Analyzing Genre Influence on IMDb Ratings for Film and TV

(v1.0) - October 2024

This project aims to explore the relationship between film genres and their IMDb ratings to provide insights into genre success for a hypothetical film studio.

Sources

This data comes from IMDb's Non-Commercial Datasets, including:

- title_basics: Title information.
- title_ratings: IMDb rating and number of votes.
- title_principals: Information on directors, writers, and key actors.
- title_akas: Alternative title information.
- title_crew: Names for crew.
- title_episode: Episode and season numbers.
- name_basics: Key names involved with the titles.

1. Data Cleaning and Preparation Process

1.1 Loaded data.

First, I imported necessary libraries.

In [2]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

In [4]:
```
import warnings
warnings.filterwarnings("ignore")
```

Then, imported raw data sets from CSV files and used head() to preview the data frames.

In [7]:
```
title_basics = pd.read_csv('/Users/dominiqueakinyemi/Desktop/csv_files/title_basics.csv', sep=',', low_memory=False)
title_basics.head()
```

Out[7]:

	tconst	titleType	primaryTitle	originalTitle	isAdult	startYear	endYear	runtimeMinutes	genres
0	tt0000001	short	Carmencita	Carmencita	0.0	1894	\N	1	Documentary,Short
1	tt0000002	short	Le clown et ses chiens	Le clown et ses chiens	0.0	1892	\N	5	Animation,Short
2	tt0000003	short	Pauvre Pierrot	Pauvre Pierrot	0.0	1892	\N	5	Animation,Comedy,Romance
3	tt0000004	short	Un bon bock	Un bon bock	0.0	1892	\N	12	Animation,Short
4	tt0000005	short	Blacksmith Scene	Blacksmith Scene	0.0	1893	\N	1	Comedy,Short

In [8]:
```
title_akas = pd.read_csv('/Users/dominiqueakinyemi/Desktop/csv_files/title_akas.csv', sep=',', low_memory=False)
title_akas.head()
```

Out[8]:

	titleId	ordering	title	region	language	types	attributes	isOriginalTitle
0	tt0000001	1	Carmencita	\N	\N	original	\N	1
1	tt0000001	2	Carmencita	DE	\N	\N	literal title	0
2	tt0000001	3	Carmencita	US	\N	imdbDisplay	\N	0
3	tt0000001	4	Carmencita - spanyol tánc	HU	\N	imdbDisplay	\N	0
4	tt0000001	5	Καρμενσίτα	GR	\N	imdbDisplay	\N	0

In [9]:
```
title_crew = pd.read_csv('/Users/dominiqueakinyemi/Desktop/csv_files/title_crew.csv', sep=',', low_memory=False)
title_crew.head()
```

Out[9]:

	tconst	directors	writers
0	tt0000001	nm0005690	\N
1	tt0000002	nm0721526	\N
2	tt0000003	nm0721526	\N
3	tt0000004	nm0721526	\N
4	tt0000005	nm0005690	\N

In [10]:
```
title_episode = pd.read_csv('/Users/dominiqueakinyemi/Desktop/csv_files/title_episode.csv', sep=',', low_memory=False)
title_episode.head()
```

Out[10]:

	tconst	parentTconst	seasonNumber	episodeNumber
0	tt0031458	tt32857063	\N	\N
1	tt0041951	tt0041038	1	9
2	tt0042816	tt0989125	1	17
3	tt0042889	tt0989125	\N	\N
4	tt0043426	tt0040051	3	42

In [11]:
```
title_principals = pd.read_csv('/Users/dominiqueakinyemi/Desktop/csv_files/title_principals.csv', sep=',', low_memory=False)
title_principals.head()
```

Out[11]:

	tconst	ordering	nconst	category	job	characters
0	tt0000001	1	nm1588970	self	\N	["Self"]
1	tt0000001	2	nm0005690	director	\N	\N
2	tt0000001	3	nm0005690	producer	producer	\N
3	tt0000001	4	nm0374658	cinematographer	director of photography	\N
4	tt0000002	1	nm0721526	director	\N	\N

In [12]:
```
title_ratings = pd.read_csv('/Users/dominiqueakinyemi/Desktop/csv_files/title_ratings.csv', sep=',', low_memory=False)
title_ratings.head()
```

Out[12]:

	tconst	averageRating	numVotes
0	tt0000001	5.7	2089
1	tt0000002	5.6	283
2	tt0000003	6.5	2096
3	tt0000004	5.4	183
4	tt0000005	6.2	2832

In [13]:
```
name_basics = pd.read_csv('/Users/dominiqueakinyemi/Desktop/csv_files/name_basics.csv', sep=',', low_memory=False)
name_basics.head()
```

Out[13]:

	nconst	primaryName	birthYear	deathYear	primaryProfession	knownForTitles
0	nm0000001	Fred Astaire	1899	1987	actor,miscellaneous,producer	tt0072308,tt0050419,tt0053137,tt0027125
1	nm0000002	Lauren Bacall	1924	2014	actress,soundtrack,archive_footage	tt0037382,tt0075213,tt0117057,tt0038355
2	nm0000003	Brigitte Bardot	1934	\N	actress,music_department,producer	tt0057345,tt0049189,tt0056404,tt0054452
3	nm0000004	John Belushi	1949	1982	actor,writer,music_department	tt0072562,tt0077975,tt0080455,tt0078723
4	nm0000005	Ingmar Bergman	1918	2007	writer,director,actor	tt0050986,tt0083922,tt0050976,tt0069467

1.2 Duplicated data frames for cleaning.

In [15]:
```
raw_dfs = ['title_basics', 'title_akas', 'title_crew', 'title_episode', 'title_principals','title_ratings','name_basics']
```

In [16]:
```
for df_name in raw_dfs:
    globals()[f"{df_name}_clean"] = globals()[df_name].copy()
```

Next, I confirmed successful duplication and reviewed data structure.

In [18]:
```
print(title_basics_clean.shape)
title_basics_clean.head()
```

```
(11127675, 9)
```

Out[18]:

	tconst	titleType	primaryTitle	originalTitle	isAdult	startYear	endYear	runtimeMinutes	genres
0	tt0000001	short	Carmencita	Carmencita	0.0	1894	\N	1	Documentary,Short
1	tt0000002	short	Le clown et ses chiens	Le clown et ses chiens	0.0	1892	\N	5	Animation,Short
2	tt0000003	short	Pauvre Pierrot	Pauvre Pierrot	0.0	1892	\N	5	Animation,Comedy,Romance
3	tt0000004	short	Un bon bock	Un bon bock	0.0	1892	\N	12	Animation,Short
4	tt0000005	short	Blacksmith Scene	Blacksmith Scene	0.0	1893	\N	1	Comedy,Short

In [19]:
```
print(title_akas_clean.shape)
title_akas_clean.head()
```

```
(47171461, 8)
```

Out[19]:

	titleId	ordering	title	region	language	types	attributes	isOriginalTitle
0	tt0000001	1	Carmencita	\N	\N	original	\N	1
1	tt0000001	2	Carmencita	DE	\N	\N	literal title	0
2	tt0000001	3	Carmencita	US	\N	imdbDisplay	\N	0
3	tt0000001	4	Carmencita - spanyol tánc	HU	\N	imdbDisplay	\N	0
4	tt0000001	5	Καρμενσίτα	GR	\N	imdbDisplay	\N	0

In [20]:
```
print(title_crew_clean.shape)
title_crew_clean.head()
```

```
(10471271, 3)
```

Out[20]:

	tconst	directors	writers
0	tt0000001	nm0005690	\N
1	tt0000002	nm0721526	\N
2	tt0000003	nm0721526	\N
3	tt0000004	nm0721526	\N
4	tt0000005	nm0005690	\N

In [21]:
```
print(title_episode_clean.shape)
title_episode_clean.head()
```

```
(8538187, 4)
```

Out[21]:

	tconst	parentTconst	seasonNumber	episodeNumber
0	tt0031458	tt32857063	\N	\N
1	tt0041951	tt0041038	1	9
2	tt0042816	tt0989125	1	17
3	tt0042889	tt0989125	\N	\N
4	tt0043426	tt0040051	3	42

In [22]:
```
print(title_principals_clean.shape)
title_principals_clean.head()
```

```
(86305808, 6)
```

Out[22]:

	tconst	ordering	nconst	category	job	characters
0	tt0000001	1	nm1588970	self	\N	["Self"]
1	tt0000001	2	nm0005690	director	\N	\N
2	tt0000001	3	nm0005690	producer	producer	\N
3	tt0000001	4	nm0374658	cinematographer	director of photography	\N
4	tt0000002	1	nm0721526	director	\N	\N

In [23]:
```
print(title_ratings_clean.shape)
title_ratings_clean.head()
```

```
(1482511, 3)
```

Out[23]:

	tconst	averageRating	numVotes
0	tt0000001	5.7	2089
1	tt0000002	5.6	283
2	tt0000003	6.5	2096
3	tt0000004	5.4	183
4	tt0000005	6.2	2832

In [24]:
```
print(name_basics_clean.shape)
name_basics_clean.head()
```

```
(13846512, 6)
```

Out[24]:

	nconst	primaryName	birthYear	deathYear	primaryProfession	knownForTitles
0	nm0000001	Fred Astaire	1899	1987	actor,miscellaneous,producer	tt0072308,tt0050419,tt0053137,tt0027125
1	nm0000002	Lauren Bacall	1924	2014	actress,soundtrack,archive_footage	tt0037382,tt0075213,tt0117057,tt0038355
2	nm0000003	Brigitte Bardot	1934	\N	actress,music_department,producer	tt0057345,tt0049189,tt0056404,tt0054452
3	nm0000004	John Belushi	1949	1982	actor,writer,music_department	tt0072562,tt0077975,tt0080455,tt0078723
4	nm0000005	Ingmar Bergman	1918	2007	writer,director,actor	tt0050986,tt0083922,tt0050976,tt0069467

