Import Libraries

```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

Import Raw Data

```
df = pd.read_csv("/content/drive/MyDrive/OUTRIX/data.csv", encoding="latin1")
```

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

	InvoiceNo	StockCode	Description	Quantity	InvoiceDate	UnitPrice	CustomerID	Country
0	536365	85123A	WHITE HANGING HEART T-LIGHT HOLDER	6	12/1/2010 8:26	2.55	17850.0	United Kingdom
1	536365	71053	WHITE METAL LANTERN	6	12/1/2010 8:26	3.39	17850.0	United Kingdom
2	536365	84406B	CREAM CUPID HEARTS COAT HANGER	8	12/1/2010 8:26	2.75	17850.0	United Kingdom
[illegible]	[illegible]	[illegible]	KNITTED UNION FLAG HOT WATER	[illegible]	12/1/2010	[illegible]	[illegible]	United

DATA CLEANING

```
# Remove duplicates
df.drop_duplicates(inplace=True)

# Convert InvoiceDate to datetime
df["InvoiceDate"] = pd.to_datetime(df["InvoiceDate"])

# Remove missing CustomerID rows
df = df.dropna(subset=["CustomerID"])

# Remove negative/zero values for Quantity & UnitPrice
df = df[(df["Quantity"] > 0) & (df["UnitPrice"] > 0)]

# Reset index
df.reset_index(drop=True, inplace=True)

# Create a new column for Total Sales
df["TotalSales"] = df["Quantity"] * df["UnitPrice"]

print("Data cleaned. Shape:", df.shape)
```

```
Data cleaned. Shape: (392692, 9)
```

Sample Data

```
df.head(10)
```

	InvoiceNo	StockCode	Description	Quantity	InvoiceDate	UnitPrice	CustomerID	Country	TotalSales
0	536365	85123A	WHITE HANGING HEART T-LIGHT HOLDER	6	2010-12-01 08:26:00	2.55	17850.0	United Kingdom	15.30
1	536365	71053	WHITE METAL LANTERN	6	2010-12-01 08:26:00	3.39	17850.0	United Kingdom	20.34
2	536365	84406B	CREAM CUPID HEARTS COAT HANGER	8	2010-12-01 08:26:00	2.75	17850.0	United Kingdom	22.00
3	536365	84029G	KNITTED UNION FLAG HOT WATER BOTTLE	6	2010-12-01 08:26:00	3.39	17850.0	United Kingdom	20.34
4	536365	84029E	RED WOOLLY HOTTIE WHITE HEART.	6	2010-12-01 08:26:00	3.39	17850.0	United Kingdom	20.34
5	536365	22752	SET 7 BABUSHKA NESTING BOXES	2	2010-12-01 08:26:00	7.65	17850.0	United Kingdom	15.30
6	536365	21730	GLASS STAR FROSTED T-LIGHT HOLDER	6	2010-12-01 08:26:00	4.25	17850.0	United Kingdom	25.50
7	536366	22633	HAND WARMER UNION JACK	6	2010-12-01 08:28:00	1.85	17850.0	United Kingdom	11.10
8	536366	22632	HAND WARMER RED POLKA DOT	6	2010-12-01 08:28:00	1.85	17850.0	United Kingdom	11.10
9	536367	84879	ASSORTED COLOUR BIRD ORNAMENT	32	2010-12-01 08:34:00	1.69	13047.0	United Kingdom	54.08

```
df.tail(10)
```

	InvoiceNo	StockCode	Description	Quantity	InvoiceDate	UnitPrice	CustomerID	Country	TotalSales
392682	581587	22726	ALARM CLOCK BAKELIKE GREEN	4	2011-12-09 12:50:00	3.75	12680.0	France	15.00
392683	581587	22730	ALARM CLOCK BAKELIKE IVORY	4	2011-12-09 12:50:00	3.75	12680.0	France	15.00
392684	581587	22367	CHILDRENS APRON SPACEBOY DESIGN	8	2011-12-09 12:50:00	1.95	12680.0	France	15.60
392685	581587	22629	SPACEBOY LUNCH BOX	12	2011-12-09 12:50:00	1.95	12680.0	France	23.40
392686	581587	23256	CHILDRENS CUTLERY SPACEBOY	4	2011-12-09 12:50:00	4.15	12680.0	France	16.60
392687	581587	22613	PACK OF 20 SPACEBOY NAPKINS	12	2011-12-09 12:50:00	0.85	12680.0	France	10.20
[illegible]	[illegible]	[illegible]	CHILDREN'S APRON	[illegible]	2011-12-09	[illegible]	[illegible]	[illegible]	[illegible]

