AAL

March 22, 2025

[ ]:
```
import os
os.environ['PATH'] = '/Library/TeX/texbin:' + os.environ['PATH']
print(os.environ['PATH'])
```

[1]:
```
# Data Wrangling
## Checking for missing values
```

[2]:
```
import pandas as pd
df = pd.read_csv('AusApparalSales4thQrt2020.csv')
print(df.info())
print(df.isna().sum())
```

```
<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
None
Date     0
Time     0
State    0
Group    0
Unit     0
Sales    0
dtype: int64
```

[ ]:
```
## The dataset has 7560 entries with 6 columns and no missing values.  Since␣
 ↪there are no missing values, and I can see that the sales dollars ('Sales')␣
 ↪and the unit quanties ('Unit') columns are datatype "int64" they are numeric␣
 ↪and ready for calculations.<br> (I can move on to next step.
```

[ ]:
```
## Normalization
```

[ ]:
```
### This will ensure that the values are in a consistent range for later␣
↪comparisons.  First find the max and mins for the numeric data and add a new␣
↪colun with that data.
```

[10]:
```
sales_min = df['Sales'].min()
sales_max = df['Sales'].max()
df['Sales_normalized'] = (df['Sales'] - sales_min) / (sales_max - sales_min)
unit_min = df['Unit'].min()
unit_max = df['Unit'].max()
df['Unit_normalized'] = (df['Unit'] - unit_min) / (unit_max - unit_min)
print(df[['Sales', 'Sales_normalized', 'Unit', 'Unit_normalized']].head()) #␣
↪test to see if that worked properly to see the original data next to the␣
↪normalized data
```

```
   Sales  Sales_normalized  Unit  Unit_normalized
0  20000          0.095238     8         0.095238
1  20000          0.095238     8         0.095238
2  10000          0.031746     4         0.031746
3  37500          0.206349    15         0.206349
4   7500          0.015873     3         0.015873
```

[ ]:
```
# Data Analysis
```

[ ]:
```
## Understand the distribution of the sales and unit data as they pertain to␣
↪other factors such as location and demographics to see which categories are␣
↪perfoming best and worst
```

[11]:
```
df.describe()
```

[11]:

	Unit	Sales	Sales_normalized	Unit_normalized
count	7560.000000	7560.000000	7560.000000	7560.000000
mean	18.005423	45013.558201	0.254054	0.254054
std	12.901403	32253.506944	0.204784	0.204784
min	2.000000	5000.000000	0.000000	0.000000
25%	8.000000	20000.000000	0.095238	0.095238
50%	14.000000	35000.000000	0.190476	0.190476
75%	26.000000	65000.000000	0.380952	0.380952
max	65.000000	162500.000000	1.000000	1.000000

[14]:
```
state_sales = df.groupby('State')['Sales'].sum()
print(state_sales)
```

```
State
NSW     74970000
NT      22580000
QLD     33417500
```

```
SA       58857500
TAS      22760000
VIC     105565000
WA       22152500
Name: Sales, dtype: int64
```

[15]:
```
## Output above shows that VIC clearly stands out as the best state for sales, followed by NSW that is doing 75% as well.  WA, TAS, and NT are lagging in comparison.
```

[ ]:
```
## Weekly, Monthly and Quarterly Reports
```

[16]:
```
### Since the .info() output shows that the date is an object and not in datetime, I need to convert it.
```

[20]:
```
df['Date'] = pd.to_datetime(df['Date'])
print(df.head(10))
```

```
        Date        Time State     Group  Unit  Sales  Sales_normalized  \
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
5 2020-10-01   Afternoon    WA       Men    10  25000          0.126984
6 2020-10-01   Afternoon    WA     Women     3   7500          0.015873
7 2020-10-01   Afternoon    WA   Seniors    11  27500          0.142857
8 2020-10-01     Evening    WA      Kids    15  37500          0.206349
9 2020-10-01     Evening    WA       Men    15  37500          0.206349

   Unit_normalized
0         0.095238
1         0.095238
2         0.031746
3         0.206349
4         0.015873
5         0.126984
6         0.015873
7         0.142857
8         0.206349
9         0.206349
```

[ ]:
```
### pandas documentation shows a few ways to generate the sales reports.<br> This is the pd.Grouper which requires passing parameters for the key being the column name and the frequency W, M or Q then referencing the column, in this case Sales and getting the sum
```

