AMAZON SALES ANALYSIS TRANSACTIONS [MARCH TO JUNE 2022]

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Problem statement:

Analyze and Provide Insights on Amazon Sales Report

Dataset link:

https://drive.google.com/file/d/1YrjYKtS1WHmINL6eafRsrDzrZaw2_WvX/view?usp=sharing

Problem Description:

The provided dataset contains information about sales transactions on Amazon, including details such as order ID, date, status, fulfilment method, sales channel, product category, size, quantity, amount, shipping details, and more. The objective is to conduct a comprehensive analysis of the data and extract actionable insights to support business decision-making.

Libraries Used:

1.numpy

2.pandas

3.scikit-learn

4.matplot.lib

5.seaborn

6.warnings

Importing Required Libraries:

```
[ ] import pandas as pd
    import numpy as np
    import matplotlib.pyplot as plt
    import seaborn as sns
    from sklearn.preprocessing import StandardScaler
    from sklearn.cluster import KMeans
    import warnings
    warnings.filterwarnings("ignore")
```

DATA CLEANING AND PRCESSING :

```
sales_data = pd.read_csv('Amazon Sale Report.csv', encoding='latin-1')
sales_data
```

	index	Order ID	Date	Status	Fulfilment	Sales Channel	ship-service-level	Category	Size	Courier Status	...	currency	Amount	ship-city	ship-state	ship-postal-code	ship-country	B2B	fulfilled-by	New	PendingS
0	0	405-8078784-5731545	04-30-22	Cancelled	Merchant	Amazon.in	Standard	T-shirt	S	On the Way	...	INR	647.62	MUMBAI	MAHARASHTRA	400081.0	IN	False	Easy Ship	NaN	NaN
1	1	171-9198151-1101146	04-30-22	Shipped - Delivered to Buyer	Merchant	Amazon.in	Standard	Shirt	3XL	Shipped	...	INR	406.00	BENGALURU	KARNATAKA	560085.0	IN	False	Easy Ship	NaN	NaN
2	2	404-0687676-7273146	04-30-22	Shipped	Amazon	Amazon.in	Expedited	Shirt	XL	Shipped	...	INR	329.00	NAVI MUMBAI	MAHARASHTRA	410210.0	IN	True	NaN	NaN	NaN
3	3	403-9615377-8133951	04-30-22	Cancelled	Merchant	Amazon.in	Standard	Blazzer	L	On the Way	...	INR	753.33	PUDUCHERRY	PUDUCHERRY	605008.0	IN	False	Easy Ship	NaN	NaN
4	4	407-1069790-7240320	04-30-22	Shipped	Amazon	Amazon.in	Expedited	Trousers	3XL	Shipped	...	INR	574.00	CHENNAI	TAMIL NADU	600073.0	IN	False	NaN	NaN	NaN
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
128971	128970	406-6001380-7673107	05-31-22	Shipped	Amazon	Amazon.in	Expedited	Shirt	XL	Shipped	...	INR	517.00	HYDERABAD	TELANGANA	500013.0	IN	False	NaN	NaN	NaN
128972	128971	402-9551604-7544318	05-31-22	Shipped	Amazon	Amazon.in	Expedited	T-shirt	M	Shipped	...	INR	999.00	GURUGRAM	HARYANA	122004.0	IN	False	NaN	NaN	NaN
128973	128972	407-9547469-3152358	05-31-22	Shipped	Amazon	Amazon.in	Expedited	Blazzer	XXL	Shipped	...	INR	690.00	HYDERABAD	TELANGANA	500049.0	IN	False	NaN	NaN	NaN
128974	128973	402-6184140-0546956	05-31-22	Shipped	Amazon	Amazon.in	Expedited	T-shirt	XS	Shipped	...	INR	1199.00	Halol	Gujarat	389350.0	IN	False	NaN	NaN	NaN
128975	128974	408-7436540-8728312	05-31-22	Shipped	Amazon	Amazon.in	Expedited	T-shirt	S	Shipped	...	INR	696.00	Raipur	CHHATTISGARH	492014.0	IN	False	NaN	NaN	NaN

128976 rows × 21 columns

```
sales_data.head(10)
```

	index	Order ID	Date	Status	Fulfilment	Sales Channel	ship-service-level	Category	Size	Courier Status	...	currency	Amount	ship-city	ship-state	ship-postal-code	ship-country	B2B	fulfilled-by	New	PendingS
0	0	405-8078784-5731545	04-30-22	Cancelled	Merchant	Amazon.in	Standard	T-shirt	S	On the Way	...	INR	647.62	MUMBAI	MAHARASHTRA	400081.0	IN	False	Easy Ship	NaN	NaN
1	1	171-9198151-1101146	04-30-22	Shipped - Delivered to Buyer	Merchant	Amazon.in	Standard	Shirt	3XL	Shipped	...	INR	406.00	BENGALURU	KARNATAKA	560085.0	IN	False	Easy Ship	NaN	NaN
2	2	404-0687676-7273146	04-30-22	Shipped	Amazon	Amazon.in	Expedited	Shirt	XL	Shipped	...	INR	329.00	NAVI MUMBAI	MAHARASHTRA	410210.0	IN	True	NaN	NaN	NaN
3	3	403-9615377-8133951	04-30-22	Cancelled	Merchant	Amazon.in	Standard	Blazzer	L	On the Way	...	INR	753.33	PUDUCHERRY	PUDUCHERRY	605008.0	IN	False	Easy Ship	NaN	NaN
4	4	407-1069790-7240320	04-30-22	Shipped	Amazon	Amazon.in	Expedited	Trousers	3XL	Shipped	...	INR	574.00	CHENNAI	TAMIL NADU	600073.0	IN	False	NaN	NaN	NaN
5	5	404-1490984-4578765	04-30-22	Shipped	Amazon	Amazon.in	Expedited	T-shirt	XL	Shipped	...	INR	824.00	GHAZIABAD	UTTAR PRADESH	201102.0	IN	False	NaN	NaN	NaN
6	6	408-5748499-6859555	04-30-22	Shipped	Amazon	Amazon.in	Expedited	T-shirt	L	Shipped	...	INR	653.00	CHANDIGARH	CHANDIGARH	160036.0	IN	False	NaN	NaN	NaN
7	7	406-7807733-3785945	04-30-22	Shipped - Delivered to Buyer	Merchant	Amazon.in	Standard	Shirt	S	Shipped	...	INR	399.00	HYDERABAD	TELANGANA	500032.0	IN	False	Easy Ship	NaN	NaN
8	8	407-5443024-5233168	04-30-22	Cancelled	Amazon	Amazon.in	Expedited	T-shirt	3XL	Cancelled	...	NaN	NaN	HYDERABAD	TELANGANA	500008.0	IN	False	NaN	NaN	NaN
9	9	402-4393761-0311520	04-30-22	Shipped	Amazon	Amazon.in	Expedited	Shirt	XXL	Shipped	...	INR	363.00	Chennai	TAMIL NADU	600041.0	IN	False	NaN	NaN	NaN

