PYTHON PROJECT

Retail Analysis with Walmart Data

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```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from matplotlib import style
style.use("ggplot")
```

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[2]:
```
ProjData = pd.read_csv("../input/walmart-store-sales/Walmart_Store_sales.csv")
```

[3]:
```
##Data Inspection
ProjData.head()
```

[3]:

	Store	Date	Weekly_Sales	Holiday_Flag	Temperature	Fuel_Price	CPI	Unemployment
0	1	05-02-2010	1643690.90	0	42.31	2.572	211.096358	8.106
1	1	12-02-2010	1641957.44	1	38.51	2.548	211.242170	8.106
2	1	19-02-2010	1611968.17	0	39.93	2.514	211.289143	8.106
3	1	26-02-2010	1409727.59	0	46.63	2.561	211.319643	8.106
4	1	05-03-2010	1554806.68	0	46.50	2.625	211.350143	8.106

```
ProjData.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 6435 entries, 0 to 6434
Data columns (total 8 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   Store          6435 non-null   int64
 1   Date           6435 non-null   object
 2   Weekly_Sales   6435 non-null   float64
 3   Holiday_Flag   6435 non-null   int64
 4   Temperature    6435 non-null   float64
 5   Fuel_Price     6435 non-null   float64
 6   CPI            6435 non-null   float64
 7   Unemployment   6435 non-null   float64
dtypes: float64(5), int64(2), object(1)
memory usage: 402.3+ KB
```

[5]:
```
ProjData.isna().sum()
```

[5]:
```
Store           0
Date            0
Weekly_Sales    0
Holiday_Flag    0
Temperature     0
Fuel_Price      0
CPI             0
Unemployment    0
dtype: int64
```

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[6]:
```
ProjData.describe()
```

[6]:

	Store	Weekly_Sales	Holiday_Flag	Temperature	Fuel_Price	CPI	Unemployment
count	6435.000000	6.435000e+03	6435.000000	6435.000000	6435.000000	6435.000000	6435.000000
mean	23.000000	1.046965e+06	0.069930	60.663782	3.358607	171.578394	7.999151
std	12.988182	5.643666e+05	0.255049	18.444933	0.459020	39.356712	1.875885
min	1.000000	2.099862e+05	0.000000	-2.060000	2.472000	126.064000	3.879000
25%	12.000000	5.533501e+05	0.000000	47.460000	2.933000	131.735000	6.891000
50%	23.000000	9.607460e+05	0.000000	62.670000	3.445000	182.616521	7.874000
75%	34.000000	1.420159e+06	0.000000	74.940000	3.735000	212.743293	8.622000
max	45.000000	3.818686e+06	1.000000	100.140000	4.468000	227.232807	14.313000

[7]:
```
ProjData.size
```

[7]:
```
51480
```

+ Code + Markdown

[8]:
```
ProjData.shape
```

[8]:
```
(6435, 8)
```

[9]:
```
#Converting Date Column in DateType
ProjData.Date = pd.to_datetime(ProjData.Date,dayfirst=True)
ProjData.Store = ProjData.Store.astype(str)
ProjData.Weekly_Sales = ProjData.Weekly_Sales.round(0).astype(int)
ProjData.Store = 'WM Store '+ ProjData.Store.astype(str)
```

[10]:
```
ProjData.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 6435 entries, 0 to 6434
Data columns (total 8 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   Store          6435 non-null   object
 1   Date           6435 non-null   datetime64[ns]
 2   Weekly_Sales   6435 non-null   int64
 3   Holiday_Flag   6435 non-null   int64
 4   Temperature    6435 non-null   float64
 5   Fuel_Price     6435 non-null   float64
 6   CPI            6435 non-null   float64
 7   Unemployment   6435 non-null   float64
```

[11]:
```
ProjData.head()
```

[11]:

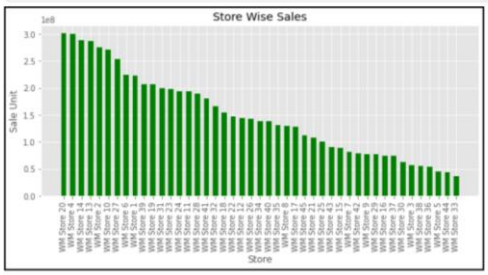
	Store	Date	Weekly_Sales	Holiday_Flag	Temperature	Fuel_Price	CPI	Unemployment
0	WM Store 1	2010-02-05	1643691	0	42.31	2.572	211.096358	8.106
1	WM Store 1	2010-02-12	1641957	1	38.51	2.548	211.242170	8.106
2	WM Store 1	2010-02-19	1611968	0	39.93	2.514	211.289143	8.106
3	WM Store 1	2010-02-26	1409728	0	46.63	2.561	211.319643	8.106
4	WM Store 1	2010-03-05	1554807	0	46.50	2.625	211.350143	8.106

[12]:
```
#Which store has maximum sales?
MaxSale = ProjData.groupby("Store")["Weekly_Sales"].sum().reset_index(name="Total_Sale").sort_values(by='Total_Sale', ascending=False)
MaxSale.head(5)
#the WM store 20 has the maximum sales value.
```

[12]:

	Store	Total_Sale
12	WM Store 20	301397795
33	WM Store 4	299543953
5	WM Store 14	288999910
4	WM Store 13	286517707
11	WM Store 2	275382440

[13]:
```
#Plotting Maximum Sale
plt.figure(figsize=(10,4),edgecolor='black',linewidth=4)
plt.bar(MaxSale['Store'], MaxSale['Total_Sale'], color='green', width=0.6)
plt.xlabel("Store")
plt.ylabel("Sale Unit")
plt.title("Store Wise Sales")
plt.xticks(rotation=90)
plt.show()
```

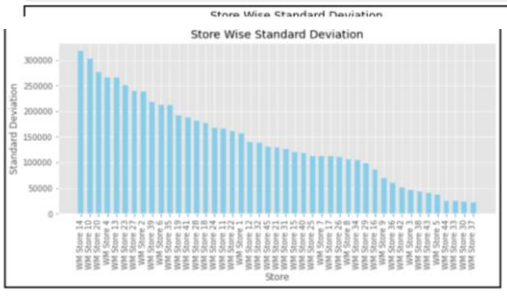


[14]:
```
#Which store has maximum standard deviation? i.e., the sales vary a lot. Also, find out the coefficient of mean to standard deviation
MaxStd = ProjData.groupby("Store")["Weekly_Sales"].std().reset_index(name="Standard Deviation").sort_values(by='Standard Deviation', asc
MaxStd['Standard Deviation']=MaxStd['Standard Deviation'].round(2)
MaxStd.head(5)
```

[14]:

	Store	Standard Deviation
5	WM Store 14	317569.96
1	WM Store 10	302262.10
12	WM Store 20	275900.52
33	WM Store 4	266201.40
4	WM Store 13	265507.00

[15]:
```
#Plotting Standard Deviation
plt.figure(figsize=(10,4),edgecolor='black',linewidth=4)
plt.bar(MaxStd['Store'], MaxStd['Standard Deviation'], color='skyblue', width=0.6)
plt.xlabel("Store")
plt.ylabel("Standard Deviation")
plt.title("Store Wise Standard Deviation")
plt.xticks(rotation=90)
plt.show()
```



[16]:
```
#the coefficient of mean to standard deviation

MaxCoef = ProjData.groupby("Store")["Weekly_Sales"].sum().reset_index(name="Total_Sale").sort_values(by='Total_Sale', ascending=False)
CoefVar = lambda x: np.std(MaxCoef['Total_Sale'], ddof=1) / np.mean(MaxCoef['Total_Sale']) * 100
CoefVal = CoefVar(MaxCoef['Total_Sale'])

print("The Coefficient of Mean to Standard Deviation is", (round(CoefVal,2)))
```