[22]:
```
weekly_sales = df.groupby(pd.Grouper(key='Date', freq='W'))['Sales'].sum()
monthly_sales = df.groupby(pd.Grouper(key='Date', freq='ME'))['Sales'].sum()
quarterly_sales = df.groupby(pd.Grouper(key='Date', freq='QE'))['Sales'].sum()
print("Weekly Sales:")
print(weekly_sales)
print("Monthly Sales:")
print(monthly_sales)
print("Quarterly Sales:")
print(quarterly_sales)
```

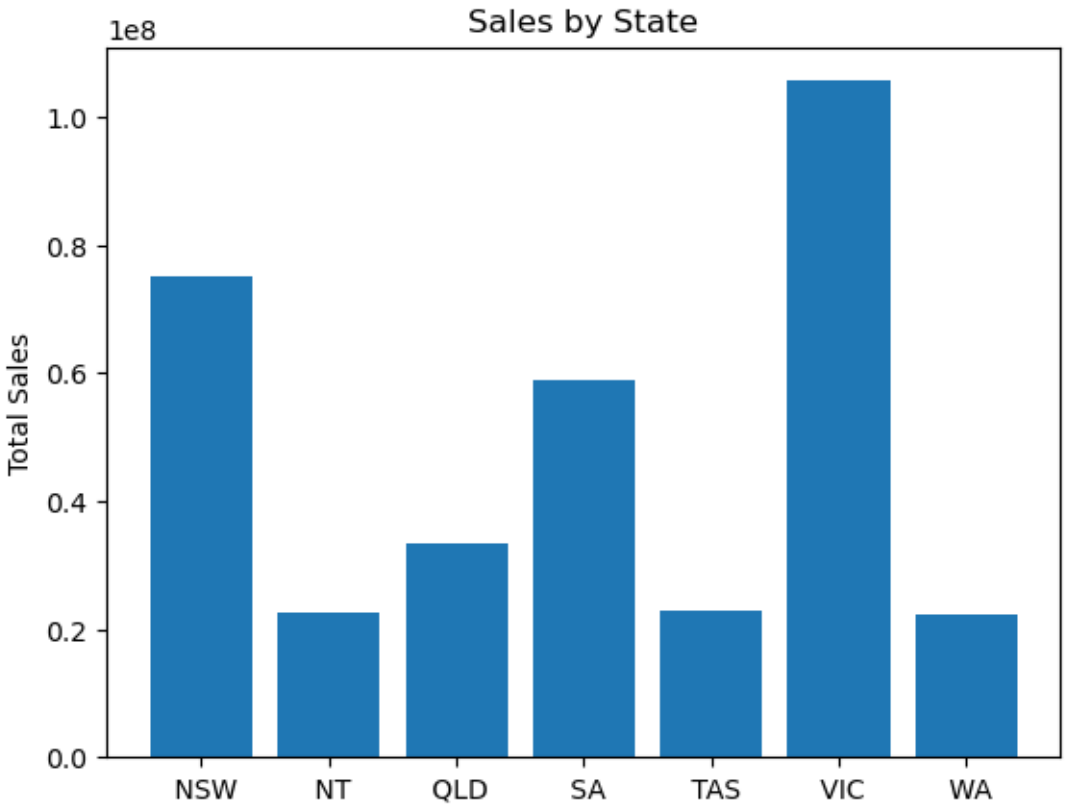
```
Weekly Sales:
Date
2020-10-04    15045000
2020-10-11    27002500
2020-10-18    26640000
2020-10-25    26815000
2020-11-01    21807500
2020-11-08    20865000
2020-11-15    21172500
2020-11-22    21112500
2020-11-29    21477500
2020-12-06    29622500
2020-12-13    31525000
2020-12-20    31655000
2020-12-27    31770000
2021-01-03    13792500
Freq: W-SUN, Name: Sales, dtype: int64
Monthly Sales:
Date
2020-10-31    114290000
2020-11-30     90682500
2020-12-31    135330000
Freq: ME, Name: Sales, dtype: int64
Quarterly Sales:
Date
2020-12-31    340302500
Freq: QE-DEC, Name: Sales, dtype: int64
```