1.3 Resolved null values using isnull(), fillna(), and dropna().

In [27]:
```
title_basics.isnull().sum() # Identified columns with null values
```

Out[27]:
```
tconst              0
titleType           0
primaryTitle       19
originalTitle      19
isAdult             1
startYear           0
endYear             0
runtimeMinutes      0
genres            637
dtype: int64
```

In [28]:
```
title_basics_clean = title_basics_clean.dropna(subset=['isAdult']) # Dropped title with null value in isAdult column
title_basics_clean.fillna({'primaryTitle': 'Unknown', 'originalTitle': 'Unknown', 'genres': 'Unknown'}, inplace=True) # Replaced string nulls
title_basics_clean.isnull().sum() # Confirmed changes
```

Out[28]:
```
tconst            0
titleType         0
primaryTitle      0
originalTitle     0
isAdult           0
startYear         0
endYear           0
runtimeMinutes    0
genres            0
dtype: int64
```

In [29]:
```
title_akas.isnull().sum()
```

Out[29]:
```
titleId              0
ordering             0
title               36
region             176
language             0
types                0
attributes           0
isOriginalTitle      0
dtype: int64
```

In [30]:
```
title_akas_clean.fillna({'title': 'Unknown', 'region': 'Unknown'}, inplace=True)
title_akas_clean.isnull().sum() # Confirmed changes
```

Out[30]:
```
titleId           0
ordering          0
title             0
region            0
language          0
types             0
attributes        0
isOriginalTitle   0
dtype: int64
```

In [31]:
```
name_basics.isnull().sum()
```

Out[31]:
```
nconst               0
primaryName          8
birthYear            0
deathYear            0
primaryProfession    0
knownForTitles       0
dtype: int64
```

In [32]:
```
name_basics_clean['primaryName'] = name_basics_clean['primaryName'].fillna('Unknown')
name_basics_clean.isnull().sum() # Confirmed changes
```

Out[32]:
```
nconst               0
primaryName          0
birthYear            0
deathYear            0
primaryProfession    0
knownForTitles       0
dtype: int64
```

In [33]:
```
title_crew_clean.isnull().sum() # Confirmed no null values
```

Out[33]:
```
tconst       0
directors    0
writers      0
dtype: int64
```

In [34]:
```
title_episode_clean.isnull().sum() # Confirmed no null values
```

Out[34]:
```
tconst           0
parentTconst     0
seasonNumber     0
episodeNumber    0
dtype: int64
```

In [35]:
```
title_principals.isnull().sum()
```

Out[35]:
```
tconst        0
ordering      0
nconst        0
category      0
job           0
characters    3
dtype: int64
```

In [36]:
```
title_principals_clean['characters'] = title_principals_clean['characters'].fillna('None')
title_principals_clean.isnull().sum() # Confirmed changes
```

Out[36]:
```
tconst        0
ordering      0
nconst        0
category      0
job           0
characters    0
dtype: int64
```

In [37]:
```
title_ratings_clean.isnull().sum()  # Confirmed no null values
```

Out[37]:
```
tconst           0
averageRating    0
numVotes         0
dtype: int64
```

1.4 Converted data types.

In [39]:
```
title_basics_clean['tconst'] = title_basics_clean['tconst'].astype(str)
title_basics_clean['titleType'] = title_basics_clean['titleType'].astype(str)
title_basics_clean['primaryTitle'] = title_basics_clean['primaryTitle'].astype(str)
title_basics_clean['originalTitle'] = title_basics_clean['originalTitle'].astype(str)
title_basics_clean['isAdult'] = title_basics_clean['isAdult'].astype(bool)
title_basics_clean['startYear'] = pd.to_datetime(title_basics_clean['startYear'], format='%Y', errors='coerce')
title_basics_clean['endYear'] = pd.to_datetime(title_basics_clean['endYear'], format='%Y', errors='coerce')
title_basics_clean['runtimeMinutes'] = pd.to_numeric(title_basics_clean['runtimeMinutes'], errors='coerce')
title_basics_clean['genres'] = title_basics_clean['genres'].astype(str)
print(title_basics_clean.dtypes)
```

```
tconst                    object
titleType                 object
primaryTitle              object
originalTitle             object
isAdult                     bool
startYear         datetime64[ns]
endYear           datetime64[ns]
runtimeMinutes           float64
genres                    object
dtype: object
```

The runtimeMinutes column was converted to numeric to coerce non-numerical errors into an acceptable format.

In [41]:
```
title_akas_clean['titleId'] = title_akas_clean['titleId'].astype(str)
title_akas_clean['ordering'] = title_akas_clean['ordering'].astype(int)
title_akas_clean['title'] = title_akas_clean['title'].astype(str)
title_akas_clean['region'] = title_akas_clean['region'].astype(str)
title_akas_clean['language'] = title_akas_clean['language'].astype(str)
title_akas_clean['types'] = title_akas_clean['types'].astype(str)
title_akas_clean['attributes'] = title_akas_clean['attributes'].astype(str)
title_akas_clean['isOriginalTitle'] = title_akas_clean['isOriginalTitle'].astype(bool)
print(title_akas_clean.dtypes)
```

```
titleId            object
ordering            int64
title              object
region             object
language           object
types              object
attributes         object
isOriginalTitle      bool
dtype: object
```

In [42]:
```
title_crew_clean['tconst'] = title_crew_clean['tconst'].astype(str)
title_crew_clean['directors'] = title_crew_clean['directors'].astype(str)
title_crew_clean['writers'] = title_crew_clean['writers'].astype(str)
print(title_crew_clean.dtypes)
```

```
tconst       object
directors    object
writers      object
dtype: object
```

In [43]:
```
title_episode_clean = title_episode_clean.replace(["\\N", "\\\\N"], 0) # Replaced \N and \\N strings with 0 due to error
title_episode_clean['tconst'] = title_episode_clean['tconst'].astype(str)
title_episode_clean['parentTconst'] = title_episode_clean['parentTconst'].astype(str)
title_episode_clean['seasonNumber'] = title_episode_clean['seasonNumber'].astype(int)
title_episode_clean['episodeNumber'] = title_episode_clean['episodeNumber'].astype(int)
print(title_episode_clean.dtypes)
```

```
tconst           object
parentTconst     object
seasonNumber      int64
episodeNumber     int64
dtype: object
```

In [44]:
```
title_principals_clean['tconst'] = title_principals_clean['tconst'].astype(str)
title_principals_clean['ordering'] = title_principals_clean['ordering'].astype(int)
title_principals_clean['nconst'] = title_principals_clean['nconst'].astype(str)
title_principals_clean['category'] = title_principals_clean['category'].astype(str)
title_principals_clean['job'] = title_principals_clean['job'].astype(str)
title_principals_clean['characters'] = title_principals_clean['characters'].astype(str)
print(title_principals_clean.dtypes)
```

```
tconst        object
ordering       int64
nconst        object
category      object
job           object
characters    object
dtype: object
```

In [45]:
```
title_ratings_clean['tconst'] = title_ratings_clean['tconst'].astype(str)
title_ratings_clean['averageRating'] = pd.to_numeric(title_ratings_clean['averageRating'], errors='coerce')
```

```
title_ratings_clean['numVotes'] = title_ratings_clean['numVotes'].astype(int)
print(title_ratings_clean.dtypes)
```

```
tconst            object
averageRating    float64
numVotes           int64
dtype: object
```

In [46]:
```
name_basics_clean['nconst'] = name_basics_clean['nconst'].astype(str)
name_basics_clean['primaryName'] = name_basics_clean['primaryName'].astype(str)
name_basics_clean['birthYear'] = pd.to_datetime(name_basics_clean['birthYear'], format='%Y', errors='coerce')
name_basics_clean['deathYear'] = pd.to_datetime(name_basics_clean['deathYear'], format='%Y', errors='coerce')
name_basics_clean['primaryProfession'] = name_basics['primaryProfession'].astype(str)
name_basics_clean['knownForTitles'] = name_basics['knownForTitles'].astype(str)
print(name_basics_clean.dtypes)
```

```
nconst                      object
primaryName                 object
birthYear           datetime64[ns]
deathYear           datetime64[ns]
primaryProfession           object
knownForTitles              object
dtype: object
```

1.5 Rechecked null values after converting data types and removed \N strings.

Converting columns from string to datetime or float allows the string values '\N' to now be visible as null values. String columns will require filtering out '\N' or '\N' values.

In [49]:
```
title_basics_clean.isnull().sum()
```

Out[49]:
```
tconst                 0
titleType              0
primaryTitle           0
originalTitle          0
isAdult                0
startYear        1415775
endYear         10997129
runtimeMinutes   7624130
genres                 0
dtype: int64
```

In [50]:
```
print(f"startYear null value percentage: {(1415775/11127674) * 100}")
print(f"endYear null value percentage: {(10997129/11127674) * 100}")
print(f"runtimeMinutes null value percentage: {(7624130/11127674) * 100}")
```

```
startYear null value percentage: 12.723009318928646
endYear null value percentage: 98.8268437770553
runtimeMinutes null value percentage: 68.5150373743875
```

Almost no titles in title_basics have an endYear, less than half have an included runtime. These are likely not viable columns for analysis.

