns.boxplot(train[c])
    plt.title(c, fontsize=20)
    plt.show()
```



In [37]:
```
def detect_outlier(col):
    quartile1 = col.quantile(0.25)
    quartile3 = col.quantile(0.75)
    IQR = quartile3 - quartile1
    lower = quartile1 - (1.5 * IQR)
    upper = quartile3 +  (1.5 * IQR)
    return lower, upper

col1=train['Sales']
print("Outliers of Sales")
detect_outlier(col1)
```

```
Outliers of Sales
```

Out[37]:
```
(-1798.5, 84133.5)
```

These are Absurd Values so imputing outliers is not a good idea.

In [41]:
```
print(train['Store_Type'].value_counts())
print('****************************************')
print(test['Store_Type'].value_counts())
```

```
S1    88752
S4    45924
S2    28896
S3    24768
Name: Store_Type, dtype: int64
****************************************
S1    10492
S4     5429
S2     3416
S3     2928
Name: Store_Type, dtype: int64
```

In [43]:
```
print(train['Location_Type'].value_counts())
print('****************************************')
print(test['Location_Type'].value_counts())
```

```
L1    85140
```

```
L2    48504
L3    29928
L5    13932
L4    10836
Name: Location_Type, dtype: int64
****************************************
L1    10065
L2     5734
L3     3538
L5     1647
L4     1281
Name: Location_Type, dtype: int64
```

In [44]:
```
print(train['Region_Code'].value_counts())
print('****************************************')
print(test['Region_Code'].value_counts())
```

```
R1    63984
R2    54180
R3    44376
R4    25800
Name: Region_Code, dtype: int64
****************************************
R1    7564
R2    6405
R3    5246
R4    3050
Name: Region_Code, dtype: int64
```

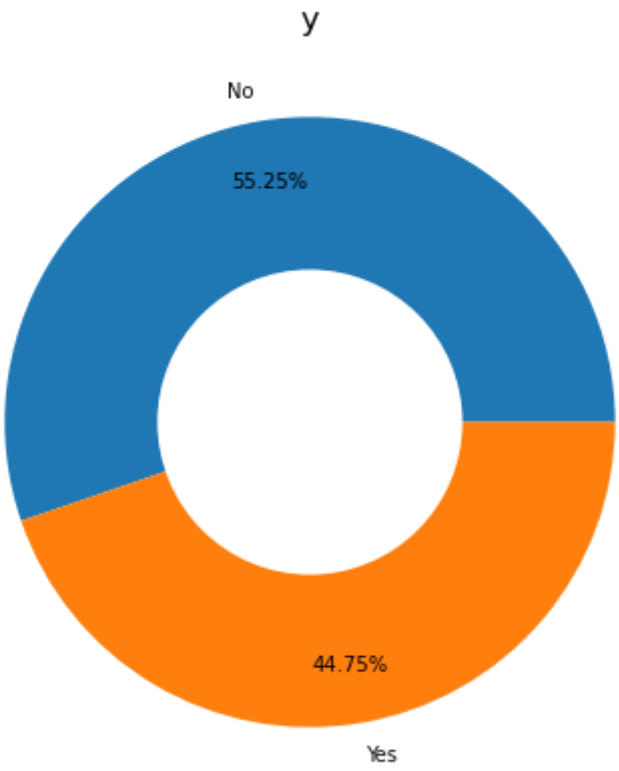
In [45]:
```
print(train['Discount'].value_counts())
print('****************************************')
print(test['Discount'].value_counts())
```

```
No     104051
Yes     84289
Name: Discount, dtype: int64
****************************************
No     12773
Yes     9492
Name: Discount, dtype: int64
```

Data Visualisation on Train Data

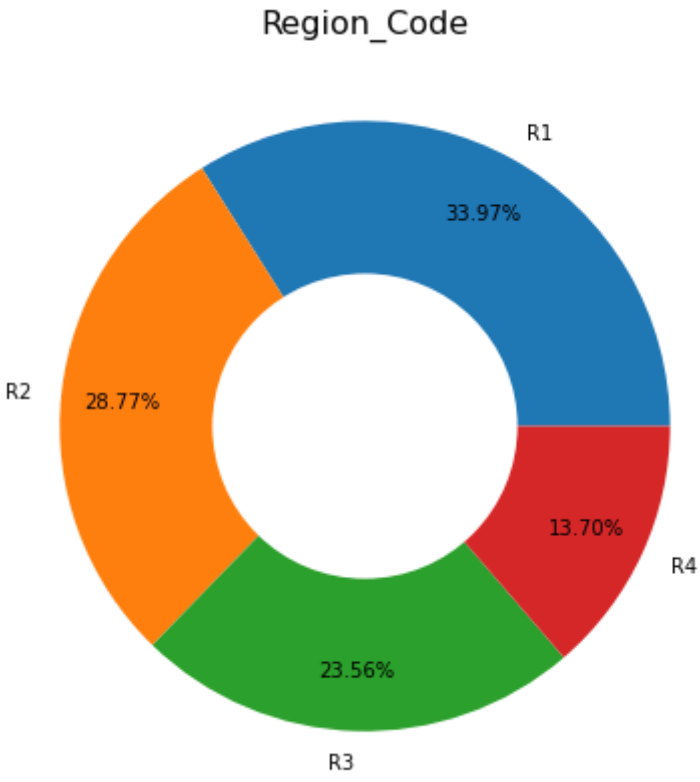
In [46]:
```
train_1 = train["Discount"].value_counts()