```
#Field Info
df.columns
```

```
Index(['InvoiceNo', 'StockCode', 'Description', 'Quantity', 'InvoiceDate',
       'UnitPrice', 'CustomerID', 'Country', 'TotalSales'],
      dtype='object')
```

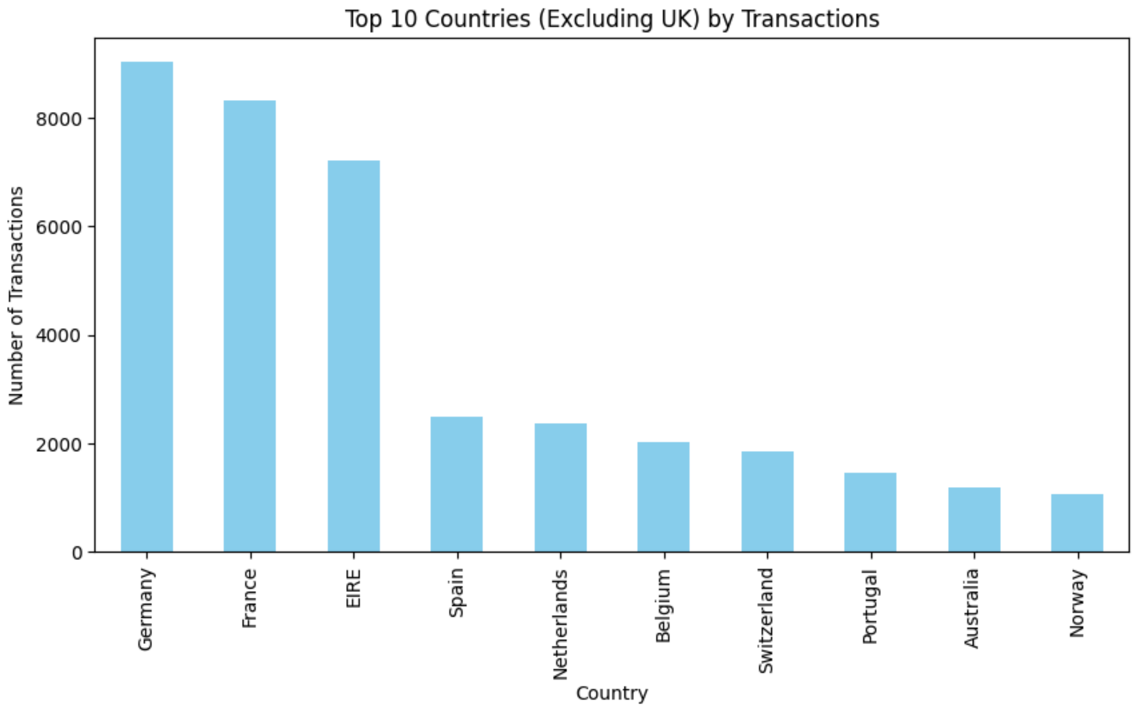
```
#Data Types
df.dtypes
```

	0
InvoiceNo	object
StockCode	object
Description	object
Quantity	int64
InvoiceDate	datetime64[ns]
UnitPrice	float64
CustomerID	float64
Country	object
TotalSales	float64

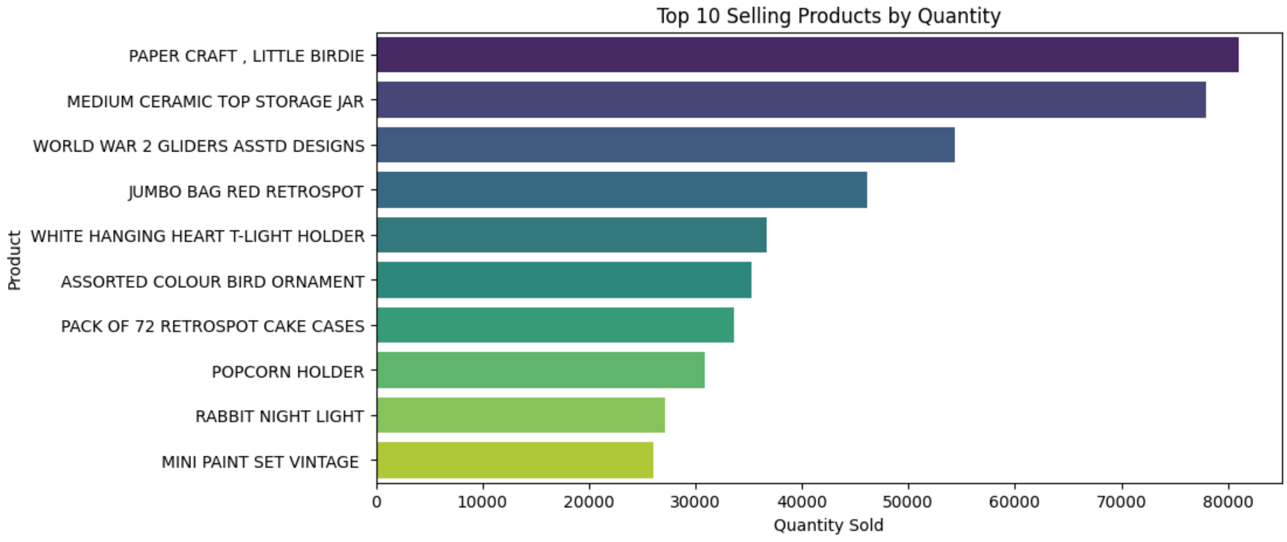
dtype: object

EDA(EXPLORATORY DATA ANALYSIS)

