TITLE: Box Office Insights via EDA

PROBLEM STATEMENT: To analyze a movie dataset to uncover insights into movie trends, financial success, and audience preferences, and to visualize these findings. The analysis will explore factors influencing movie performance and audience engagement, such as genre popularity, budget-revenue relationships, and ratings.

Loading & Preparing Movie Dataset for Analysis

```
import pandas as pd
import numpy as np

# Load dataset
try:
    df = pd.read_csv('movie_dataset.csv')  # replace with your dataset file
except FileNotFoundError:
    print("Error: 'movie_dataset.csv' not found. Please make sure the file exists and the path is correct.")
    # You might need to upload the file to your Colab environment
    # or mount your Google Drive to access it.
    # For example: from google.colab import drive
    #              drive.mount('/content/drive')
    # Then adjust the file path accordingly.
except Exception as e:
    print(f"An error occurred while loading the dataset: {e}")

if 'df' in locals():  # Check if DataFrame was successfully created
    # Convert dates
    df['release_date'] = pd.to_datetime(df['release_date'], errors='coerce')
    df['year'] = df['release_date'].dt.year

    # Fill missing budgets/revenues with median or zero
    df['budget'] = df['budget'].fillna(0)
    df['revenue'] = df['revenue'].fillna(0)

    # Check if 'genres' column exists, if not, try 'genre'
    if 'genres' in df.columns:
        # Clean genres (assuming stringified lists)
        df['genres'] = df['genres'].astype(str).str.replace('[^a-zA-Z| ]', '')
    elif 'genre' in df.columns:
        # Clean genres (assuming stringified lists)
        df['genre'] = df['genre'].astype(str).str.replace('[^a-zA-Z| ]', '')
    else:
        print("Neither 'genre' nor 'genres' column found in the DataFrame.")

    # Display the first few rows of the DataFrame
    display(df.head())
```

	index	budget	genres	homepage	id	keywords	original_language	original_title	overview
0	0	237000000	Action Adventure Fantasy Science Fiction	http://www.avatarmovie.com/	19995	culture clash future space war space colony so...	en	Avatar	In the 22nd century, a paraplegic Marine is di...
1	1	300000000	Adventure Fantasy Action	http://disney.go.com/disneypictures/pirates/	285	ocean drug abuse exotic island east india trad...	en	Pirates of the Caribbean: At World's End	Captain Barbossa, long believed to be dead, ha...
2	2	245000000	Action Adventure Crime	http://www.sonypictures.com/movies/spectre/	206647	spy based on novel secret agent sequel mi6	en	Spectre	A cryptic message from Bond's past sends him o...
3	3	250000000	Action Crime Drama Thriller	http://www.thedarkknightrises.com/	49026	dc comics crime fighter terrorist secret ident...	en	The Dark Knight Rises	Following the death of District Attorney Harve...
4	4	260000000	Action Adventure Science Fiction	http://movies.disney.com/john-carter	49529	based on novel mars medallion space travel pri...	en	John Carter	John Carter is a war-weary, former military ca...