10 rows × 21 columns

```
[ ] sales_data.tail(10)
```

	index	Order ID	Date	Status	Fulfilment	Sales Channel	ship-service-level	Category	Size	Courier Status	...	currency	Amount	ship-city	ship-state	ship-postal-code	ship-country	B2B	fulfilled-by	New	PendingS
128966	128965	408-5154281-4593912	05-31-22	Cancelled	Amazon	Amazon.in	Expedited	Trousers	3XL	Unshipped	...	INR	574.0	Prayagraj (ALLAHABAD)	UTTAR PRADESH	211007.0	IN	False	NaN	NaN	NaN
128967	128966	406-9812866-2474761	05-31-22	Shipped	Amazon	Amazon.in	Expedited	T-shirt	XS	Shipped	...	INR	1132.0	CHENNAI 600042	TAMIL NADU	600042.0	IN	False	NaN	NaN	NaN
128968	128967	404-5182288-1853947	05-31-22	Cancelled	Amazon	Amazon.in	Expedited	Shirt	XS	Cancelled	...	NaN	NaN	Kolkata	WEST BENGAL	700040.0	IN	False	NaN	NaN	NaN
128969	128968	403-7059995-7618722	05-31-22	Shipped	Amazon	Amazon.in	Expedited	T-shirt	XL	Shipped	...	INR	824.0	Delhi	DELHI	110053.0	IN	False	NaN	NaN	NaN
128970	128969	404-3802833-7250760	05-31-22	Cancelled	Amazon	Amazon.in	Expedited	T-shirt	M	Unshipped	...	INR	612.0	MUMBAI	MAHARASHTRA	400017.0	IN	False	NaN	NaN	NaN
128971	128970	406-6001380-7673107	05-31-22	Shipped	Amazon	Amazon.in	Expedited	Shirt	XL	Shipped	...	INR	517.0	HYDERABAD	TELANGANA	500013.0	IN	False	NaN	NaN	NaN
128972	128971	402-9551604-7544318	05-31-22	Shipped	Amazon	Amazon.in	Expedited	T-shirt	M	Shipped	...	INR	999.0	GURUGRAM	HARYANA	122004.0	IN	False	NaN	NaN	NaN
128973	128972	407-9547469-3152358	05-31-22	Shipped	Amazon	Amazon.in	Expedited	Blazzer	XXL	Shipped	...	INR	690.0	HYDERABAD	TELANGANA	500049.0	IN	False	NaN	NaN	NaN
128974	128973	402-6184140-0546956	05-31-22	Shipped	Amazon	Amazon.in	Expedited	T-shirt	XS	Shipped	...	INR	1199.0	Halol	Gujarat	389350.0	IN	False	NaN	NaN	NaN
128975	128974	408-7436540-8728312	05-31-22	Shipped	Amazon	Amazon.in	Expedited	T-shirt	S	Shipped	...	INR	696.0	Raipur	CHHATTISGARH	492014.0	IN	False	NaN	NaN	NaN

10 rows × 21 columns

```
[ ] sales_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 128976 entries, 0 to 128975
Data columns (total 21 columns):
 #   Column              Non-Null Count   Dtype
---  ------              --------------   -----
 0   index               128976 non-null  int64
 1   Order ID            128976 non-null  object
 2   Date                128976 non-null  object
 3   Status              128976 non-null  object
 4   Fulfilment          128976 non-null  object
 5   Sales Channel       128976 non-null  object
 6   ship-service-level  128976 non-null  object
 7   Category            128976 non-null  object
 8   Size                128976 non-null  object
 9   Courier Status      128976 non-null  object
 10  Qty                 128976 non-null  int64
 11  currency            121176 non-null  object
 12  Amount              121176 non-null  float64
 13  ship-city           128941 non-null  object
 14  ship-state          128941 non-null  object
 15  ship-postal-code    128941 non-null  float64
 16  ship-country        128941 non-null  object
 17  B2B                 128976 non-null  bool
 18  fulfilled-by        39263 non-null   object
 19  New                 0 non-null       float64
 20  Pending$            0 non-null       float64
dtypes: bool(1), float64(4), int64(2), object(14)
memory usage: 19.8+ MB
```

```
[ ] sales_data.shape
```

```
(128976, 21)
```

```
sales_data.columns
```

```
Index(['index', 'Order ID', 'Date', 'Status', 'Fulfilment', 'Sales Channel',
       'ship-service-level', 'Category', 'Size', 'Courier Status', 'Qty',
       'currency', 'Amount', 'ship-city', 'ship-state', 'ship-postal-code',
       'ship-country', 'B2B', 'fulfilled-by', 'New', 'Pending$'],
      dtype='object')
```

+ Code + Text

```
[ ] sales_data.sample(5)
```

	index	Order ID	Date	Status	Fulfilment	Sales Channel	ship-service-level	Category	Size	Courier Status	...	currency	Amount	ship-city	ship-state	ship-postal-code	ship-country	B2B	fulfilled-by	New	Pending$
37109	37108	408-2831510-4678721	04-08-2022	Cancelled	Amazon	Amazon.in	Expedited	Trousers	3XL	Unshipped	...	INR	540.0	BENGALURU	KARNATAKA	560016.0	IN	False	NaN	NaN	NaN
6078	6077	402-0742446-5384354	04-28-22	Shipped - Delivered to Buyer	Merchant	Amazon.in	Standard	Shirt	M	Shipped	...	INR	399.0	BENGALURU	KARNATAKA	560017.0	IN	False	Easy Ship	NaN	NaN
57808	57807	405-6003457-2245141	05-25-22	Shipped	Amazon	Amazon.in	Expedited	Shirt	3XL	Shipped	...	INR	544.0	ULIYAZHATHURA	KERALA	695587.0	IN	False	NaN	NaN	NaN
85263	85262	403-7009845-1333968	05-03-2022	Shipped	Amazon	Amazon.in	Expedited	Blazzer	XL	Shipped	...	INR	498.0	THANE	MAHARASHTRA	400610.0	IN	False	NaN	NaN	NaN
81508	81507	402-0939201-0600323	05-06-2022	Shipped	Amazon	Amazon.in	Expedited	Shirt	S	Shipped	...	INR	319.0	ASANSOL	WEST BENGAL	713305.0	IN	False	NaN	NaN	NaN

5 rows × 21 columns

```
[ ] sales_data.size
```

```
2708496
```

```
sales_data.nunique()
```

	0
index	128808
Order ID	120229
Date	91
Status	13
Fulfilment	2
Sales Channel	2
ship-service-level	2
Category	9
Size	11
Courier Status	4
Qty	10
currency	1
ship-state	69
ship-postal-code	9454
ship-country	1
B2B	2
fulfilled-by	1
New	0
Pending$	0

dtype: int64

```
[ ] sales_data['Fulfilment'].unique()
```

```
array(['Merchant', 'Amazon'], dtype=object)
```

```
[ ] sales_data['fulfilled-by'].unique()
```

```
array(['Easy Ship', nan], dtype=object)
```

```
[ ] sales_data['Status'].unique()
```

```
array(['Cancelled', 'Shipped - Delivered to Buyer', 'Shipped',
       'Shipped - Returned to Seller', 'Shipped - Rejected by Buyer',
       'Shipped - Lost in Transit', 'Shipped - Out for Delivery',
       'Shipped - Returning to Seller', 'Shipped - Picked Up', 'Pending',
       'Pending - Waiting for Pick Up', 'Shipped - Damaged', 'Shipping'],
      dtype=object)
```

```
[ ] sales_data['ship-service-level'].unique()
```

```
array(['Standard', 'Expedited'], dtype=object)
```

```
[ ] sales_data['B2B']
```