In [52]:
```
title_basics_clean['runtimeMinutes'] = title_basics_clean['runtimeMinutes'].fillna(0)
title_basics_clean['startYear'] = title_basics_clean['startYear'].fillna(pd.to_datetime('1678-01-01')) # Replaced missing start years with earliest pandas date
title_basics_clean['endYear'] = title_basics_clean['endYear'].fillna(pd.to_datetime('2262-01-01')) # Replaced missing or future end years with farthest pandas date
title_basics_clean.isnull().sum()
```

Out[52]:
```
tconst           0
titleType        0
primaryTitle     0
originalTitle    0
isAdult          0
startYear        0
endYear          0
runtimeMinutes   0
genres           0
dtype: int64
```

In the data set, 1678-01-01 will serve as a stand in for unknown start years and 2262-01-01 for unknown or future end years.

In [54]:
```
title_akas_clean.isnull().sum() # No null values
```

Out[54]:
```
titleId            0
ordering           0
title              0
region             0
language           0
types              0
attributes         0
isOriginalTitle    0
dtype: int64
```

In [55]:
```
title_crew_clean.isnull().sum() # No null values
```

Out[55]:
```
tconst       0
directors    0
writers      0
dtype: int64
```

In [56]:
```
title_episode_clean.isnull().sum() # No null values
```

Out[56]:
```
tconst          0
parentTconst    0
seasonNumber    0
episodeNumber   0
dtype: int64
```

In [57]:
```
title_principals_clean.isnull().sum() # No null values
```

Out[57]:
```
tconst        0
ordering      0
nconst        0
category      0
job           0
characters    0
dtype: int64
```

In [58]:
```
title_ratings_clean.isnull().sum() # No null values
```

Out[58]:
```
tconst           0
averageRating    0
numVotes         0
dtype: int64
```

In [59]:
```
name_basics_clean.isnull().sum()
```

Out[59]:
```
nconst                     0
primaryName                0
birthYear           13219708
deathYear           13612042
primaryProfession          0
knownForTitles             0
dtype: int64
```

In [60]:
```
print(f"birthYear null value percentage: {(13219708/13846512) * 100}")
print(f"deathYear null value percentage: {(13612042/13846512) * 100}")
```

```
birthYear null value percentage: 95.4731993154666
deathYear null value percentage: 98.3066493568922
```

Almost no names have accompanying birth years or recorded deaths, though this information may be available from sources outside this data set. As they are, these columns are not viable columns for analysis.

In [62]:
```
name_basics_clean['birthYear'] = name_basics_clean['birthYear'].fillna(pd.to_datetime('1678-01-01')) # Replaced missing birth years with earliest pandas date
name_basics_clean['deathYear'] = name_basics_clean['deathYear'].fillna(pd.to_datetime('2262-01-01')) # Replaced missing death years with farthest pandas date
name_basics_clean.isnull().sum()
```

Out[62]:
```
nconst              0
primaryName         0
birthYear           0
deathYear           0
primaryProfession   0
knownForTitles      0
dtype: int64
```

In the data set, 1678-01-01 will serve as a stand in for unknown birth years and 2262-01-01 for unknown or future death years.

Next, I filtered out \N strings from string columns.

In [65]:
```
# Removed remaining \N strings
title_basics_clean['titleType'] = title_basics_clean['titleType'].replace({r'\\N': 'Unknown'}, regex=True)
title_basics_clean['primaryTitle'] = title_basics_clean['primaryTitle'].replace({r'\\N': 'Unknown'}, regex=True)
title_basics_clean['originalTitle'] = title_basics_clean['originalTitle'].replace({r'\\N': 'Unknown'}, regex=True)
title_basics_clean['genres'] = title_basics_clean['genres'].replace({r'\\N': 'Unknown'}, regex=True)
null_title_basics = title_basics_clean.map(lambda x: x == '\\N' or x == r'\\N')
# Confirmed no remaining \N strings
print(title_basics_clean[null_title_basics.any(axis=1)])
```

```
Empty DataFrame
Columns: [tconst, titleType, primaryTitle, originalTitle, isAdult, startYear, endYear, runtimeMinutes, genres]
Index: []
```

In [66]:
```
title_akas_clean['title'] = title_akas_clean['title'].replace({r'\\N': 'Unknown'}, regex=True)
title_akas_clean['region'] = title_akas_clean['region'].replace({r'\\N': 'Unknown'}, regex=True)
title_akas_clean['language'] = title_akas_clean['language'].replace({r'\\N': 'Unknown'}, regex=True)
title_akas_clean['types'] = title_akas_clean['types'].replace({r'\\N': 'Unknown'}, regex=True)
title_akas_clean['attributes'] = title_akas_clean['attributes'].replace({r'\\N': 'Unknown'}, regex=True)
null_title_akas = title_akas_clean.map(lambda x: x == '\\N' or x == r'\\N')
# Confirmed no remaining \N strings
print(title_akas_clean[null_title_akas.any(axis=1)])
```

```
Empty DataFrame
Columns: [titleId, ordering, title, region, language, types, attributes, isOriginalTitle]
Index: []
```

In [67]:
```
title_crew_clean['directors'] = title_crew_clean['directors'].replace({r'\\N': 'Unknown'}, regex=True)
title_crew_clean['writers'] = title_crew_clean['writers'].replace({r'\\N': 'Unknown'}, regex=True)
null_title_crew = title_crew_clean.map(lambda x: x == '\\N' or x == r'\\N')
# Confirmed no remaining \N strings
print(title_crew_clean[null_title_crew.any(axis=1)])
```

```
Empty DataFrame
Columns: [tconst, directors, writers]
Index: []
```

In [68]:
```
title_principals_clean['category'] = title_principals_clean['category'].replace({r'\\N': 'Unknown'}, regex=True)
title_principals_clean['job'] = title_principals_clean['job'].replace({r'\\N': 'Unknown'}, regex=True)
title_principals_clean['characters'] = title_principals_clean['characters'].replace({r'\\N': 'Unknown'}, regex=True)
null_title_principals = title_principals_clean.map(lambda x: x == '\\N' or x == r'\\N')
# Confirmed no remaining \N strings
print(title_principals_clean[null_title_principals.any(axis=1)])
```

```
Empty DataFrame
Columns: [tconst, ordering, nconst, category, job, characters]
Index: []
```

In [69]:
```
name_basics_clean['primaryName'] = name_basics_clean['primaryName'].replace({r'\\N': 'Unknown'}, regex=True)
name_basics_clean['primaryProfession'] = name_basics_clean['primaryProfession'].replace({r'\\N': 'Unknown'}, regex=True)
name_basics_clean['knownForTitles'] = name_basics_clean['knownForTitles'].replace({r'\\N': 'Unknown'}, regex=True)
null_name_basics = name_basics_clean.map(lambda x: x == '\\N' or x == r'\\N')
# Confirmed no remaining \N strings
print(name_basics_clean[null_name_basics.any(axis=1)])
```

```
Empty DataFrame
Columns: [nconst, primaryName, birthYear, deathYear, primaryProfession, knownForTitles]
Index: []
```

1.6 Standardized column names using snake_case.

In [71]:
```
# Created function to convert from camelCase to snake_case
def camel_to_snake(name):
    return ''.join(['_' + i.lower() if i.isupper() else i for i in name]).lstrip('_')
# Applied to columns
title_basics_clean.columns = [camel_to_snake(col) for col in title_basics_clean.columns]
title_principals_clean.columns = [camel_to_snake(col) for col in title_principals_clean.columns]
name_basics_clean.columns = [camel_to_snake(col) for col in name_basics_clean.columns]
title_episode_clean.columns = [camel_to_snake(col) for col in title_episode_clean.columns]
title_akas_clean.columns = [camel_to_snake(col) for col in title_akas_clean.columns]
title_crew_clean.columns = [camel_to_snake(col) for col in title_crew_clean.columns]
title_ratings_clean.columns = [camel_to_snake(col) for col in title_ratings_clean.columns]
```

1.7 Checked unique categorical values.

To standardize variable formatting and spelling, I examined the unique strings in categorical columns. The remaining columns (primary_professions, genres) will be analyzed after splitting columns.

In [74]:
```
print(title_basics_clean['title_type'].unique())
```

```
['short' 'movie' 'tvShort' 'tvMovie' 'tvEpisode' 'tvSeries' 'tvMiniSeries'
 'tvSpecial' 'video' 'videoGame' 'tvPilot']
```

In [75]:
```
print(title_akas_clean['types'].unique())
```

```
['original' 'Unknown' 'imdbDisplay' 'alternative' 'festival' 'dvd'
 'working' 'tv' 'video' 'imdbDisplay\x02tv' 'alternative\x02tv'
 'imdbDisplay\x02working' 'imdbDisplay\x02festival' 'working\x02tv'
 'imdbDisplay\x02video' 'dvd\x02alternative' 'tv\x02video'
 'imdbDisplay\x02dvd' 'working\x02video' 'working\x02festival'
 'dvd\x02video' 'alternative\x02festival' 'alternative\x02video'
 'working\x02alternative']
```