plt.figure(figsize = (7,7))
plt.pie(data = train_1, x = train_1.values, labels = train_1.index, autopct = "%.2f%
circle = plt.Circle(xy = (0, 0), radius = 0.5, facecolor = 'white')
plt.gca().add_artist(circle)
plt.title("Discount", size = 16)
plt.show()
```



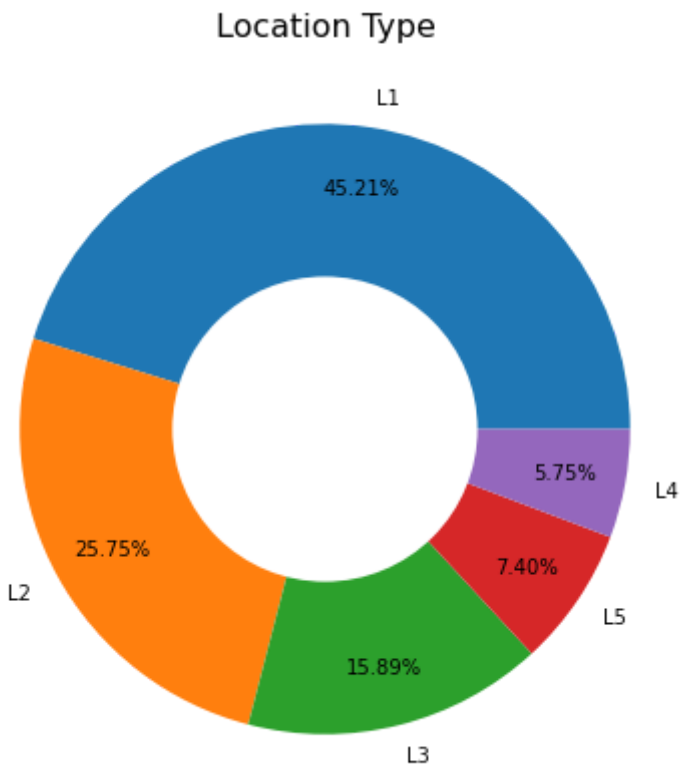
In [57]:
```
train_2 = train['Region_Code'].value_counts()