	B2B
0	False
1	False
2	True

3	False
4	False
...	...
128971	False
128972	False
128973	False
128974	False
128975	False

128976 rows × 1 columns

dtype: bool

```
sales_data['ship-state']
```

	ship-state
0	MAHARASHTRA
1	KARNATAKA
2	MAHARASHTRA
3	PUDUCHERRY
4	TAMIL NADU
...	...
128971	TELANGANA
128972	HARYANA
128973	TELANGANA
128974	Gujarat
128975	CHHATTISGARH

128976 rows × 1 columns

dtype: object

```
sales_data['ship-postal-code'].unique()
```

```
array(['MUMBAI', 'BENGALURU', 'NAVI MUMBAI', ...,
       'GULABPURA, Distt BHILWARA', 'Prayagraj (ALLAHABAD)', 'Halol'],
      dtype=object)
```

```
sales_data['ship-country'].unique()
```

```
array(['IN', nan], dtype=object)
```

```
sales_data['ship-service-level'].unique()
```

```
array(['Standard', 'Expedited'], dtype=object)
```

```
sales_data['Category'].unique()
```

```
array(['T-shirt', 'Shirt', 'Blazzer', 'Trousers', 'Perfume', 'Socks',
       'Shoes', 'Wallet', 'Watch'], dtype=object)
```

```
sales_data['Size'].unique()
```

```
array(['S', '3XL', 'XL', 'L', 'XXL', 'XS', '6XL', 'M', '4XL', 'Free',
       '5XL'], dtype=object)
```

```
sales_data['Courier Status'].unique()
```

```
array(['On the Way', 'Shipped', 'Cancelled', 'Unshipped'], dtype=object)
```

```
sales_data['Sales Channel'].unique()
```

```
array(['Amazon.in', 'Non-Amazon'], dtype=object)
```

```
replacement_dict = {('Goa', 'goa'): 'GOA', ('Delhi', 'delhi', 'New Delhi'): 'DELHI', ('Rajshthan', 'Rajasthan', 'Rajsthan', 'rajsthan', 'rajasthan', 'RJ'): 'RAJASTHAN',('Punjab', 'punjab', 'Punjab/Mohali/Zirakpur', 'PB
    'Manipur': 'MANIPUR',
    ('Odisha', 'orissa', 'Orissa'): 'ODISHA',
    ('NL', 'Nagaland'): 'NAGALAND',
    ('bihar', 'Bihar'): 'BIHAR',
    ('Puducherry', 'Pondicherry', 'PUDUCHERRY'): 'TAMIL NADU',
    'Mizoram': 'MIZORAM',
    ("Arunachal Pradesh', 'Arunachal pradesh", "AR"): 'ARUNACHAL PRADESH',
    'APO': 'ANDHRA PRADESH',
    'Meghalaya': 'MEGHALAYA',
    'Sikkim': 'SIKKIM',
    'Sikkim': 'SIKKIM',
    'Gujarat': 'GUJARAT'}
```

```
def replace_multiple(df, column, replacements):
    for keys, value in replacements.items():
        if isinstance(keys, tuple):
            sales_data["ship-state"] = sales_data["ship-state"].replace(keys, value)
        else:
            sales_data["ship-state"] = sales_data["ship-state"].replace(keys, value)

    return sales_data
```

```
sales_data = replace_multiple(sales_data, 'ship-state', replacement_dict)
```

```
sales_data['ship-state'].unique()
```

```
array(['MAHARASHTRA', 'KARNATAKA', 'TAMIL NADU', 'UTTAR PRADESH',
       'PUNJAB', 'TELANGANA', 'ANDHRA PRADESH', 'RAJASTHAN', 'DELHI',
       'HARYANA', 'ASSAM', 'JHARKHAND', 'CHHATTISGARH', 'ODISHA',
       'KERALA', 'MADHYA PRADESH', 'WEST BENGAL', 'NAGALAND', 'GUJARAT',
       'UTTARAKHAND', 'BIHAR', 'JAMMU & KASHMIR', 'HIMACHAL PRADESH',
       'ARUNACHAL PRADESH', 'GOA', 'MEGHALAYA', 'MANIPUR', 'TRIPURA',
       'LADAKH', 'DADRA AND NAGAR', 'SIKKIM', nan, 'ANDAMAN & NICOBAR',
       'MIZORAM', 'LAKSHADWEEP', 'Arunachal Pradesh', 'Arunachal pradesh'],
      dtype=object)
```

```
sales_data.isna().sum()/len(sales_data)*100
```

	0
index	0.000000
Order ID	0.000000
Date	0.000000
Status	0.000000
Fulfilment	0.000000
Sales Channel	0.000000
ship-service-level	0.000000
Category	0.000000

Size	0.000000
Courier Status	0.000000
Qty	0.000000
currency	6.047637
Amount	6.047637
ship-city	0.027137
ship-state	0.027137
ship-postal-code	0.027137
ship-country	0.027137
B2B	0.000000
fulfilled-by	69.557902
New	100.000000
PendingS	100.000000

dtype: float64

HANDLING MISSING VALUES:

```
[ ] sales_data.drop(["New", "PendingS", "fulfilled-by", "currency", "ship-country"],axis=1,inplace=True)
```

```
sales_data.head(10)
```

	index	Order ID	Date	Status	Fulfilment	Sales Channel	ship-service-level	Category	Size	Courier Status	Qty	Amount	ship-city	ship-state	ship-postal-code	B2B
0	0	405-8078784-5731545	04-30-22	Cancelled	Merchant	Amazon.in	Standard	T-shirt	S	On the Way	0	647.62	MUMBAI	MAHARASHTRA	400081.0	False
1	1	171-9198151-1101146	04-30-22	Shipped - Delivered to Buyer	Merchant	Amazon.in	Standard	Shirt	3XL	Shipped	1	406.00	BENGALURU	KARNATAKA	560085.0	False
2	2	404-0687676-7273146	04-30-22	Shipped	Amazon	Amazon.in	Expedited	Shirt	XL	Shipped	1	329.00	NAVI MUMBAI	MAHARASHTRA	410210.0	True
3	3	403-9815377-8133951	04-30-22	Cancelled	Merchant	Amazon.in	Standard	Blazzer	L	On the Way	0	753.33	PUDUCHERRY	TAMIL NADU	605008.0	False
4	4	407-1069790-7240320	04-30-22	Shipped	Amazon	Amazon.in	Expedited	Trousers	3XL	Shipped	1	574.00	CHENNAI	TAMIL NADU	600073.0	False
5	5	404-1490984-4578765	04-30-22	Shipped	Amazon	Amazon.in	Expedited	T-shirt	XL	Shipped	1	824.00	GHAZIABAD	UTTAR PRADESH	201102.0	False
6	6	408-5748499-6859555	04-30-22	Shipped	Amazon	Amazon.in	Expedited	T-shirt	L	Shipped	1	653.00	CHANDIGARH	PUNJAB	160036.0	False
7	7	406-7807733-3785945	04-30-22	Shipped - Delivered to Buyer	Merchant	Amazon.in	Standard	Shirt	S	Shipped	1	399.00	HYDERABAD	TELANGANA	500032.0	False
8	8	407-5443024-5233168	04-30-22	Cancelled	Amazon	Amazon.in	Expedited	T-shirt	3XL	Cancelled	0	NaN	HYDERABAD	TELANGANA	500008.0	False
9	9	402-4393761-0311520	04-30-22	Shipped	Amazon	Amazon.in	Expedited	Shirt	XXL	Shipped	1	363.00	Chennai	TAMIL NADU	600041.0	False

```
sales_data['Amount'].fillna(sales_data['Amount'].median(),inplace=True)
```

```
[ ] sales_data.dropna(inplace=True)
```

```
[ ] sales_data.isna().sum()/len(sales_data)*100
```