In [76]:
```
print(title_akas_clean['attributes'].unique())
```

```
['Unknown' 'literal title' 'literal English title'
 'informal alternative title' 'promotional title' 'complete title'
 'reissue title' 'informal title' 'premiere title' 'short title'
 'première title' 'bowdlerized title' 'informal English title'
 'alternative spelling' 'original script title' 'copyright title'
 'long title' 'transliterated title' 'informal short title' 'new title'
 'review title' 'subtitle' 'original subtitled version'
 'informal literal title' 'orthographically correct title' 'cut version'
 'pre-release title' 'video catalogue title' 'second part title'
 'third part title' 'fifth season title' 'fourth season title'
 'series title' 'poster title' 'rerun title' '8mm release title'
 'recut version' 'theatrical title' '16mm release title'
 'first part title' 'informal literal English title' 'first episode title'
 'segment title' 'Los Angeles première title' 'DVD box title'
 'second copyright title' 'alternative transliteration' 'short version'
 'video box title' 'restored version' 'IMAX version'
 'english transliteration' 'reissue title\x02recut version'
 '8mm release title\x02short version' 'DVD menu title' 'anthology series'
 'censored version' 'trailer title' 'silent version'
 'Berlin film festival title' 'Cannes festival title' 'dubbed version'
 'reissue title\x02added framing sequences and narration in Yiddish'
 'bootleg title' 'Bable dialect title' 'Venice film festival title'
 'reissue title\x02Yiddish dubbed' 'cable TV title'
 'uncensored intended title' 'literal translation of working title'
 'last season title' 'Yiddish dubbed' 'TV listings title'
 'YIVO translation' 'modern translation' 'long new title' "director's cut"
 'video box title\x02POLart' 'POLart' 'reissue title\x02cut version'
 'reissue title\x02YIVO translation' 'racier version'
 'redubbed comic version' '3-D version' 'syndication title'
 'fake working title' 'closing credits title' 'armed forces circuit title'
 'reissue title\x02short version' 'unauthorized video title'
 'first season title' 'summer title' 'longer version'
 'second season title' 'sixth season title' 'first episodes title'
 'Pay-TV title' 'tenth season title' 'MIFED title' '3-D video title'
 'literal French title' 'third and fourth season title'
 'videogame episode' 'new syndication title' 'promotional abbreviation'
 'ninth season title' 'eighth season title' 'X-rated version'
 'expansion title' 'correct transliteration' '16mm rental title'
 'Los Angeles premiere title' 'fourteenth season title' 'teaser title'
 'daytime version title' 'seventh season title' 'third season title'
 'video CD title' 'LD title' 'soft porn version'
 'video box title\x02cut version' 'reissue title\x02racier version'
 'second part title\x028mm release title' 'weekend title'
 'English translation of working title' 'fifteenth season title'
 'twentieth season title' 'twentyfifth season title' 'fourth part title'
 'thirtysecond season title' 'informal title\x02literal title'
 'cable TV title\x02cut version' 'twentyfirst season title'
 'closing credits title\x02pre-release title'
 'non-modified Hepburn romanization' 'Locarno film festival title'
 'eleventh season title' 'thirtythird season title'
 'rerun title\x02longer version' 'eighteenth season title'
 'thirtieth season title' 'sixteenth season title' 'twelfth season title'
 'thirteenth season title' 'thirtyfirst season title'
 'twentysecond season title' 'twentythird season title'
 'seventeenth season title' 'twentyseventh season title'
 'nineteenth season title' 'game box title'
 'title for episodes with guest hosts'
 'approximation of original mirrored title'
 'IMAX version\x02promotional title' 'twentyfourth season title'
 'twentysixth season title' 'bootleg title\x02X-rated version'
 'poster title\x02video box title' 'dubbed version\x02recut version'
 'thirtyninth season title' 'twentyninth season title'
 'thirtyfourth season title' 'American Mutoscope & Biograph catalog title'
 'twentyeighth season title' 'thirtyfifth season title'
 'thirtysixth season title' 'thirtyeighth season title' 'R-rated version'
 'original pilot title' 'thirtyseventh season title'
 'fortieth season title' 'Hakka dialect title' 'Bilbao festival title'
 'thirteenth season title\x02promotional title'
 'video box title\x02orthographically correct title' 'late Sunday edition'
 'PC version' 'fourth season title\x02recut version' 'GameCube version'
 'first segment title' 'third segment title' 'second segment title'
 'fifth part title' 'incorrect title' 'rumored']
```

In [77]:
```
print(title_principals_clean['category'].unique())
print(title_principals_clean['job'].unique())
```

```
['self' 'director' 'producer' 'cinematographer' 'composer' 'editor'
 'actor' 'actress' 'writer' 'production_designer' 'archive_footage'
 'casting_director' 'archive_sound']
['Unknown' 'producer' 'director of photography' ...
 'based on the original saga by' 'Story & Screenplay by'
 'original idea/ scriptwriter']
```

1.8 Standardized capitalization of string values.

Now I can standardized the strings returned in the previous step.

In [80]:
```
title_basics_clean['title_type'] = title_basics_clean['title_type'].str.capitalize()
```

In [81]:
```
title_akas_clean['types'] = title_akas_clean['types'].str.capitalize()
title_akas_clean['attributes'] = title_akas_clean['attributes'].str.capitalize()
```

In [82]:
```
title_principals_clean['category'] = title_principals_clean['category'].str.capitalize()
title_principals_clean['job'] = title_principals_clean['job'].str.capitalize()
```

In [83]:
```
name_basics_clean['primary_profession'] = name_basics_clean['primary_profession'].str.capitalize()
```

1.9 Dropped unnecessary columns.

In [85]:
```
title_principals_clean = title_principals_clean.drop(columns=['ordering'])
```

In [86]:
```
title_akas_clean = title_akas_clean.drop(columns=['ordering'])
```

1.10 Split professions into multiple columns in name_basics.

In [127…
```
profession_split = name_basics_clean['primary_profession'].str.split(',', expand=True) # Separated strings with .str.split
profession_split.columns = [f'profession_{i+1}' for i in range(profession_split.shape[1])]
name_basics_clean = pd.concat([name_basics_clean, profession_split], axis=1) # Rejoined with data frame
```

In [128…
```
name_basics_clean['profession_2'] = name_basics_clean['profession_2'].str.capitalize() # Capitalized new columns
name_basics_clean['profession_3'] = name_basics_clean['profession_3'].str.capitalize()
```

1.11 Split genres into multiple columns in title_basics.

In [132…
```
genres_split = title_basics_clean['genres'].str.split(',', expand=True) # Separated strings with .str.split
genres_split.columns = [f'genre_{i+1}' for i in range(genres_split.shape[1])]
title_basics_clean = pd.concat([title_basics_clean, genres_split], axis=1) # Rejoined with data frame
```

1.12 Trimmed trailing whitespaces.

I used str.strip on all string columns to ensure there were no leading or trailing spaces which would interfere with analysis.

In [135…
```
title_basics_clean['tconst'] = title_basics_clean['tconst'].str.strip()
title_basics_clean['title_type'] = title_basics_clean['title_type'].str.strip()
title_basics_clean['primary_title'] = title_basics_clean['primary_title'].str.strip()
title_basics_clean['original_title'] = title_basics_clean['original_title'].str.strip()
title_basics_clean['genres'] = title_basics_clean['genres'].str.strip()
title_basics_clean['genre_1'] = title_basics_clean['genre_1'].str.strip()
title_basics_clean['genre_2'] = title_basics_clean['genre_2'].str.strip()
title_basics_clean['genre_3'] = title_basics_clean['genre_3'].str.strip()
```

In [136…
```
title_akas_clean['title_id'] = title_akas_clean['title_id'].str.strip()
title_akas_clean['title'] = title_akas_clean['title'].str.strip()
title_akas_clean['region'] = title_akas_clean['region'].str.strip()
title_akas_clean['language'] = title_akas_clean['language'].str.strip()
title_akas_clean['types'] = title_akas_clean['types'].str.strip()
title_akas_clean['attributes'] = title_akas_clean['attributes'].str.strip()
```

In [137…
```
title_crew_clean['tconst'] = title_crew_clean['tconst'].str.strip()
title_crew_clean['directors'] = title_crew_clean['directors'].str.strip()
title_crew_clean['writers'] = title_crew_clean['writers'].str.strip()
```

In [138…
```
title_episode_clean['tconst'] = title_episode_clean['tconst'].str.strip()
title_episode_clean['parent_tconst'] = title_episode_clean['parent_tconst'].str.strip()
```

In [139…
```
title_principals_clean['tconst'] = title_principals_clean['tconst'].str.strip()
title_principals_clean['nconst'] = title_principals_clean['nconst'].str.strip()
title_principals_clean['category'] = title_principals_clean['category'].str.strip()
title_principals_clean['job'] = title_principals_clean['job'].str.strip()
title_principals_clean['characters'] = title_principals_clean['characters'].str.strip()
```

In [140…
```
title_ratings_clean['tconst'] = title_ratings_clean['tconst'].str.strip()
```

In [141…
```
name_basics_clean['nconst'] = name_basics_clean['nconst'].str.strip()
name_basics_clean['primary_name'] = name_basics_clean['primary_name'].str.strip()
name_basics_clean['primary_profession'] = name_basics_clean['primary_profession'].str.strip()
name_basics_clean['known_for_titles'] = name_basics_clean['known_for_titles'].str.strip()
name_basics_clean['profession_1'] = name_basics_clean['profession_1'].str.strip()
name_basics_clean['profession_2'] = name_basics_clean['profession_2'].str.strip()
name_basics_clean['profession_3'] = name_basics_clean['profession_3'].str.strip()
```

