In [6]:

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

# 1. SETUP
# ------------------------------------------
warnings.filterwarnings('ignore')
sns.set_style("whitegrid")
plt.rcParams['figure.figsize'] = (10, 6)
```

In [7]:

```
# 2. LOAD DATASET
# ------------------------------------------
# We load the file directly. If this fails, the file is not uploaded correct
df = pd.read_csv('online_retail_II.csv', encoding='ISO-8859-1')

print("✅ Data loaded successfully.")
print(f"   Shape: {df.shape}")
print(f"   Columns: {list(df.columns)}")
```

```
✅ Data loaded successfully.
   Shape: (525461, 8)
   Columns: ['Invoice', 'StockCode', 'Description', 'Quantity', 'InvoiceDat
e', 'Price', 'Customer ID', 'Country']
```

In [8]:

```
# 3. DATA CLEANING
# ------------------------------------------
print("\n--- STEP 2: DATA CLEANING ---")

# Create a copy
df_clean = df.copy()

# A. Drop missing Customer ID
df_clean = df_clean.dropna(subset=['Customer ID'])

# B. Remove Returns (Negative Quantity) and Invalid Prices
df_clean = df_clean[(df_clean['Quantity'] > 0) & (df_clean['Price'] > 0)]

# C. Calculate TotalPrice
df_clean['TotalPrice'] = df_clean['Quantity'] * df_clean['Price']

# D. Date Conversion (Using dayfirst=True for UK format)
print("   Converting dates... (this may take a moment)")
df_clean['InvoiceDate'] = pd.to_datetime(df_clean['InvoiceDate'], dayfirst=T