	0
index	0.0
Order ID	0.0
Date	0.0
Status	0.0
Fulfilment	0.0
Sales Channel	0.0
ship-service-level	0.0
Category	0.0
Size	0.0
Courier Status	0.0
Qty	0.0
Amount	0.0
ship-city	0.0
ship-state	0.0
ship-postal-code	0.0
B2B	0.0

dtype: float64

```
[ ] sales_data.duplicated().sum()
```

```
166
```

```
[ ] sales_data.drop_duplicates(inplace=True)
```

```
[ ] sales_data.columns
```

```
Index(['index', 'Order ID', 'Date', 'Status', 'Fulfilment', 'Sales Channel',
       'ship-service-level', 'Category', 'Size', 'Courier Status', 'Qty',
       'Amount', 'ship-city', 'ship-state', 'ship-postal-code', 'B2B'],
      dtype='object')
```

```
[ ] sales_data['ship-postal-code']= sales_data['ship-postal-code'].astype(int)
```

```
[ ] sales_data['ship-postal-code'].dtype
```

```
dtype('int64')
```

```
[ ] sales_data['Date']=pd.to_datetime(sales_data['Date'],errors='coerce')
```

```
[ ] sales_data.rename(columns={"Qty":"Quantity"},inplace=True)
```

```
[ ] sales_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 128775 entries, 0 to 128975
Data columns (total 16 columns):
 #   Column              Non-Null Count   Dtype
---  ------              --------------   -----
 0   index               128775 non-null  int64
 1   Order ID            128775 non-null  object
 2   Date                128775 non-null  datetime64[ns]
 3   Status              128775 non-null  object
 4   Fulfilment          128775 non-null  object
 5   Sales Channel       128775 non-null  object
 6   ship-service-level  128775 non-null  object
 7   Category            128775 non-null  object
 8   Size                128775 non-null  object
 9   Courier Status      128775 non-null  object
 10  Quantity            128775 non-null  int64
 11  Amount              128775 non-null  float64
 12  ship-city           128775 non-null  object
 13  ship-state          128775 non-null  object
 14  ship-postal-code    128775 non-null  int64
 15  B2B                 128775 non-null  bool
dtypes: bool(1), datetime64[ns](1), float64(1), int64(3), object(10)
memory usage: 15.8+ MB
```

```
[ ] sales_data.columns
```

```
Index(['index', 'Order ID', 'Date', 'Status', 'Fulfilment', 'Sales Channel',
       'ship-service-level', 'Category', 'Size', 'Courier Status', 'Quantity',
       'Amount', 'ship-city', 'ship-state', 'ship-postal-code', 'B2B'],
      dtype='object')
```

```
sales_data.describe()
```

	index	Date	Quantity	Amount	ship-postal-code
count	128775.000000	128775	128775.000000	128775.000000	128775.00000
mean	64564.787948	2022-05-12 12:19:14.348281344	0.904430	646.004662	463957.07107
min	0.000000	2022-03-31 00:00:00	0.000000	0.000000	110001.00000
25%	32371.500000	2022-04-20 00:00:00	1.000000	459.000000	382421.00000
50%	64589.000000	2022-05-10 00:00:00	1.000000	605.000000	500033.00000
75%	96772.500000	2022-06-04 00:00:00	1.000000	771.000000	600024.00000
max	128974.000000	2022-06-29 00:00:00	15.000000	5584.000000	989898.00000
std	37192.505842	NaN	0.313359	272.797676	191478.52940

EXPLORATORY DATA ANALYSIS :

1. Sales Overview: Understand the overall sales performance, trends, and patterns over time.

```
[ ] sales_data['Week'] = sales_data['Date'].dt.isocalendar().week
    sales_data['Year'] = sales_data['Date'].dt.year
    sales_data['Day'] = sales_data['Date'].dt.day
    sales_data['Month'] = sales_data['Date'].dt.month
```

```
[ ] sales_data['Total_Sales'] = sales_data['Amount'] * sales_data['Quantity']
```

```
[ ] sales_data['Month']=sales_data['Month'].replace({3:'March',4:'April',5:'May',6:'June'})
```

```
[ ] import datetime
    def int_to_dayname(Day):
      reference_date = datetime.date(2022, 3, 1)
      actual_date = reference_date + datetime.timedelta(days=Day - 1)
      return actual_date.strftime("%A")
```

```
[ ] sales_data['Day_Name'] = sales_data['Day'].apply(int_to_dayname)
```

```
sales_data['Total Sales in Million']= sales_data['Total_Sales']/1000000
sales_data.head()
```

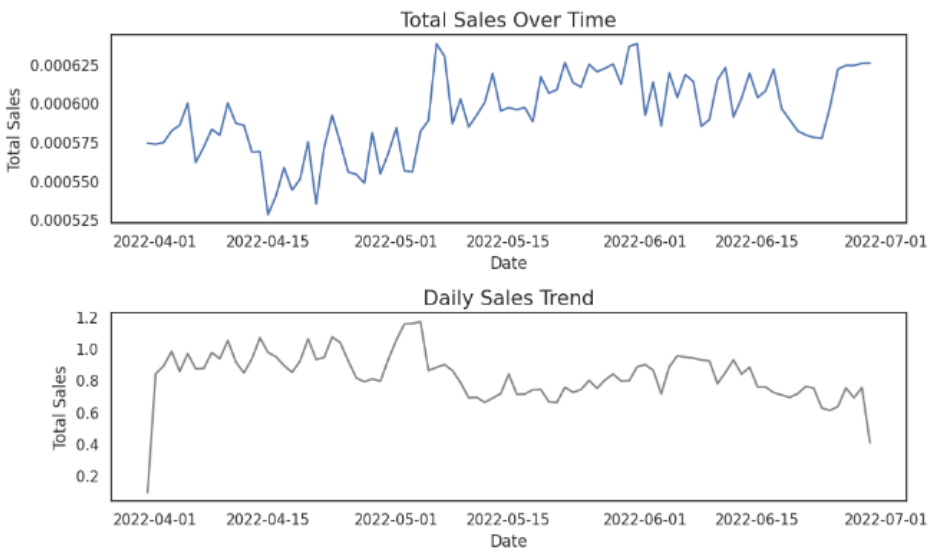
	index	Order ID	Date	Status	Fulfilment	Sales Channel	ship-service-level	Category	Size	Courier Status	...	ship-state	ship-postal-code	B2B	Week	Year	Day	Month	Total_Sales	Day_Name	Total Sales in Million
0	0	405-8078784-5731545	2022-04-30	Cancelled	Merchant	Amazon.in	Standard	T-shirt	S	On the Way	...	MAHARASHTRA	400081	False	17	2022	30	April	0.0	Wednesday	0.000000
1	1	171-9198151-1101146	2022-04-30	Shipped - Delivered to Buyer	Merchant	Amazon.in	Standard	Shirt	3XL	Shipped	...	KARNATAKA	560085	False	17	2022	30	April	405.0	Wednesday	0.000405
2	2	404-0687676-7273146	2022-04-30	Shipped	Amazon	Amazon.in	Expedited	Shirt	XL	Shipped	...	MAHARASHTRA	410210	True	17	2022	30	April	329.0	Wednesday	0.000329
3	3	403-9615377-8133951	2022-04-30	Cancelled	Merchant	Amazon.in	Standard	Blazzer	L	On the Way	...	TAMIL NADU	605008	False	17	2022	30	April	0.0	Wednesday	0.000000
4	4	407-1069790-7240320	2022-04-30	Shipped	Amazon	Amazon.in	Expedited	Trousers	3XL	Shipped	...	TAMIL NADU	600073	False	17	2022	30	April	574.0	Wednesday	0.000574

