```
# This Python 3 environment comes with many helpful analytics
libraries installed
# It is defined by the kaggle/python Docker image:
https://github.com/kaggle/docker-python
# For example, here's several helpful packages to load

import numpy as np # linear algebra
import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)

# Input data files are available in the read-only "../input/"
directory
# For example, running this (by clicking run or pressing Shift+Enter)
will list all files under the input directory

import os
for dirname, _, filenames in os.walk('/kaggle/input'):
    for filename in filenames:
        print(os.path.join(dirname, filename))

# You can write up to 20GB to the current directory (/kaggle/working/)
that gets preserved as output when you create a version using "Save &
Run All"
# You can also write temporary files to /kaggle/temp/, but they won't
be saved outside of the current session

# Import necessary libraries and connect to the database
import sqlite3
import pandas as pd

# Connect to the database
db_path = "/kaggle/input/chinook/Chinook_Sqlite.sqlite"
conn = sqlite3.connect(db_path)
```

**Database Exploration**

```
# List all tables in the database
query = "SELECT name FROM sqlite_master WHERE type='table';"
tables = pd.read_sql(query, conn)
display(tables)  # Display all available tables

# Select a table to inspect
table_name = "Invoice"
query = f"PRAGMA table_info({table_name});"
columns = pd.read_sql(query, conn)
display(columns)  # Display column information

# Preview first 5 rows of the selected table
query = f"SELECT * FROM {table_name} LIMIT 5;"
df = pd.read_sql(query, conn)
display(df)
```

```
             name
0           Album
1          Artist
2        Customer
3        Employee
4           Genre
5         Invoice
6     InvoiceLine
7       MediaType
8        Playlist
9   PlaylistTrack
10          Track
```

```
   cid              name           type  notnull dflt_value  pk
0    0         InvoiceId        INTEGER        1       None   1
1    1        CustomerId        INTEGER        1       None   0
2    2       InvoiceDate       DATETIME        1       None   0
3    3    BillingAddress   NVARCHAR(70)        0       None   0
4    4       BillingCity   NVARCHAR(40)        0       None   0
5    5      BillingState   NVARCHAR(40)        0       None   0
6    6    BillingCountry   NVARCHAR(40)        0       None   0
7    7  BillingPostalCode   NVARCHAR(10)        0       None   0
8    8             Total  NUMERIC(10,2)        1       None   0
```

```
   InvoiceId  CustomerId          InvoiceDate            BillingAddress
\
0          1           2  2009-01-01 00:00:00  Theodor-Heuss-Straße 34

1          2           4  2009-01-02 00:00:00         Ullevålsveien 14

2          3           8  2009-01-03 00:00:00          Grétrystraat 63

3          4          14  2009-01-06 00:00:00           8210 111 ST NW

4          5          23  2009-01-11 00:00:00          69 Salem Street


  BillingCity BillingState BillingCountry BillingPostalCode  Total
0   Stuttgart         None        Germany             70174   1.98
1        Oslo         None         Norway              0171   3.96
2    Brussels         None        Belgium              1000   5.94
3    Edmonton           AB         Canada           T6G 2C7   8.91
4      Boston           MA            USA              2113  13.86
```

**Revenue Insights**

```
# Total revenue by country
query = """
SELECT BillingCountry, SUM(Total) as TotalRevenue
FROM Invoice
```

```
GROUP BY BillingCountry
ORDER BY TotalRevenue DESC;
"""
df_revenue = pd.read_sql(query, conn)
display(df_revenue)
```