print("✅ Data cleaning complete.")
print(f"   Final Clean Shape: {df_clean.shape}")
```

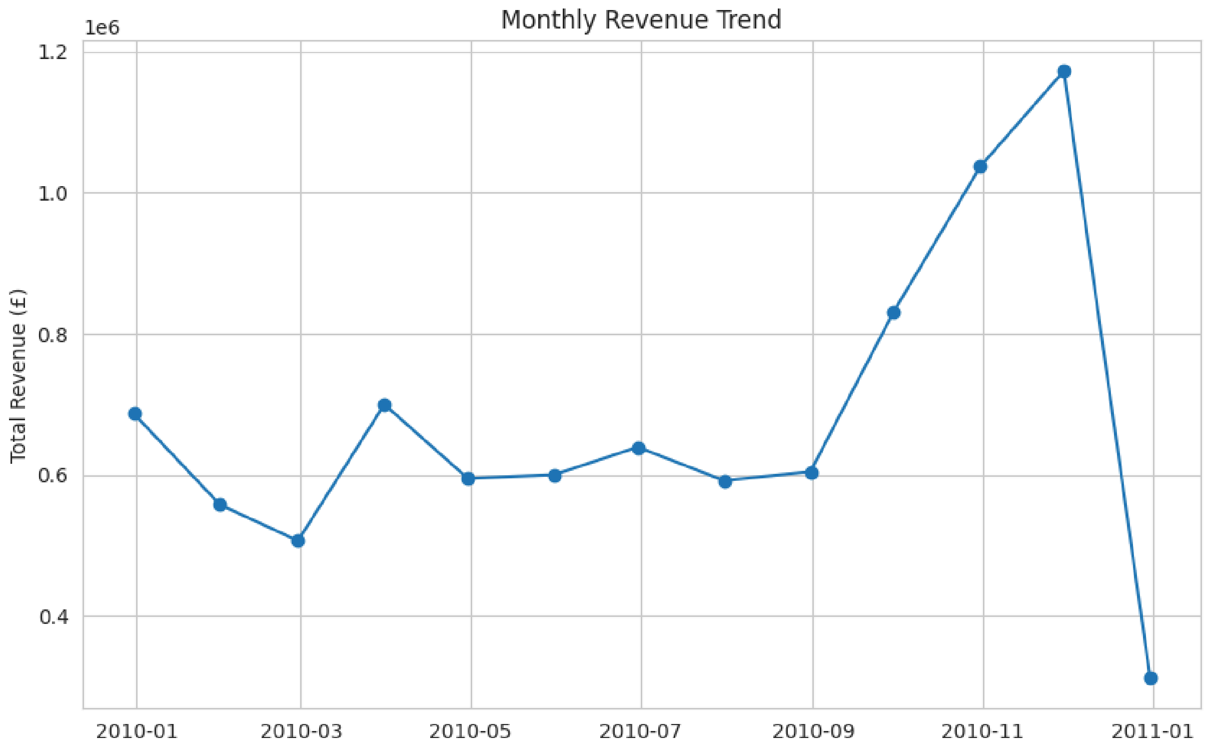
```
--- STEP 2: DATA CLEANING ---
   Converting dates... (this may take a moment)
✅ Data cleaning complete.
   Final Clean Shape: (407664, 9)
```

In [9]:

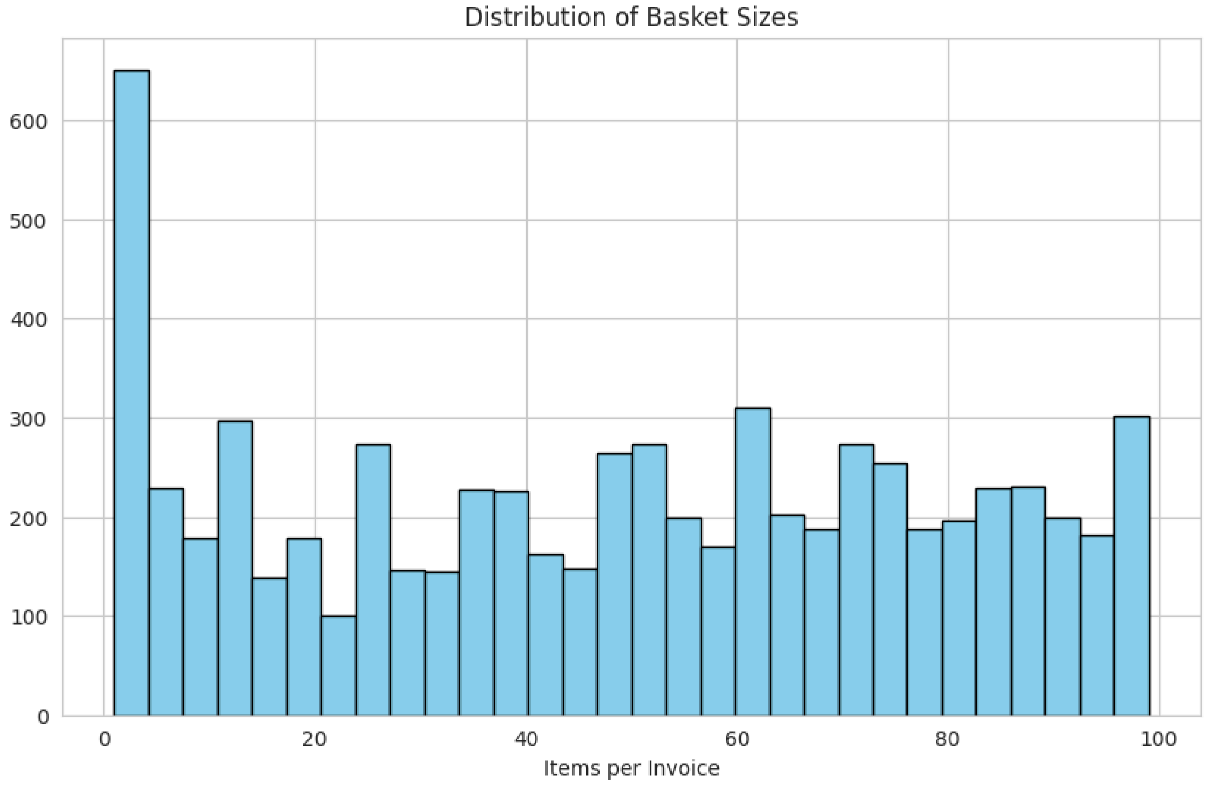
```
# 4. EXPLORATORY DATA ANALYSIS (EDA)
# ------------------------------------------
```