5 rows × 23 columns

total sales over time sales trend :

```
[ ] daily_sales = sales_data.groupby('Date')['Total Sales in Million'].sum().reset_index()
```

```
[ ] plt.figure(figsize=(10, 6))
    sns.set(style='white')
    plt.subplot(2,1,1)
    sns.lineplot(data=sales_data, x= 'Date', y='Total Sales in Million', ci=None)
    plt.title('Total Sales Over Time', fontsize=15)
    plt.xlabel('Date', fontsize=12)
    plt.ylabel('Total Sales', fontsize=12)
    plt.subplot(2,1,2)
    sns. lineplot (data=daily_sales, x='Date', y='Total Sales in Million', color='grey')
    plt.title('Daily Sales Trend', fontsize=15)
    plt.xlabel('Date', fontsize=12)
    plt.ylabel('Total Sales', fontsize=12)
    plt.tight_layout()
    plt.show()
```

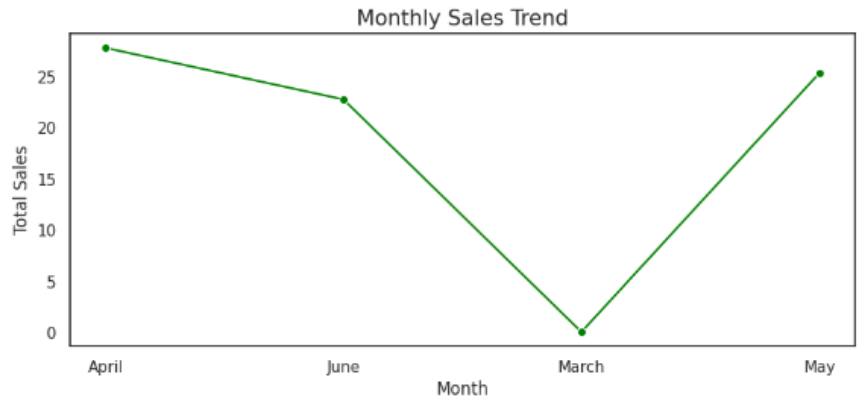



```
[ ] monthly_sales = sales_data.groupby('Month')['Total Sales in Million'].sum().reset_index()
    monthly_sales
```

	Month	Total Sales in Million
0	April	27.805861
1	June	22.776386
2	March	0.098261
3	May	25.344862

```
[ ] plt.figure(figsize=(10,4))
    sns.set(style='white')
    sns.lineplot(x='Month', y='Total Sales in Million', data=monthly_sales, color='green', marker='o')
    plt.title('Monthly Sales Trend', fontsize=15)
    plt.xlabel('Month', fontsize=12)
    plt.ylabel('Total Sales', fontsize=12)
```

```
Text(0, 0.5, 'Total Sales')
```



week sales trend and sales by day of the week:

```
[ ] weekly_sales= sales_data.groupby('Week')['Total Sales in Million'].sum().reset_index().sort_values('Total Sales in Million', ascending=False)
    weekly_sales
```

	Week	Total Sales in Million
5	18	7.005260
3	16	6.840369
2	15	6.604734
1	14	6.553733
10	23	6.315305
4	17	6.141171
9	22	6.023705
8	21	5.476505
11	24	5.385475
6	19	5.100345
7	20	5.015972
12	25	4.877384
0	13	2.821513
13	26	1.863899

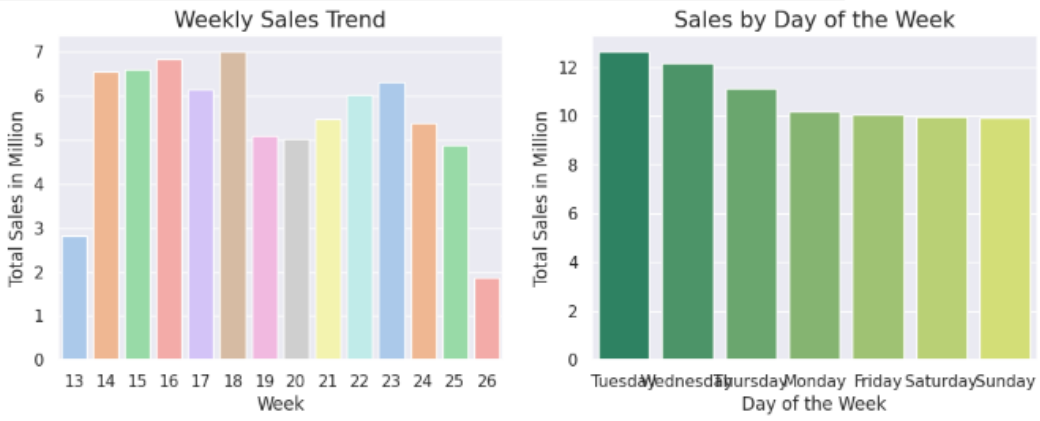
```
[ ] weekly_sales['week']=weekly_sales['Week'].astype('str')
```

```
[ ] weekday_sales= sales_data.groupby('Day_Name')['Total Sales in Million'].sum().reset_index().sort_values('Total Sales in Million', ascending=False)
    weekday_sales
```

	Day_Name	Total Sales in Million
5	Tuesday	12.628818
6	Wednesday	12.170677
4	Thursday	11.119816
1	Monday	10.179061
0	Friday	10.062556
2	Saturday	9.935046
3	Sunday	9.929396

```
plt.figure(figsize=(12,4))
sns.set(style="darkgrid")
plt.subplot(1,2,1)
sns.barplot(x='Week', y='Total Sales in Million', data=weekly_sales, palette='pastel')
plt.title('Weekly Sales Trend', fontsize=15)
plt.xlabel('Week', fontsize=12)
plt.ylabel('Total Sales in Million', fontsize=12)
sns.set(style='darkgrid')
plt.subplot(1,2,2)
sns.barplot(x='Day_Name', y='Total Sales in Million', data=weekday_sales, palette='summer')
plt.title('Sales by Day of the Week', fontsize=15)
plt.xlabel('Day of the Week', fontsize=12)
plt.ylabel("Total Sales in Million", fontsize=12)
plt.tight_layout
```

```
matplotlib.pyplot.tight_layout
def tight_layout(*, pad=1.08, h_pad=None, w_pad=None, rect=None)

Adjust the padding between and around subplots.

To exclude an artist on the Axes from the bounding box calculation
that determines the subplot parameters (i.e. legend, or annotation),
set ``a.set_in_layout(False)`` for that artist.
```