plt.figure(figsize = (7,7))
plt.pie(data = train_2, x = train_2.values, labels = train_2.index, autopct = "%.2f%
circle = plt.Circle(xy = (0, 0), radius = 0.5, facecolor = 'white')
plt.gca().add_artist(circle)
plt.title("Region_Code", size = 16)
plt.show()
```



In [58]:
```
train_3 = train['Location_Type'].value_counts()
```

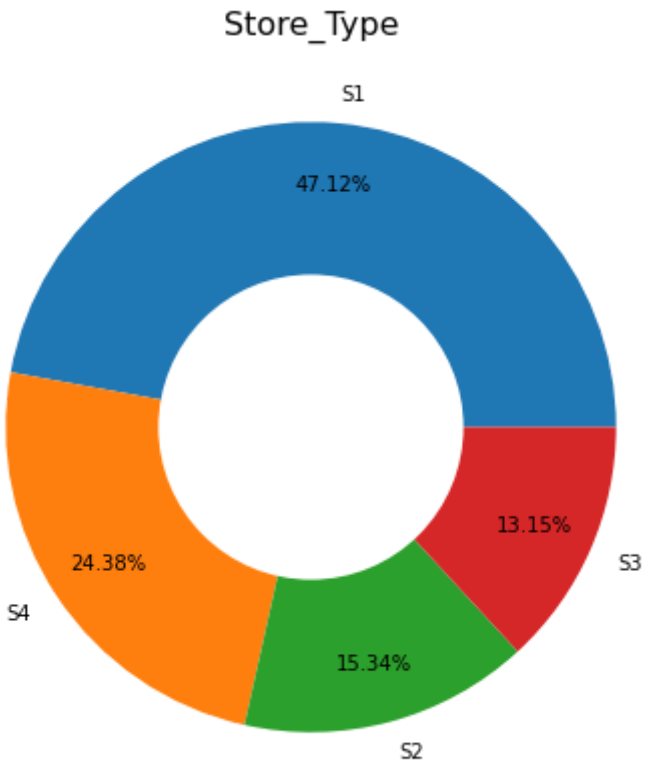
```
plt.figure(figsize = (7,7))
plt.pie(data = train_3, x = train_3.values, labels = train_3.index, autopct = "%.2f%
circle = plt.Circle(xy = (0, 0), radius = 0.5, facecolor = 'white')
plt.gca().add_artist(circle)
plt.title("Location Type", size = 16)
plt.show()
```



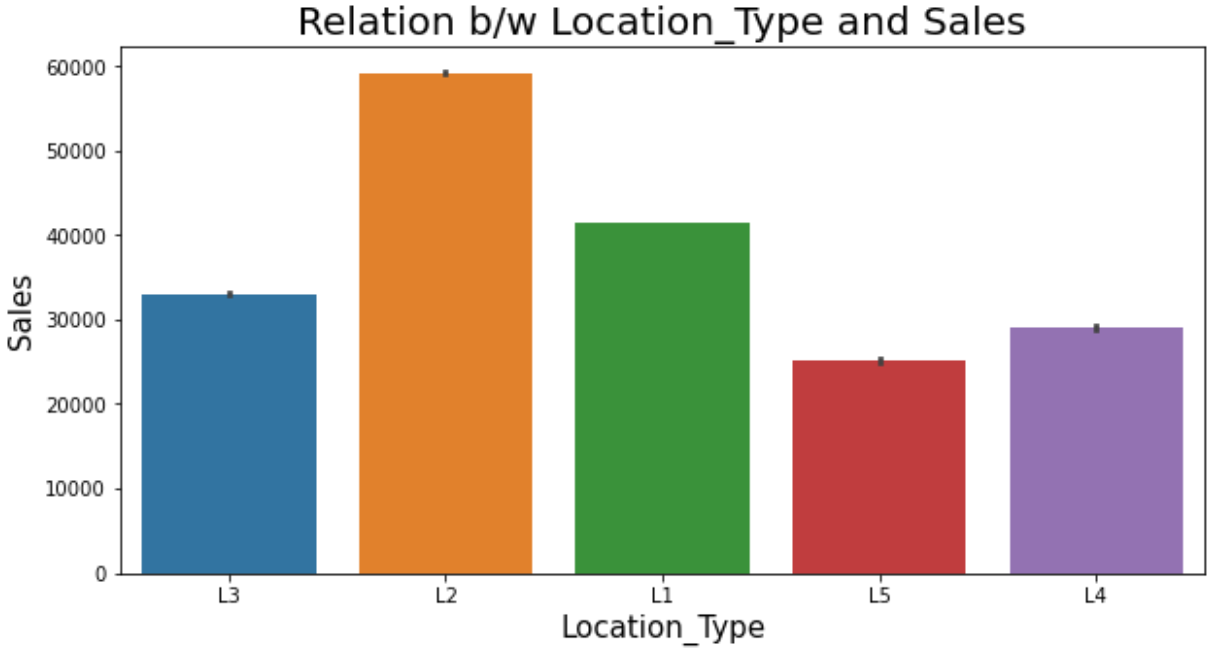
In [59]:

```
train_4 = train['Store_Type'].value_counts()