5 rows × 25 columns

New Section

Dataset Overview & Top Genres Exploration

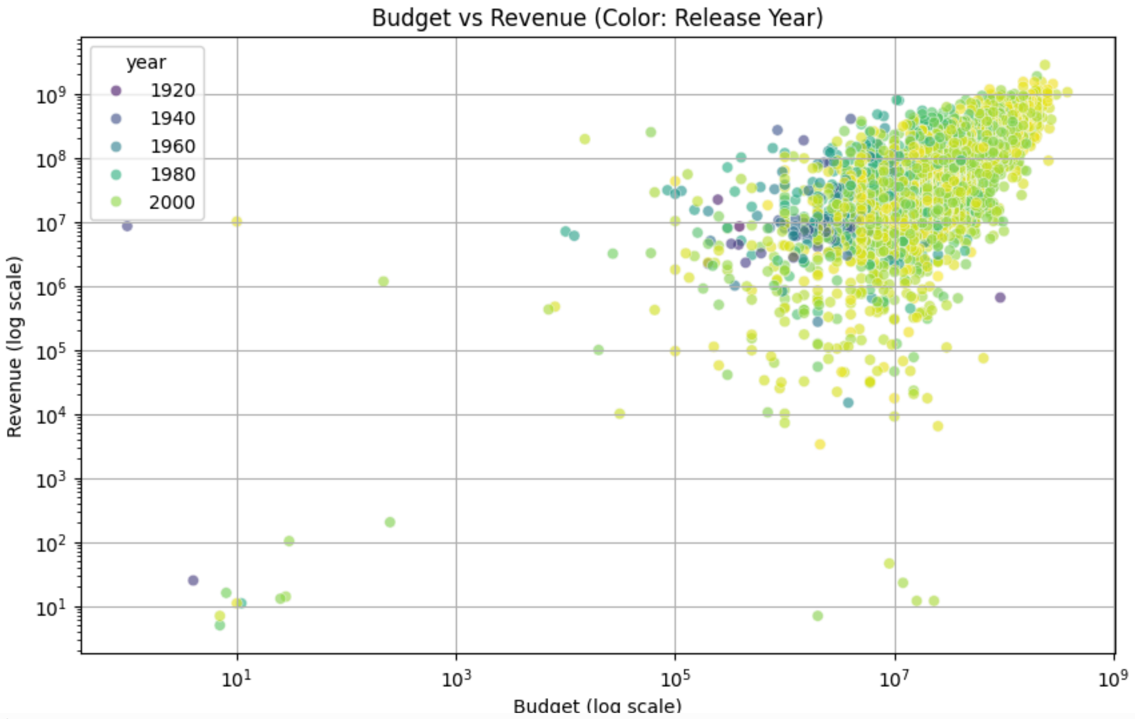
```
if 'df' in locals() and (('genres' in df.columns) or ('genre' in df.columns)):
    genre_col = 'genres' if 'genres' in df.columns else 'genre'
    print(df.describe())
    print(df.info())
    print(df[genre_col].value_counts().head(10))
else:
    print("DataFrame or genre column not found.")
```

```
             index        budget             id   popularity  \
count  4803.000000  4.803000e+03    4803.000000  4803.000000   
mean   2401.000000  2.904504e+07   57165.484281    21.492301   
min       0.000000  0.000000e+00       5.000000     0.000000   
25%    1200.500000  7.900000e+05    9014.500000     4.668070   
50%    2401.000000  1.500000e+07   14629.000000    12.921594   
75%    3601.500000  4.000000e+07   58610.500000    28.313505   
max    4802.000000  3.800000e+08  459488.000000   875.581305   
std    1386.651002  4.072239e+07   88694.614033    31.816650   

                        release_date       revenue      runtime  vote_average  \
count                           4802  4.803000e+03  4801.000000   4803.000000   
mean   2002-12-27 23:45:54.352353280  8.226064e+07   106.875859      6.092172   
min              1916-09-04 00:00:00  0.000000e+00     0.000000      0.000000   
25%              1999-07-14 00:00:00  0.000000e+00    94.000000      5.600000   
50%              2005-10-03 00:00:00  1.917000e+07   103.000000      6.200000   
75%              2011-02-16 00:00:00  9.291719e+07   118.000000      6.800000   
max              2017-02-03 00:00:00  2.787965e+09   338.000000     10.000000   
std                              NaN  1.628571e+08    22.611935      1.194612   

         vote_count         year  
count   4803.000000  4802.000000  
mean     690.217989  2002.468763  
min        0.000000  1916.000000  
25%       54.000000  1999.000000  
```

```
50%       235.000000  2005.000000
75%       737.000000  2011.000000
max     13752.000000  2017.000000
std      1234.585891    12.414354
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 4803 entries, 0 to 4802
Data columns (total 25 columns):
 #   Column                Non-Null Count  Dtype
---  ------                --------------  -----
 0   index                 4803 non-null   int64
 1   budget                4803 non-null   int64
 2   genres                4803 non-null   object
 3   homepage              1712 non-null   object
 4   id                    4803 non-null   int64
 5   keywords              4391 non-null   object
 6   original_language     4803 non-null   object
 7   original_title        4803 non-null   object
 8   overview              4800 non-null   object
 9   popularity            4803 non-null   float64
 10  production_companies  4803 non-null   object
 11  production_countries  4803 non-null   object
 12  release_date          4802 non-null   datetime64[ns]
 13  revenue               4803 non-null   int64
 14  runtime               4801 non-null   float64
 15  spoken_languages      4803 non-null   object
 16  status                4803 non-null   object
 17  tagline               3959 non-null   object
 18  title                 4803 non-null   object
 19  vote_average          4803 non-null   float64
 20  vote_count            4803 non-null   int64
 21  cast                  4760 non-null   object
 22  crew                  4803 non-null   object
 23  director              4773 non-null   object
```

Visualizing Budget vs Revenue Across Years

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

if 'df' in locals() and 'budget' in df.columns and 'revenue' in df.columns and 'year' in df.columns:
    plt.figure(figsize=(10, 6))
    sns.scatterplot(data=df, x='budget', y='revenue', hue='year', palette='viridis', alpha=0.6)
    plt.title('Budget vs Revenue (Color: Release Year)')
    plt.xscale('log')
    plt.yscale('log')
    plt.xlabel('Budget (log scale)')
    plt.ylabel('Revenue (log scale)')
    plt.grid(True)
    plt.show()
else:
    print("DataFrame or required columns not found for visualization.")
```



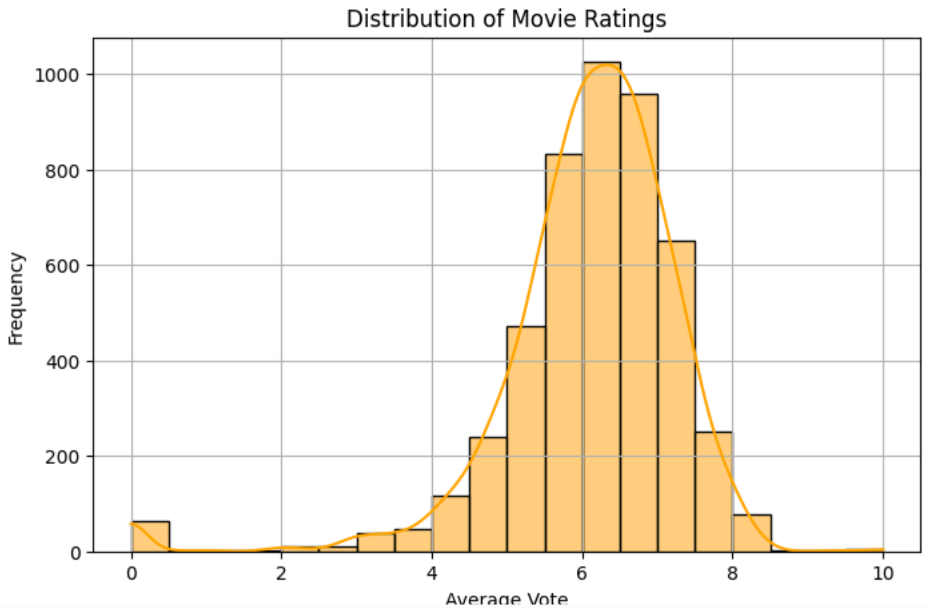
Genre Trends Over Time

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

if 'df' in locals() and 'genre' in df.columns and 'year' in df.columns:
    top_genres = df['genre'].value_counts().head(10).index
    df_genres = df[df['genre'].isin(top_genres)]

    plt.figure(figsize=(12, 6))
    sns.countplot(data=df_genres, x='year', hue='genre')
    plt.xticks(rotation=45)
    plt.title('Genre Trends Over Time')
    plt.show()
else:
    print("DataFrame or required columns not found for genre trend visualization.")
```

```
DataFrame or required columns not found for genre trend visualization.
```