1.13 Standardized string formatting.

In [143…
```
print(name_basics_clean['profession_1'].unique()) # Examined unique professions
print(name_basics_clean['profession_2'].unique())
print(name_basics_clean['profession_3'].unique())
```

```
['Actor' 'Actress' 'Writer' 'Composer' 'Music_department' 'Director'
 'Music_artist' 'Editor' 'Cinematographer' 'Producer' 'Art_director'
 'Make_up_department' 'Miscellaneous' 'Assistant_director' 'Executive'
 'Camera_department' 'Sound_department' 'Stunts' 'Soundtrack'
 'Special_effects' 'Production_designer' 'Editorial_department'
 'Production_manager' 'Costume_department' 'Casting_director'
 'Costume_designer' 'Set_decorator' 'Art_department' 'Casting_department'
 'Visual_effects' 'Location_management' 'Animation_department' 'Unknown'
 'Script_department' 'Talent_agent' 'Transportation_department' 'Manager'
 'Archive_footage' 'Legal' 'Publicist' 'Podcaster' 'Archive_sound'
 'Choreographer' 'Accountant' 'Production_department'
 'Electrical_department' 'Assistant']
['Miscellaneous' 'Soundtrack' 'Music_department' 'Writer' 'Director'
 'Producer' 'Stunts' 'Make_up_department' 'Composer' 'Actor'
 'Casting_director' None 'Actress' 'Archive_footage' 'Art_department'
 'Animation_department' 'Costume_department' 'Executive' 'Cinematographer'
 'Assistant_director' 'Editorial_department' 'Editor' 'Special_effects'
 'Camera_department' 'Production_manager' 'Script_department'
 'Talent_agent' 'Sound_department' 'Production_designer'
 'Costume_designer' 'Art_director' 'Visual_effects' 'Casting_department'
 'Transportation_department' 'Set_decorator' 'Location_management'
 'Manager' 'Archive_sound' 'Podcaster' 'Publicist' 'Legal' 'Assistant'
 'Music_artist' 'Choreographer' 'Accountant' 'Production_department'
 'Electrical_department']
['Producer' 'Archive_footage' 'Music_department' 'Actor' 'Soundtrack'
 'Miscellaneous' 'Writer' 'Director' 'Assistant_director'
 'Camera_department' 'Art_department' None 'Executive' 'Composer' 'Editor'
 'Actress' 'Costume_designer' 'Script_department' 'Stunts'
 'Editorial_department' 'Costume_department' 'Animation_department'
 'Talent_agent' 'Archive_sound' 'Cinematographer' 'Production_designer'
 'Special_effects' 'Production_manager' 'Art_director' 'Sound_department'
 'Casting_department' 'Location_management' 'Visual_effects'
 'Transportation_department' 'Set_decorator' 'Choreographer'
 'Casting_director' 'Legal' 'Make_up_department' 'Manager' 'Publicist'
 'Music_artist' 'Production_department' 'Assistant' 'Podcaster'
 'Electrical_department' 'Accountant']
```

While the column names use snake_case, strings will use spaces and capitalization for readability.

In [145…
```
name_basics_clean['profession_1'] = name_basics_clean['profession_1'].str.replace('_', ' ').str.title()
name_basics_clean['profession_2'] = name_basics_clean['profession_2'].str.replace('_', ' ').str.title()
name_basics_clean['profession_3'] = name_basics_clean['profession_3'].str.replace('_', ' ').str.title()
print(name_basics_clean['profession_1'].unique()) # Confirmed changes
print(name_basics_clean['profession_2'].unique())
print(name_basics_clean['profession_3'].unique())
```

```
['Actor' 'Actress' 'Writer' 'Composer' 'Music Department' 'Director'
 'Music Artist' 'Editor' 'Cinematographer' 'Producer' 'Art Director'
 'Make Up Department' 'Miscellaneous' 'Assistant Director' 'Executive'
 'Camera Department' 'Sound Department' 'Stunts' 'Soundtrack'
 'Special Effects' 'Production Designer' 'Editorial Department'
 'Production Manager' 'Costume Department' 'Casting Director'
 'Costume Designer' 'Set Decorator' 'Art Department' 'Casting Department'
 'Visual Effects' 'Location Management' 'Animation Department' 'Unknown'
 'Script Department' 'Talent Agent' 'Transportation Department' 'Manager'
 'Archive Footage' 'Legal' 'Publicist' 'Podcaster' 'Archive Sound'
 'Choreographer' 'Accountant' 'Production Department'
 'Electrical Department' 'Assistant']
['Miscellaneous' 'Soundtrack' 'Music Department' 'Writer' 'Director'
 'Producer' 'Stunts' 'Make Up Department' 'Composer' 'Actor'
 'Casting Director' None 'Actress' 'Archive Footage' 'Art Department'
 'Animation Department' 'Costume Department' 'Executive' 'Cinematographer'
 'Assistant Director' 'Editorial Department' 'Editor' 'Special Effects'
 'Camera Department' 'Production Manager' 'Script Department'
 'Talent Agent' 'Sound Department' 'Production Designer'
 'Costume Designer' 'Art Director' 'Visual Effects' 'Casting Department'
 'Transportation Department' 'Set Decorator' 'Location Management'
 'Manager' 'Archive Sound' 'Podcaster' 'Publicist' 'Legal' 'Assistant'
 'Music Artist' 'Choreographer' 'Accountant' 'Production Department'
 'Electrical Department']
['Producer' 'Archive Footage' 'Music Department' 'Actor' 'Soundtrack'
 'Miscellaneous' 'Writer' 'Director' 'Assistant Director'
 'Camera Department' 'Art Department' None 'Executive' 'Composer' 'Editor'
 'Actress' 'Costume Designer' 'Script Department' 'Stunts'
 'Editorial Department' 'Costume Department' 'Animation Department'
 'Talent Agent' 'Archive Sound' 'Cinematographer' 'Production Designer'
 'Special Effects' 'Production Manager' 'Art Director' 'Sound Department'
 'Casting Department' 'Location Management' 'Visual Effects'
 'Transportation Department' 'Set Decorator' 'Choreographer'
 'Casting Director' 'Legal' 'Make Up Department' 'Manager' 'Publicist'
 'Music Artist' 'Production Department' 'Assistant' 'Podcaster'
 'Electrical Department' 'Accountant']
```

In [146…
```
print(title_principals_clean['category'].unique())
```

```
['Self' 'Director' 'Producer' 'Cinematographer' 'Composer' 'Editor'
 'Actor' 'Actress' 'Writer' 'Production_designer' 'Archive_footage'
 'Casting_director' 'Archive_sound']
```

In [147…
```
title_principals_clean['category'] = title_principals_clean['category'].str.replace('_', ' ').str.title()
```

In [148…
```
print(title_principals_clean['category'].unique()) # Confirmed changes
```

```
['Self' 'Director' 'Producer' 'Cinematographer' 'Composer' 'Editor'
 'Actor' 'Actress' 'Writer' 'Production Designer' 'Archive Footage'
 'Casting Director' 'Archive Sound']
```

In [149…
```
unique_jobs = title_principals_clean['job'].unique()
print(len(unique_jobs))
```

```
41970
```

In [150…
```
title_principals_clean['job'] = title_principals_clean['job'].str.title()
unique_jobs = title_principals_clean['job'].unique()
with pd.option_context('display.max_rows', 20):
    print(pd.Series(unique_jobs)) # Confirmed changes
```

```
0                                              Unknown
1                                             Producer
2                                 Director Of Photography
3                                               Editor
4                                           Screenplay
                              ...
41965                                 Anatomy Short Film
41966    Based In Part On The Book The Day Wall Street ...
41967                         Short Story "Your Iron Lady"
41968                        Based On The Original Saga By
41969                          Original Idea/ Scriptwriter
Length: 41970, dtype: object
```

In [151…
```
print(title_akas_clean['region'].unique()) # Confirmed no invalid entries
```

```
['Unknown' 'DE' 'US' 'HU' 'GR' 'RU' 'UA' 'JP' 'RO' 'FR' 'GB' 'CA' 'PT'
 'AU' 'AR' 'FI' 'UY' 'PL' 'BG' 'RS' 'BR' 'IT' 'ES' 'TR' 'SK' 'XWW' 'DK'
 'XEU' 'CZ' 'SE' 'NZ' 'KZ' 'MX' 'NO' 'XYU' 'AT' 'VE' 'CSHH' 'SI' 'SUHH'
 'IN' 'NL' 'LT' 'HR' 'TW' 'CN' 'CO' 'IR' 'SG' 'BE' 'EC' 'IE' 'VN' 'PH'
 'DZ' 'CH' 'XWG' 'BF' 'HK' 'XSA' 'EE' 'IS' 'PR' 'DDDE' 'IL' 'EG' 'XKO'
 'CL' 'JM' 'KR' 'PE' 'BY' 'GE' 'BA' 'DO' 'TH' 'AE' 'ZA' 'PA' 'TJ' 'XSI'
 'MY' 'LV' 'ID' 'AZ' 'UZ' 'PK' 'BD' 'CU' 'AL' 'BO' 'XAS' 'YUCS' 'GT' 'PY'
 'SV' 'CR' 'KP' 'BUMM' 'MM' 'XPI' 'BJ' 'NG' 'CM' 'MA' 'GL' 'MN' 'LI' 'LU'
 'MZ' 'MK' 'BM' 'MD' 'ME' 'LB' 'IQ' 'TM' 'TN' 'HT' 'AM' 'CI' 'LK' 'NP'
 'QA' 'SY' 'TO' 'CG' 'SN' 'GH' 'JO' 'KG' 'NE' 'GN' 'VDVN' 'TD' 'SO' 'SD'
 'MC' 'TT' 'GA' 'BS' 'LY' 'AO' 'KH' 'MR' 'AF' 'MG' 'ML' 'GY' 'CY' 'ET'
 'GU' 'SR' 'MT' 'TG' 'PG' 'MU' 'BI' 'CF' 'NI' 'ZW' 'ZM' 'GW' 'DJ' 'RW'
 'TZ' 'GI' 'LA' 'SC' 'GP' 'XAU' 'FO' 'PS' 'ZRCD' 'MO' 'AW' 'KW' 'CV' 'SL'
 'SM' 'CD' 'BT' 'LS' 'HN' 'KE' 'MQ' 'AD' 'ER' 'SA' 'CSXX' 'IM' 'XKV' 'BH'
 'BB' 'BZ' 'UG' 'AG' 'NU' 'OM' 'BW' 'LR' 'AN' 'MV' 'YE' 'GM' 'KY' 'NC'
 'DM' 'TL' 'MP' 'VA' 'GQ' 'FJ' 'SZ' 'TC' 'RE' 'EH' 'PF' 'LC' 'MW' 'BN'
 'VG' 'ST' 'KM' 'FM' 'AI' 'VI' 'SB' 'GF' 'MH' 'CW' 'WS' 'VC' 'AS' 'XNA'
 'MS' 'GD' 'AQ' 'VU' 'SH' 'KI' 'KN' 'CC' 'TV' 'CK' 'PW' 'NR' 'JE']
```

