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Data set overview .

the data set is about a Retail company based on AUS, the CEO believe his business is growing up sharply so he wants to get some analysis .

possible Objectives :

1) Determine the states that are generating the highest revenues and.
2) Formulate sales programs for states with lower revenues. The Head of S&M has approached you for the same

```
!pip install dash
```

```
Collecting dash
  Downloading dash-2.14.0-py3-none-any.whl (10.4 MB)
     ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 10.4/10.4 MB 31.2 MB/s eta 0:00
Requirement already satisfied: Flask<2.3.0,>=1.0.4 in /usr/local/lib/python3.
Collecting Werkzeug<2.3.0 (from dash)
  Downloading Werkzeug-2.2.3-py3-none-any.whl (233 kB)
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Requirement already satisfied: plotly>=5.0.0 in /usr/local/lib/python3.10/dis
Collecting dash-html-components==2.0.0 (from dash)
  Downloading dash_html_components-2.0.0-py3-none-any.whl (4.1 kB)
Collecting dash-core-components==2.0.0 (from dash)
  Downloading dash_core_components-2.0.0-py3-none-any.whl (3.8 kB)
Collecting dash-table==5.0.0 (from dash)
  Downloading dash_table-5.0.0-py3-none-any.whl (3.9 kB)
Requirement already satisfied: typing-extensions>=4.1.1 in /usr/local/lib/pyt
Requirement already satisfied: requests in /usr/local/lib/python3.10/dist-pac
Collecting retrying (from dash)
  Downloading retrying-1.3.4-py3-none-any.whl (11 kB)
Collecting ansi2html (from dash)
  Downloading ansi2html-1.8.0-py3-none-any.whl (16 kB)
Requirement already satisfied: nest-asyncio in /usr/local/lib/python3.10/dist-
Requirement already satisfied: setuptools in /usr/local/lib/python3.10/dist-p
Requirement already satisfied: importlib-metadata in /usr/local/lib/python3.1
Requirement already satisfied: Jinja2>=3.0 in /usr/local/lib/python3.10/dist-
Requirement already satisfied: itsdangerous>=2.0 in /usr/local/lib/python3.10
Requirement already satisfied: click>=8.0 in /usr/local/lib/python3.10/dist-p
Requirement already satisfied: tenacity>=6.2.0 in /usr/local/lib/python3.10/d
Requirement already satisfied: packaging in /usr/local/lib/python3.10/dist-pa
Requirement already satisfied: MarkupSafe>=2.1.1 in /usr/local/lib/python3.10
Requirement already satisfied: zipp>=0.5 in /usr/local/lib/python3.10/dist-pa
Requirement already satisfied: charset-normalizer<4,>=2 in /usr/local/lib/pyt
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.10/dist-
Requirement already satisfied: urllib3<3,>=1.21.1 in /usr/local/lib/python3.1
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.1
Requirement already satisfied: six>=1.7.0 in /usr/local/lib/python3.10/dist-p
Installing collected packages: dash-table, dash-html-components, dash-core-co
  Attempting uninstall: Werkzeug
    Found existing installation: Werkzeug 3.0.0
    Uninstalling Werkzeug-3.0.0:
      Successfully uninstalled Werkzeug-3.0.0
Successfully installed Werkzeug-2.2.3 ansi2html-1.8.0 dash-2.14.0 dash-core-c
```

```
#import the librbaires that i will need in order to clean , visulize and analyze th
```

```
import pandas as pd
import numpy as np
import dash
from dash import dcc, html
import pandas as pd
import plotly.express as px
import random
import seaborn as sns
import matplotlib.pyplot as plt
import statsmodels.formula.api as smf
```

Data Exploration

0.1 look into the data set by head and info to see what & how many columns and rows we have

```
#Load the data set using pandas as df , so we can call it easily
```

```
df = pd.read_excel('data.xlsx')
```

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

	Date	Time	State	Group	Unit	Sales
0	2020-10-01	Morning	WA	Kids	8	20000
1	2020-10-01	Morning	WA	Men	8	20000
2	2020-10-01	Morning	WA	Women	4	10000
3	2020-10-01	Morning	WA	Seniors	15	37500
4	2020-10-01	Afternoon	WA	Kids	3	7500

0.2 states in AUS

```
for state in df['State'].unique():
  print(state)
```

```
    WA
    NT
    SA
    VIC
    QLD
    NSW
    TAS
```

0.3 Groups

```
#Possible groups
for group in df['Group'].unique():
  print(group)
```

```
    Kids
    Men
    Women
    Seniors
```

0.4 Time

```
#Possible Times
for Time in df['Time'].unique():
  print(Time)
```

```
Morning
Afternoon
Evening
```

0.5 Date Rnage

```
min_date = df['Date'].min()
max_date = df['Date'].max()

# Print the date range
print("Date Range: {} to {}".format(min_date, max_date))
# we see that the data is for 3 months , October, November and December , last quar
```

```
Date Range: 2020-10-01 00:00:00 to 2020-12-30 00:00:00
```

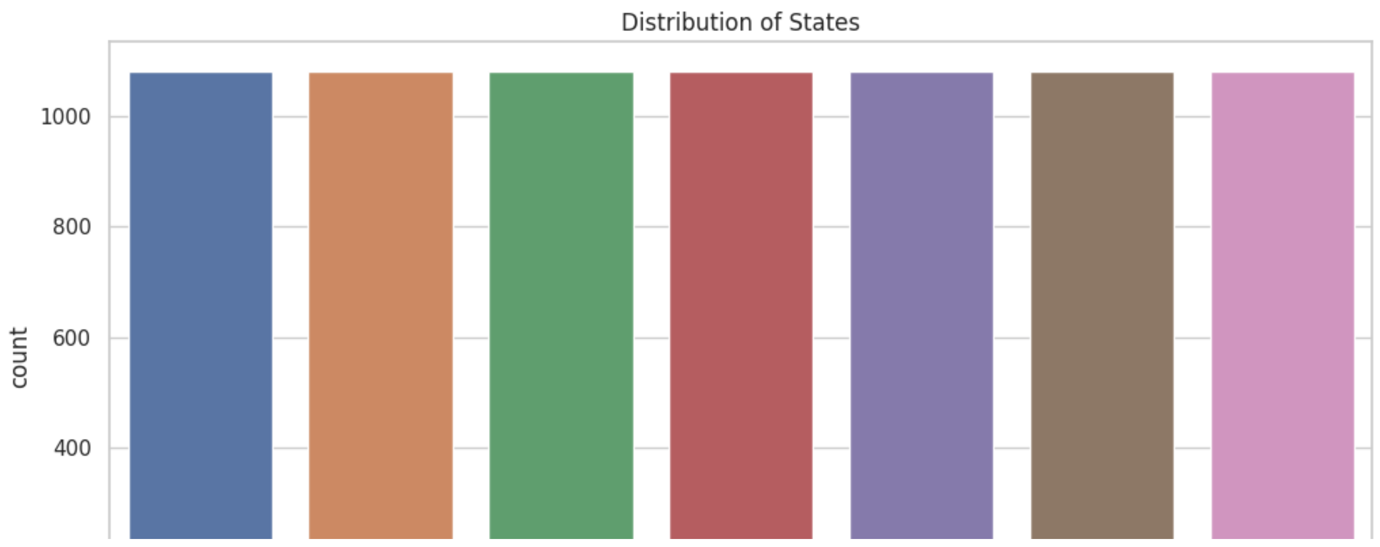
data distribution

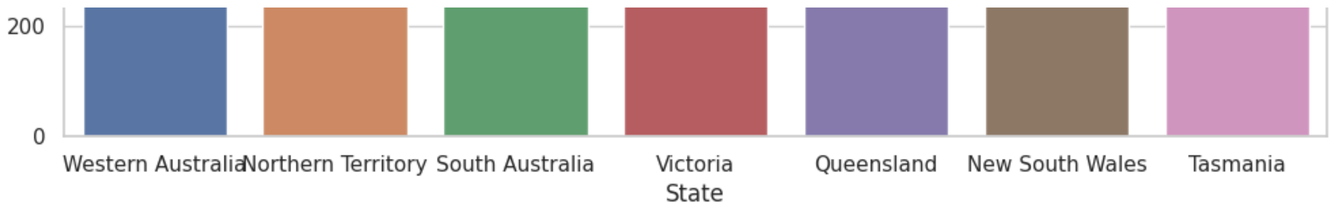
```
# Before Normalization
```

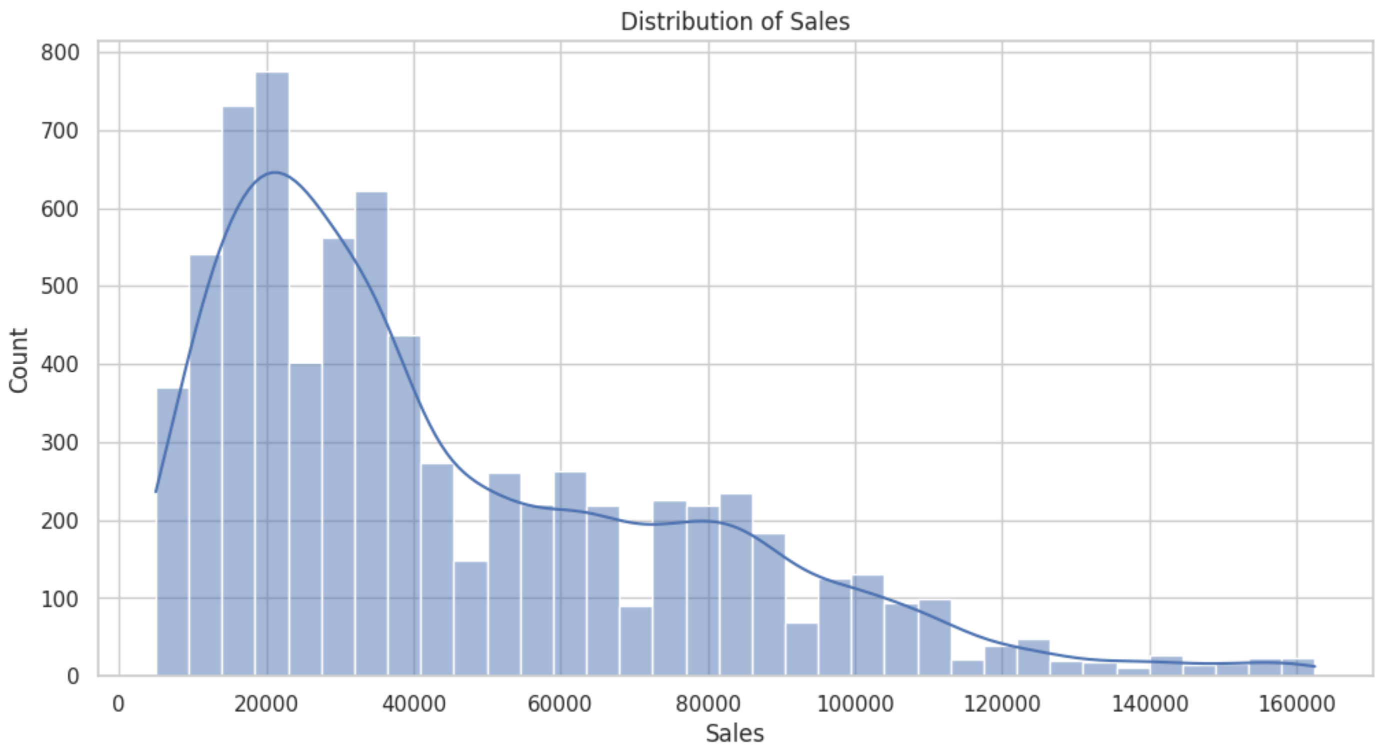
```
df.info()
```

```
<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   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
dtypes: datetime64[ns](1), int64(2), object(3)
memory usage: 354.5+ KB
```

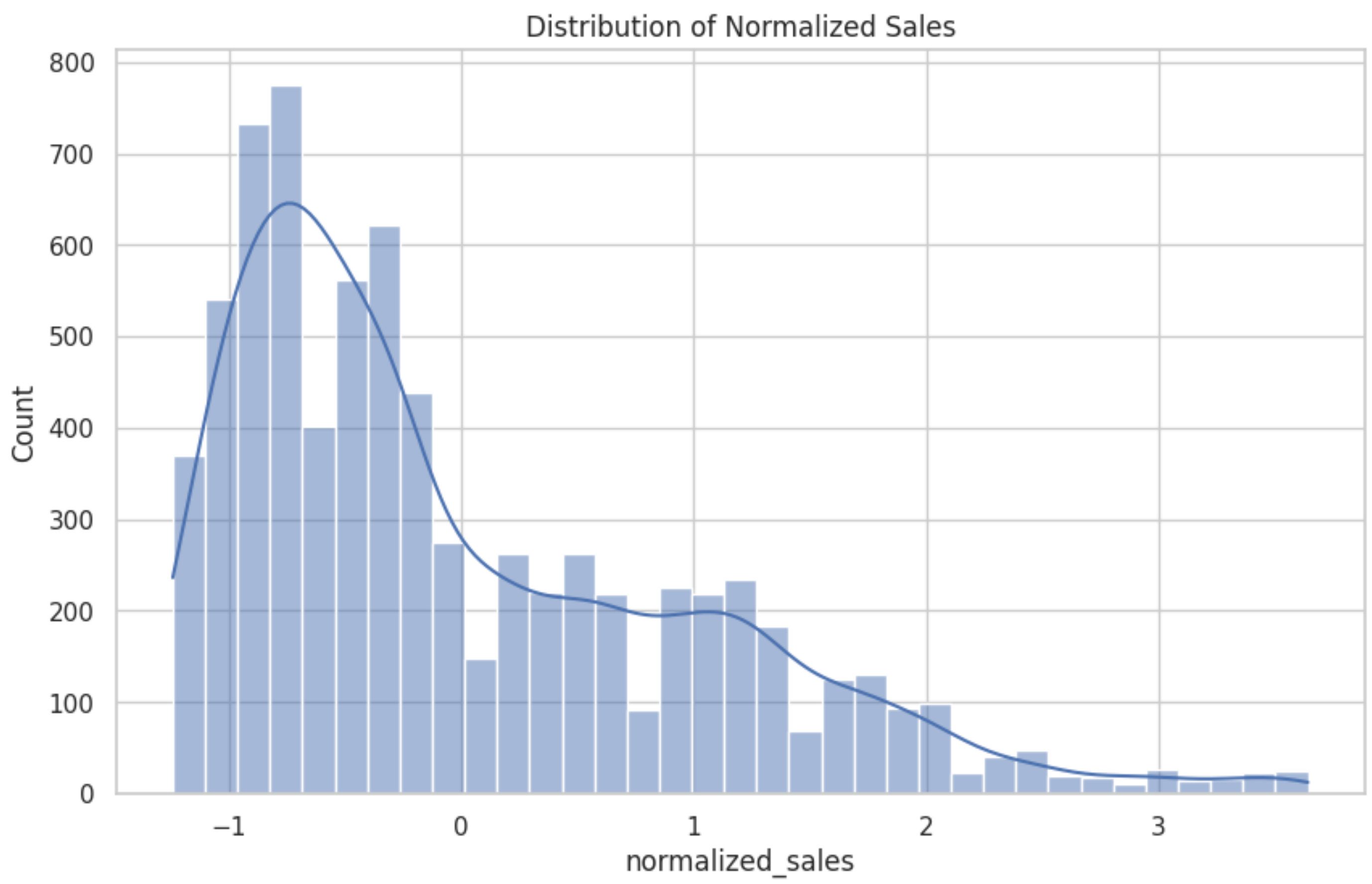
```
import seaborn as sns
import matplotlib.pyplot as plt
sns.set(style="whitegrid")
plt.figure(figsize=(12, 6))

sns.countplot(data=df, x="State", order=df["State"].value_counts().index)
plt.title("Distribution of States")

plt.figure(figsize=(12, 6))

sns.histplot(data=df, x="Sales", kde=True)
plt.title("Distribution of Sales")

plt.show()
```




200
0
Western Australia
Northern Territory
South Australia
Victoria
Queensland
New South Wales
Tasmania
State


Distribution of Sales
Count
800
700
600
500
400
300
200
100
0
0
20000
40000
60000
80000
100000
120000
140000
160000
Sales

```
import pandas as pd
from sklearn.preprocessing import StandardScaler
import seaborn as sns
import matplotlib.pyplot as plt

sales_data = df['Sales'].values.reshape(-1, 1)


scaler = StandardScaler()

normalized_sales = scaler.fit_transform(sales_data)
df['normalized_sales'] = normalized_sales

# Plot the distribution of the normalized 'sales' column
plt.figure(figsize=(10, 6))
sns.histplot(df['normalized_sales'], kde=True)
plt.title("Distribution of Normalized Sales")

plt.show()
```



Step 1: Data Wrangling

1.1 NA values : There is no missing value , all columns are 7560 rows

```
missing_count = df.isna().sum()
print(missing_count)
```

```
Date         0
Time         0
State        0
Group        0
Unit         0
Sales        0
YearMonth    0
dtype: int64
```

1.2 Data Types - All columns appear to be in an appropriate data type format.

```
df.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   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
dtypes: datetime64[ns](1), int64(2), object(3)
memory usage: 354.5+ KB
```

1.3 :duplicates

```
duplicates = df[df.duplicated()]
print(duplicates)
```

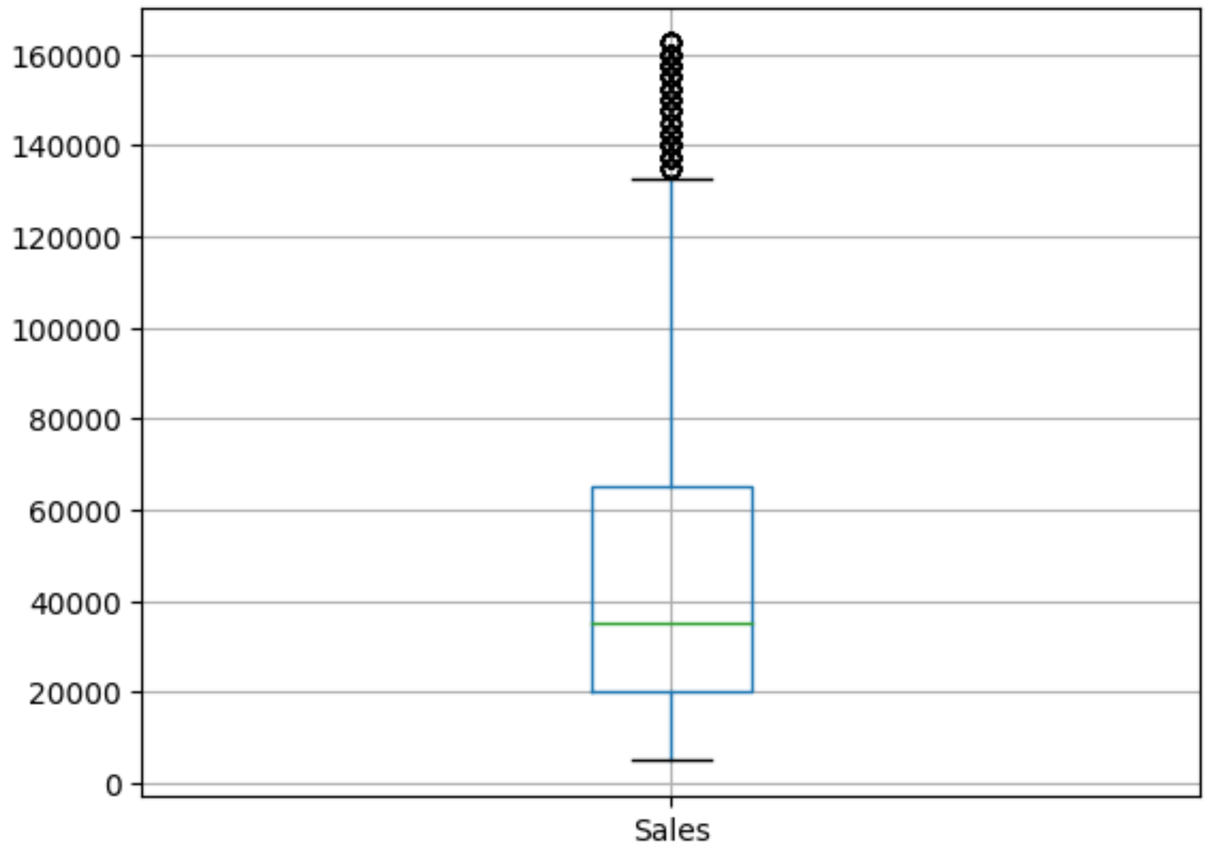
```
Empty DataFrame
Columns: [Date, Time, State, Group, Unit, Sales]
Index: []
```

```
duplicate_count = df.duplicated().sum()
print(duplicate_count)
```

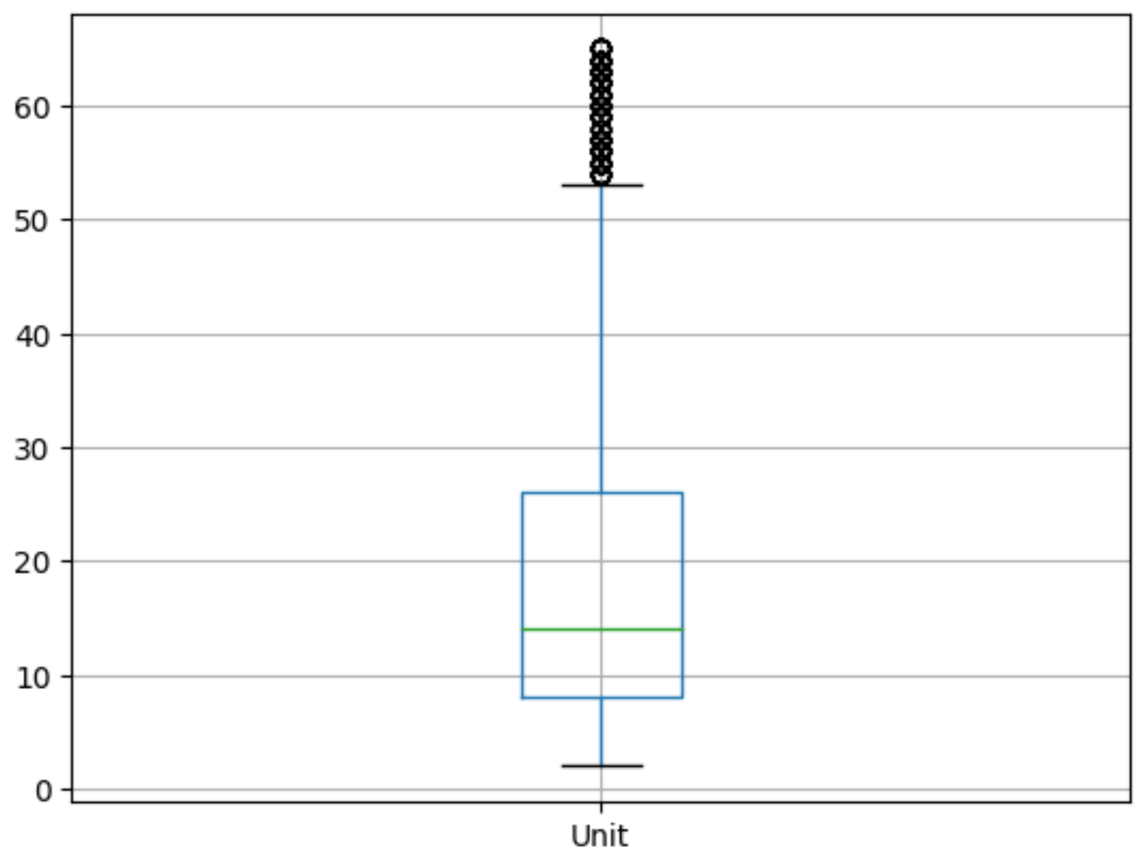
```
0
```

1.4: Outliers :

```
df.boxplot(column=['Sales'])
plt.show()
```



```
df.boxplot(column=[ 'Unit'])
plt.show()
```



1.5 stete change to its name

```
# we see that there are 7 states in AUS , but I decided to change the states names
state_mapping = {
    'SA': 'South Australia',
    'NSW': 'New South Wales',
    'VIC': 'Victoria',
    'QLD': 'Queensland',
    'WA': 'Western Australia',
    'TAS': 'Tasmania',
    'NT': 'Northern Territory'
}
df['State'] = df['State'].str.strip().replace(state_mapping)
```

--

Step 2 : Data analysis

2.1 statistical Analysis

```
#statistical analysis for 'Sales' column
sales_mean = df['Sales'].mean()
sales_median = df['Sales'].median()
sales_mode = df['Sales'].mode().values[0]
sales_std = df['Sales'].std()


unit_mean = df['Unit'].mean()
unit_median = df['Unit'].median()
unit_mode = df['Unit'].mode().values[0]
unit_std = df['Unit'].std()
unit_mean = int(unit_mean)
unit_median = int(unit_median)
unit_mode = int(unit_mode)
unit_std = int(unit_std)


print("Sales Statistics:")
print("Mean:", sales_mean)
print("Median:", sales_median)
print("Mode:", sales_mode)
print("Standard Deviation:", sales_std)
print("\nUnit Statistics:")
print("Mean:", unit_mean)
print("Median:", unit_median)
print("Mode:", unit_mode)
print("Standard Deviation:", unit_std)
```

```
Sales Statistics:
Mean: 45013.5582010582
Median: 35000.0
Mode: 22500
Standard Deviation: 32253.506943966073

Unit Statistics:
Mean: 18
Median: 14
Mode: 9
Standard Deviation: 12
```

2.2 Sales by group

```
total_sales_by_group = df.groupby('Group')['Sales'].sum().sort_values(ascending=Fal
print(total_sales_by_group)
```

```
Group
 Men        85750000
 Women      85442500
 Kids       85072500
 Seniors    84037500
Name: Sales, dtype: int64
```

From the dataset and the above table : Men are the highest group making profits , seniors are the loewst

2.3 Sales by States

```
total_sales_by_state = df.groupby('State')['Sales'].sum().sort_values(ascending=Fal
print(total_sales_by_state)
```

```
State
Victoria              105565000
New South Wales        74970000
South Australia        58857500
Queensland             33417500
Tasmania               22760000
Northern Territory     22580000
Western Australia      22152500
Name: Sales, dtype: int64
```

From the above table , Victoria has the highest sales number , W Australia is the loewst

2.4 Weekly , quartly and monthly reports

```
df['Date'] = pd.to_datetime(df['Date'])
weekly_report = df.resample('W', on='Date').sum()
# i chose from day wed so its 7 days
print("Weekly Report:")
print(weekly_report)
```

```
Weekly Report:
             Unit     Sales
Date
2020-10-04   6018  15045000
2020-10-11  10801  27002500
2020-10-18  10656  26640000
2020-10-25  10726  26815000
2020-11-01   8723  21807500
2020-11-08   8346  20865000
2020-11-15   8469  21172500
2020-11-22   8445  21112500
2020-11-29   8591  21477500
2020-12-06  11849  29622500
2020-12-13  12610  31525000
2020-12-20  12662  31655000
2020-12-27  12708  31770000
2021-01-03   5517  13792500
<ipython-input-31-ecee273b0a24>:2: FutureWarning: The default value of numeri
  weekly_report = df.resample('W', on='Date').sum()
```

```
monthly_report = df.resample('M', on='Date').sum()
print("\nMonthly Report:")
print(monthly_report)


quarterly_report = df.resample('Q', on='Date').sum()
print(quarterly_report)
```

```
              Unit      Sales
Date
2020-12-31  136121  340302500
<ipython-input-27-07bda906a4fe>:1: FutureWarning: The default value of numeri
  quarterly_report = df.resample('Q', on='Date').sum()
```

Additional analysis

```
total_sales_by_Time = df.groupby('Time')['Sales'].sum().sort_values(ascending=False
print(total_sales_by_Time)
```

```
Time
 Morning      114207500
 Afternoon    114007500
 Evening      112087500
Name: Sales, dtype: int64
```

```
total_sales_by_month = df.groupby('Month')['Sales'].sum().sort_values(ascending=Fal
print(total_sales_by_month)
```

```
Month
December    135330000
October     114290000
November     90682500
Name: Sales, dtype: int64
```

--

Step 3: Data Visualization

3.1 Dashboard

```
!pip install pandas seaborn matplotlib
```

```
pip install mpld3
```

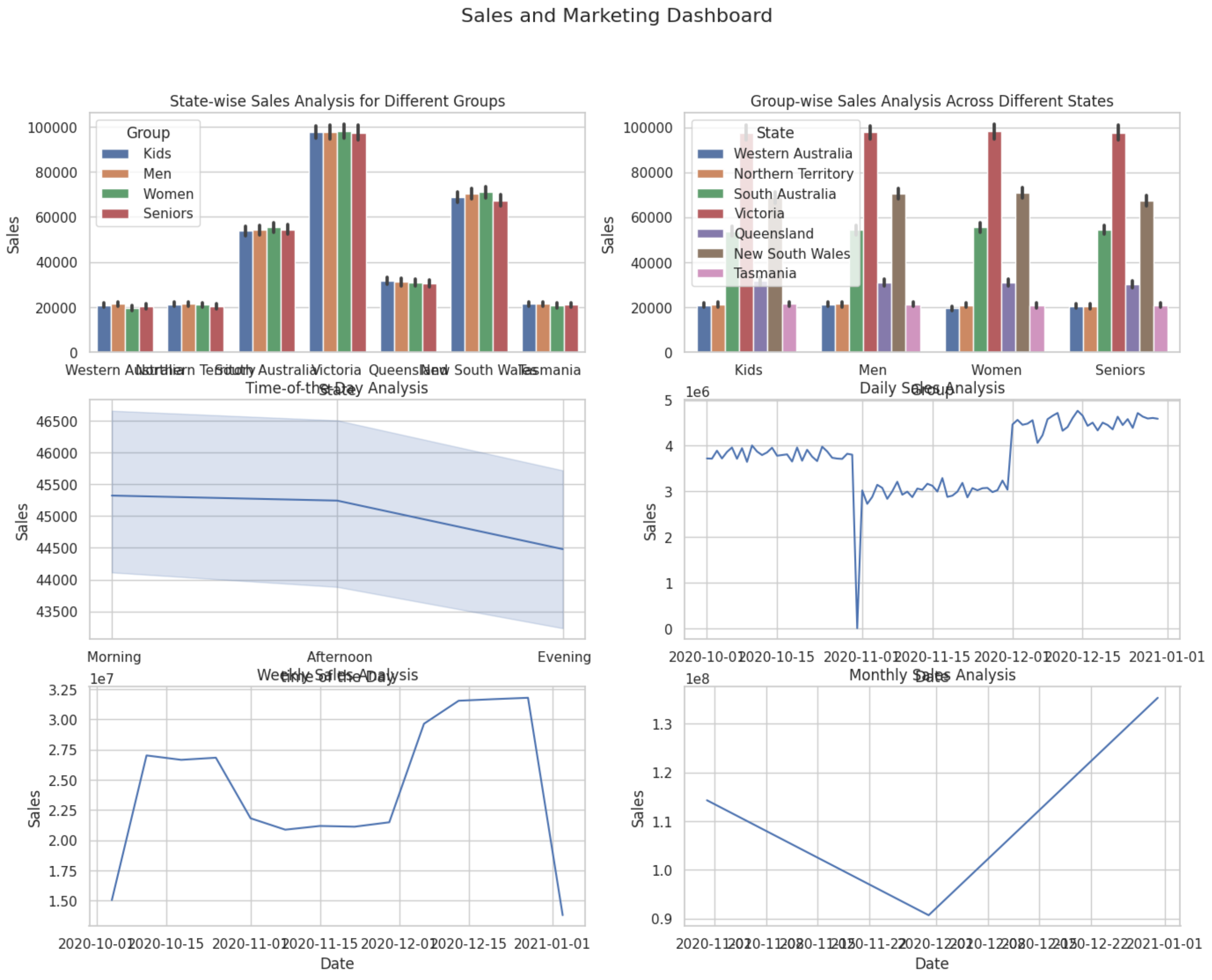
```
    Collecting mpld3
      Downloading mpld3-0.5.9-py3-none-any.whl (201 kB)
         ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 201.2/201.2 kB 4.2 MB/s eta 0:0
    Requirement already satisfied: jinja2 in /usr/local/lib/python3.10/dist-packa
    Requirement already satisfied: matplotlib in /usr/local/lib/python3.10/dist-pa
    Requirement already satisfied: MarkupSafe>=2.0 in /usr/local/lib/python3.10/d
    Requirement already satisfied: contourpy>=1.0.1 in /usr/local/lib/python3.10/
    Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.10/dist-
    Requirement already satisfied: fonttools>=4.22.0 in /usr/local/lib/python3.10
    Requirement already satisfied: kiwisolver>=1.0.1 in /usr/local/lib/python3.10
    Requirement already satisfied: numpy>=1.20 in /usr/local/lib/python3.10/dist-
    Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.10/d
    Requirement already satisfied: pillow>=6.2.0 in /usr/local/lib/python3.10/dis
    Requirement already satisfied: pyparsing>=2.3.1 in /usr/local/lib/python3.10/
    Requirement already satisfied: python-dateutil>=2.7 in /usr/local/lib/python3
    Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.10/dist-pac
    Installing collected packages: mpld3
    Successfully installed mpld3-0.5.9
```

```
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
sns.set(style="whitegrid")
fig, axes = plt.subplots(3, 2, figsize=(16, 12))
fig.suptitle("Sales and Marketing Dashboard", fontsize=16)

# Chart 1: State-wise sales analysis for different groups
sns.barplot(x='State', y='Sales', hue='Group', data=df, ax=axes[0, 0])
axes[0, 0].set_title("State-wise Sales Analysis for Different Groups")

# chart 2: Group-wise sales analysis across different states
sns.barplot(x='Group', y='Sales', hue='State', data=df, ax=axes[0, 1])
axes[0, 1].set_title("Group-wise Sales Analysis Across Different States")

# Chart 3: Time-of-the-day analysis

sns.lineplot(x='Time', y='Sales', data=df, ax=axes[1, 0])
axes[1, 0].set_title("Time-of-the-Day Analysis")
axes[1, 0].set_xlabel("time of the Day")

# Chart 4: Daily Sales Analysis
daily_sales = df.resample('D', on='Date').sum()
sns.lineplot(x=daily_sales.index, y=daily_sales['Sales'], ax=axes[1, 1])
```

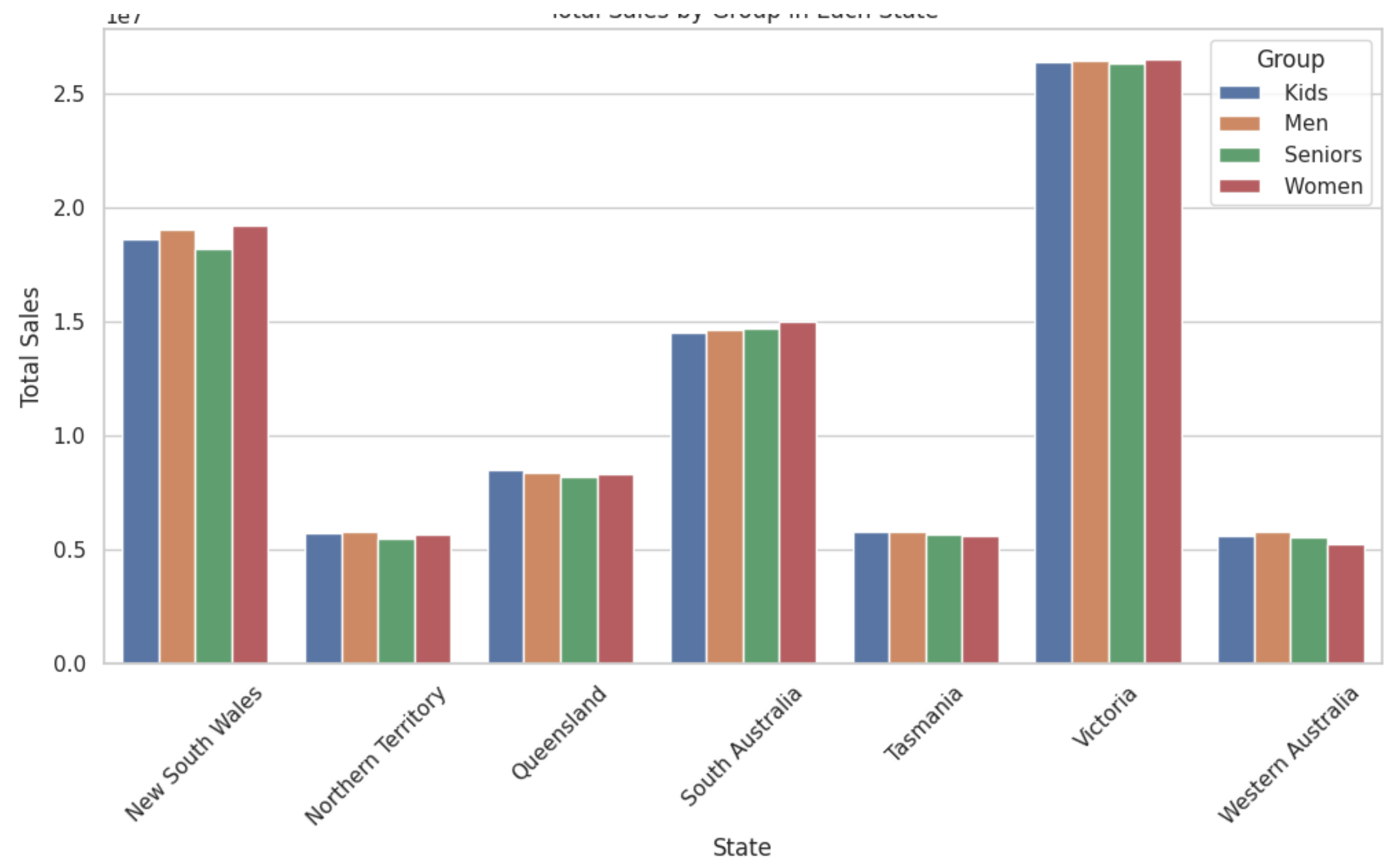
```
axes[1, 1].set_title("Daily Sales Analysis")
axes[1, 1].set_xlabel("Date")

# Chart 5: Weekly Sales Analysis
weekly_sales = df.resample('W', on='Date').sum()
sns.lineplot(x=weekly_sales.index, y=weekly_sales['Sales'], ax=axes[2, 0])
axes[2, 0].set_title("Weekly Sales Analysis")
axes[2, 0].set_xlabel("Date")

# Chart 6 Monthly Sales Analysis
monthly_sales = df.resample('M', on='Date').sum()
sns.lineplot(x=monthly_sales.index, y=monthly_sales['Sales'], ax=axes[2, 1])
axes[2, 1].set_title("Monthly Sales Analysis")
axes[2, 1].set_xlabel("Date")

# additinal :



grouped_data = df.groupby(['State', 'Group'])['Sales'].sum().reset_index()
sns.set(style="whitegrid")
plt.figure(figsize=(12, 6))
sns.barplot(data=grouped_data, x='State', y='Sales', hue='Group')
plt.title('Total Sales by Group in Each State')
plt.xlabel('State')
plt.ylabel('Total Sales')
plt.legend(title='Group')
plt.xticks(rotation=45)
plt.show()

for ax in axes.flatten():
    ax.set_ylabel("Total Sales")
    ax.legend(title="Parameter", loc="upper left")

plt.tight_layout()
plt.subplots_adjust(top=0.9)
plt.show()

import pandas as pd
import seaborn as sns
import mpld3



# save as html

# Save the figure to an HTML file
```

```
html_output = mpld3.fig_to_html(fig)
with open("outpuut.html", "w") as f:
    f.write(html_output)
```

```
<ipython-input-31-2d546aa62e94>:25: FutureWarning:

The default value of numeric_only in DataFrameGroupBy.sum is deprecated. In a

<ipython-input-31-2d546aa62e94>:31: FutureWarning:

The default value of numeric_only in DataFrameGroupBy.sum is deprecated. In a

<ipython-input-31-2d546aa62e94>:37: FutureWarning:

The default value of numeric_only in DataFrameGroupBy.sum is deprecated. In a
```



Total Sales by Group in Each State



```
WARNING:matplotlib.legend:No artists with labels found to put in legend.  Note
WARNING:matplotlib.legend:No artists with labels found to put in legend.  Note
WARNING:matplotlib.legend:No artists with labels found to put in legend.  Note
WARNING:matplotlib.legend:No artists with labels found to put in legend.  Note
<Figure size 640x480 with 0 Axes>
/usr/local/lib/python3.10/dist-packages/mpld3/mplexporter/exporter.py:179: Use

Legend element <matplotlib.offsetbox.HPacker object at 0x7ac73900bf40> not imp

/usr/local/lib/python3.10/dist-packages/mpld3/mplexporter/exporter.py:179: Use

Legend element <matplotlib.offsetbox.HPacker object at 0x7ac7390383d0> not imp

/usr/local/lib/python3.10/dist-packages/mpld3/mplexporter/exporter.py:179: Use

Legend element <matplotlib.offsetbox.HPacker object at 0x7ac739038820> not imp

/usr/local/lib/python3.10/dist-packages/mpld3/mplexporter/exporter.py:179: Use

Legend element <matplotlib.offsetbox.HPacker object at 0x7ac739038c70> not imp
```

I recommend Seaborn for data visualization because it offers aesthetically pleasing visuals, simplifies complex statistical analysis, and integrates well with Pandas. It provides built-in color palettes and supports a wide range of plot types. Using Seaborn ensures your visualizations are both informative and visually appealing.

3.2 Charts insights:

1- Victoria State has the highest sales in all groups , this is understandable because it the biggest state in AUS.

2- Tasmania has the kowest number of sales with similar behavior of all groups

3- Morning time is the best time for AUS people for Shopping

4- October has the lowest sales number , Decmber has the max , its understandable for the holidays probably

5- in the first of November, there was a crash in the sales