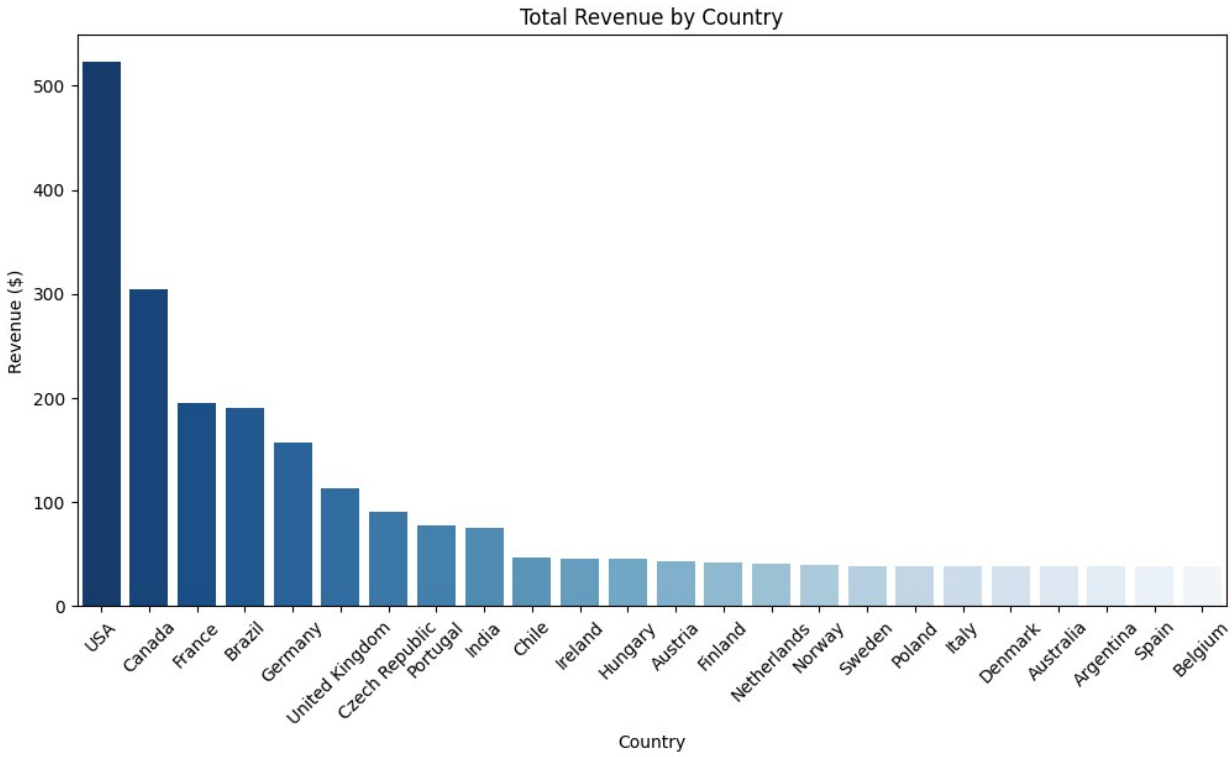
| | BillingCountry | TotalRevenue |
|---|---|---|
| 0 | USA | 523.06 |
| 1 | Canada | 303.96 |
| 2 | France | 195.10 |
| 3 | Brazil | 190.10 |
| 4 | Germany | 156.48 |
| 5 | United Kingdom | 112.86 |
| 6 | Czech Republic | 90.24 |
| 7 | Portugal | 77.24 |
| 8 | India | 75.26 |
| 9 | Chile | 46.62 |
| 10 | Ireland | 45.62 |
| 11 | Hungary | 45.62 |
| 12 | Austria | 42.62 |
| 13 | Finland | 41.62 |
| 14 | Netherlands | 40.62 |
| 15 | Norway | 39.62 |
| 16 | Sweden | 38.62 |
| 17 | Poland | 37.62 |
| 18 | Italy | 37.62 |
| 19 | Denmark | 37.62 |
| 20 | Australia | 37.62 |
| 21 | Argentina | 37.62 |
| 22 | Spain | 37.62 |
| 23 | Belgium | 37.62 |

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

# Sort revenue data for better visualization
df_revenue = df_revenue.sort_values(by="TotalRevenue",
ascending=False)

# Bar chart: Total revenue by country
plt.figure(figsize=(12,6))
sns.barplot(data=df_revenue, x="BillingCountry", y="TotalRevenue",
palette="Blues_r")

# Rotate country labels for readability
plt.xticks(rotation=45)
plt.title("Total Revenue by Country")
plt.xlabel("Country")
plt.ylabel("Revenue ($)")
plt.show()
```




**Monthly Revenue Trends**

