CHRIST
(DEEMED TO BE UNIVERSITY)
DELHI-NCR, INDIA

AI/ML Programming

MCA-475

Assignment – 02

BY

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SUBMITTED TO

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SCHOOL OF SCIENCES

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Importing Libraries

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from datetime import date
```

```
df = pd.read_csv('./Dataset/Diwali_Sales_Data.csv')
```

```
df.head()
```

✓ 0.8s Python

	User_ID	Cust_name	Product_ID	Gender	Age Group	Age	Marital_Status	State	Zone	Occupation	Product_Category	Orders
0	1002903	Sanskriti	P00125942	F	26-35	28	0	Maharashtra	Western	Healthcare	Auto	1
1	1000732	Kartik	P00110942	F	26-35	35	1	Andhra□radesh	Southern	Govt	Auto	3
2	1001990	Bindu	P00118542	F	26-35	35	1	Uttar Pradesh	Central	Automobile	Auto	3
3	1001425	Sudevi	P00237842	M	0-17	16	0	Karnataka	Southern	Construction	Auto	2
4	1000588	Joni	P00057942	M	26-35	28	1	Gujarat	Western	Food Processing	Auto	2

```
df.tail()
```

[4] ✓ 0.0s Python

	User_ID	Cust_name	Product_ID	Gender	Age Group	Age	Marital_Status	State	Zone	Occupation	Product_Category	Orders
11246	1000695	Manning	P00296942	M	18-25	19	1	Maharashtra	Western	Chemical	Office	4
11247	1004089	Reichenbach	P00171342	M	26-35	33	0	Haryana	Northern	Healthcare	Veterinary	3

```
df.tail()
```

[4] ✓ 0.0s Python

	User_ID	Cust_name	Product_ID	Gender	Age Group	Age	Marital_Status	State	Zone	Occupation	Product_Category	Orders
11246	1000695	Manning	P00296942	M	18-25	19	1	Maharashtra	Western	Chemical	Office	4
11247	1004089	Reichenbach	P00171342	M	26-35	33	0	Haryana	Northern	Healthcare	Veterinary	3
11248	1001209	Oshin	P00201342	F	36-45	40	0	Madhya Pradesh	Central	Textile	Office	4
11249	1004023	Noonan	P00059442	M	36-45	37	0	Karnataka	Southern	Agriculture	Office	3
11250	1002744	Brumley	P00281742	F	18-25	19	0	Maharashtra	Western	Healthcare	Office	3

```
df.sample()
```

[5] ✓ 0.1s Python

	User_ID	Cust_name	Product_ID	Gender	Age Group	Age	Marital_Status	State	Zone	Occupation	Product_Category	Orders	Am
6918	1003216	Pratyusmita	P00305942	F	36-45	40	1	Haryana	Northern	Lawyer	Clothing & Apparel	3	7

```
df.dtypes
```

[6] ✓ 0.0s Python

```
User_ID              int64
Cust_name           object
Product_ID          object
Gender              object
Age Group           object
Age                  int64
Marital_Status       int64
State               object
Zone                object
Occupation          object
Product_Category    object
Orders               int64
Amount             float64
Status             float64
unnamed1           float64
dtype: object
```

```
df.info()
```

[15] ✓ 0.6s Python

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 11251 entries, 0 to 11250
Data columns (total 11 columns):
 #   Column            Non-Null Count  Dtype
---  ------            --------------  -----
 0   User_ID           11251 non-null  int64
 1   Gender            11251 non-null  object
 2   Age Group         11251 non-null  object
 3   Age               11251 non-null  int64
 4   Marital_Status    11251 non-null  int64
 5   State             11251 non-null  object
 6   Zone              11251 non-null  object
 7   Occupation        11251 non-null  object
 8   Product_Category  11251 non-null  object
 9   Order_Count       11251 non-null  int64
 10  Sale_Amount       11239 non-null  float64
dtypes: float64(1), int64(4), object(6)
memory usage: 967.0+ KB
```

```
df.shape
```

[16] ✓ 0.0s Python

```
(11251, 11)
```

```
df.columns
```

[18] ✓ 0.0s Python

```
Index(['User_ID', 'Gender', 'Age Group', 'Age', 'Marital_Status', 'State',
       'Zone', 'Occupation', 'Product_Category', 'Order_Count', 'Sale_Amount'],
      dtype='object')
```