Distribution of Movie Ratings

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

if 'df' in locals() and 'vote_average' in df.columns:
    plt.figure(figsize=(8, 5))
    sns.histplot(df['vote_average'], bins=20, kde=True, color='orange')
    plt.title('Distribution of Movie Ratings')
    plt.xlabel('Average Vote')
    plt.ylabel('Frequency')
    plt.grid(True)
    plt.show()
else:
    print("DataFrame or 'vote_average' column not found for rating distribution visualization.")
```



Top 10 Most Profitable Movies

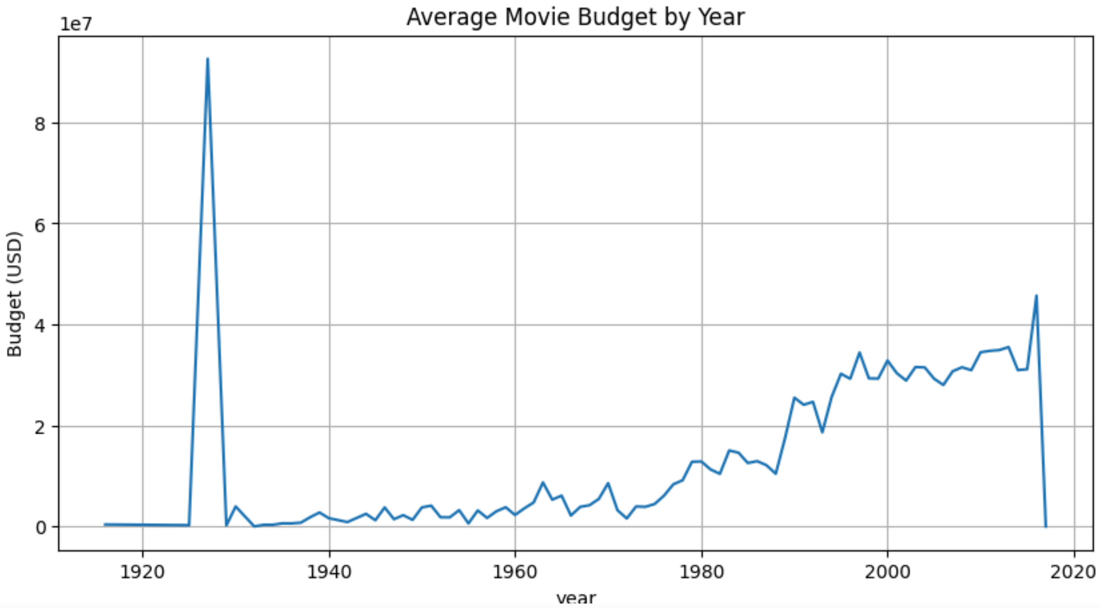
```
if 'df' in locals() and 'revenue' in df.columns and 'budget' in df.columns and 'title' in df.columns:
    df['profit'] = df['revenue'] - df['budget']
    top_profit = df[['title', 'budget', 'revenue', 'profit']].sort_values(by='profit', ascending=False).head(10)
    print(top_profit)  # Or display(top_profit) for a formatted output in Colab
else:
    print("DataFrame or required columns not found for profit calculation.")
```

```
                                    title     budget     revenue  \
0                                  Avatar  237000000  2787965087
25                                Titanic  200000000  1845034188
28                         Jurassic World  150000000  1513528810
44                              Furious 7  190000000  1506249360
```

```
16                                     The Avengers  220000000  1519557910
7                           Avengers: Age of Ultron  280000000  1405403694
124                                          Frozen  150000000  1274219009
546                                         Minions   74000000  1156730962
329  The Lord of the Rings: The Return of the King   94000000  1118888979
31                                       Iron Man 3  200000000  1215439994

         profit
0    2550965087
25   1645034188
28   1363528810
44   1316249360
16   1299557910
7    1125403694
124  1124219009
546  1082730962
329  1024888979
31   1015439994
```

Average Movie Budget by Year