plt.figure(figsize = (7,7))
plt.pie(data = train_4, x = train_4.values, labels = train_4.index, autopct = "%.2f%
circle = plt.Circle(xy = (0, 0), radius = 0.5, facecolor = 'white')
plt.gca().add_artist(circle)
plt.title("Store_Type", size = 16)
plt.show()
```



In [65]:
```
plt.figure(figsize=(10, 5))
sns.barplot(x='Location_Type', y='Sales', data=train)
plt.title('Relation b/w Location_Type and Sales', fontsize=20);
plt.xlabel('Location_Type', fontsize=15)
plt.ylabel('Sales', fontsize=15);
```



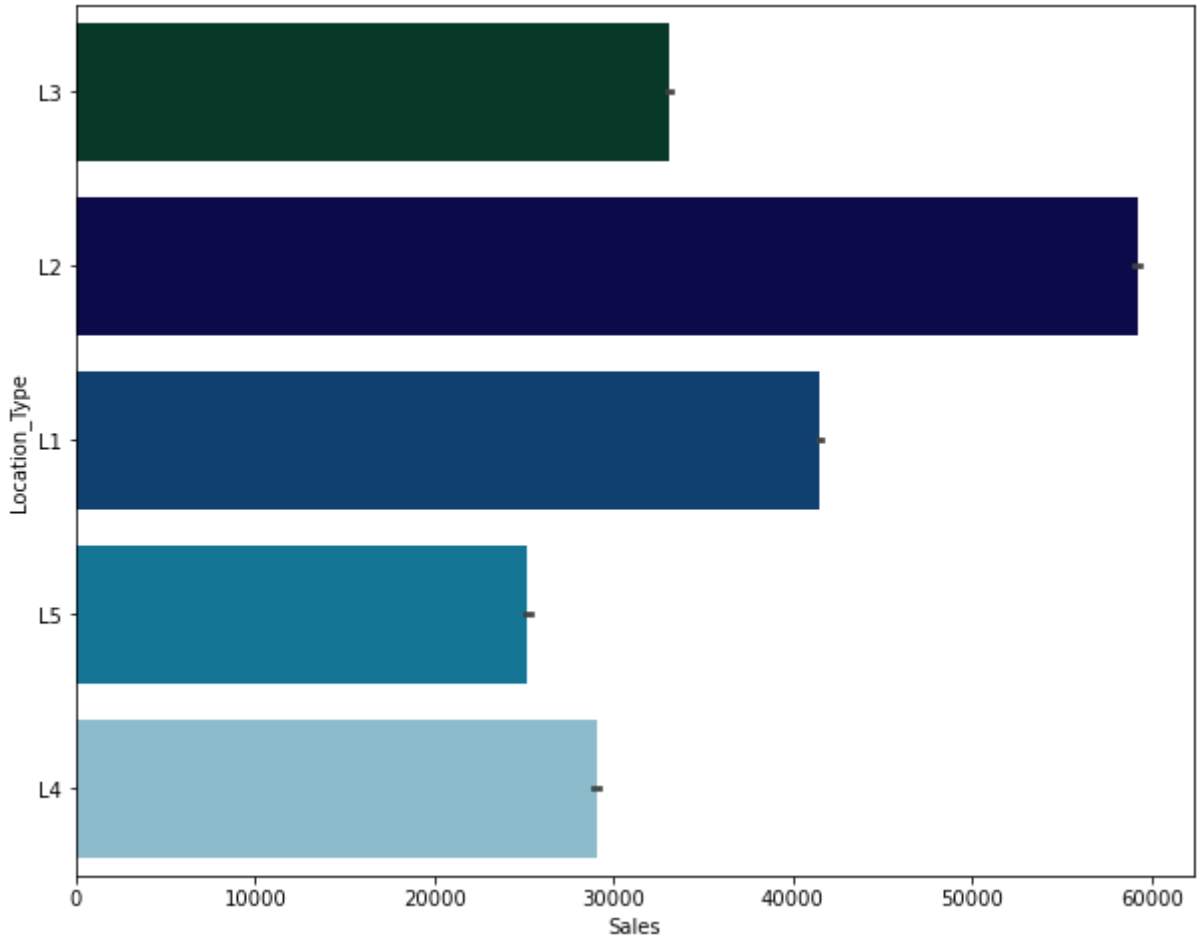
In [52]:
```
plt.figure(figsize=(10, 5))
sns.barplot(x='Store_Type', y='Sales', data=train)
plt.title('Relation b/w Store_Type and Sales', fontsize=20);
plt.xlabel('Store_Type', fontsize=15)
plt.ylabel('Sales', fontsize=15);
```

In [54]:
```
plt.figure(figsize=(10, 5))
sns.barplot(x='Discount', y='Sales', data=train)
plt.title('Relation b/w Discount and Sales', fontsize=20);
plt.xlabel('Discount', fontsize=15)
plt.ylabel('Sales', fontsize=15);
```

In [56]:
```
plt.figure(figsize=(10, 5))
sns.barplot(x='Region_Code', y='Sales', data=train)
plt.title('Relation b/w Region_Code and Sales', fontsize=20);
plt.xlabel('Region_Code', fontsize=15)
plt.ylabel('Sales', fontsize=15);
```

In [67]:
```
plt.figure(figsize=(10,8))
sns.barplot(y='Location_Type',x='Sales',data=train,palette='ocean')
```

Out[67]: <AxesSubplot:xlabel='Sales', ylabel='Location_Type'>

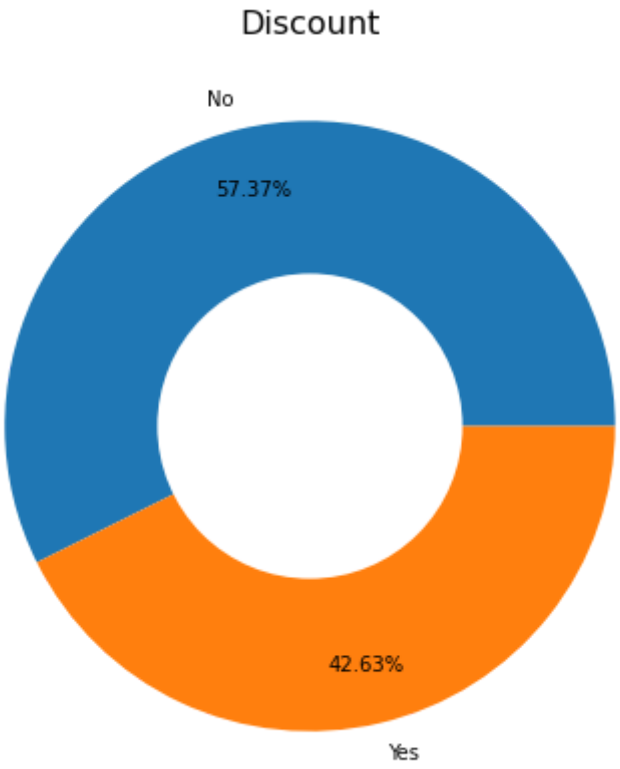


Data Visualization of Test Data

In [47]:
```
test_1 = test["Discount"].value_counts()