```
The Coefficient of Mean to Standard Deviation is 52.21
```

[17]:
```
#Which store/s has good quarterly growth rate in Q3'2012
import calendar
ProjData['year']= ProjData['Date'].dt.year
ProjData['month']= ProjData['Date'].dt.month
ProjData['day']= ProjData['Date'].dt.day
ProjData['MonthName']= ProjData['month'].apply(lambda x: calendar.month_name[x])
ProjData.head(5)
```

[17]:

	Store	Date	Weekly_Sales	Holiday_Flag	Temperature	Fuel_Price	CPI	Unemployment	year	month	day	MonthName
0	WM Store 1	2010-02-05	1643691	0	42.31	2.572	211.096358	8.106	2010	2	5	February
1	WM Store 1	2010-02-12	1641957	1	38.51	2.548	211.242170	8.106	2010	2	12	February
2	WM Store 1	2010-02-19	1611968	0	39.93	2.514	211.289143	8.106	2010	2	19	February
3	WM Store 1	2010-02-26	1409728	0	46.63	2.561	211.319643	8.106	2010	2	26	February
4	WM Store 1	2010-03-05	1554807	0	46.50	2.625	211.350143	8.106	2010	3	5	March

[18]:
```
SaleData2012 = ProjData[ProjData['year']==2012]
SaleData2012.head(5)
```

[18]:

	Store	Date	Weekly_Sales	Holiday_Flag	Temperature	Fuel_Price	CPI	Unemployment	year	month	day	MonthName
100	WM Store 1	2012-01-06	1550370	0	49.01	3.157	219.714258	7.348	2012	1	6	January
101	WM Store 1	2012-01-13	1459601	0	48.53	3.261	219.892526	7.348	2012	1	13	January
102	WM Store 1	2012-01-20	1394394	0	54.11	3.268	219.985689	7.348	2012	1	20	January
103	WM Store 1	2012-01-27	1319326	0	54.26	3.290	220.078852	7.348	2012	1	27	January
104	WM Store 1	2012-02-03	1636340	0	56.55	3.360	220.172015	7.348	2012	2	3	February

[19]:
```
def calqtr(x):
    if x['month']==1 or x['month']==2 or x['month']==3: return 1
    elif x['month']==4 or x['month']==5 or x['month']==6: return 2
    elif x['month']==7 or x['month']==8 or x['month']==9: return 3
    else: return 4

SaleData2012Qtr = SaleData2012.copy()
SaleData2012Qtr['Qtr'] = SaleData2012.apply(calqtr, axis=1)

SaleData2012Qtr.head(5)
```

[19]:

	Store	Date	Weekly_Sales	Holiday_Flag	Temperature	Fuel_Price	CPI	Unemployment	year	month	day	MonthName	Qtr
100	WM Store 1	2012-01-06	1550370	0	49.01	3.157	219.714258	7.348	2012	1	6	January	1
101	WM Store 1	2012-01-13	1459601	0	48.53	3.261	219.892526	7.348	2012	1	13	January	1
102	WM Store 1	2012-01-20	1394394	0	54.11	3.268	219.985689	7.348	2012	1	20	January	1
103	WM Store 1	2012-01-27	1319326	0	54.26	3.290	220.078852	7.348	2012	1	27	January	1
104	WM Store 1	2012-02-03	1636340	0	56.55	3.360	220.172015	7.348	2012	2	3	February	1

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[20]:
```
QtrSales = SaleData2012Qtr.groupby(["Store",'Qtr'])["Weekly_Sales"].sum().reset_index(name="Qtr_Sale").sort_values(by='Store')
QtrSales1 = pd.DataFrame(QtrSales)
QtrSales1.head()
```

[20]:

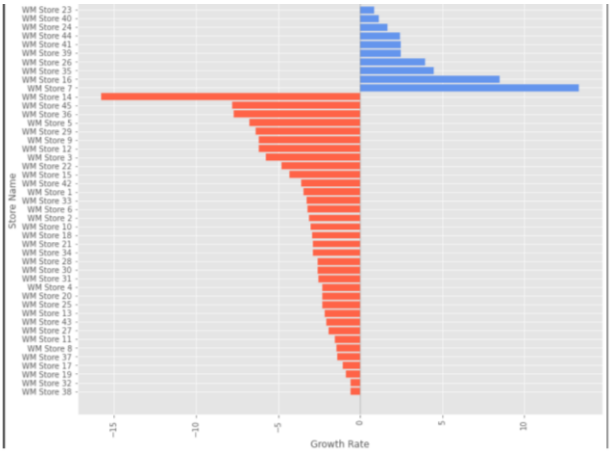
	Store	Qtr	Qtr_Sale
0	WM Store 1	1	20723764
1	WM Store 1	2	20978761
2	WM Store 1	3	20253947
3	WM Store 1	4	6245588
4	WM Store 10	1	24488946

[21]:
```
#Caculate Growth Rate.
SaleDataQ2 = QtrSales1[QtrSales1['Qtr'].isin([2, 3])].sort_values(by='Qtr_Sale',ascending=False)
GrowthRate = SaleDataQ2.pivot(index='Store', columns='Qtr', values='Qtr_Sale').reset_index()
GrowthRateF = pd.DataFrame(GrowthRate)
GrowthRateF= pd.DataFrame(GrowthRate)
GrowthRateF['GrowthRate'] = ((GrowthRateF.iloc[:,2]-GrowthRateF.iloc[:,1])/GrowthRateF.iloc[:,1]*100).round(2)
GrowthRateF = GrowthRateF.sort_values(by='GrowthRate',ascending=False)
GrowthRateF.head()
#Store 7 is the best QOQ growth rate in Quarter 3
```

[21]:

Qtr	Store	2	3	GrowthRate
42	WM Store 7	7290859	8262787	13.33
7	WM Store 16	6564336	7121544	8.49
28	WM Store 35	10838312	11322421	4.47
18	WM Store 26	13155335	13675693	3.96
32	WM Store 39	20214129	20715118	2.48

```
#Plotting 3rd Quarter Growth Rate.
plt.figure(figsize=(12,10),edgecolor='black',linewidth=4)
plt.barh(GrowthRateF['Store'][GrowthRateF['GrowthRate'] < 0], GrowthRateF['GrowthRate'][GrowthRateF['GrowthRate'] < 0], color='tomato')
plt.barh(GrowthRateF['Store'][GrowthRateF['GrowthRate'] > 0], GrowthRateF['GrowthRate'][GrowthRateF['GrowthRate'] > 0], color='cornflowe
plt.xticks(rotation=90)
plt.xlabel("Growth Rate")
plt.ylabel("Store Name")
plt.axvline(0, color='grey', lw=0.5)
plt.show()
```



[23]:
```
#Some holidays have a negative impact on sales.
#Find out holidays which have higher sales than the mean sales in non-holiday season for all stores together
HolidaySale = ProjData.copy()
HolidaySale = HolidaySale[HolidaySale['Holiday_Flag']==1]
HolidaySale.head()
```

[23]:

	Store	Date	Weekly_Sales	Holiday_Flag	Temperature	Fuel_Price	CPI	Unemployment	year	month	day	MonthName
1	WM Store 1	2010-02-12	1641957	1	38.51	2.548	211.242170	8.106	2010	2	12	February
31	WM Store 1	2010-09-10	1507461	1	78.69	2.565	211.495190	7.787	2010	9	10	September
42	WM Store 1	2010-11-26	1955624	1	64.52	2.735	211.748433	7.838	2010	11	26	November
47	WM Store 1	2010-12-31	1367320	1	48.43	2.943	211.404932	7.838	2010	12	31	December
53	WM Store 1	2011-02-11	1649615	1	36.39	3.022	212.936705	7.742	2011	2	11	February

[24]:
```
#Creating Holiday Variable.
def holiday(x):
    if x['day'] in [8,10,11,12] and x['MonthName']=='February': return "Super Bowl Day"
    elif x['day'] in [6,7,9,10] and x['MonthName']=='September': return "Labour Day"
    elif x['day'] in [23,25,26,29] and x['MonthName']=='November': return "ThanksGiving Day"
    elif x['day'] in [27,28,30,31] and x['MonthName']=='December': return "Christmas Day"
    else: return None

HolidaySale['HolidayName'] = HolidaySale.apply(holiday, axis=1)
```

```
HolidaySale['HolidayName'] = HolidaySale.apply(holiday, axis=1)
HolidaySale.head()
```

[24]:

	Store	Date	Weekly_Sales	Holiday_Flag	Temperature	Fuel_Price	CPI	Unemployment	year	month	day	MonthName	HolidayName
1	WM Store 1	2010-02-12	1641957	1	38.51	2.548	211.242170	8.106	2010	2	12	February	Super Bowl Day
31	WM Store 1	2010-09-10	1507461	1	78.69	2.565	211.495190	7.787	2010	9	10	September	Labour Day
42	WM Store 1	2010-11-26	1955624	1	64.52	2.735	211.748433	7.838	2010	11	26	November	ThanksGiving Day
47	WM Store 1	2010-12-31	1367320	1	48.43	2.943	211.404932	7.838	2010	12	31	December	Christmas Day
53	WM Store 1	2011-02-11	1649615	1	36.39	3.022	212.936705	7.742	2011	2	11	February	Super Bowl Day

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[25]:
```
NonHolidaySale = ProjData.copy()
NonHolidaySale = NonHolidaySale[NonHolidaySale['Holiday_Flag']==0]
NonHolidaySale.head()
```

[25]:

	Store	Date	Weekly_Sales	Holiday_Flag	Temperature	Fuel_Price	CPI	Unemployment	year	month	day	MonthName
0	WM Store 1	2010-02-05	1643691	0	42.31	2.572	211.096358	8.106	2010	2	5	February
2	WM Store 1	2010-02-19	1611968	0	39.93	2.514	211.289143	8.106	2010	2	19	February
3	WM Store 1	2010-02-26	1409728	0	46.63	2.561	211.319643	8.106	2010	2	26	February
4	WM Store 1	2010-03-05	1554807	0	46.50	2.625	211.350143	8.106	2010	3	5	March
5	WM Store 1	2010-03-12	1439542	0	57.79	2.667	211.380643	8.106	2010	3	12	March

[26]:
```
#Non holiday session mean value.
NonHolidayMean = NonHolidaySale.groupby("Store")["Weekly_Sales"].mean().reset_index(name="Average Sale").sort_values(by='Average Sale',
NonHolidayMean['Average Sale']=NonHolidayMean['Average Sale'].round(2)
NonHolidayMean = pd.DataFrame(NonHolidayMean)
NonHolidayMean = NonHolidayMean.reset_index(drop=True)
NonHolidayMean.head()
```

[26]:

	Store	Average Sale
0	WM Store 20	2097048.45
1	WM Store 4	2083555.84
2	WM Store 14	2013489.32
3	WM Store 13	1995393.00
4	WM Store 2	1914208.79

[27]:
```
#Mapping non holiday Mean value in holiday sales data.
meandict = NonHolidayMean.set_index('Store')['Average Sale'].to_dict()
HolidaySale['NonHolidayAvgSale'] = HolidaySale['Store'].map(meandict)
HolidaySale.head(5)
```

[27]:

	Store	Date	Weekly_Sales	Holiday_Flag	Temperature	Fuel_Price	CPI	Unemployment	year	month	day	MonthName	HolidayName	NonHolidayAvgSale
1	WM Store 1	2010-02-12	1641957	1	38.51	2.548	211.242170	8.106	2010	2	12	February	Super Bowl Day	1546957.42

[27]:

	Store	Date	Weekly_Sales	Holiday_Flag	Temperature	Fuel_Price	CPI	Unemployment	year	month	day	MonthName	HolidayName	NonHolidayAvgSale
1	WM Store 1	2010-02-12	1641957	1	38.51	2.548	211.242170	8.106	2010	2	12	February	Super Bowl Day	1546957.42
31	WM Store 1	2010-09-10	1507461	1	78.69	2.565	211.495190	7.787	2010	9	10	September	Labour Day	1546957.42
42	WM Store 1	2010-11-26	1955624	1	64.52	2.735	211.748433	7.838	2010	11	26	November	ThanksGiving Day	1546957.42
47	WM Store 1	2010-12-31	1367320	1	48.43	2.943	211.404932	7.838	2010	12	31	December	Christmas Day	1546957.42
53	WM Store 1	2011-02-11	1649615	1	36.39	3.022	212.936705	7.742	2011	2	11	February	Super Bowl Day	1546957.42

[28]:

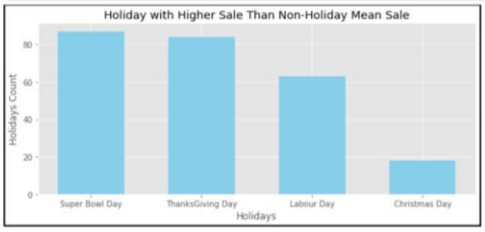
```
#Fetching holiday which has high sales than non holiday session.
HighSale = HolidaySale.query('Weekly_Sales > NonHolidayAvgSale')
HighSale.head()
```

[28]:

	Store	Date	Weekly_Sales	Holiday_Flag	Temperature	Fuel_Price	CPI	Unemployment	year	month	day	MonthName	HolidayName	NonHolidayAvgSale
1	WM Store 1	2010-02-12	1641957	1	38.51	2.548	211.242170	8.106	2010	2	12	February	Super Bowl Day	1546957.42
42	WM Store 1	2010-11-26	1955624	1	64.52	2.735	211.748433	7.838	2010	11	26	November	ThanksGiving Day	1546957.42
53	WM Store 1	2011-02-11	1649615	1	36.39	3.022	212.936705	7.742	2011	2	11	February	Super Bowl Day	1546957.42
94	WM Store 1	2011-11-25	2033321	1	60.14	3.236	218.467621	7.866	2011	11	25	November	ThanksGiving Day	1546957.42
105	WM Store 1	2012-02-10	1802477	1	48.02	3.409	220.265178	7.348	2012	2	10	February	Super Bowl Day	1546957.42

[29]:

```
holiday = HighSale['HolidayName'].value_counts()
holiday = pd.DataFrame(holiday).reset_index()
plt.figure(figsize=(10,4),edgecolor='black',linewidth=4)
plt.bar(holiday['index'], holiday['HolidayName'], color='skyblue', width=0.6)
plt.xlabel("Holidays")
plt.ylabel("Holidays Count")
plt.title("Holiday with Higher Sale Than Non-Holiday Mean Sale")
plt.show()
```



[30]:

```
#Provide a monthly and semester view of sales in units and give insights
```

[30]:

```
#Provide a monthly and semester view of sales in units and give insights
#Monthly Sale of all store
MonthlySale = ProjData.groupby("MonthName")["Weekly_Sales"].sum().reset_index(name="Total_Sale").sort_values(by='Total_Sale', ascending=
MonthlySale['Total_Sale']=MonthlySale['Total_Sale'].round(2)
MonthlySale.head()
```

[30]:

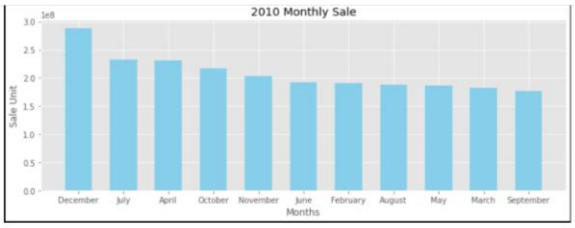
	MonthName	Total_Sale
5	July	650000979
0	April	646859782
6	June	622629884
1	August	613090208
7	March	592785886

[31]:

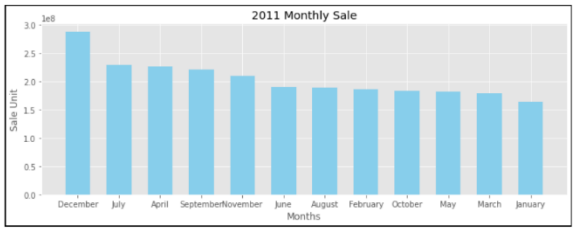
```
#Plotting Monthly Sale of all years
style.use("ggplot")
plt.figure(figsize=(12,4),edgecolor='black',linewidth=4)
plt.bar(MonthlySale['MonthName'], MonthlySale['Total_Sale'], color='skyblue', width=0.6)
plt.xlabel("Months")
plt.ylabel("Sale Unit")
plt.title("Overall Monthly Sale")
plt.xticks(rotation=45)
plt.show()
```

[32]:

```
#Year Wise Monthly Sale = 2010
Sale2010 = ProjData[ProjData['year']==2010].groupby("MonthName")["Weekly_Sales"].sum().reset_index(name="Total_Sale").sort_values(by='To
Sale2010['Total_Sale']=Sale2010['Total_Sale'].round(2)
plt.figure(figsize=(12,4),edgecolor='black',linewidth=4)
plt.bar(Sale2010['MonthName'], Sale2010['Total_Sale'], color='skyblue', width=0.6)
plt.xlabel("Months")
plt.ylabel("Sale Unit")
plt.title("2010 Monthly Sale")
plt.show()
```



[33]:
```
#Year Wise Monthly Sale= 2011
Sale2011 = ProjData[ProjData['year']==2011].groupby("MonthName")["Weekly_Sales"].sum().reset_index(name="Total_Sale").sort_values(by='Total_Sale', ascending=False)
Sale2011['Total_Sale']=Sale2011['Total_Sale'].round(2)
plt.figure(figsize=(12,4),edgecolor='black',linewidth=4)
plt.bar(Sale2011['MonthName'], Sale2011['Total_Sale'], color='skyblue', width=0.6)
plt.xlabel("Months")
plt.ylabel("Sale Unit")
plt.title("2011 Monthly Sale")
plt.show()
```



[34]:
```
#Year Wise Monthly Sale = 2012
Sale2012 = ProjData[ProjData['year']==2012].groupby("MonthName")["Weekly_Sales"].sum().reset_index(name="Total_Sale").sort_values(by='Total_Sale', ascending=Fals
Sale2012['Total_Sale']=Sale2012['Total_Sale'].round(2)
plt.figure(figsize=(12,4),edgecolor='black',linewidth=4)
plt.bar(Sale2012['MonthName'], Sale2012['Total_Sale'], color='skyblue', width=0.6)
plt.xlabel("Months")
plt.ylabel("Sale Unit")
plt.title("2012 Monthly Sale")
plt.show()
```

[35]:
```
#Plotting yearly Sale
YearlySale = ProjData.groupby("year")["Weekly_Sales"].sum().reset_index(name="Total_Sale").sort_values(by='Total_Sale', ascending=False)
YearlySale['Total_Sale']=YearlySale['Total_Sale'].round(2)
YearlySale['year']=YearlySale['year'].astype(str)
YearlySale.head()
```

[35]:

	year	Total_Sale
1	2011	2448200008
0	2010	2288886120
2	2012	2000132851

[36]:
```
#Plotting Year Sale
import matplotlib.pyplot as plt
import seaborn as sns
from matplotlib import style
style.use("ggplot")
plt.figure(figsize=(12,4),edgecolor='black',linewidth=4)
plt.bar(YearlySale['year'], YearlySale['Total_Sale'], color='skyblue', width=0.4)
plt.xlabel("Year")
plt.ylabel("Sale Unit")
plt.title("Yearly Sale")
plt.show()
```

[37]:
```
#Statistical Task
#For Store 1 – Build  prediction models to forecast demand
from sklearn.preprocessing import LabelEncoder
LabEncoder = LabelEncoder()
Store1Data = ProjData[ProjData['Store']=='WM Store 1']
Store1Data = Store1Data.copy()
Store1Data['Date_New'] = LabEncoder.fit_transform(Store1Data['Date'])
Store1Data.drop(['Store','Date','Holiday_Flag','year','month','day','MonthName'],axis=1 , inplace = True)
Store1Data.head()
```

[37]:

	Weekly_Sales	Temperature	Fuel_Price	CPI	Unemployment	Date_New
0	1643691	42.31	2.572	211.096358	8.106	0
1	1641957	38.51	2.548	211.242170	8.106	1
2	1611968	39.93	2.514	211.289143	8.106	2
3	1409728	46.63	2.561	211.319643	8.106	3
4	1554807	46.50	2.625	211.350143	8.106	4

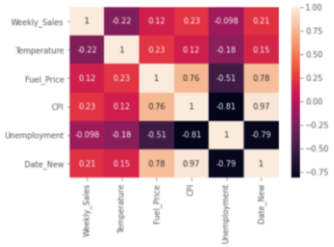
```
#Correlation matrix of Variables.
corrmatrix = Store1Data.corr()
print("Correlation matrix is : ")
print(corrmatrix)
```

```
Correlation matrix is :
              Weekly_Sales  Temperature  Fuel_Price       CPI  Unemployment  \
Weekly_Sales      1.000000    -0.222701    0.124592  0.225408     -0.097955
Temperature      -0.222701     1.000000    0.228493  0.118503     -0.180695
Fuel_Price        0.124592     0.228493    1.000000  0.755259     -0.513944
CPI               0.225408     0.118503    0.755259  1.000000     -0.813471
Unemployment     -0.097955    -0.180695   -0.513944 -0.813471      1.000000
Date_New          0.214539     0.154069    0.781789  0.973943     -0.791222

              Date_New
Weekly_Sales  0.214539
Temperature   0.154069
Fuel_Price    0.781789
CPI           0.973943
Unemployment -0.791222
Date_New      1.000000
```

+ Code + Markdown

[39]:
```
#Heatmap of Variables
ax = sns.heatmap(Store1Data.corr(), annot=True)
```



[40]:
```
#Looking heatmap and correlation table, Date,CPI,FuelPrice have correlation to Weekly Sales but all of these have multi colinearity, so

LRModelData = Store1Data[['Weekly_Sales','Date_New']]
LRModelData.shape
```

[40]: (143, 2)

```
# Creating train Test Data.
from sklearn.model_selection import train_test_split
T = LRModelData.drop("Weekly_Sales", axis=1)
X = np.array(T).reshape((-1, 1))
y = LRModelData["Weekly_Sales"]
X_train, X_test, y_train, y_test = train_test_split(X, y , test_size = 0.2, random_state = 21)
```

[42]:
```
print("Shape of X_train is " , X_train.shape)
print("Shape of y_train is " , y_train.shape)
print("======================================")
print("Shape of X_test is " , X_test.shape)
print("Shape of y_test is " , y_test.shape)
```

```
Shape of X_train is  (114, 1)
Shape of y_train is  (114,)
======================================
Shape of X_test is  (29, 1)
Shape of y_test is  (29,)
```

[43]:
```
from sklearn.linear_model import LinearRegression
LRModel = LinearRegression()
LRModel.fit(X_train,y_train)
```

[43]: LinearRegression()

[44]:
```
#Prediction
ypred = LRModel.predict(X_test)
ypred = ypred.round(2)
```

[45]:
```
from sklearn.metrics import mean_squared_error
from sklearn.metrics import mean_absolute_error

print("The RMSE value of the LR model on the test data is: ",np.sqrt(mean_squared_error(y_test , ypred)))
print("The MAE value of the LR model on the test data is: ", mean_absolute_error(y_test, ypred))
```

```
The RMSE value of the LR model on the test data is:  152074.97115154992
The MAE value of the LR model on the test data is:  108321.98689655172
```

[46]:
```
ActPred = pd.DataFrame({"Actual Sales" : y_test, "Predicted Sales": ypred})
ActPred.head()
```

[46]:

	Actual Sales	Predicted Sales
97	1881177	1574923.48
107	1539388	1583034.94
7	1404430	1501920.29
92	1594939	1570867.75
26	1605492	1517332.07

[47]:
```
# Plotting the value.
plt.figure(figsize=(8,4),edgecolor='black',linewidth=4)
plt.scatter(X_test, y_test, color='red')
plt.plot(X_train, LRModel.predict(X_train), color='blue') # plotting the regression line
plt.title("Sales vs Day")
plt.xlabel("Days")
plt.ylabel("Sales")
plt.show()
```

[47]:
```
# Plotting the value.
plt.figure(figsize=(8,4),edgecolor='black',linewidth=4)
plt.scatter(X_test, y_test, color='red')
plt.plot(X_train, LRModel.predict(X_train), color='blue') # plotting the regression line
plt.title("Sales vs Day")
plt.xlabel("Days")
plt.ylabel("Sales")
plt.show()
```

SOURCE CODE

```
# %% [code] {"execution":{"iopub.status.busy":"2021-06-
11T22:58:28.494601Z","iopub.execute_input":"2021-06-
11T22:58:28.494983Z","iopub.status.idle":"2021-06-
11T22:58:28.887805Z","shell.execute_reply.started":"2021-06-
11T22:58:28.494902Z","shell.execute_reply":"2021-06-11T22:58:28.886862Z"}}

import pandas as pd

import numpy as np

import matplotlib.pyplot as plt

import seaborn as sns

from matplotlib import style

style.use("ggplot")


# %% [code] {"execution":{"iopub.status.busy":"2021-06-
11T22:58:28.889073Z","iopub.execute_input":"2021-06-
11T22:58:28.889310Z","iopub.status.idle":"2021-06-
11T22:58:28.906705Z","shell.execute_reply.started":"2021-06-
11T22:58:28.889287Z","shell.execute_reply":"2021-06-11T22:58:28.905686Z"}}

ProjData = pd.read_csv("../input/walmart-store-sales/Walmart_Store_sales.csv")


# %% [code] {"execution":{"iopub.status.busy":"2021-06-
11T22:58:28.908512Z","iopub.execute_input":"2021-06-
11T22:58:28.908865Z","iopub.status.idle":"2021-06-
11T22:58:28.928524Z","shell.execute_reply.started":"2021-06-
11T22:58:28.908833Z","shell.execute_reply":"2021-06-11T22:58:28.927343Z"}}

##Data Inspection

ProjData.head()


# %% [code] {"execution":{"iopub.status.busy":"2021-06-
11T22:58:28.930501Z","iopub.execute_input":"2021-06-
11T22:58:28.930997Z","iopub.status.idle":"2021-06-
11T22:58:28.951543Z","shell.execute_reply.started":"2021-06-
11T22:58:28.930950Z","shell.execute_reply":"2021-06-11T22:58:28.950628Z"}}

ProjData.info()


# %% [code] {"execution":{"iopub.status.busy":"2021-06-
11T22:58:28.953211Z","iopub.execute_input":"2021-06-
```

11T22:58:28.953620Z","iopub.status.idle":"2021-06-
11T22:58:28.963200Z","shell.execute_reply.started":"2021-06-
11T22:58:28.953574Z","shell.execute_reply":"2021-06-11T22:58:28.962089Z"}}

ProjData.isna().sum()

%% [code] {"execution":{"iopub.status.busy":"2021-06-
11T22:58:28.969133Z","iopub.execute_input":"2021-06-
11T22:58:28.969738Z","iopub.status.idle":"2021-06-
11T22:58:29.012329Z","shell.execute_reply.started":"2021-06-
11T22:58:28.969677Z","shell.execute_reply":"2021-06-11T22:58:29.011283Z"}}

ProjData.describe()

%% [code] {"execution":{"iopub.status.busy":"2021-06-
11T22:58:29.015922Z","iopub.execute_input":"2021-06-
11T22:58:29.016260Z","iopub.status.idle":"2021-06-
11T22:58:29.025583Z","shell.execute_reply.started":"2021-06-
11T22:58:29.016230Z","shell.execute_reply":"2021-06-11T22:58:29.023824Z"}}

ProjData.size

%% [code] {"execution":{"iopub.status.busy":"2021-06-
11T22:58:29.027150Z","iopub.execute_input":"2021-06-
11T22:58:29.027550Z","iopub.status.idle":"2021-06-
11T22:58:29.039803Z","shell.execute_reply.started":"2021-06-
11T22:58:29.027512Z","shell.execute_reply":"2021-06-11T22:58:29.038551Z"}}

ProjData.shape

%% [code] {"execution":{"iopub.status.busy":"2021-06-
11T22:58:29.041595Z","iopub.execute_input":"2021-06-
11T22:58:29.042032Z","iopub.status.idle":"2021-06-
11T22:58:29.072729Z","shell.execute_reply.started":"2021-06-
11T22:58:29.041986Z","shell.execute_reply":"2021-06-11T22:58:29.071510Z"}}

#Converting Date Column in DateType

ProjData.Date = pd.to_datetime(ProjData.Date,dayfirst=True)

ProjData.Store = ProjData.Store.astype(str)

ProjData.Weekly_Sales = ProjData.Weekly_Sales.round(0).astype(int)

ProjData.Store = 'WM Store '+ ProjData.Store.astype(str)

%% [code] {"execution":{"iopub.status.busy":"2021-06-11T22:58:29.074459Z","iopub.execute_input":"2021-06-11T22:58:29.075184Z","iopub.status.idle":"2021-06-11T22:58:29.102450Z","shell.execute_reply.started":"2021-06-11T22:58:29.075136Z","shell.execute_reply":"2021-06-11T22:58:29.101588Z"}}

```
ProjData.info()
```

%% [code] {"execution":{"iopub.status.busy":"2021-06-11T22:58:29.104950Z","iopub.execute_input":"2021-06-11T22:58:29.105553Z","iopub.status.idle":"2021-06-11T22:58:29.121450Z","shell.execute_reply.started":"2021-06-11T22:58:29.105496Z","shell.execute_reply":"2021-06-11T22:58:29.120404Z"}}

```
ProjData.head()
```

%% [code] {"execution":{"iopub.status.busy":"2021-06-11T22:58:29.122893Z","iopub.execute_input":"2021-06-11T22:58:29.123556Z","iopub.status.idle":"2021-06-11T22:58:29.144784Z","shell.execute_reply.started":"2021-06-11T22:58:29.123503Z","shell.execute_reply":"2021-06-11T22:58:29.143568Z"}}

```
#Which store has maximum sales?

MaxSale =
ProjData.groupby("Store")["Weekly_Sales"].sum().reset_index(name="Total_Sale").sort_values(by='
Total_Sale', ascending=False)

MaxSale.head(5)

#the WM store 20 has the maximum sales value.
```

%% [code] {"execution":{"iopub.status.busy":"2021-06-11T22:58:29.146211Z","iopub.execute_input":"2021-06-11T22:58:29.146802Z","iopub.status.idle":"2021-06-11T22:58:29.660782Z","shell.execute_reply.started":"2021-06-11T22:58:29.146757Z","shell.execute_reply":"2021-06-11T22:58:29.659914Z"}}

```
#Plotting Maximum Sale

plt.figure(figsize=(10,4),edgecolor='black',linewidth=4)

plt.bar(MaxSale['Store'], MaxSale['Total_Sale'], color='green', width=0.6)

plt.xlabel("Store")

plt.ylabel("Sale Unit")

plt.title("Store Wise Sales")
```

```
plt.xticks(rotation=90)

plt.show()


# %% [code] {"execution":{"iopub.status.busy":"2021-06-
11T22:58:29.662134Z","iopub.execute_input":"2021-06-
11T22:58:29.662758Z","iopub.status.idle":"2021-06-
11T22:58:29.679169Z","shell.execute_reply.started":"2021-06-
11T22:58:29.662710Z","shell.execute_reply":"2021-06-11T22:58:29.678079Z"}}

#Which store has maximum standard deviation? i.e., the sales vary a lot. Also, find out the
coefficient of mean to standard deviation

MaxStd = ProjData.groupby("Store")["Weekly_Sales"].std().reset_index(name="Standard
Deviation").sort_values(by='Standard Deviation', ascending=False)

MaxStd['Standard Deviation']=MaxStd['Standard Deviation'].round(2)

MaxStd.head(5)


# %% [code] {"execution":{"iopub.status.busy":"2021-06-
11T22:58:29.680759Z","iopub.execute_input":"2021-06-
11T22:58:29.681339Z","iopub.status.idle":"2021-06-
11T22:58:30.201826Z","shell.execute_reply.started":"2021-06-
11T22:58:29.681288Z","shell.execute_reply":"2021-06-11T22:58:30.200796Z"}}

#Plotting Standard Deviation

plt.figure(figsize=(10,4),edgecolor='black',linewidth=4)

plt.bar(MaxStd['Store'], MaxStd['Standard Deviation'], color='skyblue', width=0.6)

plt.xlabel("Store")

plt.ylabel("Standard Deviation")

plt.title("Store Wise Standard Deviation")

plt.xticks(rotation=90)

plt.show()


# %% [code] {"execution":{"iopub.status.busy":"2021-06-
11T22:58:30.203119Z","iopub.execute_input":"2021-06-
11T22:58:30.203718Z","iopub.status.idle":"2021-06-
11T22:58:30.215915Z","shell.execute_reply.started":"2021-06-
11T22:58:30.203672Z","shell.execute_reply":"2021-06-11T22:58:30.214813Z"}}

#the coefficient of mean to standard deviation
```

```
MaxCoef =
ProjData.groupby("Store")["Weekly_Sales"].sum().reset_index(name="Total_Sale").sort_values(by='
Total_Sale', ascending=False)

CoefVar = lambda x: np.std(MaxCoef['Total_Sale'], ddof=1) / np.mean(MaxCoef['Total_Sale']) * 100

CoefVal = CoefVar(MaxCoef['Total_Sale'])


print("The Coefficient of Mean to Standard Deviation is", (round(CoefVal,2)))


# %% [code] {"execution":{"iopub.status.busy":"2021-06-
11T22:58:30.217414Z","iopub.execute_input":"2021-06-
11T22:58:30.217882Z","iopub.status.idle":"2021-06-
11T22:58:30.263144Z","shell.execute_reply.started":"2021-06-
11T22:58:30.217841Z","shell.execute_reply":"2021-06-11T22:58:30.261958Z"}}

#Which store/s has good quarterly growth rate in Q3'2012

import calendar

ProjData['year']= ProjData['Date'].dt.year

ProjData['month']= ProjData['Date'].dt.month

ProjData['day']= ProjData['Date'].dt.day

ProjData['MonthName']= ProjData['month'].apply(lambda x: calendar.month_name[x])

ProjData.head(5)


# %% [code] {"execution":{"iopub.status.busy":"2021-06-
11T22:58:30.264656Z","iopub.execute_input":"2021-06-
11T22:58:30.265059Z","iopub.status.idle":"2021-06-
11T22:58:30.286452Z","shell.execute_reply.started":"2021-06-
11T22:58:30.265015Z","shell.execute_reply":"2021-06-11T22:58:30.284751Z"}}

SaleData2012 = ProjData[ProjData['year']==2012]

SaleData2012.head(5)


# %% [code] {"execution":{"iopub.status.busy":"2021-06-
11T22:58:30.288996Z","iopub.execute_input":"2021-06-
11T22:58:30.289307Z","iopub.status.idle":"2021-06-
11T22:58:30.367051Z","shell.execute_reply.started":"2021-06-
11T22:58:30.289278Z","shell.execute_reply":"2021-06-11T22:58:30.365663Z"}}

def calqtr(x):

    if x['month']==1 or x['month']==2 or x['month']==3: return 1
```

```
    elif x['month']==4 or x['month']==5 or x['month']==6: return 2
    elif x['month']==7 or x['month']==8 or x['month']==9: return 3
    else: return 4

SaleData2012Qtr = SaleData2012.copy()
SaleData2012Qtr['Qtr'] = SaleData2012.apply(calqtr, axis=1)

SaleData2012Qtr.head(5)

# %% [code] {"execution":{"iopub.status.busy":"2021-06-
11T22:58:30.368947Z","iopub.execute_input":"2021-06-
11T22:58:30.369401Z","iopub.status.idle":"2021-06-
11T22:58:30.390561Z","shell.execute_reply.started":"2021-06-
11T22:58:30.369354Z","shell.execute_reply":"2021-06-11T22:58:30.389769Z"}}
QtrSales =
SaleData2012Qtr.groupby(["Store",'Qtr'])["Weekly_Sales"].sum().reset_index(name="Qtr_Sale").sort
_values(by='Store')
QtrSales1 = pd.DataFrame(QtrSales)
QtrSales1.head()

# %% [code] {"execution":{"iopub.status.busy":"2021-06-
11T22:58:30.391557Z","iopub.execute_input":"2021-06-
11T22:58:30.391959Z","iopub.status.idle":"2021-06-
11T22:58:30.413802Z","shell.execute_reply.started":"2021-06-
11T22:58:30.391931Z","shell.execute_reply":"2021-06-11T22:58:30.412460Z"}}
#Caculate Growth Rate.
SaleDataQ2 = QtrSales1[QtrSales1['Qtr'].isin([2, 3])].sort_values(by='Qtr_Sale',ascending=False)
GrowthRate = SaleDataQ2.pivot(index='Store', columns='Qtr', values='Qtr_Sale').reset_index()
GrowthRateF= pd.DataFrame(GrowthRate)
GrowthRateF['GrowthRate'] = ((GrowthRateF.iloc[:,2]-
GrowthRateF.iloc[:,1])/GrowthRateF.iloc[:,1]*100).round(2)
GrowthRateF = GrowthRateF.sort_values(by='GrowthRate',ascending=False)
GrowthRateF.head()
#Store 7 is the best QOQ growth rate in Quarter 3
```

%% [code] {"execution":{"iopub.status.busy":"2021-06-11T22:58:30.415285Z","iopub.execute_input":"2021-06-11T22:58:30.415681Z","iopub.status.idle":"2021-06-11T22:58:30.998449Z","shell.execute_reply.started":"2021-06-11T22:58:30.415647Z","shell.execute_reply":"2021-06-11T22:58:30.997262Z"}}

#Plotting 3rd Quarter Growth Rate.

```
plt.figure(figsize=(12,10),edgecolor='black',linewidth=4)

plt.barh(GrowthRateF['Store'][GrowthRateF['GrowthRate'] < 0], GrowthRateF['GrowthRate'][GrowthRateF['GrowthRate']  < 0], color='tomato')

plt.barh(GrowthRateF['Store'][GrowthRateF['GrowthRate'] > 0], GrowthRateF['GrowthRate'][GrowthRateF['GrowthRate'] > 0], color='cornflowerblue')

plt.xticks(rotation=90)

plt.xlabel("Growth Rate")

plt.ylabel("Store Name")

plt.axvline(0, color='grey', lw=0.5)

plt.show()
```

%% [code] {"execution":{"iopub.status.busy":"2021-06-11T22:58:30.999902Z","iopub.execute_input":"2021-06-11T22:58:31.000329Z","iopub.status.idle":"2021-06-11T22:58:31.022558Z","shell.execute_reply.started":"2021-06-11T22:58:31.000283Z","shell.execute_reply":"2021-06-11T22:58:31.021083Z"}}

#Some holidays have a negative impact on sales.

#Find out holidays which have higher sales than the mean sales in non-holiday season for all stores together

```
HolidaySale = ProjData.copy()

HolidaySale = HolidaySale[HolidaySale['Holiday_Flag']==1]

HolidaySale.head()
```

%% [code] {"execution":{"iopub.status.busy":"2021-06-11T22:58:31.024194Z","iopub.execute_input":"2021-06-11T22:58:31.024608Z","iopub.status.idle":"2021-06-11T22:58:31.062496Z","shell.execute_reply.started":"2021-06-11T22:58:31.024564Z","shell.execute_reply":"2021-06-11T22:58:31.061362Z"}}

#Creating Holiday Variable.

```
def holiday(x):
    if x['day'] in [8,10,11,12] and x['MonthName']=='February': return "Super Bowl Day"
    elif x['day'] in [6,7,9,10] and x['MonthName']=='September': return "Labour Day"
    elif x['day'] in [23,25,26,29] and x['MonthName']=='November': return "ThanksGiving Day"
    elif x['day'] in [27,28,30,31] and x['MonthName']=='December': return "Christmas Day"
    else: return None

HolidaySale['HolidayName'] = HolidaySale.apply(holiday, axis=1)
HolidaySale.head()

# %% [code] {"execution":{"iopub.status.busy":"2021-06-
11T22:58:31.063828Z","iopub.execute_input":"2021-06-
11T22:58:31.064361Z","iopub.status.idle":"2021-06-
11T22:58:31.096391Z","shell.execute_reply.started":"2021-06-
11T22:58:31.064325Z","shell.execute_reply":"2021-06-11T22:58:31.095257Z"}}
NonHolidaySale = ProjData.copy()
NonHolidaySale = NonHolidaySale[NonHolidaySale['Holiday_Flag']==0]
NonHolidaySale.head()

# %% [code] {"execution":{"iopub.status.busy":"2021-06-
11T22:58:31.097542Z","iopub.execute_input":"2021-06-
11T22:58:31.098006Z","iopub.status.idle":"2021-06-
11T22:58:31.114193Z","shell.execute_reply.started":"2021-06-
11T22:58:31.097972Z","shell.execute_reply":"2021-06-11T22:58:31.113310Z"}}
#Non holiday session mean value.
NonHolidayMean =
NonHolidaySale.groupby("Store")["Weekly_Sales"].mean().reset_index(name="Average
Sale").sort_values(by='Average Sale', ascending=False)
NonHolidayMean['Average Sale']=NonHolidayMean['Average Sale'].round(2)
NonHolidayMean = pd.DataFrame(NonHolidayMean)
NonHolidayMean = NonHolidayMean.reset_index(drop=True)
NonHolidayMean.head()

# %% [code] {"execution":{"iopub.status.busy":"2021-06-
11T22:58:31.115509Z","iopub.execute_input":"2021-06-
```

11T22:58:31.116087Z","iopub.status.idle":"2021-06-11T22:58:31.149944Z","shell.execute_reply.started":"2021-06-11T22:58:31.116048Z","shell.execute_reply":"2021-06-11T22:58:31.148695Z"}}

#Mapping non holiday Mean value in holiday sales data.

meandict = NonHolidayMean.set_index('Store')['Average Sale'].to_dict()

HolidaySale['NonHolidayAvgSale'] = HolidaySale['Store'].map(meandict)

HolidaySale.head(5)

%% [code] {"execution":{"iopub.status.busy":"2021-06-11T22:58:31.152071Z","iopub.execute_input":"2021-06-11T22:58:31.152386Z","iopub.status.idle":"2021-06-11T22:58:31.188466Z","shell.execute_reply.started":"2021-06-11T22:58:31.152356Z","shell.execute_reply":"2021-06-11T22:58:31.187375Z"}}

#Fetching holiday which has high sales than non holiday session.

HighSale = HolidaySale.query('Weekly_Sales > NonHolidayAvgSale')

HighSale.head()

%% [code] {"execution":{"iopub.status.busy":"2021-06-11T22:58:31.190263Z","iopub.execute_input":"2021-06-11T22:58:31.190601Z","iopub.status.idle":"2021-06-11T22:58:31.328178Z","shell.execute_reply.started":"2021-06-11T22:58:31.190563Z","shell.execute_reply":"2021-06-11T22:58:31.327040Z"}}

holiday = HighSale['HolidayName'].value_counts()

holiday = pd.DataFrame(holiday).reset_index()

plt.figure(figsize=(10,4),edgecolor='black',linewidth=4)

plt.bar(holiday['index'], holiday['HolidayName'], color='skyblue', width=0.6)

plt.xlabel("Holidays")

plt.ylabel("Holidays Count")

plt.title("Holiday with Higher Sale Than Non-Holiday Mean Sale")

plt.show()

%% [code] {"execution":{"iopub.status.busy":"2021-06-11T22:58:31.329796Z","iopub.execute_input":"2021-06-11T22:58:31.330090Z","iopub.status.idle":"2021-06-11T22:58:31.345347Z","shell.execute_reply.started":"2021-06-11T22:58:31.330062Z","shell.execute_reply":"2021-06-11T22:58:31.344453Z"}}

#Provide a monthly and semester view of sales in units and give insights

#Monthly Sale of all store

MonthlySale =
ProjData.groupby("MonthName")["Weekly_Sales"].sum().reset_index(name="Total_Sale").sort_values(by='Total_Sale', ascending=False)

MonthlySale['Total_Sale']=MonthlySale['Total_Sale'].round(2)

MonthlySale.head()

%% [code] {"execution":{"iopub.status.busy":"2021-06-11T22:58:31.346878Z","iopub.execute_input":"2021-06-11T22:58:31.347269Z","iopub.status.idle":"2021-06-11T22:58:31.538121Z","shell.execute_reply.started":"2021-06-11T22:58:31.347237Z","shell.execute_reply":"2021-06-11T22:58:31.536972Z"}}

#Plotting Monthly Sale of all years

style.use("ggplot")

plt.figure(figsize=(12,4),edgecolor='black',linewidth=4)

plt.bar(MonthlySale['MonthName'], MonthlySale['Total_Sale'], color='skyblue', width=0.6)

plt.xlabel("Months")

plt.ylabel("Sale Unit")

plt.title("Overall Monthly Sale")

plt.xticks(rotation=45)

plt.show()

%% [code] {"execution":{"iopub.status.busy":"2021-06-11T22:58:31.539706Z","iopub.execute_input":"2021-06-11T22:58:31.540099Z","iopub.status.idle":"2021-06-11T22:58:31.721137Z","shell.execute_reply.started":"2021-06-11T22:58:31.540053Z","shell.execute_reply":"2021-06-11T22:58:31.720230Z"}}

#Year Wise Monthly Sale = 2010

Sale2010 =
ProjData[ProjData['year']==2010].groupby("MonthName")["Weekly_Sales"].sum().reset_index(name="Total_Sale").sort_values(by='Total_Sale', ascending=False)

Sale2010['Total_Sale']=Sale2010['Total_Sale'].round(2)

plt.figure(figsize=(12,4),edgecolor='black',linewidth=4)

plt.bar(Sale2010['MonthName'], Sale2010['Total_Sale'], color='skyblue', width=0.6)

```
plt.xlabel("Months")

plt.ylabel("Sale Unit")

plt.title("2010 Monthly Sale")

plt.show()


# %% [code] {"execution":{"iopub.status.busy":"2021-06-
11T22:58:31.724536Z","iopub.execute_input":"2021-06-
11T22:58:31.724887Z","iopub.status.idle":"2021-06-
11T22:58:31.906113Z","shell.execute_reply.started":"2021-06-
11T22:58:31.724856Z","shell.execute_reply":"2021-06-11T22:58:31.905365Z"}}

#Year Wise Monthly Sale= 2011

Sale2011 =
ProjData[ProjData['year']==2011].groupby("MonthName")["Weekly_Sales"].sum().reset_index(name
="Total_Sale").sort_values(by='Total_Sale', ascending=False)

Sale2011['Total_Sale']=Sale2011['Total_Sale'].round(2)

plt.figure(figsize=(12,4),edgecolor='black',linewidth=4)

plt.bar(Sale2011['MonthName'], Sale2011['Total_Sale'], color='skyblue', width=0.6)

plt.xlabel("Months")

plt.ylabel("Sale Unit")

plt.title("2011 Monthly Sale")

plt.show()


# %% [code] {"execution":{"iopub.status.busy":"2021-06-
11T22:58:31.909175Z","iopub.execute_input":"2021-06-
11T22:58:31.909588Z","iopub.status.idle":"2021-06-
11T22:58:32.190255Z","shell.execute_reply.started":"2021-06-
11T22:58:31.909556Z","shell.execute_reply":"2021-06-11T22:58:32.189537Z"}}

#Year Wise Monthly Sale = 2012

Sale2012 =
ProjData[ProjData['year']==2012].groupby("MonthName")["Weekly_Sales"].sum().reset_index(name
="Total_Sale").sort_values(by='Total_Sale', ascending=False)

Sale2012['Total_Sale']=Sale2012['Total_Sale'].round(2)

plt.figure(figsize=(12,4),edgecolor='black',linewidth=4)

plt.bar(Sale2012['MonthName'], Sale2012['Total_Sale'], color='skyblue', width=0.6)

plt.xlabel("Months")
```

```
plt.ylabel("Sale Unit")

plt.title("2012 Monthly Sale")

plt.show()


# %% [code] {"execution":{"iopub.status.busy":"2021-06-
11T22:58:32.191307Z","iopub.execute_input":"2021-06-
11T22:58:32.191691Z","iopub.status.idle":"2021-06-
11T22:58:32.206252Z","shell.execute_reply.started":"2021-06-
11T22:58:32.191662Z","shell.execute_reply":"2021-06-11T22:58:32.205075Z"}}

#Plotting yearly Sale

YearlySale =
ProjData.groupby("year")["Weekly_Sales"].sum().reset_index(name="Total_Sale").sort_values(by='T
otal_Sale', ascending=False)

YearlySale['Total_Sale']=YearlySale['Total_Sale'].round(2)

YearlySale['year']=YearlySale['year'].astype(str)

YearlySale.head()


# %% [code] {"execution":{"iopub.status.busy":"2021-06-
11T22:58:32.207961Z","iopub.execute_input":"2021-06-
11T22:58:32.208286Z","iopub.status.idle":"2021-06-
11T22:58:32.332619Z","shell.execute_reply.started":"2021-06-
11T22:58:32.208253Z","shell.execute_reply":"2021-06-11T22:58:32.331248Z"}}

#Plotting Year Sale

import matplotlib.pyplot as plt

import seaborn as sns

from matplotlib import style

style.use("ggplot")

plt.figure(figsize=(12,4),edgecolor='black',linewidth=4)

plt.bar(YearlySale['year'], YearlySale['Total_Sale'], color='skyblue', width=0.4)

plt.xlabel("Year")

plt.ylabel("Sale Unit")

plt.title("Yearly Sale")

plt.show()
```

%% [code] {"execution":{"iopub.status.busy":"2021-06-11T22:58:32.334147Z","iopub.execute_input":"2021-06-11T22:58:32.334549Z","iopub.status.idle":"2021-06-11T22:58:32.395614Z","shell.execute_reply.started":"2021-06-11T22:58:32.334504Z","shell.execute_reply":"2021-06-11T22:58:32.394896Z"}}

#Statistical Task

#For Store 1 – Build prediction models to forecast demand

from sklearn.preprocessing import LabelEncoder

LabEncoder = LabelEncoder()

Store1Data = ProjData[ProjData['Store']=='WM Store 1']

Store1Data = Store1Data.copy()

Store1Data['Date_New'] = LabEncoder.fit_transform(Store1Data['Date'])

Store1Data.drop(['Store','Date','Holiday_Flag','year','month','day','MonthName'],axis=1 , inplace = True)

Store1Data.head()

%% [code] {"execution":{"iopub.status.busy":"2021-06-11T22:58:32.396544Z","iopub.execute_input":"2021-06-11T22:58:32.396941Z","iopub.status.idle":"2021-06-11T22:58:32.408366Z","shell.execute_reply.started":"2021-06-11T22:58:32.396911Z","shell.execute_reply":"2021-06-11T22:58:32.407034Z"}}

#Correlation matrix of Variables.

corrmatrix = Store1Data.corr()

print("Correlation matrix is : ")

print(corrmatrix)

%% [code] {"execution":{"iopub.status.busy":"2021-06-11T22:58:32.409742Z","iopub.execute_input":"2021-06-11T22:58:32.410060Z","iopub.status.idle":"2021-06-11T22:58:32.805940Z","shell.execute_reply.started":"2021-06-11T22:58:32.410018Z","shell.execute_reply":"2021-06-11T22:58:32.805168Z"}}

#Heatmap of Variables

ax = sns.heatmap(Store1Data.corr(), annot=True)

%% [code] {"execution":{"iopub.status.busy":"2021-06-11T22:58:32.806941Z","iopub.execute_input":"2021-06-

11T22:58:32.807344Z","iopub.status.idle":"2021-06-
11T22:58:32.814444Z","shell.execute_reply.started":"2021-06-
11T22:58:32.807304Z","shell.execute_reply":"2021-06-11T22:58:32.813577Z"}}

#Looking heatmap and correlation table, Date,CPI,FuelPrice have correlation to Weekly Sales but all of these have multi colinearity, so we will build the model on Date Variable.

```
LRModelData = Store1Data[['Weekly_Sales','Date_New']]

LRModelData.shape
```

%% [code] {"execution":{"iopub.status.busy":"2021-06-
11T22:58:32.815777Z","iopub.execute_input":"2021-06-
11T22:58:32.816274Z","iopub.status.idle":"2021-06-
11T22:58:32.843572Z","shell.execute_reply.started":"2021-06-
11T22:58:32.816236Z","shell.execute_reply":"2021-06-11T22:58:32.842729Z"}}

```
# Creating train Test Data.

from sklearn.model_selection import train_test_split

T = LRModelData.drop("Weekly_Sales", axis=1)

X = np.array(T).reshape((-1, 1))

y = LRModelData["Weekly_Sales"]

X_train, X_test, y_train, y_test = train_test_split(X, y , test_size = 0.2, random_state = 21)
```

%% [code] {"execution":{"iopub.status.busy":"2021-06-
11T22:58:32.844657Z","iopub.execute_input":"2021-06-
11T22:58:32.845091Z","iopub.status.idle":"2021-06-
11T22:58:32.852297Z","shell.execute_reply.started":"2021-06-
11T22:58:32.845051Z","shell.execute_reply":"2021-06-11T22:58:32.851240Z"}}

```
print("Shape of X_train is " , X_train.shape)

print("Shape of y_train is " , y_train.shape)

print("====================================")

print("Shape of X_test is " , X_test.shape)

print("Shape of y_test is " , y_test.shape)
```

%% [code] {"execution":{"iopub.status.busy":"2021-06-
11T22:58:32.854191Z","iopub.execute_input":"2021-06-
11T22:58:32.854943Z","iopub.status.idle":"2021-06-

11T22:58:32.888275Z","shell.execute_reply.started":"2021-06-11T22:58:32.854894Z","shell.execute_reply":"2021-06-11T22:58:32.887030Z"}}

```
from sklearn.linear_model import LinearRegression

LRModel = LinearRegression()

LRModel.fit(X_train,y_train)
```

%% [code] {"execution":{"iopub.status.busy":"2021-06-11T22:58:32.889343Z","iopub.execute_input":"2021-06-11T22:58:32.889612Z","iopub.status.idle":"2021-06-11T22:58:32.894966Z","shell.execute_reply.started":"2021-06-11T22:58:32.889584Z","shell.execute_reply":"2021-06-11T22:58:32.894022Z"}}

```
#Prediction

ypred = LRModel.predict(X_test)

ypred = ypred.round(2)
```

%% [code] {"execution":{"iopub.status.busy":"2021-06-11T22:58:32.896587Z","iopub.execute_input":"2021-06-11T22:58:32.897010Z","iopub.status.idle":"2021-06-11T22:58:32.911183Z","shell.execute_reply.started":"2021-06-11T22:58:32.896977Z","shell.execute_reply":"2021-06-11T22:58:32.910050Z"}}

```
from sklearn.metrics import mean_squared_error

from sklearn.metrics import mean_absolute_error


print("The RMSE value of the LR model on the test data is: ",np.sqrt(mean_squared_error(y_test , ypred)))

print("The MAE value of the LR model on the test data is: ", mean_absolute_error(y_test, ypred))
```

%% [code] {"execution":{"iopub.status.busy":"2021-06-11T22:58:32.912842Z","iopub.execute_input":"2021-06-11T22:58:32.913195Z","iopub.status.idle":"2021-06-11T22:58:32.933443Z","shell.execute_reply.started":"2021-06-11T22:58:32.913163Z","shell.execute_reply":"2021-06-11T22:58:32.932121Z"}}

```
ActPred = pd.DataFrame({"Actual Sales" : y_test, "Predicted Sales": ypred})

ActPred.head()
```

%% [code] {"execution":{"iopub.status.busy":"2021-06-11T22:58:32.935146Z","iopub.execute_input":"2021-06-11T22:58:32.935759Z","iopub.status.idle":"2021-06-11T22:58:33.093737Z","shell.execute_reply.started":"2021-06-11T22:58:32.935498Z","shell.execute_reply":"2021-06-11T22:58:33.091877Z"}}

Plotting the value.

```
plt.figure(figsize=(8,4),edgecolor='black',linewidth=4)

plt.scatter(X_test, y_test, color='red')

plt.plot(X_train, LRModel.predict(X_train), color='blue') # plotting the regression line

plt.title("Sales vs Day")

plt.xlabel("Days")

plt.ylabel("Sales")

plt.show()
```