```
# Top 10 countries by transactions (excluding UK for variety)
plt.figure(figsize=(10,5))
df[df["Country"]!="United Kingdom"]["Country"].value_counts().head(10).plot(kind="bar", color="skyblue")
plt.title("Top 10 Countries (Excluding UK) by Transactions")
plt.ylabel("Number of Transactions")
plt.xticks(rotation=90)
plt.show()
```

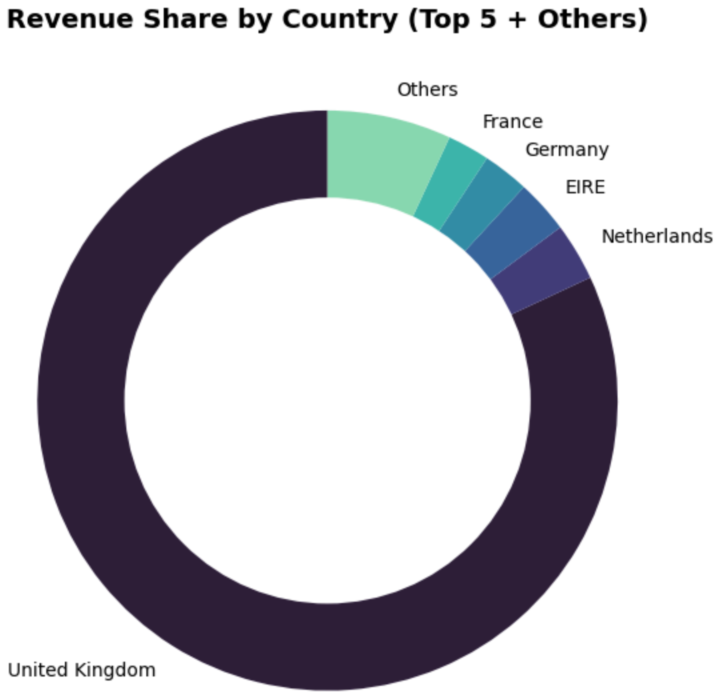