```
import matplotlib.pyplot as plt

if 'df' in locals() and 'year' in df.columns and 'budget' in df.columns:
    budget_year = df.groupby('year')['budget'].mean()
    plt.figure(figsize=(10, 5))
    budget_year.plot()
    plt.title('Average Movie Budget by Year')
    plt.ylabel('Budget (USD)')
    plt.grid(True)
    plt.show()
else:
    print("DataFrame or required columns not found for budget analysis.")
```



Initial Dataset Overview

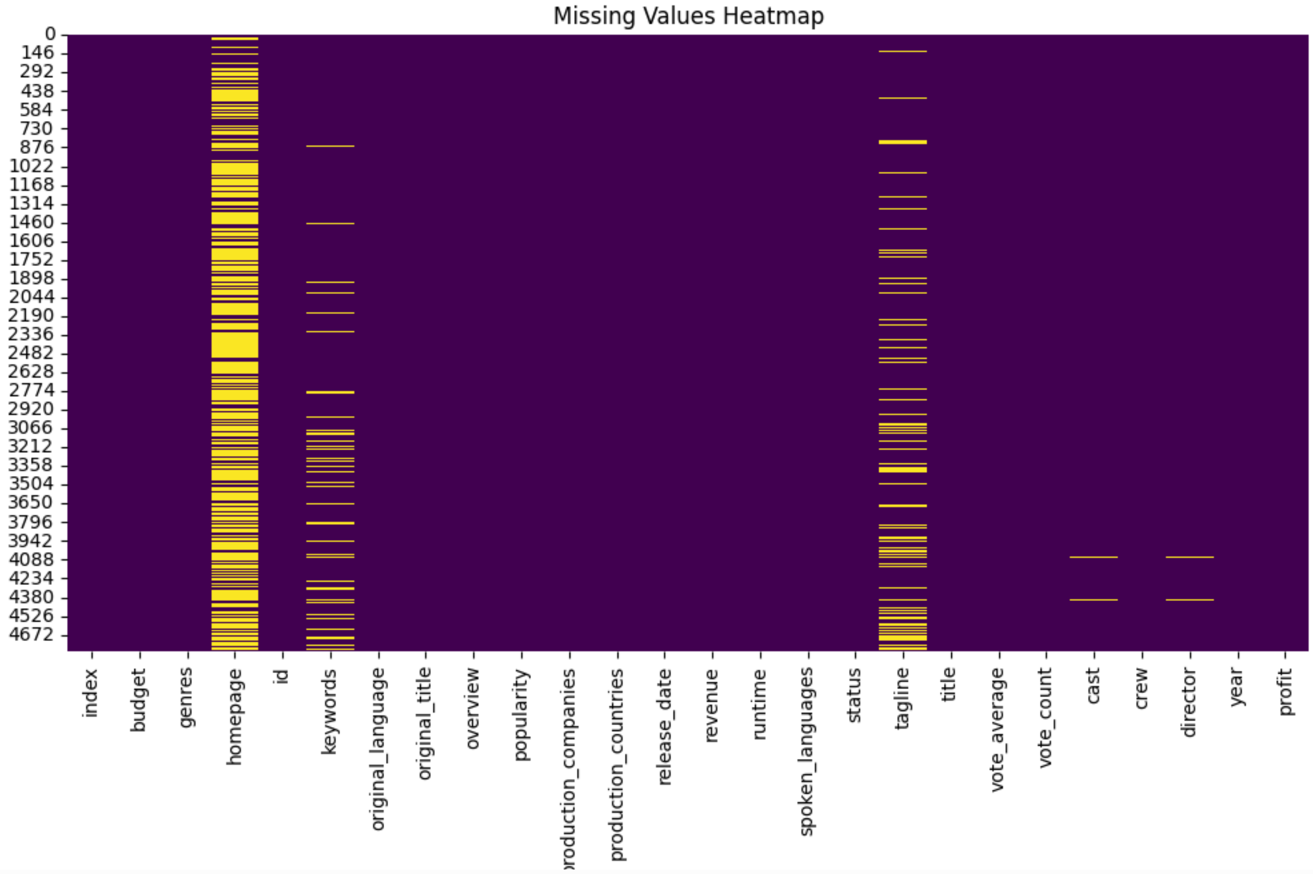
```
if 'df' in locals():
    print(df.head())
    print(df.shape)
    print(df.columns)
else:
    print("DataFrame not found.")
```

```
   index     budget                                   genres  \
0      0  237000000  Action Adventure Fantasy Science Fiction
1      1  300000000                 Adventure Fantasy Action
2      2  245000000                   Action Adventure Crime
3      3  250000000              Action Crime Drama Thriller
4      4  260000000          Action Adventure Science Fiction

                                     homepage      id  \
0                 http://www.avatarmovie.com/   19995
1  http://disney.go.com/disneypictures/pirates/     285
```

```
2   http://www.sonypictures.com/movies/spectre/  206647
3            http://www.thedarkknightrises.com/   49026
4          http://movies.disney.com/john-carter   49529