2. Product Analysis: Analyze the distribution of product categories, sizes, and qutanties sold to identify popular products:

analyze product category distrubtion

```
[ ] category_dist= sales_data['Category'].value_counts()
    category_dist
```

Category	count
T-shirt	50207
Shirt	49786
Blazzer	15488
Trousers	10605
Perfume	1157
Wallet	926
Socks	439
Shoes	164
Watch	3

dtype: int64

product size distrubtion

```
size_counts = sales_data['Size'].value_counts()
size_counts
```

Size	count
M	22343
L	21768
XL	20516
XXL	17780
S	16748
3XL	14625
XS	11032
Free	2250
6XL	738
5XL	550
4XL	425

dtype: int64

popular product by category and size

```
quantity_sold = sales_data.groupby(['Category', 'Size'])['Quantity'].sum().reset_index()
popular_product=quantity_sold.nlargest(5,   'Quantity')
popular_product
```

	Category	Size	Quantity
31	T-shirt	M	8346
12	Shirt	L	8031
15	Shirt	XL	7825
13	Shirt	M	7699
30	T-shirt	L	7385

```
plt.figure(figsize=(10,7))
sns.set(style='white')
plt.subplot(2,2,1)
sns.histplot(x='Category', data=sales_data, color='orange')
plt.title('Product Category Distribution', fontsize=14)
plt.xlabel("Category", fontsize=12)
plt.ylabel("Count", fontsize=12)
plt.xticks(rotation=45, ha='right')

plt.subplot(2,2,2)
sns.countplot(x='Size', data=sales_data, palette= 'Purples_d')
plt.title('Size Distribution', fontsize=14)
plt.xlabel("Size", fontsize=12)
plt.ylabel("Count", fontsize=12)
plt.xticks(rotation=45, ha='right')
```

```
plt.subplot(2,2,3)
sns.barplot(x='Category', y='Quantity', data=popular_product, hue='Size', palette='RdPu', saturation=0.9)
plt.title('Popular Products by Category, Size and Quantity', fontsize=14)
plt.xlabel("Category", fontsize=12)
plt.ylabel("Quantity", fontsize=12)
plt.xticks(rotation=45, ha='right')
plt.tight_layout()
plt.show()
```

3. **Fulfillment Analysis: Investigate the fulfillment methods used and their effectiveness in delivering orders.**

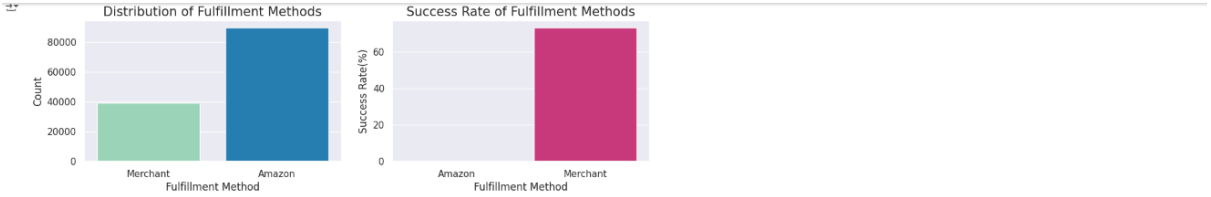
```
fulfillment_dist= sales_data['Fulfilment'].value_counts().reset_index()
fulfillment_dist
```

	Fulfilment	count
0	Amazon	89575
1	Merchant	39200

sucess rate analysis

```
success_rate = sales_data[(sales_data['Status'] == 'Shipped - Delivered to Buyer') | (sales_data['Status']=='shipped')].groupby('Fulfilment').size() / sales_data.groupby('Fulfilment').size() * 100
Sr=success_rate.reset_index(name='Success Rate')
```

```
plt.figure(figsize =(12,3))
sns.set(style='darkgrid')
plt.subplot(1,2,1)
sns.countplot(data=sales_data, x='Fulfilment', palette='YlGnBu', saturation=0.9)
plt.title("Distribution of Fulfillment Methods", fontsize=15)
plt.xlabel('Fulfillment Method', fontsize=12)
plt.ylabel('Count', fontsize=12)
plt.subplot(1,2,2)
sns.barplot(x='Fulfilment',y='Success Rate',data=Sr,palette='PuRd')
plt.title('Success Rate of Fulfillment Methods', fontsize=15)
plt.xlabel('Fulfillment Method', fontsize=12)
plt.ylabel('Success Rate(%)', fontsize=12)
plt.show()
```



4. Customer Segmentation: Segment customers based on their buying behaviour, location, and other relevant factors.

```
customer_data = sales_data.groupby('Order ID').agg({'Amount': 'sum', 'Quantity': 'sum', 'Quantity': 'sum', 'ship-city': 'first', 'ship-state': 'first', 'ship-postal-code': 'first', 'B2B': 'first'}).reset_index()
```

```
customer_data.rename(columns={'Amount': 'Total Amount spent', 'Quantity': 'Total Quantity purchased'}, inplace=True)
```

```
print(customer_data.head())
```