```
# Top 10 selling products
top_products = df.groupby("Description")["Quantity"].sum().sort_values(ascending=False).head(10)
plt.figure(figsize=(10,5))
sns.barplot(x=top_products.values, y=top_products.index, hue=top_products.index, palette="viridis", legend=False)
plt.title("Top 10 Selling Products by Quantity")
plt.xlabel("Quantity Sold")
plt.ylabel("Product")
plt.show()
```

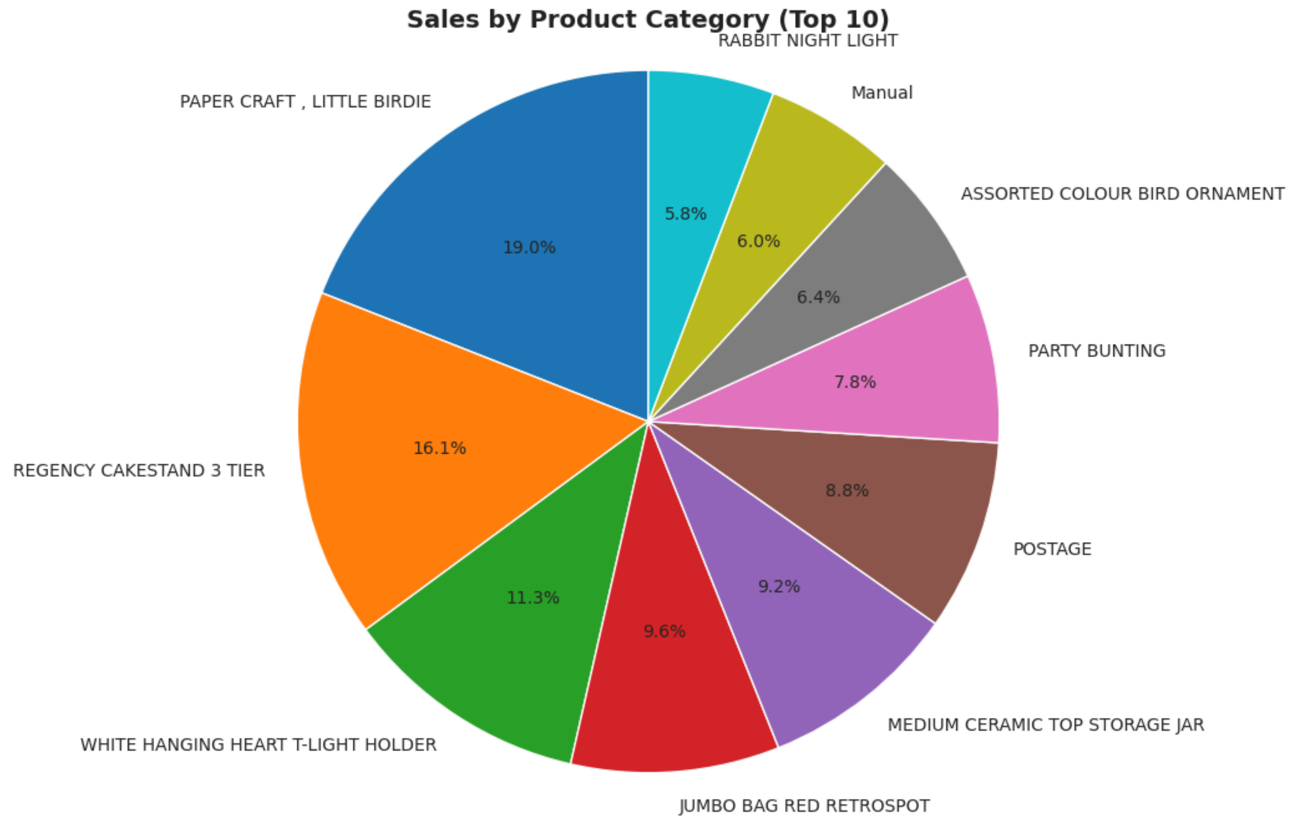


```
# Revenue by Country
revenue_by_country = df.groupby("Country")["TotalSales"].sum().sort_values(ascending=False)