plt.figure(figsize = (7,7))
plt.pie(data = test_1, x = test_1.values, labels = test_1.index, autopct = "%.2f%%",
```

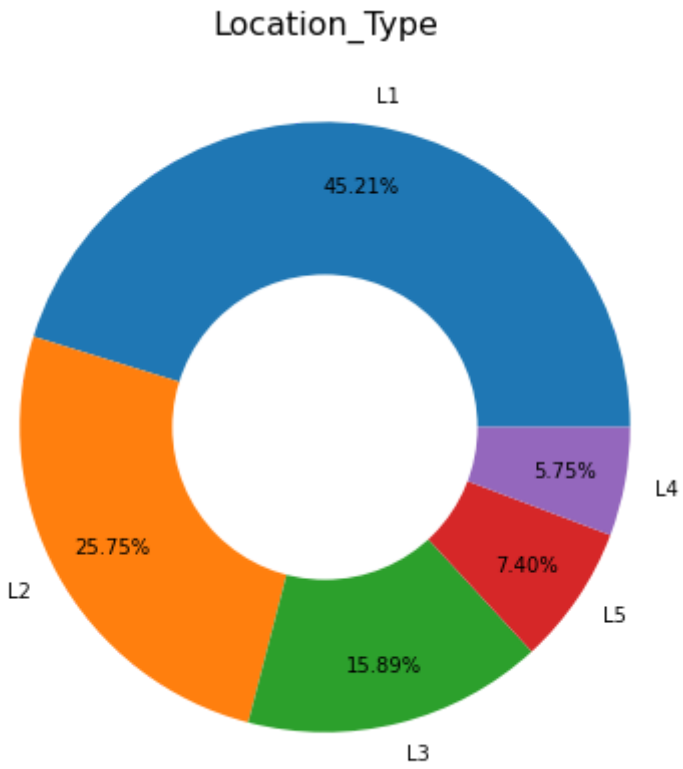
```
circle = plt.Circle(xy = (0, 0), radius = 0.5, facecolor = 'white')
plt.gca().add_artist(circle)
plt.title("Discount", size = 16)
plt.show()
```



In [60]:

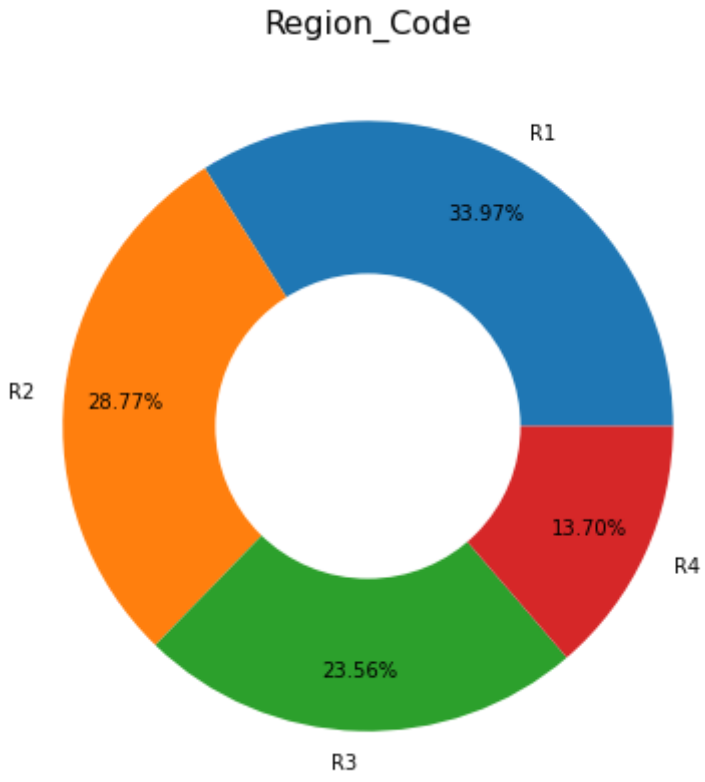
```
test_2 = test["Location_Type"].value_counts()