                                            keywords original_language  \
0  culture clash future space war space colony so...                en
1  ocean drug abuse exotic island east india trad...                en
2         spy based on novel secret agent sequel mi6                en
3  dc comics crime fighter terrorist secret ident...                en
4  based on novel mars medallion space travel pri...                en

                             original_title  \
0                                    Avatar
1  Pirates of the Caribbean: At World's End
2                                   Spectre
3                     The Dark Knight Rises
4                               John Carter

                                            overview  popularity  ...  \
0  In the 22nd century, a paraplegic Marine is di...  150.437577  ...
1  Captain Barbossa, long believed to be dead, ha...  139.082615  ...
2  A cryptic message from Bond’s past sends him o...  107.376788  ...
3  Following the death of District Attorney Harve...  112.312950  ...
4  John Carter is a war-weary, former military ca...   43.926995  ...

     status                                         tagline  \
0  Released                     Enter the World of Pandora.
1  Released  At the end of the world, the adventure begins.
2  Released                            A Plan No One Escapes
3  Released                                  The Legend Ends
4  Released            Lost in our world, found in another.

                                      title  vote_average  vote_count  \
0                                    Avatar           7.2       11800
1  Pirates of the Caribbean: At World's End           6.9        4500
2                                   Spectre           6.3        4466
3                     The Dark Knight Rises           7.6        9106
4                               John Carter           6.1        2124

                                                cast  \
0  Sam Worthington Zoe Saldana Sigourney Weaver S...
1  Johnny Depp Orlando Bloom Keira Knightley Stel...
2  Daniel Craig Christoph Waltz L\u00e9a Seydoux ...
3  Christian Bale Michael Caine Gary Oldman Anne ...
4  Taylor Kitsch Lynn Collins Samantha Morton Wil...

                                                crew           director  \
0  [{'name': 'Stephen E. Rivkin', 'gender': 0, 'd...      James Cameron
```

Missing Values Heatmap

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

if 'df' in locals():
    plt.figure(figsize=(12, 6))
    sns.heatmap(df.isnull(), cbar=False, cmap='viridis')
    plt.title("Missing Values Heatmap")
    plt.show()
else:
    print("DataFrame not found for missing values heatmap.")
```



Top 10 Highest Budget Movies

```
if 'df' in locals() and 'title' in df.columns and 'budget' in df.columns:
    top_budget_movies = df[['title', 'budget']].sort_values(by='budget', ascending=False).head(10)
    print(top_budget_movies)  # Or display(top_budget_movies) for formatted output in Colab
else:
    print("DataFrame or required columns not found for budget analysis.")
```

```
                                          title     budget
17  Pirates of the Caribbean: On Stranger Tides  380000000
1      Pirates of the Caribbean: At World's End  300000000
7                       Avengers: Age of Ultron  280000000
10                             Superman Returns  270000000
6                                       Tangled  260000000
4                                   John Carter  260000000
5                                  Spider-Man 3  258000000
13                              The Lone Ranger  255000000
9            Batman v Superman: Dawn of Justice  250000000
8        Harry Potter and the Half-Blood Prince  250000000
```

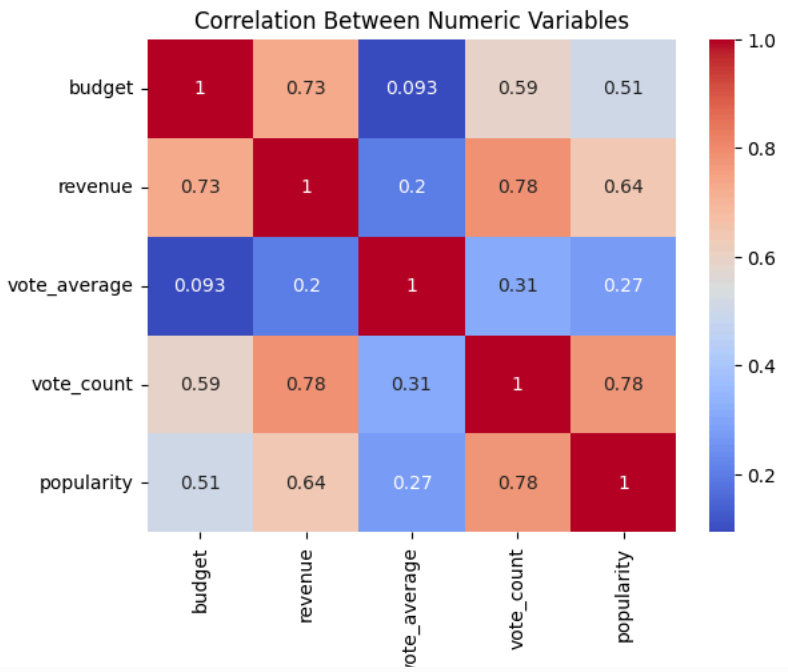
Top 10 Highest Grossing Movies

```
if 'df' in locals() and 'title' in df.columns and 'revenue' in df.columns:
    top_revenue_movies = df[['title', 'revenue']].sort_values(by='revenue', ascending=False).head(10)
    print(top_revenue_movies)  # Or display(top_revenue_movies) for formatted output in Colab
else:
    print("DataFrame or required columns not found for revenue analysis.")
```

```
                          title     revenue
0                        Avatar  2787965087
25                      Titanic  1845034188
16                 The Avengers  1519557910
28               Jurassic World  1513528810
44                    Furious 7  1506249360
7       Avengers: Age of Ultron  1405403694
124                      Frozen  1274219009
31                   Iron Man 3  1215439994
546                     Minions  1156730962
26   Captain America: Civil War  1153304495
```