# Take top 5 countries, group the rest as "Others"
top_n = 5
top_countries = revenue_by_country.head(top_n)
```

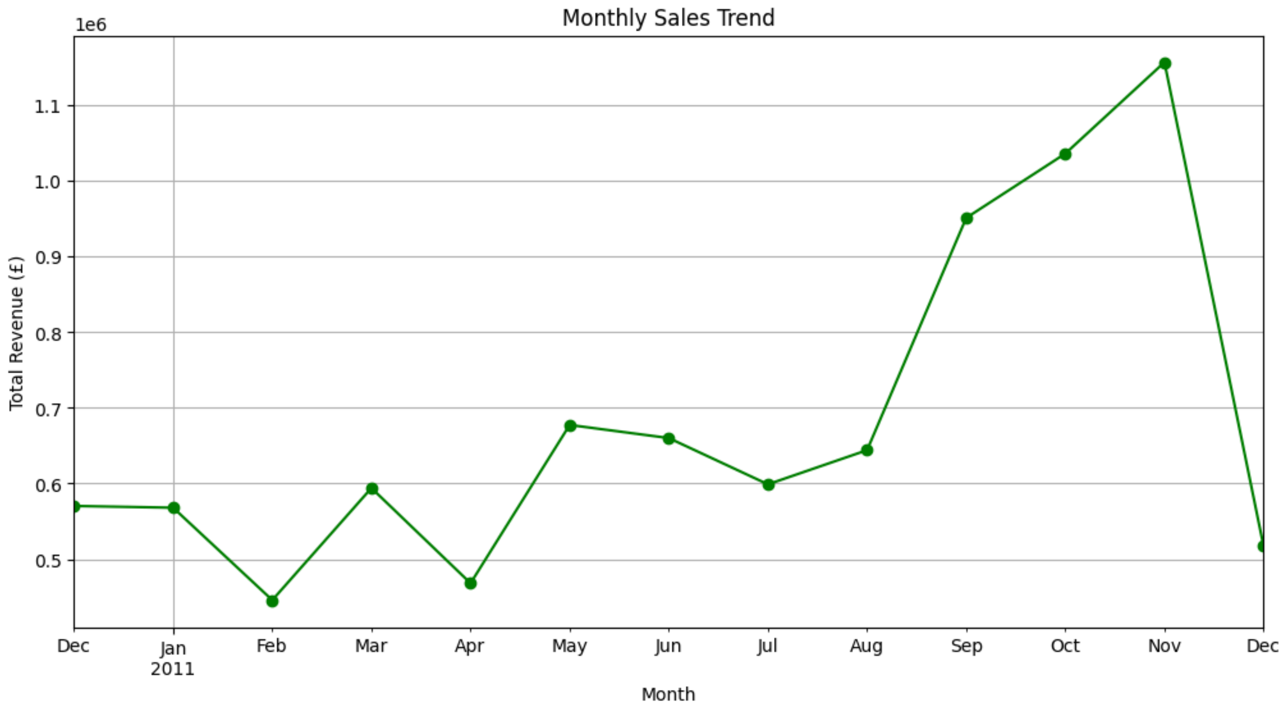
```
others = pd.Series(revenue_by_country[top_n:].sum(), index=["Others"])
revenue_final = pd.concat([top_countries, others])

# Colors
colors = sns.color_palette("mako", len(revenue_final))

# Donut chart
plt.figure(figsize=(6,6))
wedges, texts, autotexts = plt.pie(revenue_final.values,labels=revenue_final.index,
                                   autopct='%1.1f%%',startangle=90,colors=colors,
                                   textprops={'fontsize': 10})

# Donut hole
centre_circle = plt.Circle((0,0),0.70,fc='white')
fig = plt.gcf()
fig.gca().add_artist(centre_circle)

# Styling
plt.title("Revenue Share by Country (Top 5 + Others)", fontsize=14, weight='bold')
for autotext in autotexts:
    autotext.set_color('white')
    autotext.set_fontsize(9)

plt.tight_layout()
plt.show()
```



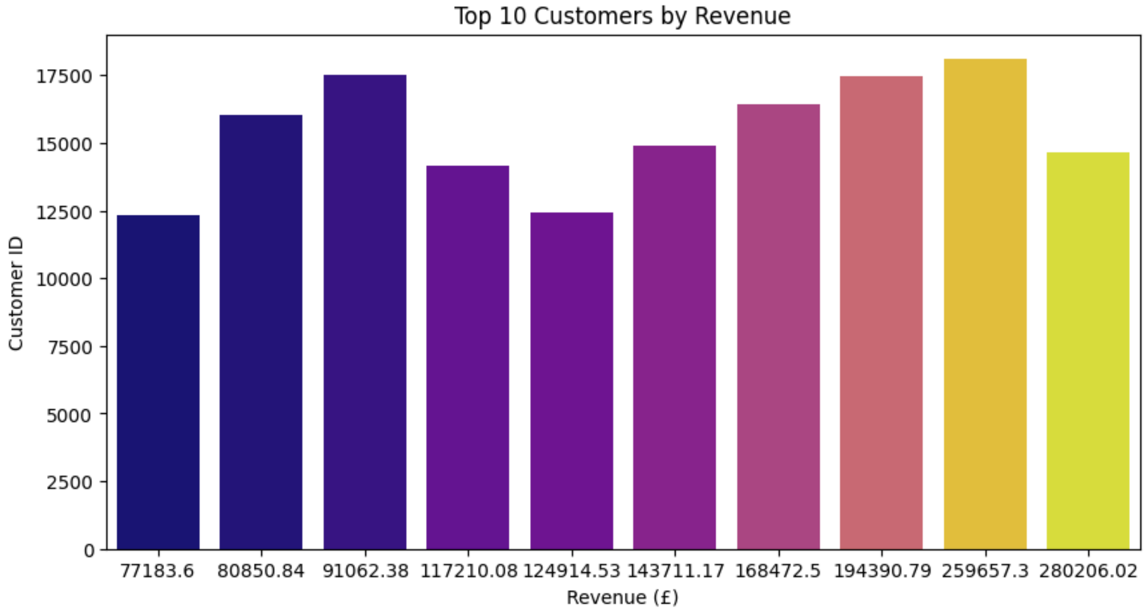
```
# Sales by Product Category (Top 10 for clarity)
sales_by_product = df.groupby("Description")["TotalSales"].sum().sort_values(ascending=False).head(10)