[ ]:
```
# Data Visualization
```

[ ]:
```
## State-wise
```

[28]:
```
import matplotlib.pyplot as plt

# group sales by state and total them, converts the index back into a regular␣
 ↪column with default integers index
state_sales = df.groupby('State')['Sales'].sum().reset_index()
```

```
# take the state names and total the sales
states = state_sales['State']
sales_totals = state_sales['Sales']

# defining the color for each bar to be blue
bar_colors = ['tab:blue'] * len(states)

# create the bar chart
fig, ax = plt.subplots()
ax.bar(states, sales_totals, color=bar_colors)

# create the chart labels
ax.set_ylabel('Total Sales')
ax.set_title('Sales by State')
# legend is not necessary because all the bars are the same color

plt.show()
```



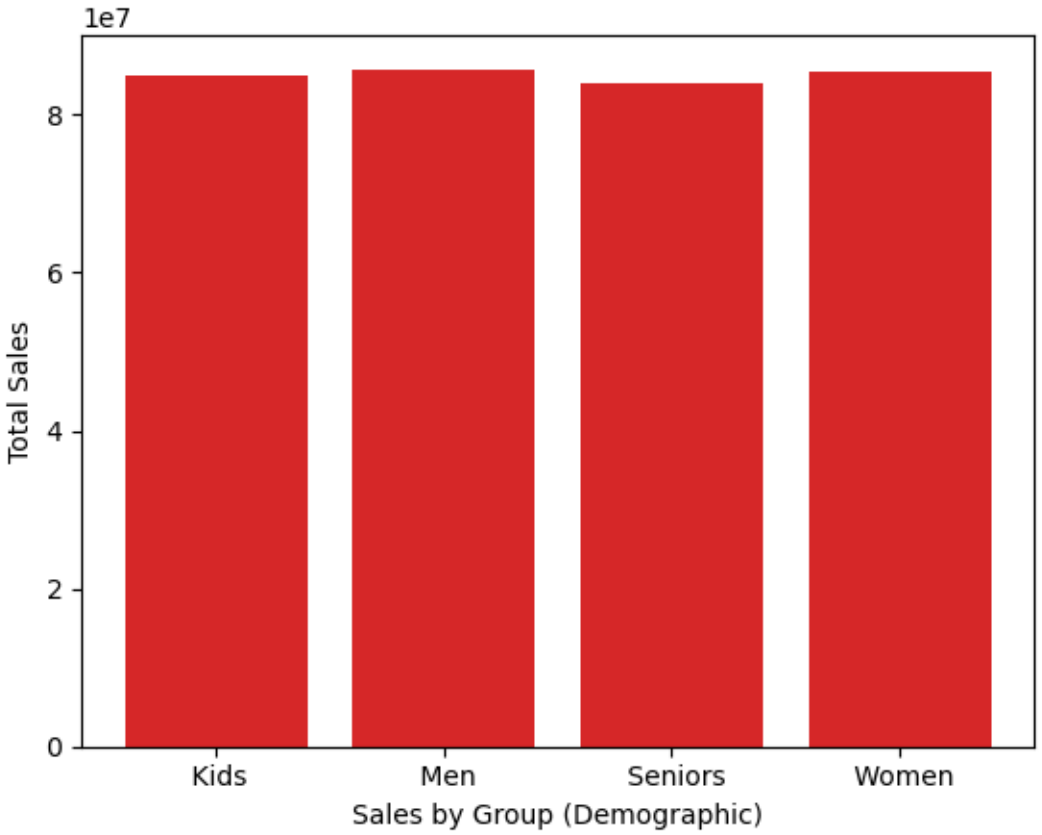
[ ]:
```
## Group-wise (Demographic)
```

[30]:
```
demo_sales = df.groupby('Group')['Sales'].sum() # creates the report for sales␣
 ↪by group
print(demo_sales)
```

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

[ ]:
```
## this report shows that there is not significant difference between the␣
 ↪different age groups
```

[35]:
```
# get all the sales and group them by group and total them then reset the index
demo_sales = df.groupby('Group')['Sales'].sum().reset_index()

# define groups as the sales per group
groups = demo_sales['Group']
group_totals = demo_sales['Sales']

# let all the bar colors be yellow
bar_colors = ['tab:red'] * len(groups)

# create the bar chart
fig, ax = plt.subplots()
ax.bar(groups, group_totals, color=bar_colors)

# create the labels
ax.set_ylabel('Total Sales')
ax.set_xlabel('Sales by Group (Demographic)')

plt.show()
```