In [152…
```
print(title_akas_clean['language'].unique())
```

```
['Unknown' 'ja' 'en' 'sv' 'bg' 'tr' 'ru' 'es' 'sr' 'cs' 'fr' 'hi' 'cmn'
 'sk' 'fa' 'ca' 'qbn' 'nl' 'pt' 'uz' 'uk' 'qbp' 'ar' 'rn' 'bs' 'ga' 'de'
 'yue' 'th' 'yi' 'ka' 'hr' 'sl' 'he' 'it' 'tg' 'kk' 'da' 'el' 'fi' 'be'
 'gsw' 'eu' 'gl' 'az' 'ms' 'pl' 'id' 'mr' 'qbo' 'mi' 'la' 'ta' 'lt' 'lv'
 'af' 'hy' 'ur' 'bn' 'te' 'ro' 'kn' 'ml' 'mk' 'tl' 'cy' 'et' 'gd' 'qal'
 'gu' 'lb' 'zu' 'xh' 'eka' 'ko' 'tk' 'ky' 'wo' 'zh' 'hu' 'no' 'is' 'sq'
 'vi' 'pa' 'sd' 'ps' 'ku' 'roa' 'tn' 'rm' 'su' 'jv' 'st' 'prs' 'jsl' 'fro'
 'haw' 'mn' 'am' 'ne' 'qac' 'lo' 'my' 'myv' 'br' 'iu' 'hil' 'cr']
```

In [153…
```
title_akas_clean['language'] = title_akas_clean['language'].str.upper() # Capitalized abbreviations
title_akas_clean.loc[title_akas_clean['language'] == 'UNKNOWN', 'language'] = 'Unknown'
print(title_akas_clean['language'].unique()) # Confirmed changes
```

```
['Unknown' 'JA' 'EN' 'SV' 'BG' 'TR' 'RU' 'ES' 'SR' 'CS' 'FR' 'HI' 'CMN'
 'SK' 'FA' 'CA' 'QBN' 'NL' 'PT' 'UZ' 'UK' 'QBP' 'AR' 'RN' 'BS' 'GA' 'DE'
 'YUE' 'TH' 'YI' 'KA' 'HR' 'SL' 'HE' 'IT' 'TG' 'KK' 'DA' 'EL' 'FI' 'BE'
 'GSW' 'EU' 'GL' 'AZ' 'MS' 'PL' 'ID' 'MR' 'QBO' 'MI' 'LA' 'TA' 'LT' 'LV'
 'AF' 'HY' 'UR' 'BN' 'TE' 'RO' 'KN' 'ML' 'MK' 'TL' 'CY' 'ET' 'GD' 'QAL'
 'GU' 'LB' 'ZU' 'XH' 'EKA' 'KO' 'TK' 'KY' 'WO' 'ZH' 'HU' 'NO' 'IS' 'SQ'
 'VI' 'PA' 'SD' 'PS' 'KU' 'ROA' 'TN' 'RM' 'SU' 'JV' 'ST' 'PRS' 'JSL' 'FRO'
 'HAW' 'MN' 'AM' 'NE' 'QAC' 'LO' 'MY' 'MYV' 'BR' 'IU' 'HIL' 'CR']
```

In [154…
```
print(title_akas_clean['types'].unique())
```

```
['Original' 'Unknown' 'Imdbdisplay' 'Alternative' 'Festival' 'Dvd'
 'Working' 'Tv' 'Video' 'Imdbdisplay\x02tv' 'Alternative\x02tv'
 'Imdbdisplay\x02working' 'Imdbdisplay\x02festival' 'Working\x02tv'
 'Imdbdisplay\x02video' 'Dvd\x02alternative' 'Tv\x02video'
 'Imdbdisplay\x02dvd' 'Working\x02video' 'Working\x02festival'
 'Dvd\x02video' 'Alternative\x02festival' 'Alternative\x02video'
 'Working\x02alternative']
```

The types column contains some entries that are two types separated by '\x02'. I will split these and capitalize the second string.

In [156…
```
title_types_split = title_akas_clean['types'].str.split('\x02')
def standardize_types(type_list):
    standardized = set()
    for t in type_list:
        t_clean = t.strip().capitalize()
        if t_clean.lower() == 'dvd':
            t_clean = 'DVD'
        elif t_clean.lower() == 'tv':
            t_clean = 'TV'
        standardized.add(t_clean)
    return ', '.join(sorted(standardized))
title_akas_clean['types_standardized'] = title_types_split.apply(standardize_types)
print(title_akas_clean['types_standardized'].unique())
```

```
['Original' 'Unknown' 'Imdbdisplay' 'Alternative' 'Festival' 'DVD'
 'Working' 'TV' 'Video' 'Imdbdisplay, TV' 'Alternative, TV'
 'Imdbdisplay, Working' 'Festival, Imdbdisplay' 'TV, Working'
 'Imdbdisplay, Video' 'Alternative, DVD' 'TV, Video' 'DVD, Imdbdisplay'
 'Video, Working' 'Festival, Working' 'DVD, Video' 'Alternative, Festival'
 'Alternative, Video' 'Alternative, Working']
```

In [157…
```
title_akas_clean.drop(columns=['types'], inplace=True)
title_akas_clean.rename(columns={'types_standardized': 'types'}, inplace=True)
```

In [158…
```
print(title_akas_clean['attributes'].unique())
```

```
['Unknown' 'Literal title' 'Literal english title'
 'Informal alternative title' 'Promotional title' 'Complete title'
 'Reissue title' 'Informal title' 'Premiere title' 'Short title'
 'Première title' 'Bowdlerized title' 'Informal english title'
 'Alternative spelling' 'Original script title' 'Copyright title'
 'Long title' 'Transliterated title' 'Informal short title' 'New title'
 'Review title' 'Subtitle' 'Original subtitled version'
 'Informal literal title' 'Orthographically correct title' 'Cut version'
 'Pre-release title' 'Video catalogue title' 'Second part title'
 'Third part title' 'Fifth season title' 'Fourth season title'
 'Series title' 'Poster title' 'Rerun title' '8mm release title'
 'Recut version' 'Theatrical title' '16mm release title'
 'First part title' 'Informal literal english title' 'First episode title'
 'Segment title' 'Los angeles première title' 'Dvd box title'
 'Second copyright title' 'Alternative transliteration' 'Short version'
 'Video box title' 'Restored version' 'Imax version'
 'English transliteration' 'Reissue title\x02recut version'
 '8mm release title\x02short version' 'Dvd menu title' 'Anthology series'
 'Censored version' 'Trailer title' 'Silent version'
 'Berlin film festival title' 'Cannes festival title' 'Dubbed version'
 'Reissue title\x02added framing sequences and narration in yiddish'
 'Bootleg title' 'Bable dialect title' 'Venice film festival title'
 'Reissue title\x02yiddish dubbed' 'Cable tv title'
 'Uncensored intended title' 'Literal translation of working title'
 'Last season title' 'Yiddish dubbed' 'Tv listings title'
 'Yivo translation' 'Modern translation' 'Long new title' "Director's cut"
 'Video box title\x02polart' 'Polart' 'Reissue title\x02cut version'
 'Reissue title\x02yivo translation' 'Racier version'
 'Redubbed comic version' '3-d version' 'Syndication title'
 'Fake working title' 'Closing credits title' 'Armed forces circuit title'
 'Reissue title\x02short version' 'Unauthorized video title'
 'First season title' 'Summer title' 'Longer version'
 'Second season title' 'Sixth season title' 'First episodes title'
 'Pay-tv title' 'Tenth season title' 'Mifed title' '3-d video title'
 'Literal french title' 'Third and fourth season title'
 'Videogame episode' 'New syndication title' 'Promotional abbreviation'
 'Ninth season title' 'Eighth season title' 'X-rated version'
 'Expansion title' 'Correct transliteration' '16mm rental title'
 'Los angeles premiere title' 'Fourteenth season title' 'Teaser title'
 'Daytime version title' 'Seventh season title' 'Third season title'
 'Video cd title' 'Ld title' 'Soft porn version'
 'Video box title\x02cut version' 'Reissue title\x02racier version'
 'Second part title\x028mm release title' 'Weekend title'
 'English translation of working title' 'Fifteenth season title'
 'Twentieth season title' 'Twentyfifth season title' 'Fourth part title'
 'Thirtysecond season title' 'Informal title\x02literal title'
 'Cable tv title\x02cut version' 'Twentyfirst season title'
 'Closing credits title\x02pre-release title'
 'Non-modified hepburn romanization' 'Locarno film festival title'
 'Eleventh season title' 'Thirtythird season title'
 'Rerun title\x02longer version' 'Eighteenth season title'
 'Thirtieth season title' 'Sixteenth season title' 'Twelfth season title'
 'Thirteenth season title' 'Thirtyfirst season title'
 'Twentysecond season title' 'Twentythird season title'
 'Seventeenth season title' 'Twentyseventh season title'
 'Nineteenth season title' 'Game box title'
 'Title for episodes with guest hosts'
 'Approximation of original mirrored title'
 'Imax version\x02promotional title' 'Twentyfourth season title'
 'Twentysixth season title' 'Bootleg title\x02x-rated version'
 'Poster title\x02video box title' 'Dubbed version\x02recut version'
 'Thirtyninth season title' 'Twentyninth season title'
 'Thirtyfourth season title' 'American mutoscope & biograph catalog title'
 'Twentyeighth season title' 'Thirtyfifth season title'
 'Thirtysixth season title' 'Thirtyeighth season title' 'R-rated version'
 'Original pilot title' 'Thirtyseventh season title'
 'Fortieth season title' 'Hakka dialect title' 'Bilbao festival title'
 'Thirteenth season title\x02promotional title'
 'Video box title\x02orthographically correct title' 'Late sunday edition'
 'Pc version' 'Fourth season title\x02recut version' 'Gamecube version'
 'First segment title' 'Third segment title' 'Second segment title'
 'Fifth part title' 'Incorrect title' 'Rumored']
```