EDA and Data Cleaning

We will perform exploratory data analysis, use groupby, rename columns, and drop multiple columns as done in car sales analysis.

```
# Drop multiple columns using a list
cols_to_drop = ['Status', 'unnamed1', 'Cust_name', 'Product_ID']
df.drop(columns=cols_to_drop, inplace=True, errors='ignore')
# Rename columns for clarity
df.rename(columns={'Amount': 'Sale_Amount', 'Orders': 'Order_Count'}, inplace=True)
df.head()
```

[7] ✓ 1.4s Python

	User_ID	Gender	Age Group	Age	Marital_Status	State	Zone	Occupation	Product_Category	Order_Count	Sale_Amount
0	1002903	F	26-35	28	0	Maharashtra	Western	Healthcare	Auto	1	23952.0
1	1000732	F	26-35	35	1	Andhra□radesh	Southern	Govt	Auto	3	23934.0
2	1001990	F	26-35	35	1	Uttar Pradesh	Central	Automobile	Auto	3	23924.0
3	1001425	M	0-17	16	0	Karnataka	Southern	Construction	Auto	2	23912.0
4	1000588	M	26-35	28	1	Gujarat	Western	Food Processing	Auto	2	23877.0

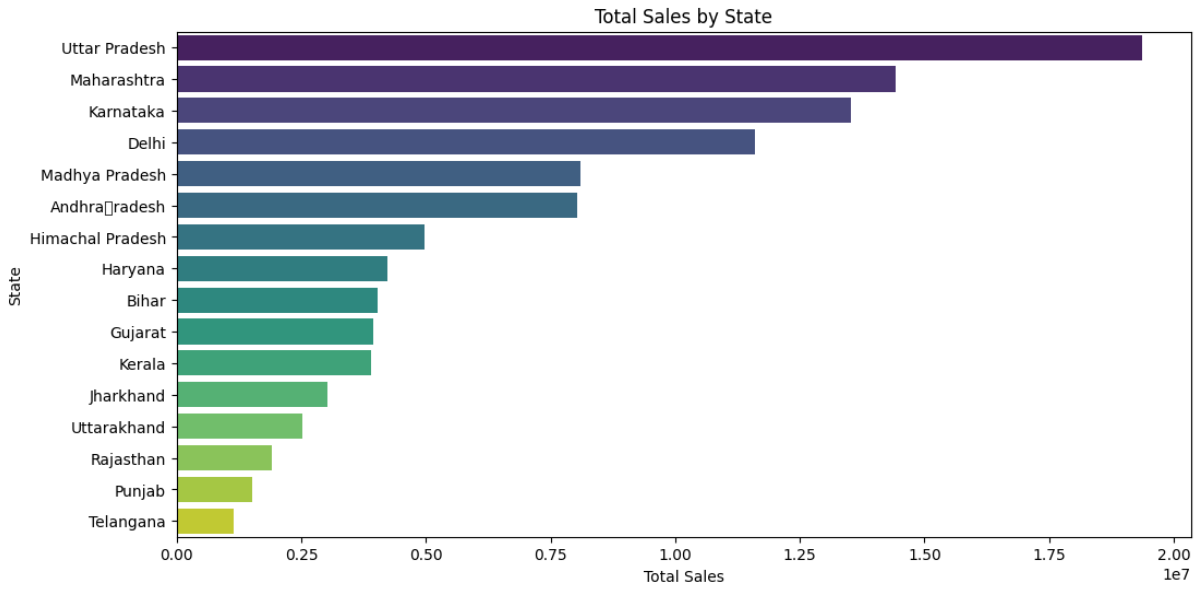
```
# Group by State and Gender to get total sales and order count
grouped = df.groupby(['State', 'Gender'])[['Sale_Amount', 'Order_Count']].sum().reset_index()
grouped.head()
```