plt.figure(figsize=(8,8))
plt.pie(
    sales_by_product,
    labels=sales_by_product.index,
    autopct="%.1f%%",
    startangle=90
)
plt.title("Sales by Product Category (Top 10)", fontsize=14, weight="bold")
plt.axis("equal")  # Makes it a perfect circle
plt.show()
```



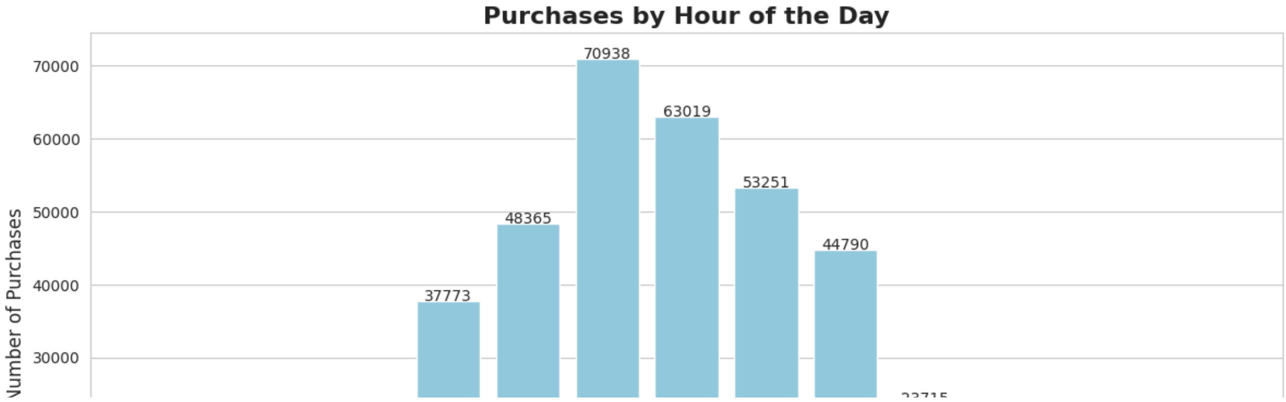
```
# Monthly sales trend
df["Month"] = df["InvoiceDate"].dt.to_period("M")
monthly_sales = df.groupby("Month")["TotalSales"].sum()

plt.figure(figsize=(12,6))
monthly_sales.plot(kind="line", marker="o", color="green")
plt.title("Monthly Sales Trend")
plt.xlabel("Month")
plt.ylabel("Total Revenue (£)")
plt.grid(True)
plt.show()
```



```
# Top 10 customers by revenue
# Make sure to run the data cleaning cell above before running this cell.
top_customers = df.groupby("CustomerID")["TotalSales"].sum().sort_values(ascending=False).head(10)
plt.figure(figsize=(10,5))
sns.barplot(x=top_customers.values, y=top_customers.index, hue=top_customers.values, palette="plasma", legend=False)
plt.title("Top 10 Customers by Revenue")
plt.xlabel("Revenue (£)")
plt.ylabel("Customer ID")
plt.show()
```



```
# Hourly purchase behavior
df["Hour"] = df["InvoiceDate"].dt.hour
# Set style
sns.set_style("whitegrid")
plt.figure(figsize=(12,6))
sns.countplot(x="Hour", data=df, color="skyblue")  # Use 'color' instead of palette if no hue
# Titles and labels
plt.title("Purchases by Hour of the Day", fontsize=16, fontweight='bold')
plt.xlabel("Hour of Day", fontsize=12)
plt.ylabel("Number of Purchases", fontsize=12)
# Optional: Annotate counts on top of bars
hour_counts = df["Hour"].value_counts().sort_index()
for i, count in enumerate(hour_counts):
    plt.text(i, count + 5, str(count), ha='center')

plt.tight_layout()
plt.show()
```


Purchases by Hour of the Day
Number of Purchases