```
query = """
SELECT strftime('%Y-%m', InvoiceDate) as Month, SUM(Total) as
MonthlyRevenue
FROM Invoice
GROUP BY Month
ORDER BY Month;
"""
df_monthly = pd.read_sql(query, conn)
display(df_monthly)
```

| | Month | MonthlyRevenue |
|---|---|---|
| 0 | 2009-01 | 35.64 |
| 1 | 2009-02 | 37.62 |
| 2 | 2009-03 | 37.62 |
| 3 | 2009-04 | 37.62 |
| 4 | 2009-05 | 37.62 |
| 5 | 2009-06 | 37.62 |
| 6 | 2009-07 | 37.62 |
| 7 | 2009-08 | 37.62 |
| 8 | 2009-09 | 37.62 |
| 9 | 2009-10 | 37.62 |
| 10 | 2009-11 | 37.62 |
| 11 | 2009-12 | 37.62 |
| 12 | 2010-01 | 52.62 |
| 13 | 2010-02 | 46.62 |

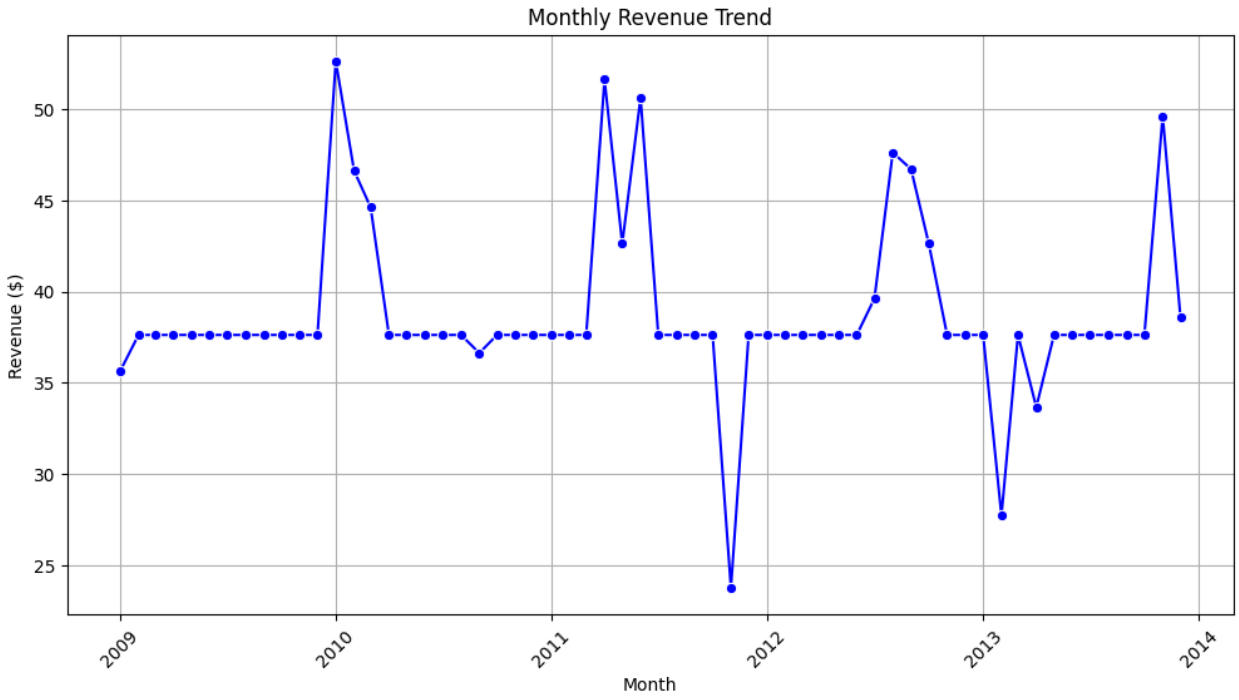
```
14  2010-03           44.62
15  2010-04           37.62
16  2010-05           37.62
17  2010-06           37.62
18  2010-07           37.62
19  2010-08           37.62
20  2010-09           36.63
21  2010-10           37.62
22  2010-11           37.62
23  2010-12           37.62
24  2011-01           37.62
25  2011-02           37.62
26  2011-03           37.62
27  2011-04           51.62
28  2011-05           42.62
29  2011-06           50.62
30  2011-07           37.62
31  2011-08           37.62
32  2011-09           37.62
33  2011-10           37.62
34  2011-11           23.76
35  2011-12           37.62
36  2012-01           37.62
37  2012-02           37.62
38  2012-03           37.62
39  2012-04           37.62
40  2012-05           37.62
41  2012-06           37.62
42  2012-07           39.62
43  2012-08           47.62
44  2012-09           46.71
45  2012-10           42.62
46  2012-11           37.62
47  2012-12           37.62
48  2013-01           37.62
49  2013-02           27.72
50  2013-03           37.62
51  2013-04           33.66
52  2013-05           37.62
53  2013-06           37.62
54  2013-07           37.62
55  2013-08           37.62
56  2013-09           37.62
57  2013-10           37.62
58  2013-11           49.62
59  2013-12           38.62
```

```
# Convert 'Month' to datetime for proper sorting
df_monthly["Month"] = pd.to_datetime(df_monthly["Month"])
```

```
# Line chart: Monthly revenue
plt.figure(figsize=(12,6))
sns.lineplot(data=df_monthly, x="Month", y="MonthlyRevenue",
marker="o", color="blue")

# Format the chart
plt.title("Monthly Revenue Trend")
plt.xlabel("Month")
plt.ylabel("Revenue ($)")
plt.xticks(rotation=45)
plt.grid(True)
plt.show()
```

```
/usr/local/lib/python3.10/dist-packages/seaborn/_oldcore.py:1119:
FutureWarning: use_inf_as_na option is deprecated and will be removed
in a future version. Convert inf values to NaN before operating
instead.
  with pd.option_context('mode.use_inf_as_na', True):
/usr/local/lib/python3.10/dist-packages/seaborn/_oldcore.py:1119:
FutureWarning: use_inf_as_na option is deprecated and will be removed
in a future version. Convert inf values to NaN before operating
instead.
  with pd.option_context('mode.use_inf_as_na', True):
```




**Top Spending Customers**