[8] ✓ 1.3s Python

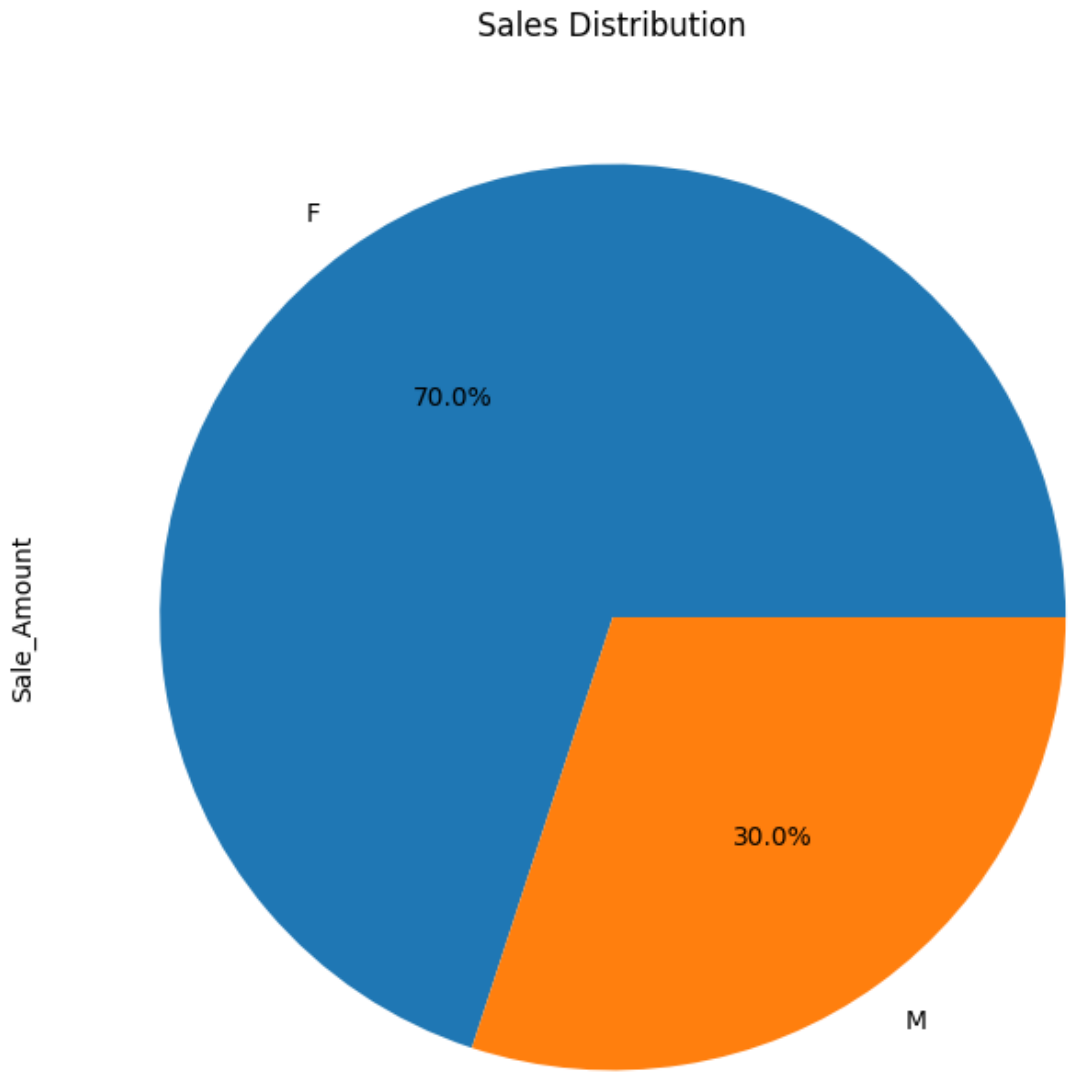
	State	Gender	Sale_Amount	Order_Count
0	Andhra□radesh	F	5511219.99	1394
1	Andhra□radesh	M	2525927.00	660
2	Bihar	F	2819281.00	749
3	Bihar	M	1203476.00	313
4	Delhi	F	8264499.45	1872

```
# Plot total sales by State
state_sales = df.groupby('State')['Sale_Amount'].sum().sort_values(ascending=False)
plt.figure(figsize=(12,6))
sns.barplot(x=state_sales.values, y=state_sales.index, palette='viridis')
plt.title('Total Sales by State')
plt.xlabel('Total Sales')
plt.ylabel('State')
plt.show()
```

[9] ✓ 13.9s Python



```
df.groupby('Gender')['Sale_Amount'].sum().plot(kind='pie', autopct='%1.1f%%',
figsize=(8, 8), title='Sales Distribution')
```



```
df.nunique()
```

[22] ✓ 0.1s Python

```
User_ID            3755
Gender                2
Age Group             7
Age                  81
Marital_Status        2
State                16
Zone                  5
Occupation           15
Product_Category     18
Order_Count           4
Sale_Amount        6584
dtype: int64
```

```
df['Sale_Amount'].isnull().sum()
```