In [159…
```
title_akas_clean['attributes'] = (
    title_akas_clean['attributes']
    .str.replace(r'\x02', ', ', regex=True)
    .str.strip()
    .str.title()
)
print(title_akas_clean['attributes'].unique()) # Confirmed changes
```

```
['Unknown' 'Literal Title' 'Literal English Title'
 'Informal Alternative Title' 'Promotional Title' 'Complete Title'
 'Reissue Title' 'Informal Title' 'Premiere Title' 'Short Title'
 'Première Title' 'Bowdlerized Title' 'Informal English Title'
 'Alternative Spelling' 'Original Script Title' 'Copyright Title'
 'Long Title' 'Transliterated Title' 'Informal Short Title' 'New Title'
 'Review Title' 'Subtitle' 'Original Subtitled Version'
 'Informal Literal Title' 'Orthographically Correct Title' 'Cut Version'
 'Pre-Release Title' 'Video Catalogue Title' 'Second Part Title'
 'Third Part Title' 'Fifth Season Title' 'Fourth Season Title'
 'Series Title' 'Poster Title' 'Rerun Title' '8Mm Release Title'
 'Recut Version' 'Theatrical Title' '16Mm Release Title'
 'First Part Title' 'Informal Literal English Title' 'First Episode Title'
 'Segment Title' 'Los Angeles Première Title' 'Dvd Box Title'
 'Second Copyright Title' 'Alternative Transliteration' 'Short Version'
 'Video Box Title' 'Restored Version' 'Imax Version'
 'English Transliteration' 'Reissue Title, Recut Version'
 '8Mm Release Title, Short Version' 'Dvd Menu Title' 'Anthology Series'
 'Censored Version' 'Trailer Title' 'Silent Version'
 'Berlin Film Festival Title' 'Cannes Festival Title' 'Dubbed Version'
 'Reissue Title, Added Framing Sequences And Narration In Yiddish'
 'Bootleg Title' 'Bable Dialect Title' 'Venice Film Festival Title'
 'Reissue Title, Yiddish Dubbed' 'Cable Tv Title'
 'Uncensored Intended Title' 'Literal Translation Of Working Title'
 'Last Season Title' 'Yiddish Dubbed' 'Tv Listings Title'
 'Yivo Translation' 'Modern Translation' 'Long New Title' "Director'S Cut"
 'Video Box Title, Polart' 'Polart' 'Reissue Title, Cut Version'
 'Reissue Title, Yivo Translation' 'Racier Version'
 'Redubbed Comic Version' '3-D Version' 'Syndication Title'
 'Fake Working Title' 'Closing Credits Title' 'Armed Forces Circuit Title'
 'Reissue Title, Short Version' 'Unauthorized Video Title'
 'First Season Title' 'Summer Title' 'Longer Version'
 'Second Season Title' 'Sixth Season Title' 'First Episodes Title'
 'Pay-Tv Title' 'Tenth Season Title' 'Mifed Title' '3-D Video Title'
 'Literal French Title' 'Third And Fourth Season Title'
 'Videogame Episode' 'New Syndication Title' 'Promotional Abbreviation'
 'Ninth Season Title' 'Eighth Season Title' 'X-Rated Version'
 'Expansion Title' 'Correct Transliteration' '16Mm Rental Title'
 'Los Angeles Premiere Title' 'Fourteenth Season Title' 'Teaser Title'
 'Daytime Version Title' 'Seventh Season Title' 'Third Season Title'
 'Video Cd Title' 'Ld Title' 'Soft Porn Version'
 'Video Box Title, Cut Version' 'Reissue Title, Racier Version'
 'Second Part Title, 8Mm Release Title' 'Weekend Title'
 'English Translation Of Working Title' 'Fifteenth Season Title'
 'Twentieth Season Title' 'Twentyfifth Season Title' 'Fourth Part Title'
 'Thirtysecond Season Title' 'Informal Title, Literal Title'
 'Cable Tv Title, Cut Version' 'Twentyfirst Season Title'
 'Closing Credits Title, Pre-Release Title'
 'Non-Modified Hepburn Romanization' 'Locarno Film Festival Title'
 'Eleventh Season Title' 'Thirtythird Season Title'
 'Rerun Title, Longer Version' 'Eighteenth Season Title'
 'Thirtieth Season Title' 'Sixteenth Season Title' 'Twelfth Season Title'
 'Thirteenth Season Title' 'Thirtyfirst Season Title'
 'Twentysecond Season Title' 'Twentythird Season Title'
 'Seventeenth Season Title' 'Twentyseventh Season Title'
 'Nineteenth Season Title' 'Game Box Title'
 'Title For Episodes With Guest Hosts'
 'Approximation Of Original Mirrored Title'
 'Imax Version, Promotional Title' 'Twentyfourth Season Title'
 'Twentysixth Season Title' 'Bootleg Title, X-Rated Version'
 'Poster Title, Video Box Title' 'Dubbed Version, Recut Version'
 'Thirtyninth Season Title' 'Twentyninth Season Title'
 'Thirtyfourth Season Title' 'American Mutoscope & Biograph Catalog Title'
 'Twentyeighth Season Title' 'Thirtyfifth Season Title'
 'Thirtysixth Season Title' 'Thirtyeighth Season Title' 'R-Rated Version'
 'Original Pilot Title' 'Thirtyseventh Season Title'
 'Fortieth Season Title' 'Hakka Dialect Title' 'Bilbao Festival Title'
 'Thirteenth Season Title, Promotional Title'
 'Video Box Title, Orthographically Correct Title' 'Late Sunday Edition'
 'Pc Version' 'Fourth Season Title, Recut Version' 'Gamecube Version'
 'First Segment Title' 'Third Segment Title' 'Second Segment Title'
 'Fifth Part Title' 'Incorrect Title' 'Rumored']
```

In [164…
```
print(title_basics_clean['title_type'].unique())
```

```
['Short' 'Movie' 'Tvshort' 'Tvmovie' 'Tvepisode' 'Tvseries' 'Tvminiseries'
 'Tvspecial' 'Video' 'Videogame' 'Tvpilot']
```

In [165…
```
title_type_mapping = {
    'Short': 'Short',
    'Movie': 'Movie',
    'Tvshort': 'TV Short',
    'Tvmovie': 'TV Movie',
    'Tvepisode': 'TV Episode',
    'Tvseries': 'TV Series',
    'Tvminiseries': 'TV Miniseries',
    'Tvspecial': 'TV Special',
    'Video': 'Video',
    'Videogame': 'Video Game',
    'Tvpilot': 'TV Pilot'
}
title_basics_clean['title_type'] = title_basics_clean['title_type'].replace(title_type_mapping)
print(title_basics_clean['title_type'].unique())
```

```
['Short' 'Movie' 'TV Short' 'TV Movie' 'TV Episode' 'TV Series'
 'TV Miniseries' 'TV Special' 'Video' 'Video Game' 'TV Pilot']
```

In [166…
```
print(title_basics_clean['genre_1'].unique()) # Confirmed no invalid entries
print(title_basics_clean['genre_2'].unique())
print(title_basics_clean['genre_3'].unique())
```

```
['Documentary' 'Animation' 'Comedy' 'Short' 'Romance' 'News' 'Drama'
 'Fantasy' 'Horror' 'Biography' 'Music' 'Crime' 'Family' 'Adventure'
 'Action' 'History' 'Unknown' 'Mystery' 'Musical' 'War' 'Sci-Fi' 'Western'
 'Thriller' 'Sport' 'Film-Noir' 'Talk-Show' 'Game-Show' 'Adult'
 'Reality-TV']
['Short' 'Comedy' None 'Sport' 'Documentary' 'Horror' 'News' 'War'
 'Western' 'Fantasy' 'Drama' 'Family' 'Romance' 'Crime' 'History'
 'Adventure' 'Music' 'Sci-Fi' 'Mystery' 'Thriller' 'Biography' 'Animation'
 'Musical' 'Film-Noir' 'Game-Show' 'Talk-Show' 'Reality-TV' 'Adult']
[None 'Romance' 'Sport' 'Short' 'Horror' 'War' 'Fantasy' 'Drama' 'Comedy'
 'Crime' 'Western' 'Family' 'Mystery' 'Sci-Fi' 'Biography' 'Musical'
 'History' 'Thriller' 'Music' 'Film-Noir' 'Documentary' 'News' 'Animation'
 'Reality-TV' 'Talk-Show' 'Game-Show' 'Adventure']
```

1.14 Replaced tconst with title names in name_basics df.

In [191…
```
# Created title dictionary
title_dictionary = dict(zip(title_basics_clean['tconst'], title_basics_clean['primary_title']))
```