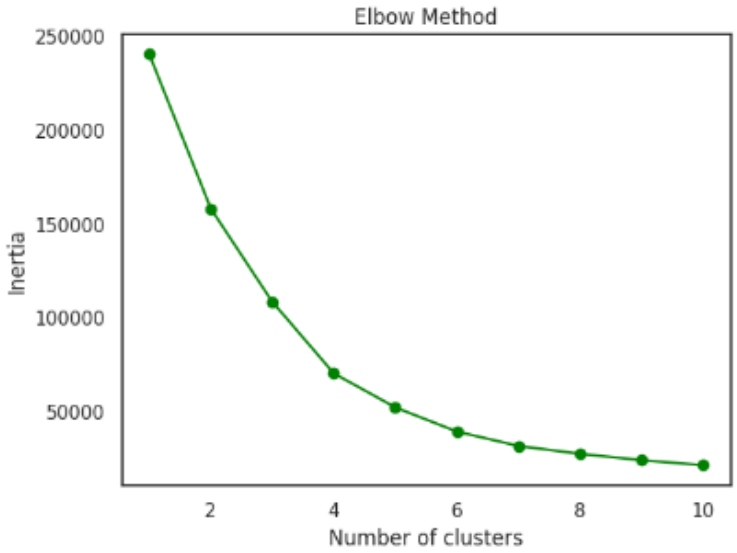
```
              Order ID  Total Amount spent  Total Quantity purchased  \
0  171-0000547-8192359               301.0                         1
1  171-0000902-4490745               544.0                         1
2  171-0001409-6228339               422.0                         1
3  171-0003082-5110755               563.0                         1
4  171-0003738-2052324               379.0                         1

          ship-city     ship-state  ship-postal-code    B2B
0  PIMPRI CHINCHWAD    MAHARASHTRA            412101  False
1            Howrah    WEST BENGAL            711104  False
2             KODAD      TELANGANA            508206  False
3     GREATER NOIDA  UTTAR PRADESH            201306  False
4         FIROZABAD  UTTAR PRADESH            283203  False
```

```
features = customer_data[['Total Amount spent', 'Total Quantity purchased']]
```

```
scaler = StandardScaler()
scaled_features = scaler.fit_transform(features)
```

```
inertia = []
for n in range(1, 11):
  kmeans = KMeans(n_clusters=n, random_state=42)
  kmeans.fit(scaled_features)
  inertia.append(kmeans.inertia_)
```

```
sns.set(style='white')
plt.plot(range(1, 11), inertia, marker='o', color="green")
plt.xlabel('Number of clusters')
plt.ylabel('Inertia')
plt.title('Elbow Method')
plt.show()
```




```
optimal_clusters = 3
```

```
kmeans = KMeans(n_clusters=optimal_clusters, random_state=42)
customer_data['Cluster'] = kmeans.fit_predict(scaled_features)
```

```
print(customer_data.head())
```

```
             Order ID  Total Amount spent  Total Quantity purchased  \
0  171-0000547-8192359               301.0                         1
1  171-0000902-4490745               544.0                         1
2  171-0001409-6228339               422.0                         1
3  171-0003082-5110755               563.0                         1
4  171-0003738-2052324               379.0                         1

          ship-city     ship-state  ship-postal-code    B2B  Cluster
0  PIMPRI CHINCHWAD    MAHARASHTRA            412101  False        0
1           Howrah    WEST BENGAL            711104  False        0
2            KODAD      TELANGANA            508206  False        0
3    GREATER NOIDA  UTTAR PRADESH            201306  False        0
4        FIROZABAD  UTTAR PRADESH            283203  False        0
```

```
cluster_analysis = customer_data.groupby('Cluster').agg({'Total Amount spent': ['mean', 'sum'], 'Total Quantity purchased': ['mean', 'sum'], 'ship-city': 'count', 'ship-state': 'first', 'ship-postal-code': 'first', 'B2
```

```
cluster_analysis.columns = [ 'Avg Amount spent', 'Total Amount spent', 'Avg Quantity purchased', 'Total Quantity purchased', 'customer count', 'Representative City', 'Representative State', 'Representative Postal Code'
```

```
cluster_analysis
```

	Avg Amount spent	Total Amount spent	Avg Quantity purchased	Total Quantity purchased	customer count	Representative City	Representative State	Representative Postal Code	B2B
0	0	649.009248	66385858.00	1.006208	102923	102288	MAHARASHTRA	412101	False
1	1	1521.238652	9108122.60	2.262780	13545	5986	GUJARAT	380015	False
2	2	645.365120	7697269.79	0.000000	0	11927	GUJARAT	382424	False

```
plt.figure(figsize=(10, 4))
sns.set(style='white')
sns.scatterplot(x='Total Amount spent', y='Total Quantity purchased', hue='Cluster', data=customer_data, palette='YlGnBu')
plt.title('Customer Segments')
plt.xlabel('Total Amount Spent')
plt.ylabel('Total Quantity Purchased')
plt.legend(loc='lower right')
plt.show()
```

5. Geographical Analysis: Explore the geographical distribution of sales, focusing on states and cities.

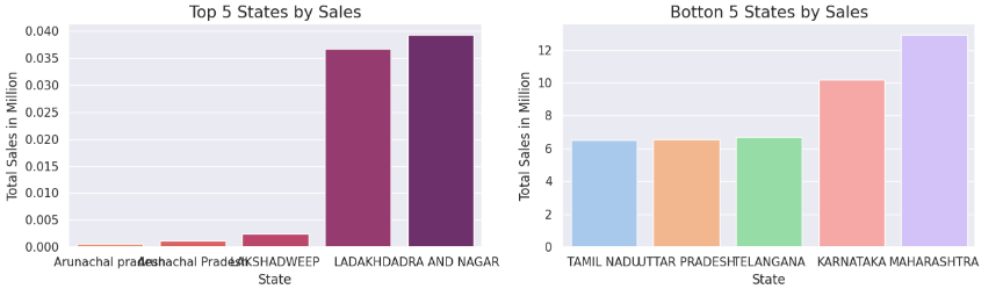
```
top_sales_states = sales_data.groupby('ship-state')['Total Sales in Million'].sum().reset_index().sort_values(by='Total Sales in Million', ascending=True).head(5)
top_sales_states
```

	ship-state	Total Sales in Million
5	Arunachal pradesh	0.000602
4	Arunachal Pradesh	0.001235
19	LAKSHADWEEP	0.002441
18	LADAKH	0.036737
8	DADRA AND NAGAR	0.039276

```
bottom_sales_states = sales_data.groupby('ship-state')['Total Sales in Million'].sum().reset_index().sort_values(by='Total Sales in Million', ascending=True).tail(5)
bottom_sales_states
```

	ship-state	Total Sales in Million
30	TAMIL NADU	6.505236
33	UTTAR PRADESH	6.553145
31	TELANGANA	6.699150
16	KARNATAKA	10.208746
21	MAHARASHTRA	12.921668

```
plt.figure(figsize=(13,4))
sns.set(style="darkgrid")
plt.subplot(1,2,1)
sns.barplot(x='ship-state', y='Total Sales in Million',data=top_sales_states,palette='flare', saturation=0.9)
plt.title('Top 5 States by Sales', fontsize=15)
plt.ylabel('Total Sales in Million', fontsize=12)
plt.xlabel('State', fontsize=12)
plt.subplot(1,2,2)
sns.barplot(x='ship-state', y='Total Sales in Million', data=bottom_sales_states, palette='pastel', saturation=0.8)
plt.title('Botton 5 States by Sales', fontsize=15)
plt.ylabel('Total Sales in Million', fontsize=12)
plt.xlabel('State', fontsize=12)
plt.tight_layout()
```