plt.figure(figsize = (7,7))
plt.pie(data = test_2, x = test_2.values, labels = test_2.index, autopct = "%.2f%%",
circle = plt.Circle(xy = (0, 0), radius = 0.5, facecolor = 'white')
plt.gca().add_artist(circle)
plt.title("Location_Type", size = 16)
plt.show()
```



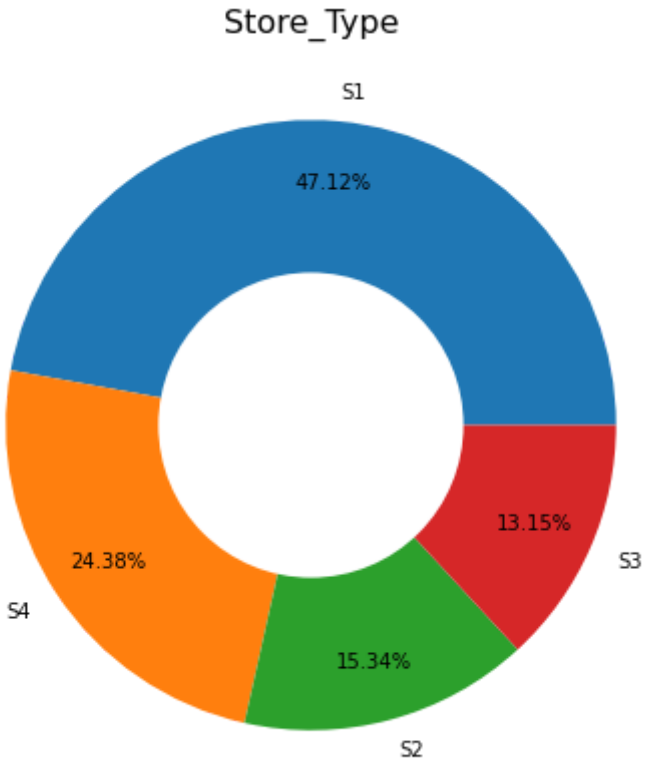
In [61]:
```
test_3 = test["Region_Code"].value_counts()

plt.figure(figsize = (7,7))
plt.pie(data = test_3, x = test_3.values, labels = test_3.index, autopct = "%.2f%%",
circle = plt.Circle(xy = (0, 0), radius = 0.5, facecolor = 'white')
plt.gca().add_artist(circle)
plt.title("Region_Code", size = 16)
plt.show()
```



In [62]:
```
test_4 = test["Store_Type"].value_counts()
```

```
plt.figure(figsize = (7,7))
plt.pie(data = test_4, x = test_4.values, labels = test_4.index, autopct = "%.2f%%",
circle = plt.Circle(xy = (0, 0), radius = 0.5, facecolor = 'white')
plt.gca().add_artist(circle)
plt.title("Store_Type", size = 16)
plt.show()
```



Data Pre-Processing

Label Encoding

In [69]:
```
label_RC = LabelEncoder()
label_LT = LabelEncoder()
label_ST = LabelEncoder()
label_D  = LabelEncoder()


train['Region_Code'] = label_RC.fit_transform(train['Region_Code'])
train['Location_Type'] = label_LT.fit_transform(train['Location_Type'])
train['Store_Type'] = label_ST.fit_transform(train['Store_Type'])
train['Discount'] = label_D.fit_transform(train['Discount'])
```

In [70]:
```
train.head()
```

Out[70]:

	ID	Store_id	Store_Type	Location_Type	Region_Code	Date	Holiday	Discount	#Order
0	T1000001	1	0	2	0	2018-01-01	1	1	9
1	T1000002	253	3	1	0	2018-01-01	1	1	60
2	T1000003	252	2	1	0	2018-01-01	1	1	42

	ID	Store_id	Store_Type	Location_Type	Region_Code	Date	Holiday	Discount	#Order
3	T1000004	251	1	2	0	2018-01-01	1	1	23
4	T1000005	250	1	2	3	2018-01-01	1	1	62

In [71]:
```
label_RC1 = LabelEncoder()
label_LT1 = LabelEncoder()
label_ST1 = LabelEncoder()
label_D1 = LabelEncoder()