```
query = """
SELECT c.CustomerId, c.FirstName || ' ' || c.LastName AS CustomerName,
```

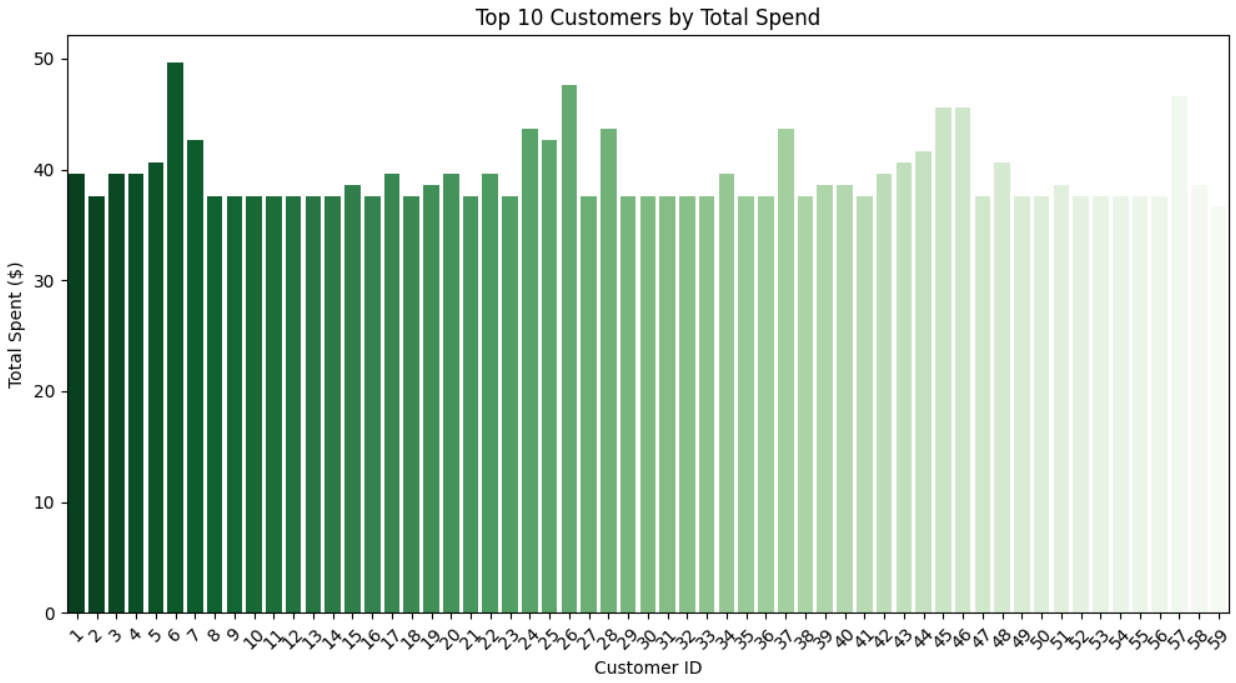
```
       COUNT(i.InvoiceId) AS PurchaseCount,
       SUM(i.Total) AS TotalSpent
FROM Customer c
JOIN Invoice i ON c.CustomerId = i.CustomerId
GROUP BY c.CustomerId, CustomerName
ORDER BY TotalSpent DESC
LIMIT 10;
"""
df_top_customers = pd.read_sql(query, conn)
display(df_top_customers)
```

| | CustomerId | CustomerName | PurchaseCount | TotalSpent |
|---|---|---|---|---|
| 0 | 6 | Helena Holý | 7 | 49.62 |
| 1 | 26 | Richard Cunningham | 7 | 47.62 |
| 2 | 57 | Luis Rojas | 7 | 46.62 |
| 3 | 45 | Ladislav Kovács | 7 | 45.62 |
| 4 | 46 | Hugh O'Reilly | 7 | 45.62 |
| 5 | 28 | Julia Barnett | 7 | 43.62 |
| 6 | 24 | Frank Ralston | 7 | 43.62 |
| 7 | 37 | Fynn Zimmermann | 7 | 43.62 |
| 8 | 7 | Astrid Gruber | 7 | 42.62 |
| 9 | 25 | Victor Stevens | 7 | 42.62 |

```
# Sort customers by spending
df_customers = df_customers.sort_values(by="TotalSpent",
ascending=False)

# Bar chart: Top spending customers
plt.figure(figsize=(12,6))
sns.barplot(data=df_customers, x="CustomerId", y="TotalSpent",
palette="Greens_r")

# Format chart
plt.xticks(rotation=45)
plt.title("Top 10 Customers by Total Spend")
plt.xlabel("Customer ID")
plt.ylabel("Total Spent ($)")
plt.show()
```




**Revenue by Music Genre**