Correlation Between Key Numeric Features

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

if 'df' in locals() and all(col in df.columns for col in ['budget', 'revenue', 'vote_average', 'vote_count', 'popularity']):
    corr = df[['budget', 'revenue', 'vote_average', 'vote_count', 'popularity']].corr()
    sns.heatmap(corr, annot=True, cmap='coolwarm')
    plt.title('Correlation Between Numeric Variables')
    plt.show()
else:
    print("DataFrame or required columns not found for correlation analysis.")
```



Low-Budget, Highly Rated Movies

```
if 'df' in locals() and all(col in df.columns for col in ['budget', 'vote_average', 'title']):
    filtered = df[(df['budget'] < 1_000_000) & (df['vote_average'] > 7.5)]
    print(filtered[['title', 'budget', 'vote_average']])
else:
    print("DataFrame or required columns not found for filtering.")
```

```
                                   title  budget  vote_average
463                              Déjà Vu       0           8.0
1028                             Solaris       0           7.7
2170                              Psycho  806948           8.2
2386                        One Man's Hero       0           9.3
2796                  The Prisoner of Zenda       0           8.4
2862                          About Time       0           7.8
3206                             Polisse       0           7.9
3208          Star Wars: Clone Wars: Volume 1       0           8.0
3503                        Lake of Fire       0           8.0
3510                                Emma       0           7.6
3519                    Stiff Upper Lips       0          10.0
3716                       Lilya 4-ever       0           7.7
3723                 Anne of Green Gables       0           8.2
3931                     Days of Heaven       0           7.6
3989                 Lage Raho Munna Bhai       0           7.6
3992                          Sardaarji       0           9.5
4045                 Dancer, Texas Pop. 81       0          10.0
4093                    Touching the Void       0           7.6
4164                          The Square       0           7.8
4208                          The Bubble       0           7.6
4238                        Modern Times       1           8.1
4247                 Me You and Five Bucks       1          10.0
4303                   The Second Mother       0           7.8
4329                          Casablanca  878000           7.9
4374                 Dream with the Fishes       0           7.7
4403                      The Jimmy Show       0           8.0
4405                    Karachi se Lahore       0           8.0
4416                         Hidden Away       0           7.6
4432                    On the Waterfront  910000           8.0
4452                        A Separation  800000           7.7
```

```
4456                          Raising Victor Vargas  800000          7.8
4457                                  Pandora's Box       0          7.6
4459                                   Live-In Maid       0          7.8
4468                Iraq for Sale: The War Profiteers       0          8.0
4471                     Kevin Hart: Laugh at My Pain       0          7.7
4474                                 The Conformist  750000          7.6
4479                                      High Noon  730000          7.6
4480                                    Hoop Dreams  700000          7.7
4571  Rise of the Entrepreneur: The Search for a Bet...       0          8.0
4579                   Monty Python and the Holy Grail  400000          7.8
4591                             Cries and Whispers       0          7.8
4602                                   12 Angry Men  350000          8.2
4603                                   My Dog Tulip       0          7.6
4604                           It Happened One Night  325000          7.7
4606                             Tupac: Resurrection  300000          8.0
4615                                 Pierrot le Fou  300000          7.6
4662                                 Little Big Top       0         10.0
4663                             Along the Roadside     250          7.7
4672                             A Fistful of Dollars  200000          7.6
4678                     The Business of Fancydancing  200000          8.0
4679                                Call + Response       0          8.0
4685                       The Case of the Grinning Cat       0          7.7
4686                                          Ordet       0          7.8
4688                             The Man from Earth       0          7.7
4695                             Children of Heaven  180000          7.8
4755                                       Counting   50000          8.3
4766                                  The Last Waltz       0          7.9
```

Top 10 Most Frequent Production Companies

```
if 'df' in locals() and 'production_companies' in df.columns:
    df['production_companies'] = df['production_companies'].astype(str)
    top_production_companies = df['production_companies'].str.split(',').explode().str.strip().value_counts().head(10)
    print(top_production_companies)
else:
    print("DataFrame or 'production_companies' column not found.")
```