```
print("\n--- STEP 3: GENERATING CHARTS ---")

# Chart 1: Revenue Trend
print("   1. Plotting Revenue Over Time...")
monthly_rev = df_clean.set_index('InvoiceDate').resample('M')['TotalPrice'].

plt.figure()
plt.plot(monthly_rev.index, monthly_rev.values, marker='o', color='#1f77b4')
plt.title('Monthly Revenue Trend')
plt.ylabel('Total Revenue (£)')
plt.grid(True)
plt.show()

# Chart 2: Basket Size
print("\n   2. Plotting Basket Sizes...")
basket_sizes = df_clean.groupby('Invoice')['Quantity'].sum()

plt.figure()
plt.hist(basket_sizes[basket_sizes < 100], bins=30, color='skyblue', edgecol
plt.title('Distribution of Basket Sizes')
plt.xlabel('Items per Invoice')
plt.show()

# Chart 3: Top Products
print("\n   3. Plotting Top 10 Products...")
top_products = df_clean.groupby('Description')['TotalPrice'].sum().sort_valu

plt.figure()
sns.barplot(x=top_products.values, y=top_products.index, palette='viridis')
plt.title('Top 10 Products by Revenue')
plt.show()

# Chart 4: Top Countries
print("\n   4. Plotting Revenue by Country...")
country_rev = df_clean.groupby('Country')['TotalPrice'].sum().sort_values(as

plt.figure(figsize=(8, 5))
sns.barplot(x=country_rev.values, y=country_rev.index, palette='magma')
plt.title('Top 5 Countries by Revenue')
plt.show()

# Chart 5: Customer Loyalty
print("\n   5. Plotting Customer Frequency...")
customer_freq = df_clean.groupby('Customer ID')['Invoice'].nunique()

plt.figure()
plt.hist(customer_freq, bins=50, range=(0, 20), color='salmon', edgecolor='b
plt.title('Purchase Frequency per Customer')
plt.xlabel('Number of Purchases')
plt.show()
```

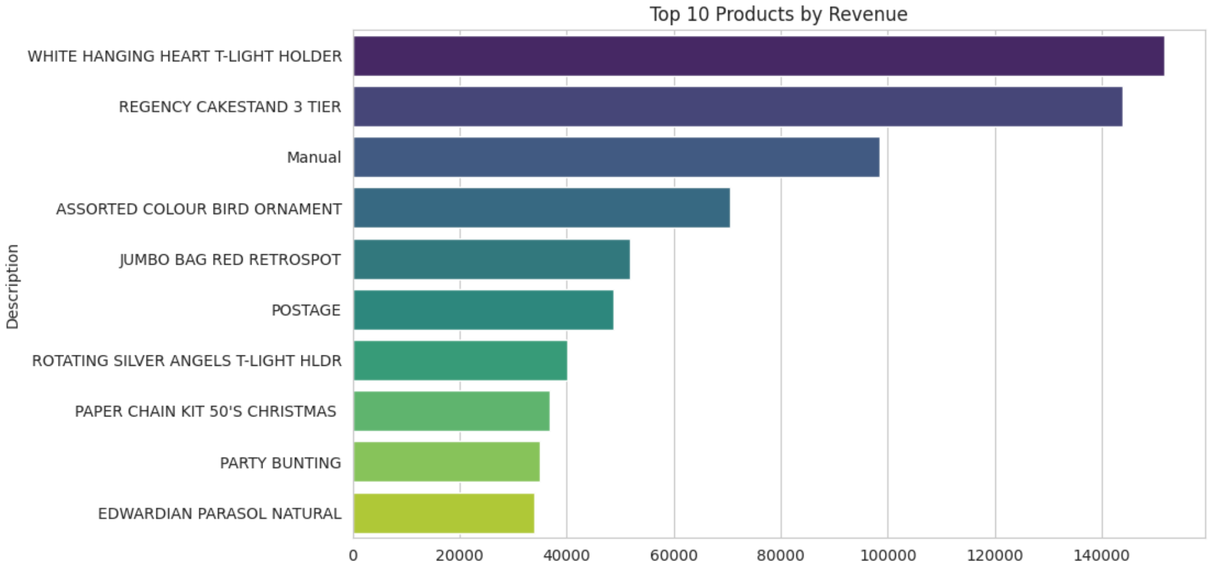
```
--- STEP 3: GENERATING CHARTS ---
   1. Plotting Revenue Over Time...
```



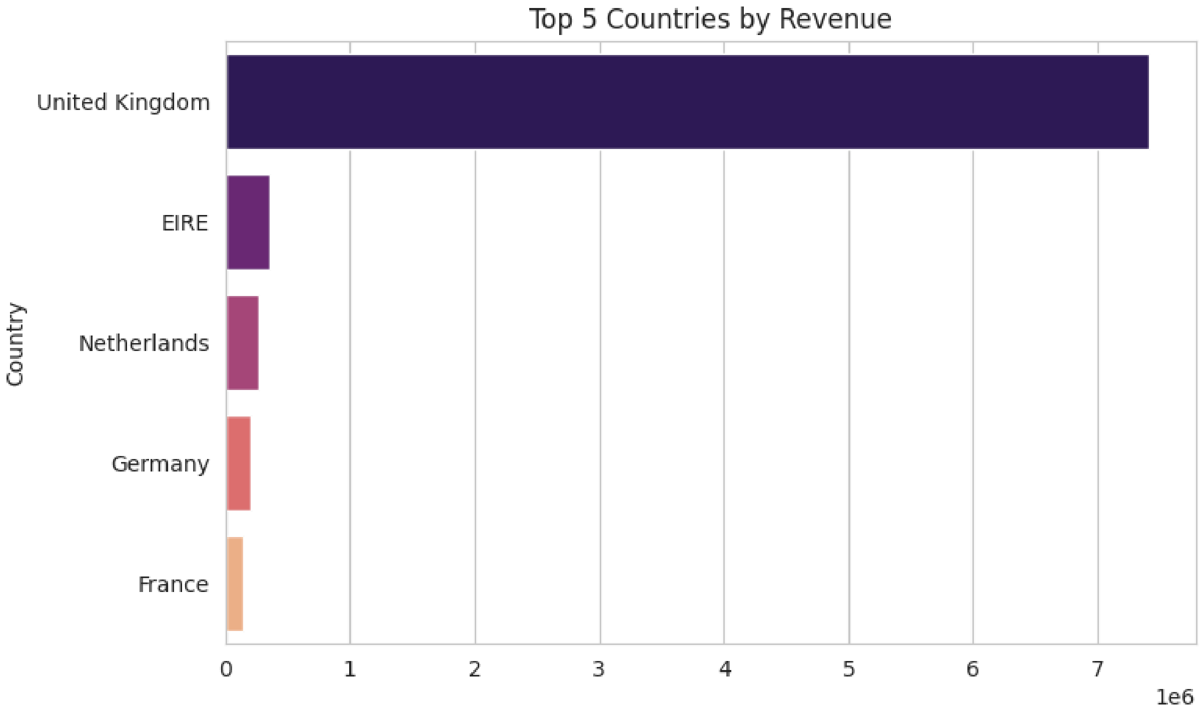
```
2. Plotting Basket Sizes...
```



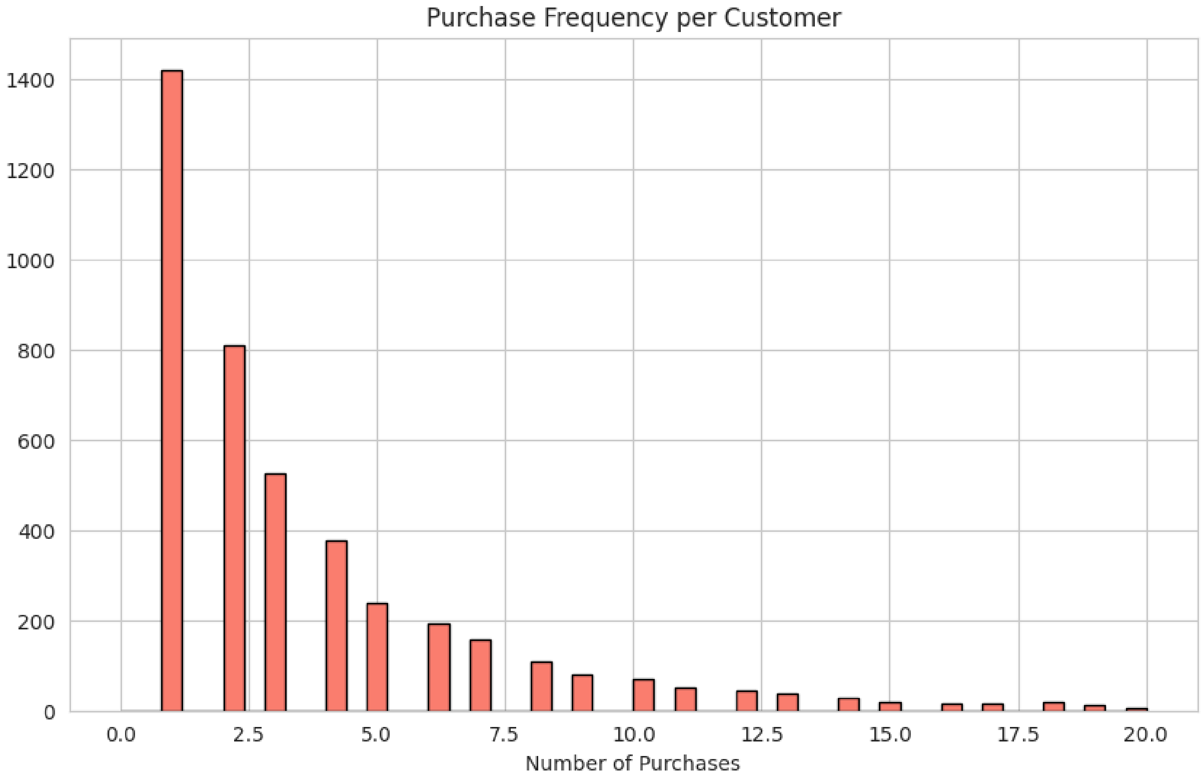
```
3. Plotting Top 10 Products...
```



```
4. Plotting Revenue by Country...
```



```
5. Plotting Customer Frequency...
```



In [10]:

```
# 5. FINAL REFLECTION
# ------------------------------------------
print("\n" + "="*40)
print("FINAL SUMMARY")
print("="*40)
print("1. Seasonality: Revenue peaks in Q4 (Holiday Season).")
print("2. Market: The UK is the dominant market (>90%).")
print("3. Retention: Most customers are one-time buyers.")
print("NEXT STEP: I will build a Churn Prediction Model.")
```

```
========================================
FINAL SUMMARY
========================================
1. Seasonality: Revenue peaks in Q4 (Holiday Season).
2. Market: The UK is the dominant market (>90%).
3. Retention: Most customers are one-time buyers.
NEXT STEP: I will build a Churn Prediction Model.
```