```
query = """
SELECT g.Name AS Genre, SUM(il.UnitPrice * il.Quantity) AS
TotalRevenue
FROM InvoiceLine il
JOIN Track t ON il.TrackId = t.TrackId
JOIN Genre g ON t.GenreId = g.GenreId
GROUP BY g.Name
ORDER BY TotalRevenue DESC;
"""
df_genre_revenue = pd.read_sql(query, conn)
display(df_genre_revenue)
```

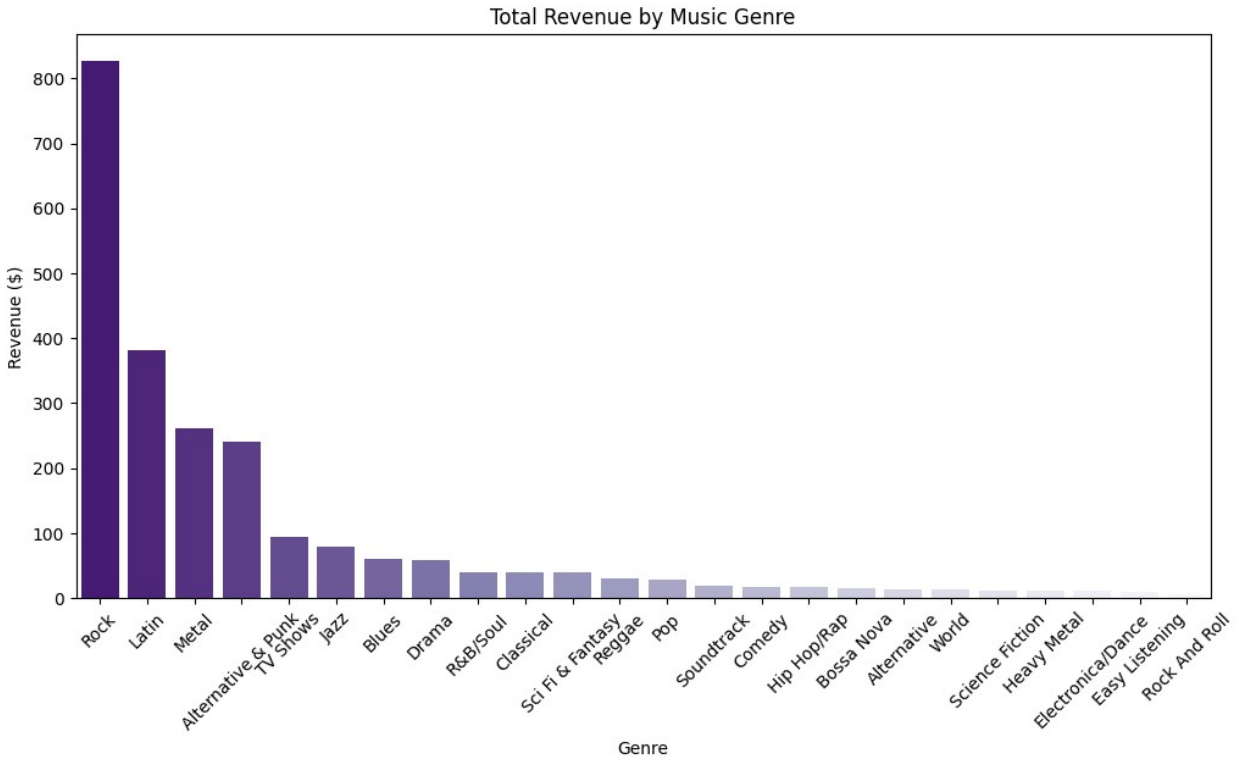
| | Genre | TotalRevenue |
|---|---|---|
| 0 | Rock | 826.65 |
| 1 | Latin | 382.14 |
| 2 | Metal | 261.36 |
| 3 | Alternative & Punk | 241.56 |
| 4 | TV Shows | 93.53 |
| 5 | Jazz | 79.20 |
| 6 | Blues | 60.39 |
| 7 | Drama | 57.71 |
| 8 | R&B/Soul | 40.59 |
| 9 | Classical | 40.59 |
| 10 | Sci Fi & Fantasy | 39.80 |
| 11 | Reggae | 29.70 |
| 12 | Pop | 27.72 |
| 13 | Soundtrack | 19.80 |

```
14               Comedy          17.91
15          Hip Hop/Rap          16.83
16           Bossa Nova          14.85
17          Alternative          13.86
18                World          12.87
19      Science Fiction          11.94
20          Heavy Metal          11.88
21    Electronica/Dance          11.88
22       Easy Listening           9.90
23        Rock And Roll           5.94
```

```
# Sort genre revenue for visualization
df_genre_revenue = df_genre_revenue.sort_values(by="TotalRevenue",
ascending=False)

# Bar chart: Revenue by Genre
plt.figure(figsize=(12,6))
sns.barplot(data=df_genre_revenue, x="Genre", y="TotalRevenue",
palette="Purples_r")