```
production_companies
[]                                                     351
[{"name": "Paramount Pictures"                         281
[{"name": "Universal Pictures"                         260
{"name": "Warner Bros."                                254
"id": 33}                                              252
"id": 4}                                               223
[{"name": "Columbia Pictures"                          200
"id": 6194}                                            192
"id": 306}                                             182
[{"name": "Twentieth Century Fox Film Corporation"    177
Name: count, dtype: int64
```

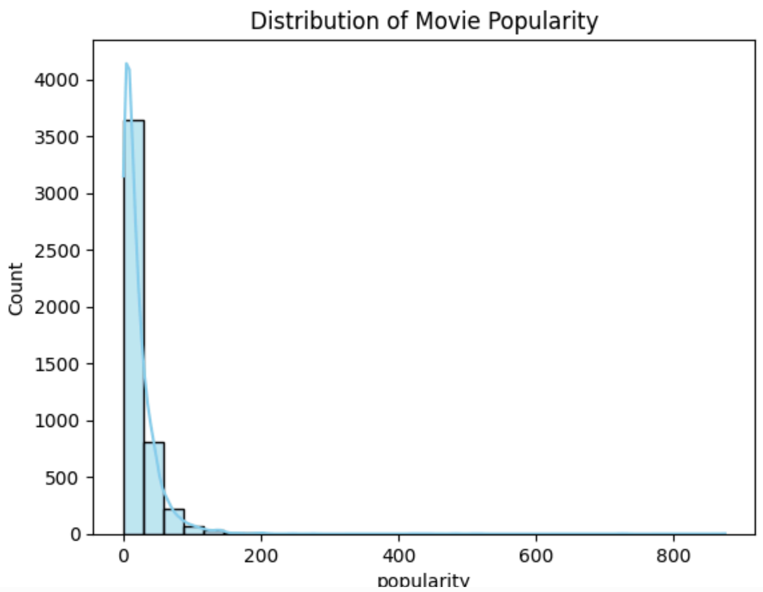
Average Runtime by Genre

```
import matplotlib.pyplot as plt

if 'df' in locals() and 'genre' in df.columns and 'runtime' in df.columns:
    avg_runtime = df.groupby('genre')['runtime'].mean().sort_values(ascending=False)
    avg_runtime.plot(kind='bar', figsize=(10, 5), color='teal')
    plt.title('Average Runtime by Genre')
    plt.ylabel('Minutes')
    plt.show()
else:
    print("DataFrame or required columns not found for runtime analysis.")
```

```
DataFrame or required columns not found for runtime analysis.
```

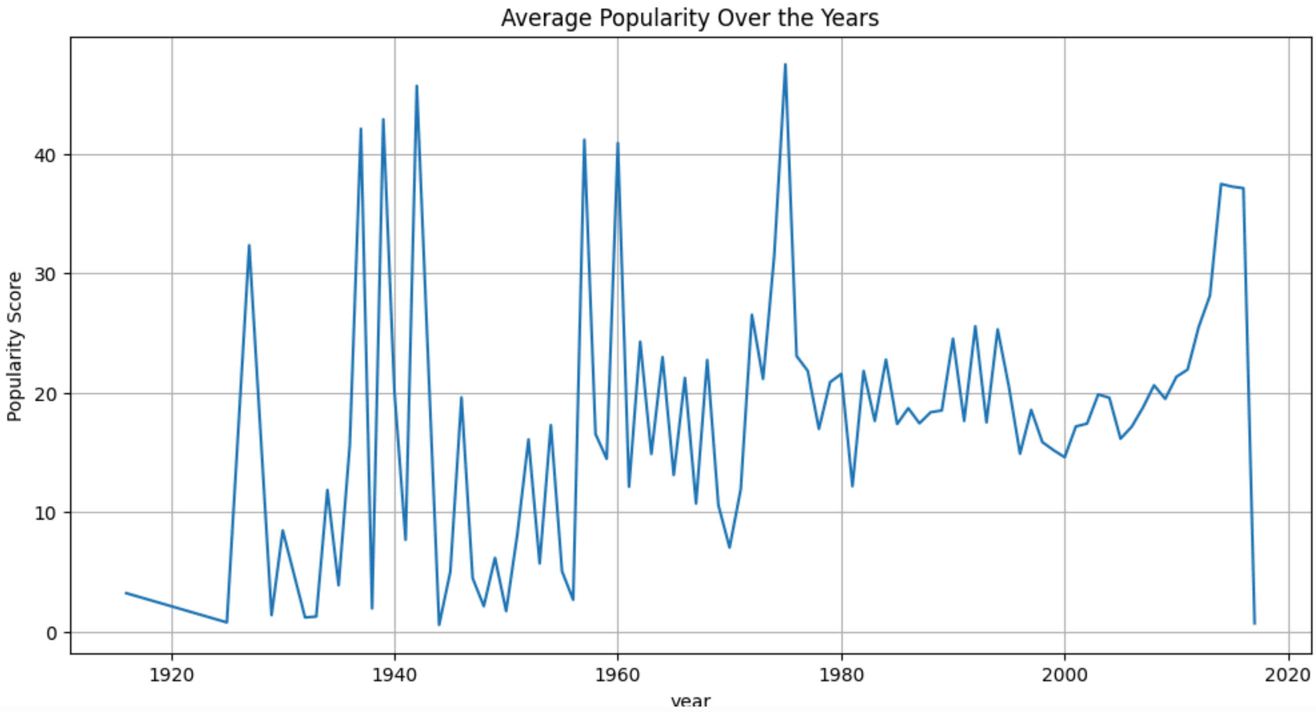
Distribution of Movie Popularity Scores

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

if 'df' in locals() and 'popularity' in df.columns:
    sns.histplot(df['popularity'], bins=30, kde=True, color='skyblue')
    plt.title("Distribution of Movie Popularity")
    plt.show()
else:
    print("DataFrame or 'popularity' column not found for popularity distribution visualization.")
```