test['Region_Code'] = label_RC1.fit_transform(test['Region_Code'])
test['Location_Type'] = label_LT1.fit_transform(test['Location_Type'])
test['Store_Type'] = label_ST1.fit_transform(test['Store_Type'])
test['Discount'] = label_D1.fit_transform(test['Discount'])
```

In [72]:
```
test.head()
```

Out[72]:

	ID	Store_id	Store_Type	Location_Type	Region_Code	Date	Holiday	Discount
0	T1188341	171	3	1	2	2019-06-01	0	0
1	T1188342	172	0	0	0	2019-06-01	0	0
2	T1188343	173	3	1	0	2019-06-01	0	0
3	T1188344	174	0	0	3	2019-06-01	0	0
4	T1188345	170	0	0	1	2019-06-01	0	0

Model Building

In [163…
```
train = train.select_dtypes(exclude='object')
test = test.select_dtypes(exclude='object')
```

In [164…
```
x = train.drop(["Sales"], axis = 1).copy()
y = train["Sales"].copy()
```

In [165…
```
x_train, x_test, y_train, y_test = train_test_split(x,y,test_size=0.1, random_state=
```

1.Linear Regression

In [166…
```
regressor = LinearRegression()
regressor.fit(x_train, y_train)
prediction = regressor.predict(x_test)
rmse_Lreg = np.sqrt(mean_squared_error(y_test, prediction))
print('RMSE value is = {}'.format(rmse_Lreg))
r2_Lreg = r2_score(y_test, prediction)
print('R-squared value is {}'.format(r2_Lreg))
```

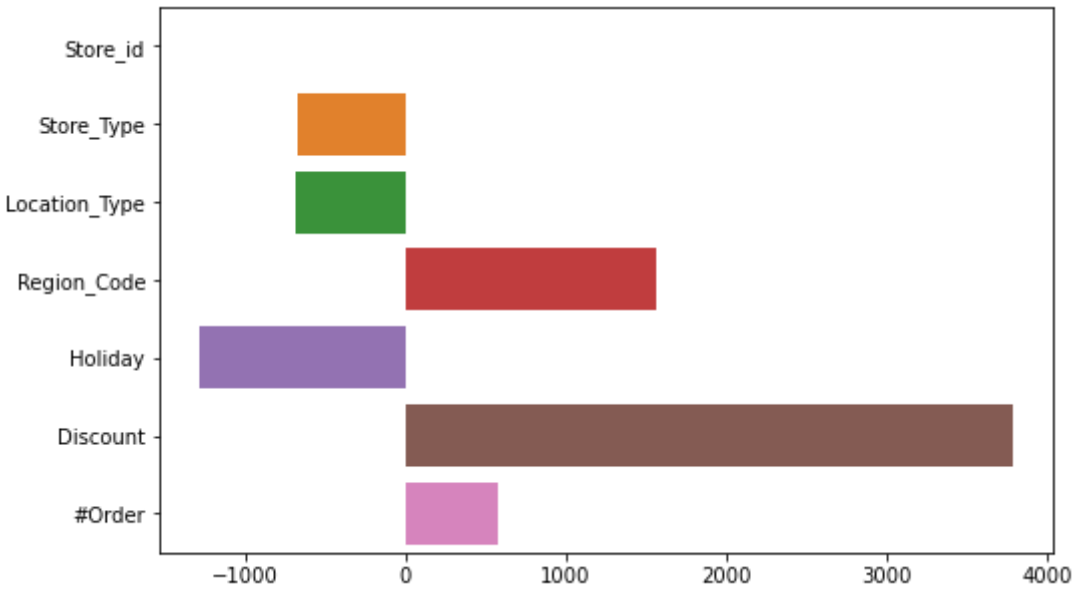
```
RMSE value is = 5523.809792021703
R-squared value is 0.9105052362413247
```

In [190…
```
features= x.columns
LR = LinearRegression(normalize=True)
```