plt.xticks(rotation=45)
plt.title("Total Revenue by Music Genre")
plt.xlabel("Genre")
plt.ylabel("Revenue ($)")
plt.show()
```




**Most Purchased Songs**

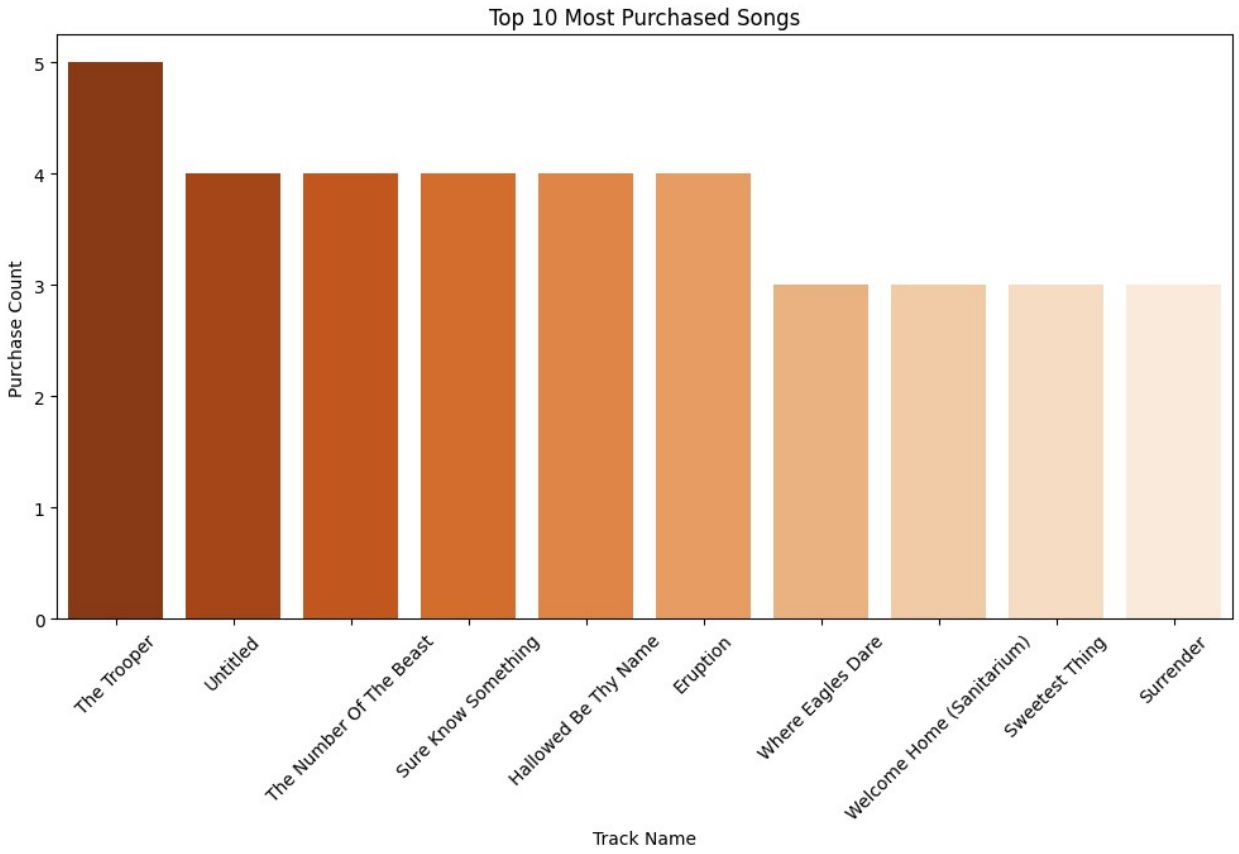
```
query = """
SELECT t.Name AS Track, COUNT(il.InvoiceLineId) AS PurchaseCount
FROM InvoiceLine il
JOIN Track t ON il.TrackId = t.TrackId
GROUP BY t.Name
ORDER BY PurchaseCount DESC
LIMIT 10;
"""
df_top_tracks = pd.read_sql(query, conn)
display(df_top_tracks)
```

| | Track | PurchaseCount |
|---|---|---|
| 0 | The Trooper | 5 |
| 1 | Untitled | 4 |
| 2 | The Number Of The Beast | 4 |
| 3 | Sure Know Something | 4 |
| 4 | Hallowed Be Thy Name | 4 |
| 5 | Eruption | 4 |
| 6 | Where Eagles Dare | 3 |
| 7 | Welcome Home (Sanitarium) | 3 |
| 8 | Sweetest Thing | 3 |
| 9 | Surrender | 3 |

```
# Sort tracks by purchase count
df_top_tracks = df_top_tracks.sort_values(by="PurchaseCount",
ascending=False)

# Bar chart: Most purchased songs
plt.figure(figsize=(12,6))
sns.barplot(data=df_top_tracks, x="Track", y="PurchaseCount",
palette="Oranges_r")

plt.xticks(rotation=45)
plt.title("Top 10 Most Purchased Songs")
plt.xlabel("Track Name")
plt.ylabel("Purchase Count")
plt.show()
```




**Artists Generating the Most Revenue**