[25] ✓ 0.0s Python

```
12
```

```
df['Sale_Amount'].value_counts()
```

[26] ✓ 0.7s Python

```
Sale_Amount
7907.0     11
7956.0     10
7086.0      9
6923.0      8
7037.0      8
           ..
12078.0     1
12079.0     1
12082.0     1
12083.0     1
188.0       1
Name: count, Length: 6584, dtype: int64
```

```
df.rename(columns={'Sale_Amount': 'Total_Sales', 'Order_Count': 'Total_Orders'}, inplace=True)
df.head()
```

[33] ✓ 0.9s Python


```
df.rename(columns={'Sale_Amount': 'Total_Sales', 'Order_Count': 'Total_Orders'}, inplace=True)
df.head()
```

[33] ✓ 0.9s Python

	User_ID	Gender	Age Group	Age	Marital_Status	State	Zone	Occupation	Product_Category	Total_Orders	Total_Sales
0	1002903	F	26-35	28	0	Maharashtra	Western	Healthcare	Auto	1	23952.0
1	1000732	F	26-35	35	1	AndhraPradesh	Southern	Govt	Auto	3	23934.0
2	1001990	F	26-35	35	1	Uttar Pradesh	Central	Automobile	Auto	3	23924.0
3	1001425	M	0-17	16	0	Karnataka	Southern	Construction	Auto	2	23912.0
4	1000588	M	26-35	28	1	Gujarat	Western	Food Processing	Auto	2	23877.0