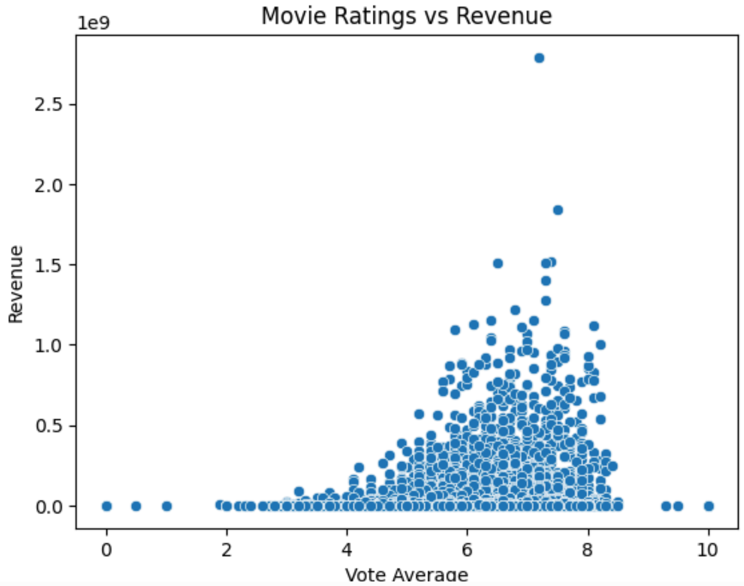
Average Movie Popularity Over the Years

```
import matplotlib.pyplot as plt

if 'df' in locals() and 'year' in df.columns and 'popularity' in df.columns:
    df.groupby('year')['popularity'].mean().plot(figsize=(12, 6))
    plt.title("Average Popularity Over the Years")
    plt.ylabel("Popularity Score")
    plt.grid()
    plt.show()
else:
    print("DataFrame or required columns not found for popularity analysis.")
```



Movie Ratings vs Revenue

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

if 'df' in locals() and 'vote_average' in df.columns and 'revenue' in df.columns:
    sns.scatterplot(data=df, x='vote_average', y='revenue')
    plt.title("Movie Ratings vs Revenue")
    plt.xlabel("Vote Average")
    plt.ylabel("Revenue")
    plt.show()
else:
    print("DataFrame or required columns not found for scatter plot visualization.")
```



Profit Margin Calculation and Summary Statistics

```
import numpy as np

if 'df' in locals() and all(col in df.columns for col in ['revenue', 'budget']):
    df['profit'] = df['revenue'] - df['budget']
    df['profit_margin'] = (df['profit'] / df['budget']).replace([np.inf, -np.inf], np.nan)
    print(df['profit_margin'].describe())
else:
    print("DataFrame or required columns not found for profit margin calculation.")
```

```
count    3.766000e+03
mean     2.532490e+03
std      1.394602e+05
min     -1.000000e+00
25%     -5.090214e-01
50%      8.675333e-01
75%      2.941424e+00
max      8.499999e+06
Name: profit_margin, dtype: float64
```

Genres Ranked by Average Revenue

```
import matplotlib.pyplot as plt

if 'df' in locals() and 'genre' in df.columns and 'revenue' in df.columns:
    genre_revenue = df.groupby('genre')['revenue'].mean().sort_values(ascending=False)
    genre_revenue.plot(kind='bar', figsize=(10, 5), color='coral')
    plt.title("Genres by Average Revenue")
    plt.ylabel("Average Revenue")
    plt.show()
else:
    print("DataFrame or required columns not found for genre revenue analysis.")
```

```
DataFrame or required columns not found for genre revenue analysis.
```

Budget Range per Genre

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

if 'df' in locals() and 'genre' in df.columns and 'budget' in df.columns:
    plt.figure(figsize=(12, 6))
    sns.boxplot(x='genre', y='budget', data=df)
    plt.xticks(rotation=45)
    plt.title("Budget Range per Genre")
    plt.show()
else:
    print("DataFrame or required columns not found for box plot visualization."
```

```
DataFrame or required columns not found for box plot visualization.
```

Revenue Distribution by Genre

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

if 'df' in locals() and 'genre' in df.columns and 'revenue' in df.columns:
    plt.figure(figsize=(12, 6))
    sns.violinplot(x='genre', y='revenue', data=df, scale='width', inner='quartile')
    plt.xticks(rotation=45)
    plt.title("Revenue Distribution by Genre")
    plt.show()
else:
    print("DataFrame or required columns not found for violin plot visualization.")
```

```
DataFrame or required columns not found for violin plot visualization.
```

Top 10 Most Voted Movies

```
if 'df' in locals() and 'title' in df.columns and 'vote_count' in df.columns:
    top_voted_movies = df[['title', 'vote_count']].sort_values(by='vote_count', ascending=False).head(10)
    print(top_voted_movies)  # Or display(top_voted_movies) for formatted output in Colab
else:
    print("DataFrame or required columns not found for vote count analysis.")
```

```
                       title  vote_count
96                 Inception       13752
65           The Dark Knight       12002
0                     Avatar       11800
16              The Avengers       11776
788                 Deadpool       10995
95              Interstellar       10867
287         Django Unchained       10099
94   Guardians of the Galaxy        9742
426         The Hunger Games        9455
127       Mad Max: Fury Road        9427
```