```
query = """
SELECT ar.Name AS Artist, SUM(il.UnitPrice * il.Quantity) AS
TotalRevenue
FROM InvoiceLine il
JOIN Track t ON il.TrackId = t.TrackId
JOIN Album al ON t.AlbumId = al.AlbumId
JOIN Artist ar ON al.ArtistId = ar.ArtistId
GROUP BY ar.Name
ORDER BY TotalRevenue DESC
LIMIT 10;
"""
df_top_artists = pd.read_sql(query, conn)
display(df_top_artists)
```

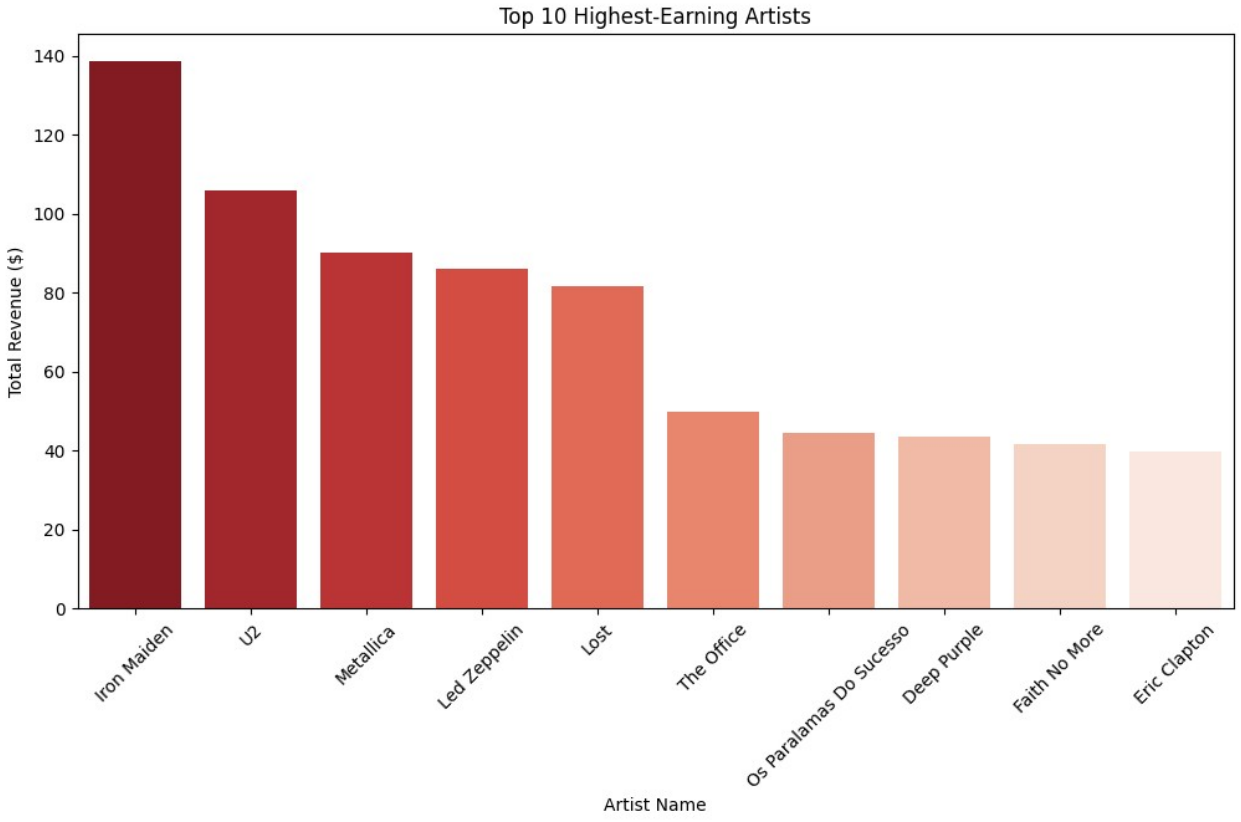
| | Artist | TotalRevenue |
|---|---|---|
| 0 | Iron Maiden | 138.60 |
| 1 | U2 | 105.93 |
| 2 | Metallica | 90.09 |
| 3 | Led Zeppelin | 86.13 |
| 4 | Lost | 81.59 |
| 5 | The Office | 49.75 |
| 6 | Os Paralamas Do Sucesso | 44.55 |

```
7               Deep Purple         43.56
8             Faith No More         41.58
9              Eric Clapton         39.60
```

```
# Sort artist revenue
df_top_artists = df_top_artists.sort_values(by="TotalRevenue",
ascending=False)

# Bar chart: Highest-earning artists
plt.figure(figsize=(12,6))
sns.barplot(data=df_top_artists, x="Artist", y="TotalRevenue",
palette="Reds_r")

plt.xticks(rotation=45)
plt.title("Top 10 Highest-Earning Artists")
plt.xlabel("Artist Name")
plt.ylabel("Total Revenue ($)")
plt.show()
```




**Customer Revenue by Country**