```
LR.fit(x_train,y_train)
y_pred = LR.predict(x_test)
coef = pd.Series(LR.coef_,features).sort_values()
```

In [168…
```
# Barplot for coefficients
plt.figure(figsize=(8,5))
sns.barplot(LR.coef_,features)
```

Out[168… <AxesSubplot:>



In [177…
```
submission=pd.read_excel(r'C:\Users\JAYADEVA JAVALI\Desktop\sub.csv')
```

In [179…
```
submission=pd.read_excel(r'C:\Users\JAYADEVA JAVALI\Desktop\sub.csv',header=None)
```

In [187…
```
submission['Sales']=y_pred
```

In [181…
```
submission.head()
```

Out[181…

	Sales
0	46483.253508
1	34621.663614
2	37429.558698
3	26578.515559
4	24843.749720

In [182…
```
submission.to_csv(r'C:\Users\JAYADEVA JAVALI\Desktop\AV\submission.csv')
```

In [191…
```
submission.isnull().sum()
```

Out[191…
```
Sales    0
dtype: int64
```

2.Random Forest Regressor

In [185…
```
RFreg_model = RandomForestRegressor()
RFreg_model.fit(x_train,y_train)
prediction2 = RFreg_model.predict(x_test)
```

```
rmse_RFreg = np.sqrt(mean_squared_error(y_test, prediction2))
print('RMSE value is = {}'.format(rmse_RFreg))
r2_RFreg = r2_score(y_test, prediction2)
print('R-squared value is {}'.format(r2_RFreg))
```

```
RMSE value is = 4542.179580098943
R-squared value is 0.9394869844264035
```

3.Polynomial Regressor

In [84]:
```
from sklearn.preprocessing import PolynomialFeatures
from sklearn.linear_model import LinearRegression
poly_reg = PolynomialFeatures(degree = 4)
X_poly = poly_reg.fit_transform(x_train)
regressor = LinearRegression()
regressor.fit(X_poly, y_train)
prediction3 = regressor.predict(poly_reg.transform(x_test))

ploy_reg = np.sqrt(mean_squared_error(y_test, prediction3))
print('RMSE value is = {}'.format(ploy_reg))
r2_poly_reg = r2_score(y_test, prediction3)
print('R-squared value is {}'.format(r2_poly_reg))
```

```
RMSE value is = 4679.009556424654
R-squared value is 0.9357862461110387
```

4.Decision Tree Regressor

In [85]:
```
regressor1 = DecisionTreeRegressor(random_state = 0)
regressor1.fit(x_train, y_train)
prediction4 = regressor1.predict(x_test)
dt_reg = np.sqrt(mean_squared_error(y_test, prediction4))
print('RMSE value is = {}'.format(dt_reg))
r2_dt_reg = r2_score(y_test, prediction4)
print('R-squared value is {}'.format(r2_dt_reg))
```

```
RMSE value is = 5069.780276435869
R-squared value is 0.9246126513183084
```

5.XGBoost Regressor

In [87]:
```
SEED=42
xgbr = XGBRegressor(learning_rate = 0.1, n_estimators = 200, random_state = SEED)
xgbr.fit(x_train,y_train)
prediction5 = xgbr.predict(x_test)
xgbr_reg = np.sqrt(mean_squared_error(y_test, prediction5))
print('RMSE value is = {}'.format(xgbr_reg))
r2_xgbr_reg = r2_score(y_test, prediction5)
print('R-squared value is {}'.format(r2_xgbr_reg))
```

```
RMSE value is = 4138.711008580953
R-squared value is 0.9497599110957692
```

Comparision of Models

In [127…
```
Result= pd.DataFrame({'Actual Sales':y_test,'Predicted Sales By LinearRegression':pr
Result
```

Out[127…

	Actual Sales	Predicted Sales By LinearRegression	Predicted Sales By RandomForest	Predicted Sales By PolynomialRegressor	Predicted Sales By DecisionTreeRegressor	Xgl

	Actual Sales	Predicted Sales By LinearRegression	Predicted Sales By RandomForest	Predicted Sales By PolynomialRegressor	Predicted Sales By DecisionTreeRegressor	Xgl
152226	42081.00	46483.253508	45455.908857	46399.746490	45153.000000	46
48745	40770.00	34621.663614	36590.550900	39081.422135	33951.000000	38
24500	33114.00	37429.558698	33779.663953	34772.163666	33778.875000	33
83014	25473.00	26578.515559	27802.869512	30002.329504	27688.125000	27
20636	27315.00	24843.749720	27274.860734	23935.380782	27529.800000	25
...	...	...	...	...	...	
132413	57468.00	46437.266896	47775.506563	46491.961633	47600.250000	47
112141	37380.00	39133.736025	37505.966571	37713.517960	37562.000000	38
91253	45378.00	35310.682633	44278.077363	42003.971119	44344.285714	44
58406	69534.00	63393.828063	65304.075400	65347.895159	65787.000000	62
161969	27869.76	26396.737615	27463.856087	25210.903829	28476.000000	28

18834 rows × 6 columns

In [ ]: