Start coding or generate with AI.

SALES ANALYSIS USING PYTHON LIBRARIES

Project statement: AAL, established in 2000, is a well-known brand in Australia, particularly recognized for its clothing business. It has opened branches in various states, metropolises, and tier-1 and tier-2 cities across the country. The brand caters to all age groups, from kids to the elderly. Currently experiencing a surge in business, AAL is actively pursuing expansion opportunities. To facilitate informed investment decisions, the CEO has assigned the responsibility to the head of AAL's sales and marketing (S&M) department. The specific tasks include: 1) Identify the states that are generating the highest revenues. 2) Develop sales programs for states with lower revenues. The head of sales and marketing has requested your assistance with this task. Analyze the sales data of the company for the fourth quarter in Australia, examining it on a state-by-state basis. Provide insights to assist the company in making data-driven decisions for the upcoming year

```
#import the required libraries.
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from scipy import stats
```

```
# Create a pandas data frame and read the AusApparalSales4thQrt2020.csv file
df1 = pd.read_csv('AusApparalSales4thQrt2020.csv')
```

```
#view the top 5 entities of the df
df1.head()
```

	Date	Time	State	Group	Unit	Sales
0	1-Oct-2020	Morning	WA	Kids	8	20000
1	1-Oct-2020	Morning	WA	Men	8	20000
2	1-Oct-2020	Morning	WA	Women	4	10000
3	1-Oct-2020	Morning	WA	Seniors	15	37500
4	1-Oct-2020	Afternoon	WA	Kids	3	7500

```
#get the basic info about the df
df1.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 7560 entries, 0 to 7559
Data columns (total 6 columns):
 #   Column  Non-Null Count  Dtype
---  ------  --------------  -----
 0   Date    7560 non-null   object
 1   Time    7560 non-null   object
 2   State   7560 non-null   object
 3   Group   7560 non-null   object
 4   Unit    7560 non-null   int64
 5   Sales   7560 non-null   int64
dtypes: int64(2), object(4)
memory usage: 354.5+ KB
```

#1. Data wrangling

```
#a. Ensure that the data is clean and free from any missing or incorrect entries.
#o Inspect the data manually to identify missing or incorrect information using the functions isna() and notna()
df1.isna().sum()
```

```
         0
 Date    0
 Time    0
 State   0
 Group   0
 Unit    0
 Sales   0

dtype: int64
```

```
df1.notna().sum()
```

```
            0
 Date    7560
 Time    7560
 State   7560
 Group   7560
 Unit    7560
 Sales   7560

dtype: int64
```

OBSERVATION

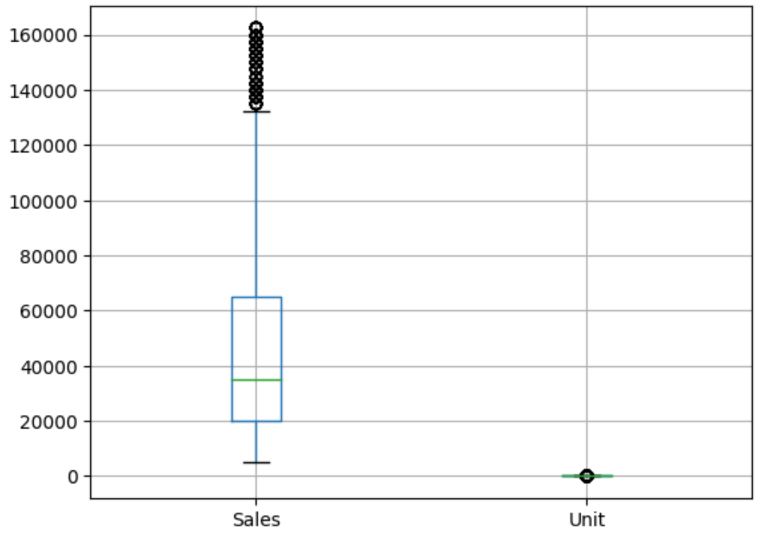
- *It's observed that there are no columns with null/Nan values.*
- Unit ans Sales are the columns with numeric values.

```
#Converting the 'Date' column to datetime delta.
df1['Date'] = pd.to_datetime(df1['Date'])
```

Converted the dtype of column 'Date' into 'datetime

```
df1.boxplot(column=['Sales','Unit'])
```

```
<Axes: >
```



Observation:

1.Since Value of Unit sold is much lower than the values of the Sales, the plotting of Sales and Units together will not be easy to understand.

2.So the values of these columns neeed to be Normalized to get a better visualization of the values.

Normalization of columns namely 'Unit' and 'Sales using MinMaxScaler() from Scikitlearn Library

```
from sklearn.preprocessing import MinMaxScaler
```

```
# Assign the columns "Unit" and "Sales" to the variable X
X=df1[['Unit','Sales']]
#Initiate the MinMaxScaler() using the variable Scaler.
scaler=MinMaxScaler()
#Noemalize the valus of X using "scaler.fit_transform" method and asign it to X_Scaled.
#Xscaled as as result holds the array of Normalized values of Unit ans Sales.
X_scaled=scaler.fit_transform(X)
X_scaled
```

```
array([[0.0952381 , 0.0952381 ],
       [0.0952381 , 0.0952381 ],
       [0.03174603, 0.03174603],
       ...,
       [0.20634921, 0.20634921],
       [0.14285714, 0.14285714],
       [0.17460317, 0.17460317]])
```

```
# Convert X_scaled to a DataFrame with appropriate column names
X_scaled_df = pd.DataFrame(X_scaled, columns=['scaled_Unit', 'scaled_Sales'])

# Concatenate the scaled data with the original DataFrame
df1_merged = pd.concat([df1, X_scaled_df], axis=1)

print(df1_merged)
```

```
           Date       Time State    Group  Unit  Sales  scaled_Unit  \
0    2020-10-01    Morning    WA     Kids     8  20000     0.095238
1    2020-10-01    Morning    WA      Men     8  20000     0.095238
2    2020-10-01    Morning    WA    Women     4  10000     0.031746
3    2020-10-01    Morning    WA  Seniors    15  37500     0.206349
4    2020-10-01  Afternoon    WA     Kids     3   7500     0.015873
...         ...        ...   ...      ...   ...    ...          ...
7555 2020-12-30  Afternoon   TAS  Seniors    14  35000     0.190476
7556 2020-12-30    Evening   TAS     Kids    15  37500     0.206349
7557 2020-12-30    Evening   TAS      Men    15  37500     0.206349
7558 2020-12-30    Evening   TAS    Women    11  27500     0.142857
7559 2020-12-30    Evening   TAS  Seniors    13  32500     0.174603

      scaled_Sales
0         0.095238
1         0.095238
2         0.031746
3         0.206349
4         0.015873
...            ...
7555      0.190476
7556      0.206349
7557      0.206349
7558      0.142857
7559      0.174603

[7560 rows x 8 columns]
```

```
df1_merged.info()
```

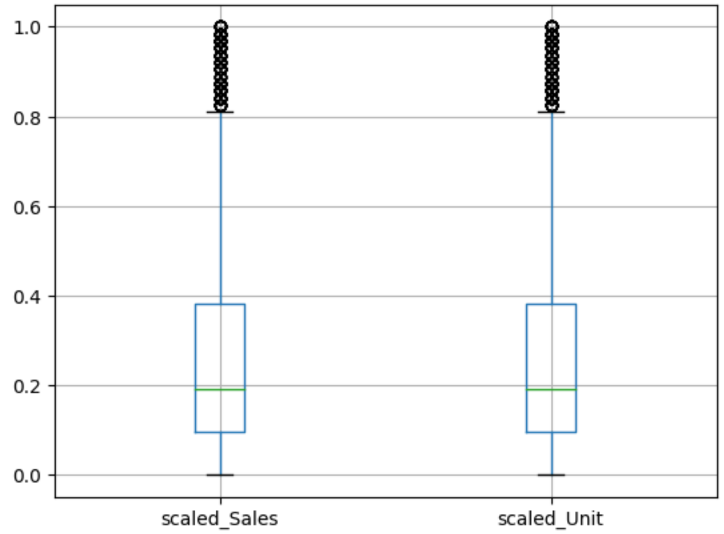
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 7560 entries, 0 to 7559
Data columns (total 8 columns):
 #   Column        Non-Null Count  Dtype
---  ------        --------------  -----
 0   Date          7560 non-null   datetime64[ns]
 1   Time          7560 non-null   object
 2   State         7560 non-null   object
 3   Group         7560 non-null   object
 4   Unit          7560 non-null   int64
 5   Sales         7560 non-null   int64
 6   scaled_Unit   7560 non-null   float64
 7   scaled_Sales  7560 non-null   float64
dtypes: datetime64[ns](1), float64(2), int64(2), object(3)
memory usage: 472.6+ KB
```

2. Data analysis

a.Perform descriptive statistical analysis on the data in the Sales and Unit columns. Utilize techniques such as mean, median, mode, and standard deviation for this analysis.

```
df1_merged.boxplot(column=['scaled_Sales','scaled_Unit'])
```

```
<Axes: >
```



***Observation:** 1.The values of Scaled_Sales and scaled_Unit are almost similar as they are normalized using the formula* **((X-min(X))/(max(X)-min(X))**

```
df1_merged[['scaled_Unit','scaled_Sales']].describe()
```

	scaled_Unit	scaled_Sales
count	7560.000000	7560.000000
mean	0.254054	0.254054
std	0.204784	0.204784
min	0.000000	0.000000
25%	0.095238	0.095238
50%	0.190476	0.190476
75%	0.380952	0.380952
max	1.000000	1.000000

```
df1_merged[['scaled_Unit','scaled_Sales']].median()
```

	0
scaled_Unit	0.190476
scaled_Sales	0.190476

dtype: float64

Observation

1. *As both the Scaled_Unit and Scaled_Sales are the columns with Numeric Values, calculation of mode is not applicable.*
2. *The basic discriptive statistics is given by the .describe() function.To calculate the median values of the .median() function is used *

b. Identify the group with the highest sales and the group with the lowest sales based on the data provided

```
Sales_by_group=df1_merged.groupby('Group')['Sales'].agg([ 'min', 'max'])
Sales_by_group
```

	min	max
Group		
Kids	5000	162500
Men	5000	160000
Seniors	5000	162500
Women	5000	162500

c. Generate weekly, monthly, and quarterly reports to document and present the results of the analysis conducted

```
# Weekly Report
df1_merged['Week'] = df1_merged['Date'].dt.isocalendar().week
weekly_sales = df1_merged.groupby('Week')['Sales'].sum()
print("The weekly sales is\n" ,weekly_sales)

# Monthly Report
df1_merged['Month'] = df1_merged['Date'].dt.month
monthly_sales = df1_merged.groupby('Month')['Sales'].sum()
print("\nMonthly Sales Report:\n",monthly_sales)
print(monthly_sales)

# Quarterly Report
df1_merged['Quarter'] = df1_merged['Date'].dt.quarter
quarterly_sales = df1_merged['Sales'].sum()
print("\nQuarterly Sales Report:\n")
print("Total Sales for the Quarter:", quarterly_sales)
```

```
The weekly sales is
 Week
40    15045000
41    27002500
42    26640000
43    26815000
44    21807500
45    20865000
46    21172500
47    21112500
48    21477500
49    29622500
50    31525000
51    31655000
52    31770000
53    13792500
Name: Sales, dtype: int64

Monthly Sales Report:
 Month
10    114290000
11     90682500
12    135330000
Name: Sales, dtype: int64
Month
10    114290000
11     90682500
12    135330000
Name: Sales, dtype: int64

Quarterly Sales Report:

Total Sales for the Quarter: 340302500
```

3) Data visualization

a. Use suitable data visualization libraries to construct a dashboard for the head of sales and marketing. The dashboard should encompass key parameters:

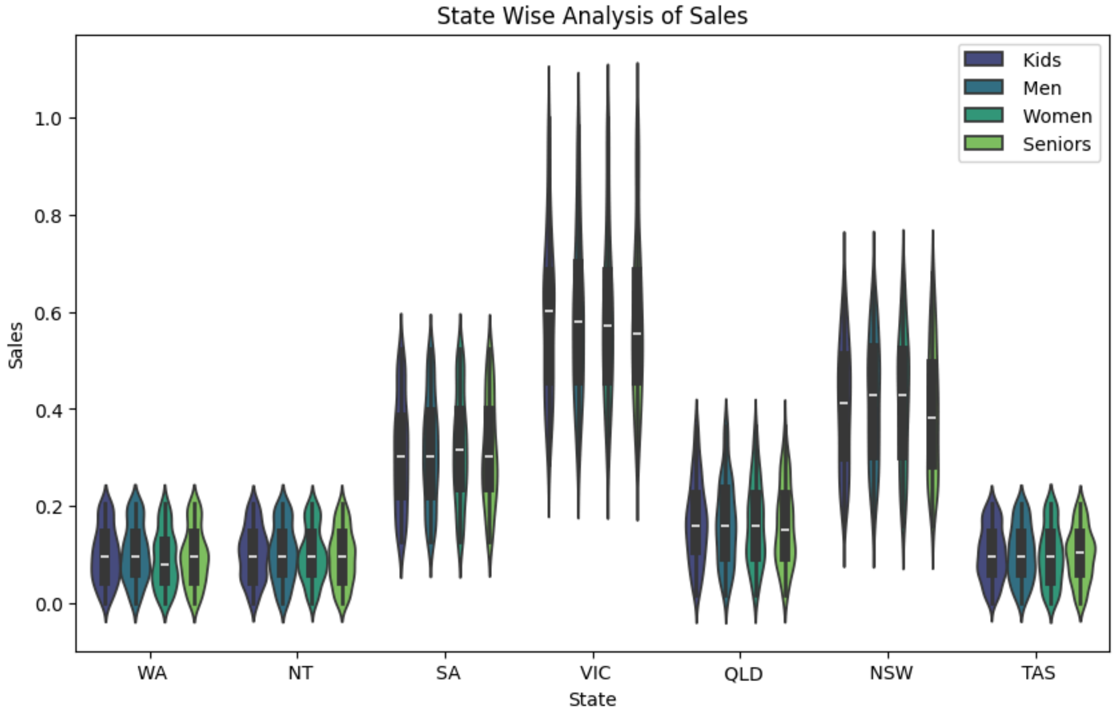
o State-wise sales analysis for different demographic groups (kids, women, men, and seniors).

o Group-wise sales analysis (Kids, Women, Men, and Seniors) across various states.

*o Time-of-the-day analysis: Identify peak and off-peak sales periods to facilitate strategic planning for S&M teams. *

This information aids in designing programs like hyper-personalization and Next Best Offersto enhance sales

```
#State-wise sales analysis for different demographic groups (kids, women, men, and seniors).
plt.figure(figsize=(10, 6))
sns.violinplot(x='State', y='scaled_Sales', hue='Group', data=df1_merged,palette='viridis')
plt.title('State Wise Analysis of Sales')
plt.xlabel('State')
plt.ylabel('Sales')
plt.legend()
plt.show()
```



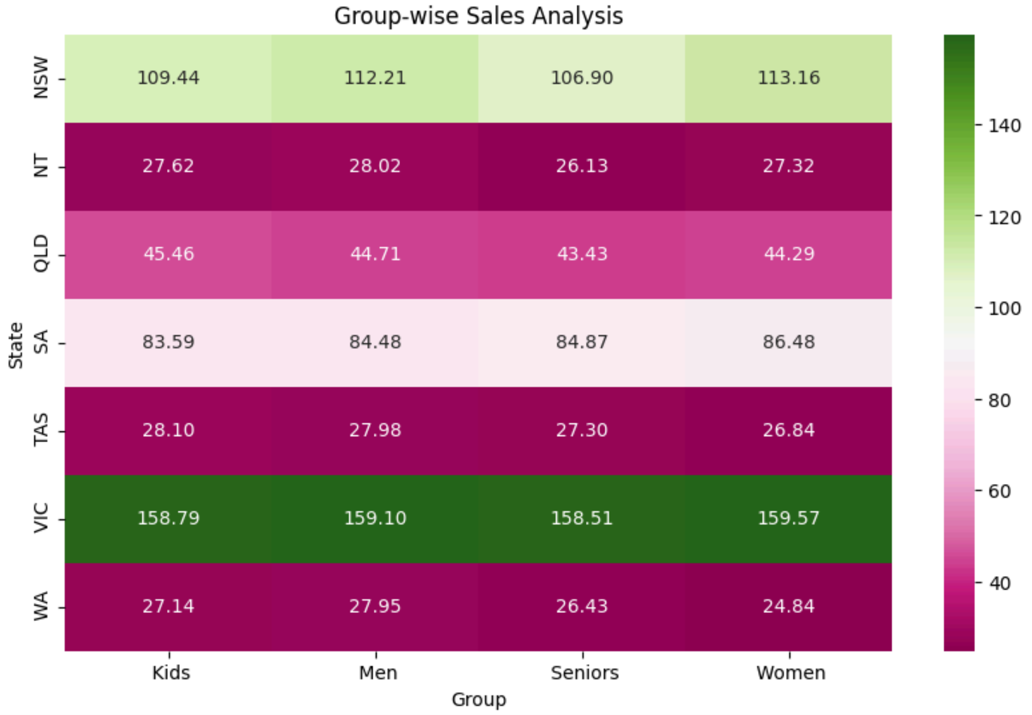
Observation

=> The highest Sales is from the State 'VIC' and the lowest sales is from the state WA & NT

=> The Sales from the Group "Women' is higher in the states such as VIC,SA & NSW.

```
#creating a pivot table to analyse the group_wise sales across the states.
sales_pivot = df1_merged.pivot_table(index='State', columns='Group', values='scaled_Sales', aggfunc='sum')
```

```
# Group-wise sales analysis (Kids, Women, Men, and Seniors) across various states.

plt.figure(figsize=(10, 6))
sns.heatmap(sales_pivot,annot=True,cmap='PiYG',fmt=".2f")
plt.title('Group-wise Sales Analysis')
plt.xlabel('Group')
plt.ylabel('State')
plt.show()
```



Observation:

1. The States 'WA','NT','TAS', have the lowest sales numbers.

2.the highest Sales is from the VIC and the difference between sales from different groups is very miniscual.

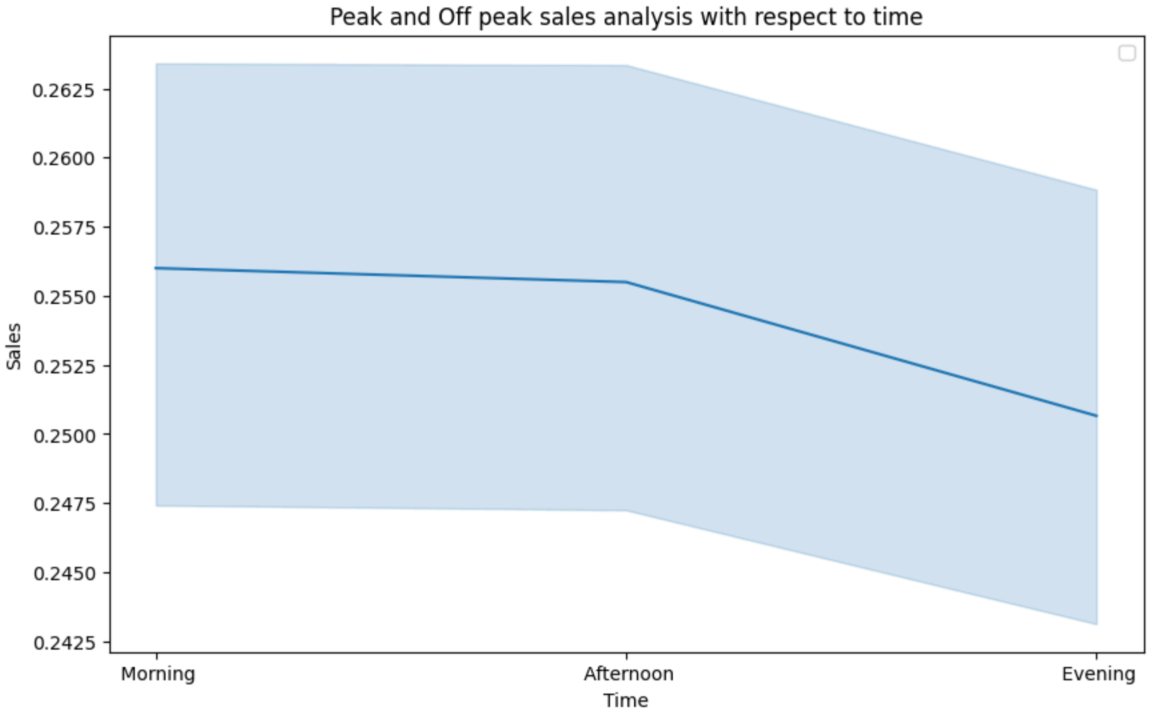
3. if we analyse the groupwise sales across the individual states, we get to know about the target group in each state.

eg. WA has the highest sales from Senior group

***QLD and TAS has the highest sales from the Kids group vice versa. ***

```
plt.figure(figsize=(10, 6))
sns.lineplot(x='Time', y='scaled_Sales', data=df1_merged,palette='viridis')
plt.title('Peak and Off peak sales analysis with respect to time')
plt.xlabel('Time')
plt.ylabel('Sales')
plt.legend()
plt.show()
```

```
<ipython-input-26-ecbd240c4125>:2: UserWarning: Ignoring `palette` because no `hue` variable has been assigned.
  sns.lineplot(x='Time', y='scaled_Sales', data=df1_merged,palette='viridis')
WARNING:matplotlib.legend:No artists with labels found to put in legend.  Note that artists whose label start with an underscore are
```



Observation:

The Sales is slightly higher during the afternoon time.(only a slight difference from the Morning sales).

The Sales gradually decreses as it reaches the evening time.

So Majority of the customers prefer Morning or Afternoon than evening.

b. Ensure the visualization is clear and accessible for effective Decision making by the head of sales and marketing (S&M).

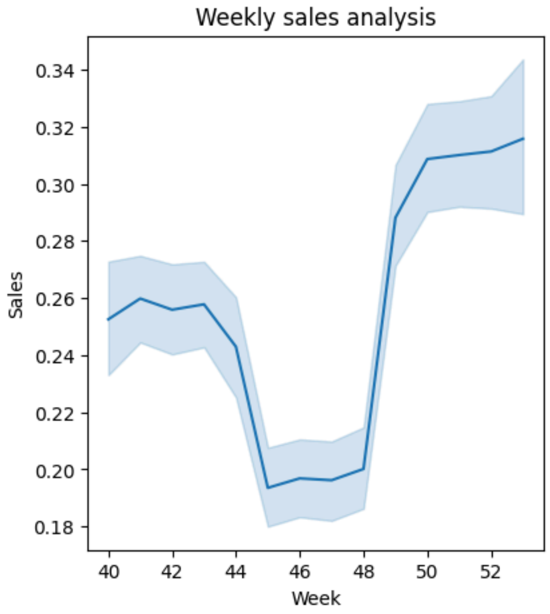
***The dashboard must contain daily, weekly, monthly, and quarterly charts ***

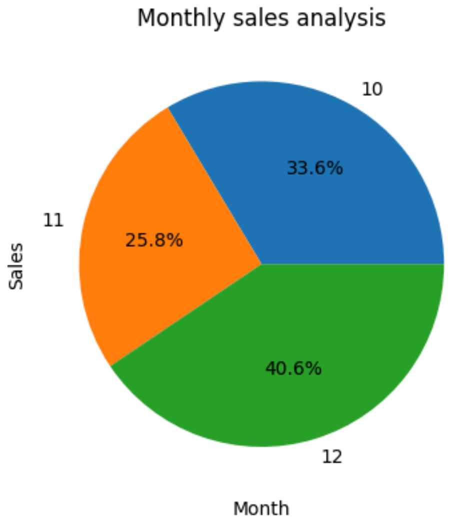
```
df1_merged.head()
```

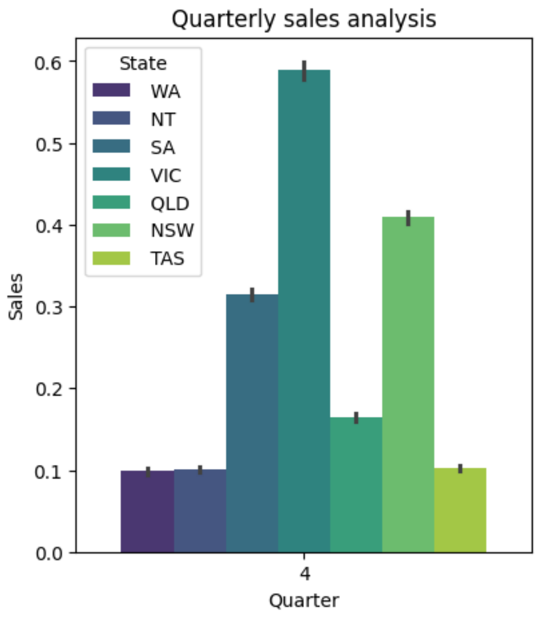
	Date	Time	State	Group	Unit	Sales	scaled_Unit	scaled_Sales	Week	Month	Quarter
0	2020-10-01	Morning	WA	Kids	8	20000	0.095238	0.095238	40	10	4
1	2020-10-01	Morning	WA	Men	8	20000	0.095238	0.095238	40	10	4
2	2020-10-01	Morning	WA	Women	4	10000	0.031746	0.031746	40	10	4
3	2020-10-01	Morning	WA	Seniors	15	37500	0.206349	0.206349	40	10	4
4	2020-10-01	Afternoon	WA	Kids	3	7500	0.015873	0.015873	40	10	4

```
#Sales Anlysis with respect to the week, month and the Quarter

plt.figure(figsize=(15, 5))
plt.subplot(1,3,1)
sns.lineplot(x='Week',y='scaled_Sales',data=df1_merged,palette='Greens')
plt.title('Weekly sales analysis')
plt.xlabel('Week')
plt.ylabel('Sales')

plt.figure
plt.subplot(1,3,2)
monthly_sales=df1_merged.groupby('Month')['scaled_Sales'].sum()
plt.pie(monthly_sales,labels=monthly_sales.index,autopct='%1.1f%%')
plt.title('Monthly sales analysis')
plt.xlabel('Month')
plt.ylabel('Sales')

plt.figure(figsize=(15, 5))
plt.subplot(1,3,3)
sns.barplot(x='Quarter',y='scaled_Sales',data=df1_merged,hue='State',palette='viridis')
plt.title('Quarterly sales analysis')
plt.xlabel('Quarter')
plt.ylabel('Sales')

plt.show()
```

```
<ipython-input-43-ccc583b933fe>:5: UserWarning:

Ignoring `palette` because no `hue` variable has been assigned.
```







Weekly Analysis *: Used line plotfrom Seaborn analyse the peaks and downs of sales every week.*

Monthly Analysis: *Used pie chart from matplotlib to have a better analysis on the distribuition of sales every month.*

Quarterly Sales: *Represented it with a barplot to understand which state had good sales and which sales had the lowest sales. this will be helpful for the Marketing team change their strategy to bring more business.*

Observation:

# As we can see in weekly Analysis from the week 44 to 47 the sales are at their lowest and from 48 to 52 it raised drastically.

*# As mentioned in the problem statement , the sales data of the Q4 (Oct -Dec) has been given here. So from week 48 to 52 has massive raise in Sales because of Christmas. *

# It proves that Marketing Strategies need to built strong during no festival times to attract the customers and also to have a good business in all the months.

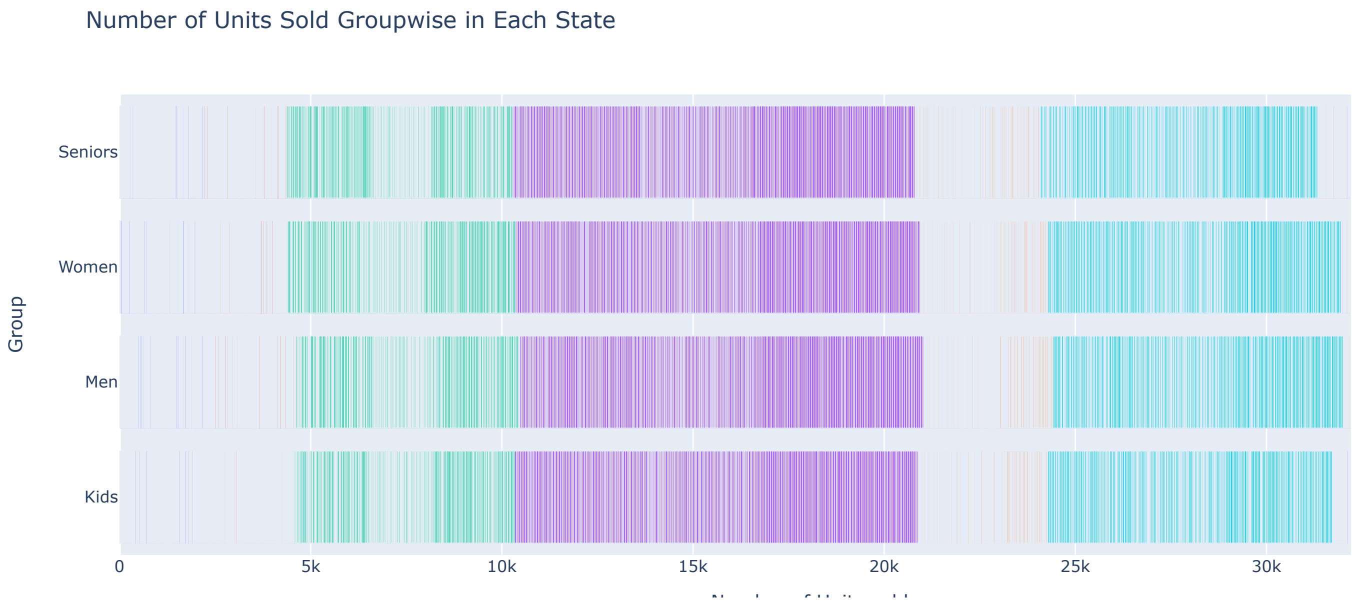
** The plot and the library I recommend is bar plot from plotly.**

Plotly lets us to hover through the data points which is an added advantage. we zoom a particular set of data points. we can dowload the graph as png as well. in general it's equipped with great visualization tools for business purposes.

The Anlaysis on the no of units sold from each Group in each state has done below for example using plotly.

This will give a clear picture about the demand and Supply. eg.which Group category is doing more sales in each state.

```
#import plotly.
import plotly.express as px


# Barplot to show number of units sold in every state which wil be helpful to understand whether to restock new/existing collection or

fig=px.bar(df1_merged,x='Unit',y='Group',color='State',title='Number of Units Sold Groupwise in Each State',
           labels={'Unit': 'Number of Units sold'})
fig.show()
```


Number of Units Sold Groupwise in Each State
Seniors
Women
Men
Kids
Group
5k
10k
15k
20k
25k
30k