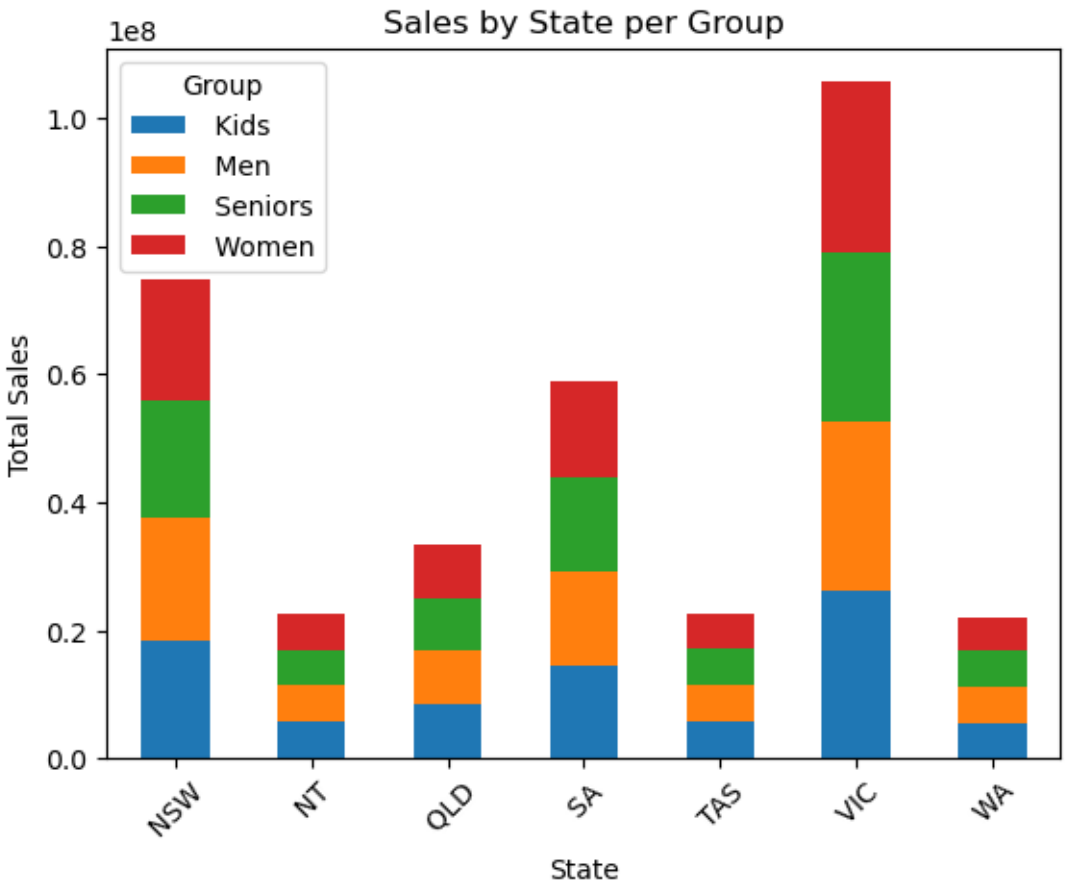
[36]:
```
# now that there is quite a variance in sales per state yet the sales per group␣
↪are somewhat constant, let's look at the sales by group in each state
```

[37]:
```
sales_by_state_group = df.groupby(['State', 'Group'])['Sales'].sum().unstack()
print(sales_by_state_group)
```

```
Group      Kids       Men   Seniors     Women
State
NSW    18587500  19022500  18187500  19172500
NT      5700000   5762500   5465000   5652500
QLD     8510000   8392500   8190000   8325000
SA     14515000  14655000  14717500  14970000
TAS     5775000   5757500   5650000   5577500
VIC    26360000  26407500  26315000  26482500
WA      5625000   5752500   5512500   5262500
```

[38]:
```
sales_by_state_group.plot(kind='bar', stacked=True)
plt.ylabel('Total Sales')
plt.title('Sales by State per Group')
plt.xticks(rotation=45)  # For better readability if there are many states
```

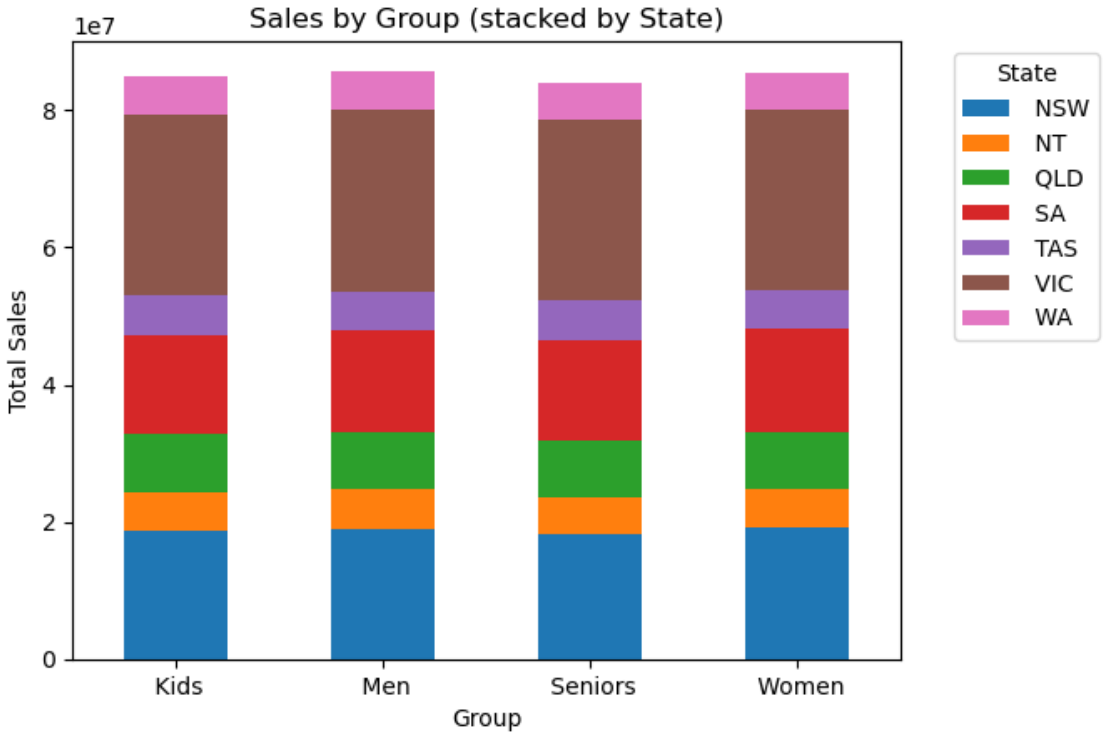
```
plt.show()
```



[ ]:
```
# this look pretty consistent, so let's look at sales by state by group
```

[40]:
```
import matplotlib.pyplot as plt

# Group by 'Group' and 'State', then sum Sales and unstack to pivot data.
sales_by_group_state = df.groupby(['Group', 'State'])['Sales'].sum().unstack()

# Create the stacked bar chart
sales_by_group_state.plot(kind='bar', stacked=True)

plt.ylabel('Total Sales')
plt.title('Sales by Group (stacked by State)')
plt.xticks(rotation=0)  # Adjust rotation if needed for readability
plt.legend(title='State', bbox_to_anchor=(1.05, 1), loc='upper left')  #␣
 ↪optional: place legend outside
```

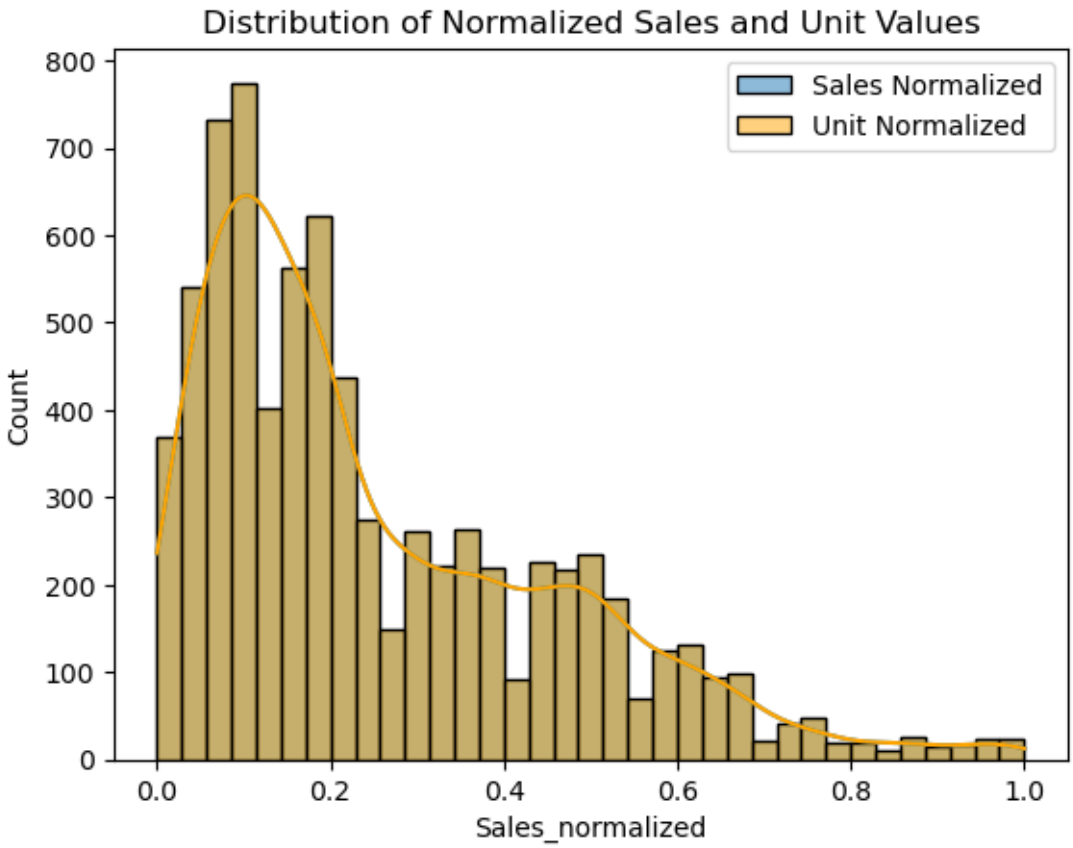
```
plt.show()
```



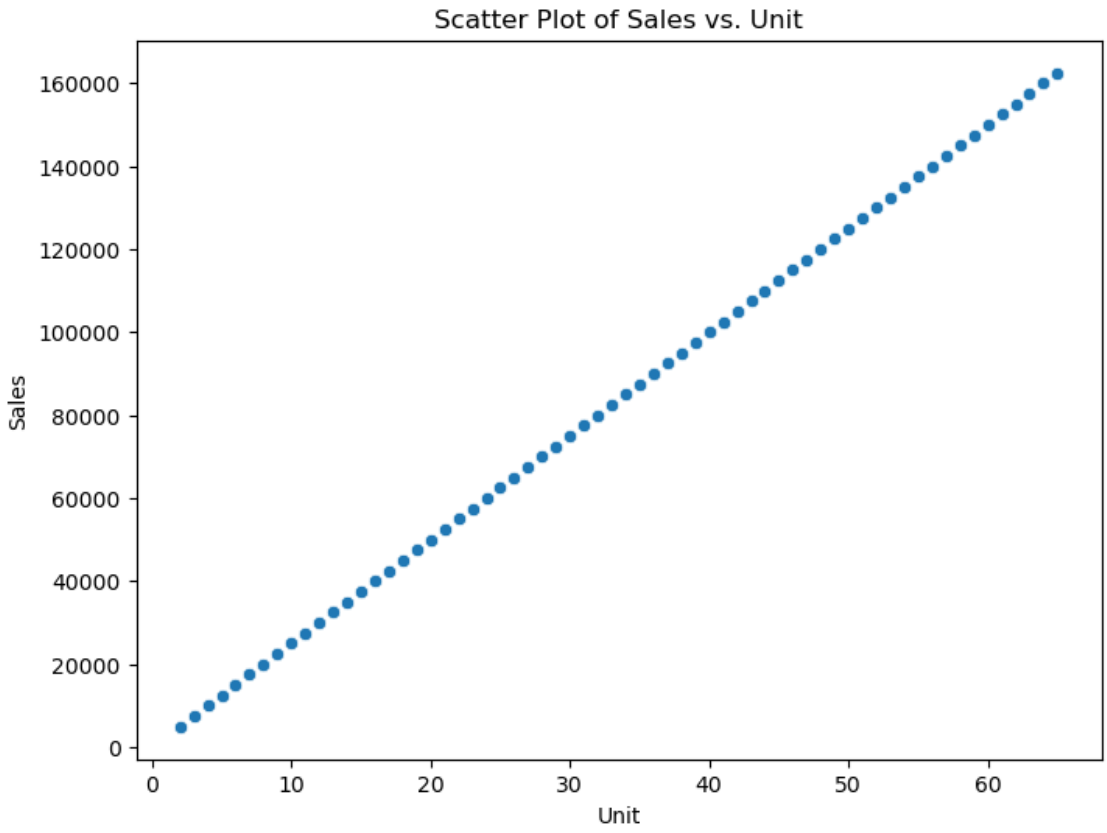
[41]:
```
# this is also quite consistently showing that the major difference in sales as␣
↪to do with the state and not any of the groups
```

[ ]:
```
# Using the normalized data to make some comparisons
```

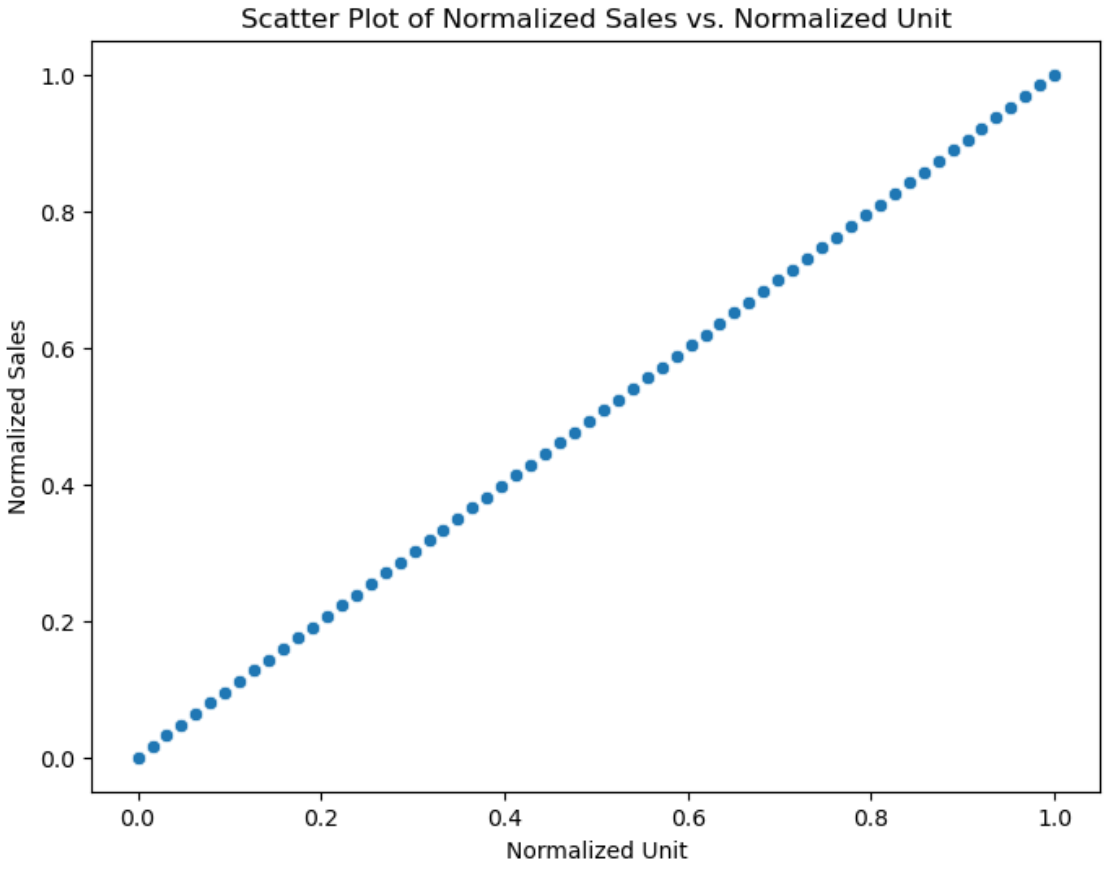
[42]:
```
import seaborn as sns
import matplotlib.pyplot as plt

sns.histplot(df['Sales_normalized'], kde=True, label='Sales Normalized')
sns.histplot(df['Unit_normalized'], kde=True, label='Unit Normalized',␣
↪color='orange')
plt.legend()
plt.title('Distribution of Normalized Sales and Unit Values')
plt.show()
```



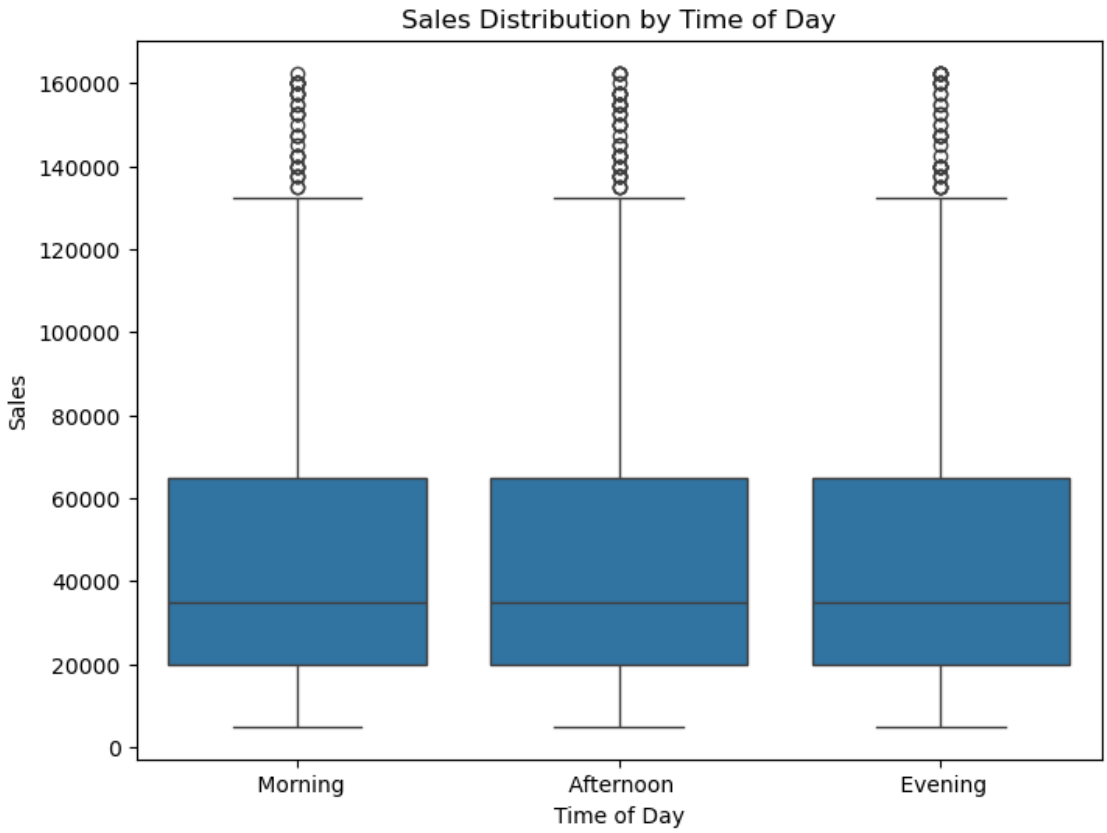
[43]:
```
import seaborn as sns
import matplotlib.pyplot as plt

plt.figure(figsize=(8,6))
sns.scatterplot(x='Unit', y='Sales', data=df)
plt.title("Scatter Plot of Sales vs. Unit")
plt.xlabel("Unit")
plt.ylabel("Sales")
plt.show()
```



[44]:
```
plt.figure(figsize=(8,6))
sns.scatterplot(x='Unit_normalized', y='Sales_normalized', data=df)
plt.title("Scatter Plot of Normalized Sales vs. Normalized Unit")
plt.xlabel("Normalized Unit")
plt.ylabel("Normalized Sales")
plt.show()
```



[45]:
```
import seaborn as sns
import matplotlib.pyplot as plt

plt.figure(figsize=(8,6))
sns.boxplot(x='Time', y='Sales', data=df)
plt.title("Sales Distribution by Time of Day")
plt.xlabel("Time of Day")
plt.ylabel("Sales")
plt.show()
```



[3]:
```
import os
print(os.environ['PATH'])
```

```
/Users/sheilamcgovern/anaconda3/bin:/Users/sheilamcgovern/anaconda3/condabin:/opt/homebrew/opt/node@20/bin:/opt/homebrew/opt/node@16/bin:/opt/homebrew/bin:/opt/homebrew/sbin:/usr/local/bin:/System/Cryptexes/App/usr/bin:/usr/bin:/bin:/usr/sbin:/sbin:/var/run/com.apple.security.cryptexd/codex.system/bootstrap/usr/local/bin:/var/run/com.apple.security.cryptexd/codex.system/bootstrap/usr/bin:/var/run/com.apple.security.cryptexd/codex.system/bootstrap/usr/appleinternal/bin
```

[ ]:
```
```