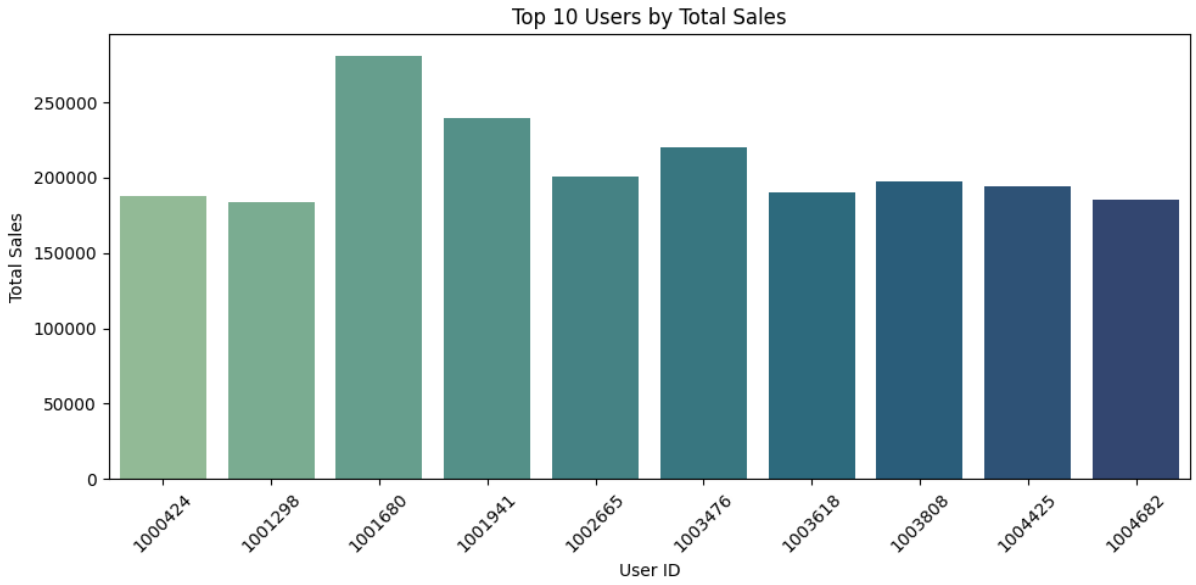
```
df['Occupation'].unique()
```

[32] ✓ 0.0s Python

```
array(['Healthcare', 'Govt', 'Automobile', 'Construction',
       'Food Processing', 'Lawyer', 'IT Sector', 'Media', 'Banking',
       'Retail', 'Hospitality', 'Aviation', 'Agriculture', 'Textile',
       'Chemical'], dtype=object)
```

```python
# Analyze unique User_IDs and perform groupby operations
unique_users = df['User_ID'].nunique()
print(f'Total unique users: {unique_users}')

# Group by User_ID to get total orders and sales per user
user_group = df.groupby('User_ID').agg({
    'Total_Orders': 'sum',
    'Total_Sales': ['sum', 'mean', 'count']
}).reset_index()
user_group.columns = ['User_ID', 'Total_Orders', 'Total_Sales_Sum',
'Total_Sales_Mean', 'Order_Count']
user_group.head()

# Find top 10 users by total sales
top_users = user_group.sort_values('Total_Sales_Sum',
ascending=False).head(10)
print('Top 10 users by total sales:')
print(top_users)

# Plot top 10 users by total sales
plt.figure(figsize=(10,5))
sns.barplot(data=top_users, x='User_ID', y='Total_Sales_Sum', palette='crest')
plt.title('Top 10 Users by Total Sales')
plt.xlabel('User ID')
plt.ylabel('Total Sales')
plt.xticks(rotation=45)
plt.tight_layout()
plt.show()
```

```
Total unique users: 3755
Top 10 users by total sales:
      User_ID  Total_Orders  Total_Sales_Sum  Total_Sales_Mean  Order_Count
1045  1001680            58         281034.0      11709.750000           24
1197  1001941            52         239147.0      10870.318182           22
2134  1003476            57         220435.0      11601.842105           19
1628  1002665            50         201104.0      10584.421053           19
2355  1003808            55         197660.0       8593.913043           23
2741  1004425            48         194343.0       9717.150000           20
2226  1003618            39         189921.0      11870.062500           16
274   1000424            48         187679.0       9877.842105           19
2898  1004682            51         185122.0       9743.263158           19
807   1001298            44         184045.0      10826.176471           17
C:\Users\Dell\AppData\Local\Temp\ipykernel_10692\863326916.py:20: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `x` variable to `hue` and set `leg

  sns.barplot(data=top_users, x='User_ID', y='Total_Sales_Sum', palette='crest')
```

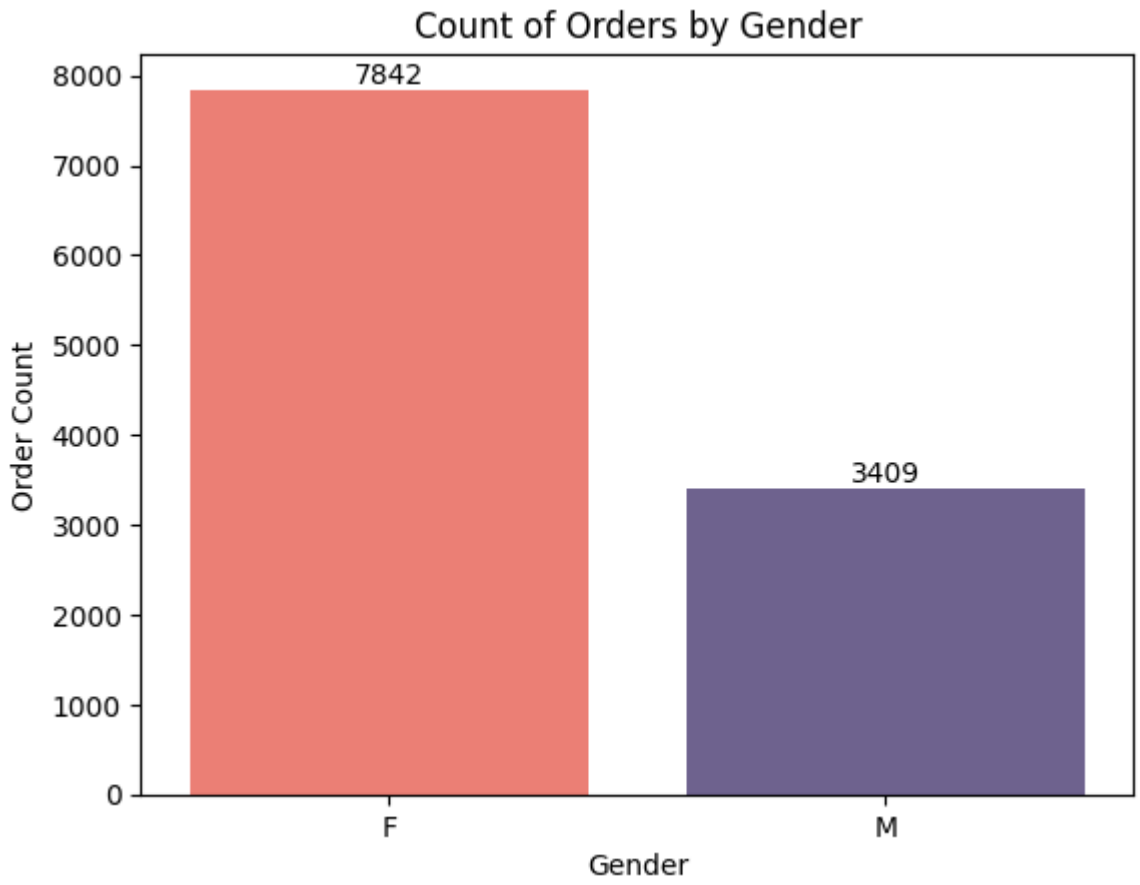


Comparative Graphs: Total Sales by Gender and Occupation, and Sale Amount by Age Group and Gender

```
# Countplot of Gender with custom colors and value labels
custom_palette = ['#FF6F61', '#6B5B95']  # Example: pink and purple
ax = sns.countplot(data=df, x='Gender', palette=custom_palette)
for bars in ax.containers:
    ax.bar_label(bars)
plt.title('Count of Orders by Gender')
plt.xlabel('Gender')
plt.ylabel('Order Count')
plt.show()
```

29] ✓ 1.3s Python

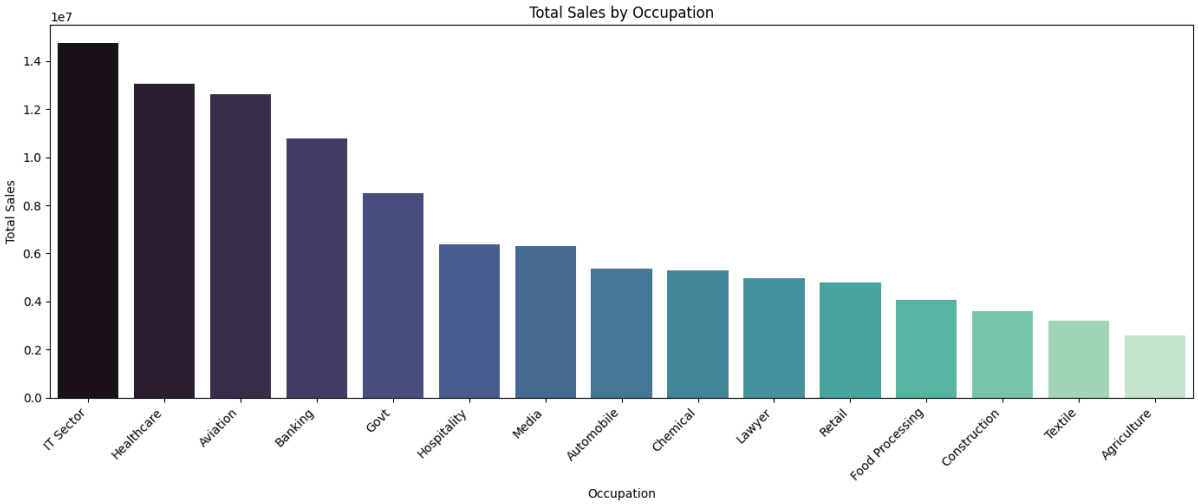
```
C:\Users\Dell\AppData\Local\Temp\ipykernel_10692\181065888.py:3: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `x` variable to `hue` and set `leg

  ax = sns.countplot(data=df, x='Gender', palette=custom_palette)
```



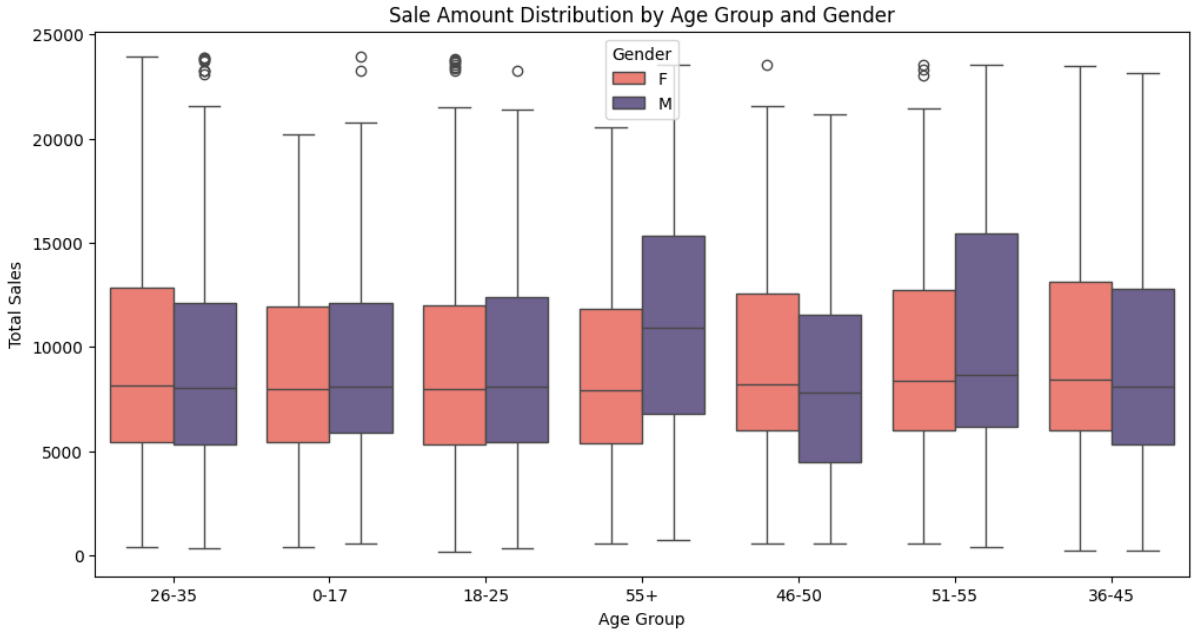

```
    plt.figure(figsize=(14,6))
    order = df.groupby('Occupation')['Total_Sales'].sum().sort_values(ascending=False).index
    sns.barplot(data=df, x='Occupation', y='Total_Sales', estimator=sum, ci=None, order=order, palette='mako')
    plt.title('Total Sales by Occupation')
    plt.xlabel('Occupation')
    plt.ylabel('Total Sales')
    plt.xticks(rotation=45, ha='right')
    plt.tight_layout()
    plt.show()
```

94] ✓ 1.6s Python

```
C:\Users\Dell\AppData\Local\Temp\ipykernel_10692\895434034.py:3: FutureWarning:

The `ci` parameter is deprecated. Use `errorbar=None` for the same effect.

  sns.barplot(data=df, x='Occupation', y='Total_Sales', estimator=sum, ci=None, order=order, palette='mako')
C:\Users\Dell\AppData\Local\Temp\ipykernel_10692\895434034.py:3: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `x` variable to `hue` and set `leg

  sns.barplot(data=df, x='Occupation', y='Total_Sales', estimator=sum, ci=None, order=order, palette='mako')
```



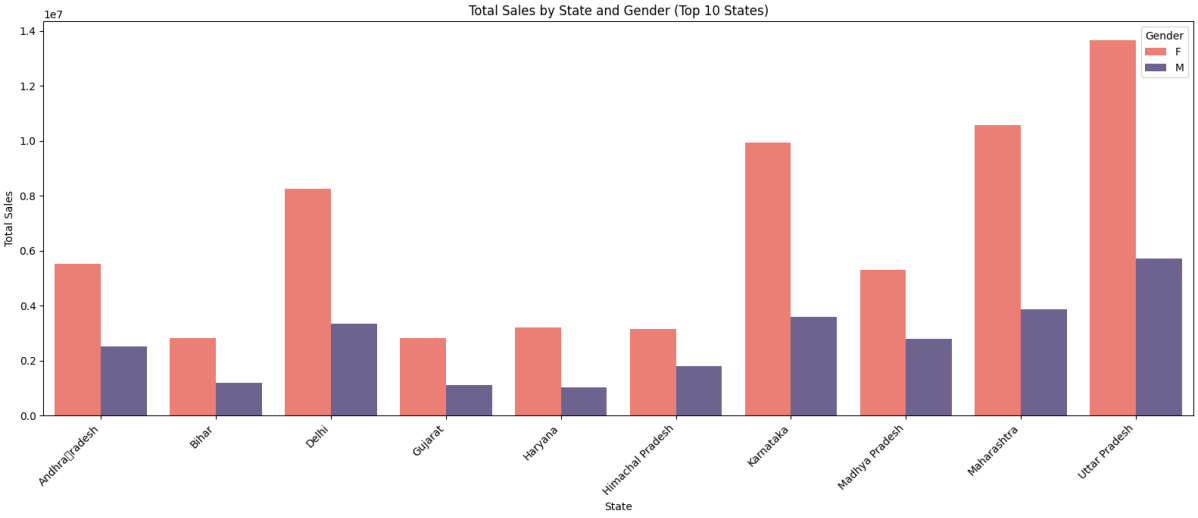

```
plt.figure(figsize=(12,6))
sns.boxplot(data=df, x='Age Group', y='Total_Sales', hue='Gender',
palette=custom_palette)
plt.title('Sale Amount Distribution by Age Group and Gender')
plt.xlabel('Age Group')
plt.ylabel('Total Sales')
plt.legend(title='Gender')
plt.show()
```

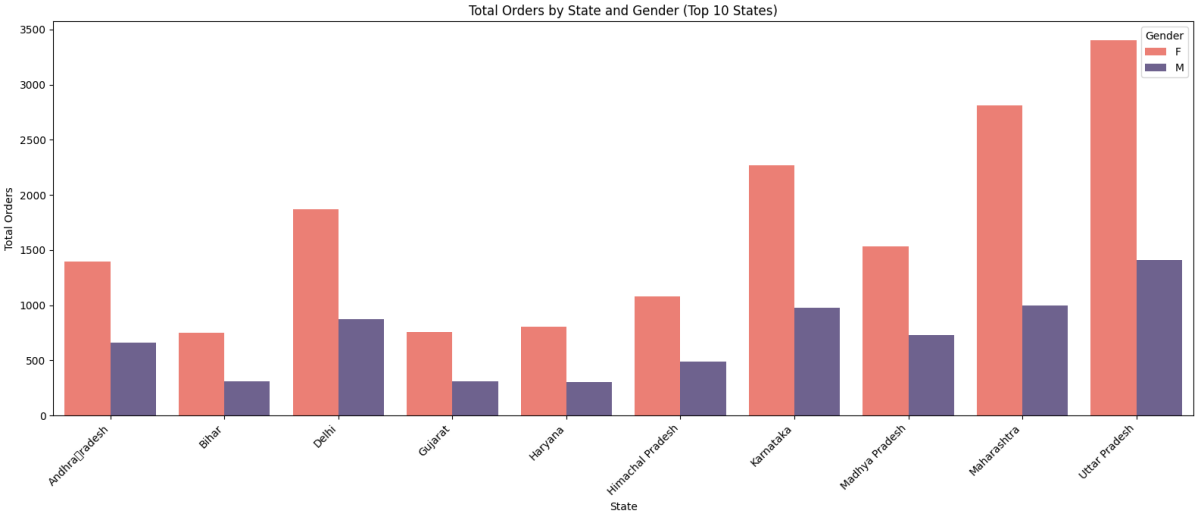


Analysis: State, Gender, Sale Amount, and Order Count

```
state_gender_group = df.groupby(['State', 'Gender']).agg({'Total_Sales':
'sum', 'Total_Orders': 'sum'}).reset_index()
```

```
top_states =
state_gender_group.groupby('State')['Total_Sales'].sum().sort_values(ascending
=False).head(10).index
filtered = state_gender_group[state_gender_group['State'].isin(top_states)]

plt.figure(figsize=(16,7))
sns.barplot(data=filtered, x='State', y='Total_Sales', hue='Gender',
palette=custom_palette)
plt.title('Total Sales by State and Gender (Top 10 States)')
plt.xlabel('State')
plt.ylabel('Total Sales')
plt.xticks(rotation=45, ha='right')
plt.legend(title='Gender')
plt.tight_layout()
plt.show()

plt.figure(figsize=(16,7))
sns.barplot(data=filtered, x='State', y='Total_Orders', hue='Gender',
palette=custom_palette)
plt.title('Total Orders by State and Gender (Top 10 States)')
plt.xlabel('State')
plt.ylabel('Total Orders')
plt.xticks(rotation=45, ha='right')
plt.legend(title='Gender')
plt.tight_layout()
plt.show()
```




Total Orders by State and Gender (Top 10 States)
Gender
F
M
Total Orders
0
500
1000
1500
2000
2500
3000
3500
Andhra□radesh
Bihar
Delhi
Gujarat
Haryana
Himachal Pradesh
Karnataka
Madhya Pradesh
Maharashtra
Uttar Pradesh
State