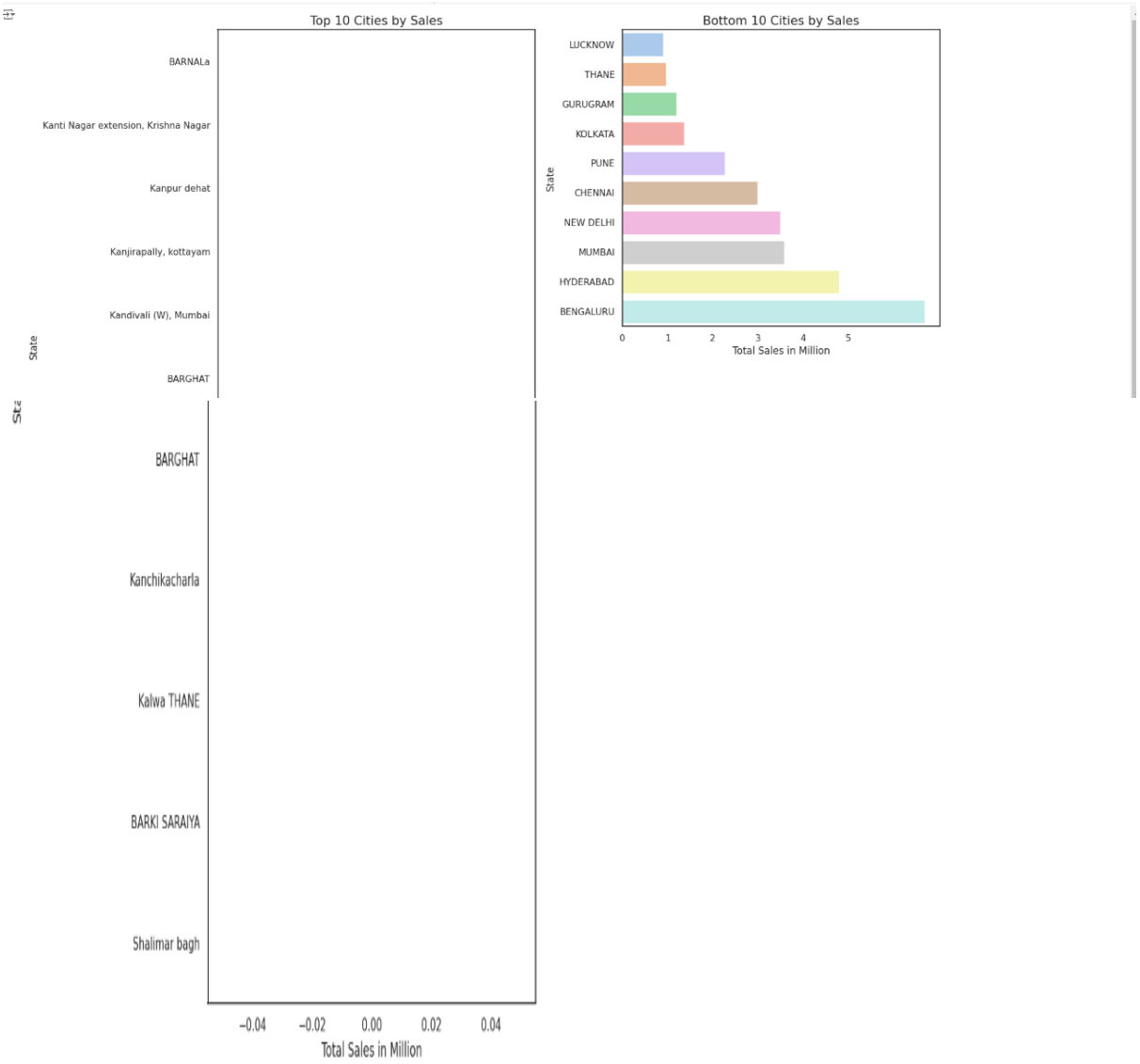

```
top_sales_cities = sales_data.groupby('ship-city')['Total Sales in Million'].sum().reset_index().sort_values(by='Total Sales in Million', ascending=True).head(10)
top_sales_cities
```

	ship-city	Total Sales in Million
704	BARNALa	0.0
4023	Kanti Nagar extension, Krishna Nagar	0.0
4020	Kanpur dehat	0.0
4009	Kanjirapally, kottayam	0.0
3996	Kandivali (W), Mumbai	0.0
690	BARGHAT	0.0
3987	Kanchikacharla	0.0
3962	Kalwa THANE	0.0
701	BARKI SARAIYA	0.0
7328	Shalimar bagh	0.0

```
bottom_sales_cities = sales_data.groupby('ship-city')['Total Sales in Million'].sum().reset_index().sort_values(by='Total Sales in Million', ascending=True).tail(10)
bottom_sales_cities
```

	ship-city	Total Sales in Million
4395	LUCKNOW	0.895673
7583	THANE	0.968244
2618	GURUGRAM	1.192451
3710	KOLKATA	1.368826
6156	PUNE	2.270924
1464	CHENNAI	2.994311
5391	NEW DELHI	3.490346
4793	MUMBAI	3.585314
2904	HYDERABAD	4.793958
775	BENGALURU	6.698265

```
plt.figure(figsize=(16,12))
sns.set(style="white")
plt.subplot(1,2,1)
sns.barplot(y='ship-city', x='Total Sales in Million', data=top_sales_cities, palette='tab20b')
plt.title('Top 10 Cities by Sales', fontsize=15)
plt.xlabel('Total Sales in Million', fontsize=12)
plt.ylabel('State', fontsize=12)
plt.subplot(2,2,2)
sns.barplot(y='ship-city', x='Total Sales in Million', data=bottom_sales_cities, palette='pastel')
plt.title('Bottom 10 Cities by Sales', fontsize=15)
plt.xlabel('Total Sales in Million', fontsize=12)
plt.ylabel("State", fontsize=12)
plt.xticks([0, 1, 2, 3, 4, 5])
plt.tight_layout()
```


Top 10 Cities by Sales
BARNALa
Kanti Nagar extension, Krishna Nagar
Kanpur dehat
Kanjirapally, kottayam
Kandivali (W), Mumbai
BARGHAT
State
Bottom 10 Cities by Sales
LUCKNOW
THANE
GURUGRAM
KOLKATA
PUNE
CHENNAI
NEW DELHI
MUMBAI
HYDERABAD
BENGALURU
State
0
1
2
3
4
5
Total Sales in Million
BARGHAT
Kanchikacharla
Kalwa THANE
BARKI SARAIYA
Shalimar bagh
−0.04
−0.02
0.00
0.02
0.04
Total Sales in Million

6.Business Insights: Provide actionable insights and recommendations based on the analysis to optimize sales strategies, improve customer satisfaction, and enhance overall business performance.

Optimize Sales Strategies:

Focus on Popular Products: You identified the top-selling product categories and sizes. Consider Increasing stock and variety within these categories. Running targeted marketing campaigns highlighting these products. Bundling popular products together for promotions.

Capitalize on Peak Sales Periods: Your analysis revealed weekly and daily sales trends. Use this information to: Schedule appropriate staffing levels to handle increased demand. Plan promotions or discounts during high-traffic periods. Adjust inventory levels to avoid stockouts during peak seasons. Improve Customer Satisfaction Enhance Fulfillment Efficiency: You analyzed the success rates of different fulfillment methods.

To improve customer satisfaction:

Address any issues with underperforming fulfillment methods. Consider offering expedited shipping options for time-sensitive customers. Communicate clearly with customers about shipping expectations and potential delays.

Personalize Customer Experience: Your customer segmentation analysis revealed distinct customer groups.

** Leverage this information to:** Tailor marketing messages and promotions to specific customer segments. Develop loyalty programs or exclusive offers for high-value customers. Provide personalized product recommendations based on customer preferences.

Enhance Overall Business Performance

Target Underperforming Regions: Your geographical analysis identified states and cities with lower sales.

** To improve performance:** Investigate the reasons for lower sales in these areas. Consider targeted marketing campaigns or partnerships to increase brand awareness. Evaluate the feasibility of expanding distribution channels in these regions. Monitor and Adapt: Continuously track key metrics and analyze sales data to identify emerging trends and patterns. This will enable you toAdapt your sales strategies and marketing efforts as needed.Stay ahead of the competition and capitalize on new opportunities. Make data-driven decisions to optimize your overall business performance.