```
query = """
SELECT c.CustomerId, c.FirstName || ' ' || c.LastName AS CustomerName,
```

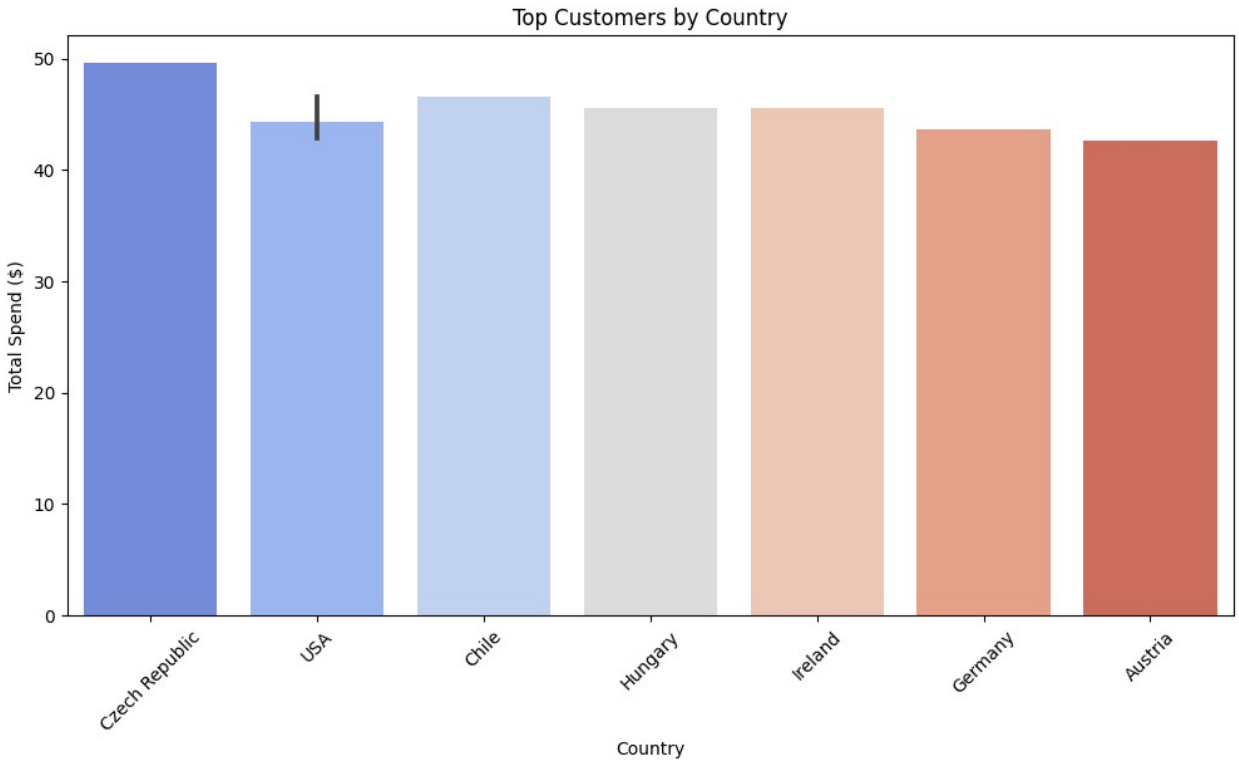
```
       c.Country, SUM(i.Total) AS TotalSpent
FROM Customer c
JOIN Invoice i ON c.CustomerId = i.CustomerId
GROUP BY c.CustomerId, CustomerName, c.Country
ORDER BY TotalSpent DESC
LIMIT 10;
"""
df_customer_location = pd.read_sql(query, conn)
display(df_customer_location)
```

| | CustomerId | CustomerName | Country | TotalSpent |
|---|---|---|---|---|
| 0 | 6 | Helena Holý | Czech Republic | 49.62 |
| 1 | 26 | Richard Cunningham | USA | 47.62 |
| 2 | 57 | Luis Rojas | Chile | 46.62 |
| 3 | 45 | Ladislav Kovács | Hungary | 45.62 |
| 4 | 46 | Hugh O'Reilly | Ireland | 45.62 |
| 5 | 28 | Julia Barnett | USA | 43.62 |
| 6 | 24 | Frank Ralston | USA | 43.62 |
| 7 | 37 | Fynn Zimmermann | Germany | 43.62 |
| 8 | 7 | Astrid Gruber | Austria | 42.62 |
| 9 | 25 | Victor Stevens | USA | 42.62 |

```
# Sort customer data by total spent
df_customer_location =
df_customer_location.sort_values(by="TotalSpent", ascending=False)

# Bar chart: Top spending customers by country
plt.figure(figsize=(12,6))
sns.barplot(data=df_customer_location, x="Country", y="TotalSpent",
palette="coolwarm")

plt.xticks(rotation=45)
plt.title("Top Customers by Country")
plt.xlabel("Country")
plt.ylabel("Total Spend ($)")
plt.show()
```




**Customer Purchase Frequency**

```
query = """
SELECT CustomerId, COUNT(InvoiceId) AS PurchaseFrequency
FROM Invoice
GROUP BY CustomerId
ORDER BY PurchaseFrequency DESC
LIMIT 10;
"""
df_repeat_customers = pd.read_sql(query, conn)
display(df_repeat_customers)
```

| | CustomerId | PurchaseFrequency |
|---|---|---|
| 0 | 1 | 7 |
| 1 | 2 | 7 |
| 2 | 3 | 7 |
| 3 | 4 | 7 |
| 4 | 5 | 7 |
| 5 | 6 | 7 |
| 6 | 7 | 7 |
| 7 | 8 | 7 |
| 8 | 9 | 7 |
| 9 | 10 | 7 |