In [192…
```
# Created function to map titles from dictionary
def replace_with_title(tconst_str):
    if pd.isna(tconst_str):
        return None
    return ', '.join(str(title_dictionary.get(tconst.strip(), tconst.strip())) for tconst in tconst_str.split(','))
name_basics_clean['known_for_titles'] = name_basics_clean['known_for_titles'].apply(replace_with_title)
```

1.15 Mapped titles and names to tconst and nconst in title_principals df.

In [194…
```
# Created name dictionary
name_dictionary = dict(zip(name_basics_clean['nconst'], name_basics_clean['primary_name']))
```

In [195…
```
# Mapped titles from dictionary
title_principals_clean['primary_title'] = title_principals_clean['tconst'].map(title_dictionary)
title_principals_clean['primary_name'] = title_principals_clean['nconst'].map(name_dictionary)
```

1.16 Merged tables to create title_data df.

In [197…
```
title_data = pd.merge(title_basics_clean, title_ratings_clean, on='tconst', how='inner')
title_data.head()
```

Out[197…

	tconst	title_type	primary_title	original_title	is_adult	start_year	end_year	runtime_minutes	genres	genre_1	genre_2	genre_3	average_rating	num_votes
0	tt0000001	Short	Carmencita	Carmencita	False	1894-01-01	2262-01-01	1.0	Documentary,Short	Documentary	Short	None	5.7	2089
1	tt0000002	Short	Le clown et ses chiens	Le clown et ses chiens	False	1892-01-01	2262-01-01	5.0	Animation,Short	Animation	Short	None	5.6	283
2	tt0000003	Short	Pauvre Pierrot	Pauvre Pierrot	False	1892-01-01	2262-01-01	5.0	Animation,Comedy,Romance	Animation	Comedy	Romance	6.5	2096
3	tt0000004	Short	Un bon bock	Un bon bock	False	1892-01-01	2262-01-01	12.0	Animation,Short	Animation	Short	None	5.4	183
4	tt0000005	Short	Blacksmith Scene	Blacksmith Scene	False	1893-01-01	2262-01-01	1.0	Comedy,Short	Comedy	Short	None	6.2	2832

In [198…
```
title_data = pd.merge(title_data, title_crew_clean, on='tconst', how='inner')
title_data.head()
```

Out[198…

	tconst	title_type	primary_title	original_title	is_adult	start_year	end_year	runtime_minutes	genres	genre_1	genre_2	genre_3	average_rating	num_votes	directors	writers
0	tt0000001	Short	Carmencita	Carmencita	False	1894-01-01	2262-01-01	1.0	Documentary,Short	Documentary	Short	None	5.7	2089	nm0005690	Unknown
1	tt0000002	Short	Le clown et ses chiens	Le clown et ses chiens	False	1892-01-01	2262-01-01	5.0	Animation,Short	Animation	Short	None	5.6	283	nm0721526	Unknown
2	tt0000003	Short	Pauvre Pierrot	Pauvre Pierrot	False	1892-01-01	2262-01-01	5.0	Animation,Comedy,Romance	Animation	Comedy	Romance	6.5	2096	nm0721526	Unknown
3	tt0000004	Short	Un bon bock	Un bon bock	False	1892-01-01	2262-01-01	12.0	Animation,Short	Animation	Short	None	5.4	183	nm0721526	Unknown
4	tt0000005	Short	Blacksmith Scene	Blacksmith Scene	False	1893-01-01	2262-01-01	1.0	Comedy,Short	Comedy	Short	None	6.2	2832	nm0005690	Unknown

In [199…
```
print(title_data.dtypes) # Checked column data types after merge
```

```
tconst                  object
title_type              object
primary_title           object
original_title          object
is_adult                  bool
start_year      datetime64[ns]
end_year        datetime64[ns]
runtime_minutes        float64
genres                  object
genre_1                 object
genre_2                 object
genre_3                 object
average_rating         float64
num_votes                int64
directors               object
writers                 object
dtype: object
```

1.17 Replaced nconst with director and writer names in title_data df.

In [201…
```
# Merge primary_names based on nconst
title_data = title_data.merge(name_basics_clean[['nconst', 'primary_name']],
                              left_on = 'directors',
                              right_on = 'nconst',
                              how = 'left')
title_data = title_data.rename(columns={'primary_name': 'director_name'})
title_data = title_data.drop(columns=['directors', 'nconst'])
title_data.head()
```

Out[201…

	tconst	title_type	primary_title	original_title	is_adult	start_year	end_year	runtime_minutes	genres	genre_1	genre_2	genre_3	average_rating	num_votes	writers	director_name
0	tt0000001	Short	Carmencita	Carmencita	False	1894-01-01	2262-01-01	1.0	Documentary,Short	Documentary	Short	None	5.7	2089	Unknown	William K.L. Dickson
1	tt0000002	Short	Le clown et ses chiens	Le clown et ses chiens	False	1892-01-01	2262-01-01	5.0	Animation,Short	Animation	Short	None	5.6	283	Unknown	Émile Reynaud
2	tt0000003	Short	Pauvre Pierrot	Pauvre Pierrot	False	1892-01-01	2262-01-01	5.0	Animation,Comedy,Romance	Animation	Comedy	Romance	6.5	2096	Unknown	Émile Reynaud
3	tt0000004	Short	Un bon bock	Un bon bock	False	1892-01-01	2262-01-01	12.0	Animation,Short	Animation	Short	None	5.4	183	Unknown	Émile Reynaud
4	tt0000005	Short	Blacksmith Scene	Blacksmith Scene	False	1893-01-01	2262-01-01	1.0	Comedy,Short	Comedy	Short	None	6.2	2832	Unknown	William K.L. Dickson

In [202…
```
title_data = title_data.merge(name_basics_clean[['nconst', 'primary_name']],
                              left_on='writers',
                              right_on='nconst',
                              how='left')
title_data = title_data.rename(columns={'primary_name': 'writer_name'})
title_data = title_data.drop(columns=['writers', 'nconst'])
title_data.head()
```

Out[202…

	tconst	title_type	primary_title	original_title	is_adult	start_year	end_year	runtime_minutes	genres	genre_1	genre_2	genre_3	average_rating	num_votes	director_name	writer_nam
0	tt0000001	Short	Carmencita	Carmencita	False	1894-01-01	2262-01-01	1.0	Documentary,Short	Documentary	Short	None	5.7	2089	William K.L. Dickson	Nal
1	tt0000002	Short	Le clown et ses chiens	Le clown et ses chiens	False	1892-01-01	2262-01-01	5.0	Animation,Short	Animation	Short	None	5.6	283	Émile Reynaud	Nal
2	tt0000003	Short	Pauvre Pierrot	Pauvre Pierrot	False	1892-01-01	2262-01-01	5.0	Animation,Comedy,Romance	Animation	Comedy	Romance	6.5	2096	Émile Reynaud	Nal
3	tt0000004	Short	Un bon bock	Un bon bock	False	1892-01-01	2262-01-01	12.0	Animation,Short	Animation	Short	None	5.4	183	Émile Reynaud	Nal
4	tt0000005	Short	Blacksmith Scene	Blacksmith Scene	False	1893-01-01	2262-01-01	1.0	Comedy,Short	Comedy	Short	None	6.2	2832	William K.L. Dickson	Nal

In [203…
```
title_data.isnull().sum() # Checked for null values
```

Out[203…
```
tconst                  0
title_type              0
primary_title           0
original_title          0
is_adult                0
start_year              0
end_year                0
runtime_minutes         0
genres                  0
genre_1                 0
genre_2            525139
genre_3            949308
average_rating          0
num_votes               0
director_name      428136
writer_name       1017323
dtype: int64
```

Nulls are present in genre columns because titles can have anywhere from one to three genres. I will replace the null genres with "None" to indicate no additional genre listed. Writer and director names are either missing from the data or didn't exist on the project. Null names will be replaced with "Unknown"

In [206…
```
title_data['genre_2'] = title_data['genre_2'].fillna('None')
title_data['genre_3'] = title_data['genre_3'].fillna('None')
title_data['director_name'] = title_data['director_name'].fillna('Unknown')
title_data['writer_name'] = title_data['writer_name'].fillna('Unknown')
title_data.isnull().sum() # Confirmed changes
```

Out[206…
```
tconst            0
title_type        0
primary_title     0
original_title    0
is_adult          0
start_year        0
end_year          0
runtime_minutes   0
genres            0
genre_1           0
genre_2           0
genre_3           0
average_rating    0
num_votes         0
director_name     0
writer_name       0
dtype: int64
```

1.18 Removed any duplicate rows.

In [208…
```
print("Number of rows before removing duplicates:", len(title_data))
title_data = title_data.drop_duplicates()
print("Number of rows after removing duplicates:", len(title_data))
```

```
Number of rows before removing duplicates: 1468993
Number of rows after removing duplicates: 1468993
```

In [209…
```
print("Number of rows before removing duplicates:", len(name_basics_clean))
name_basics_clean = name_basics_clean.drop_duplicates()
print("Number of rows after removing duplicates:", len(name_basics_clean))
```

```
Number of rows before removing duplicates: 13846512
Number of rows after removing duplicates: 13846512
```

In [210…
```
print("Number of rows before removing duplicates:", len(title_principals_clean))
title_principals_clean = title_principals_clean.drop_duplicates()
print("Number of rows after removing duplicates:", len(title_principals_clean))
```

```
Number of rows before removing duplicates: 86305808
Number of rows after removing duplicates: 86007873
```

In [211…
```
print("Number of rows before removing duplicates:", len(title_episode_clean))
title_episode_clean = title_episode_clean.drop_duplicates()
print("Number of rows after removing duplicates:", len(title_episode_clean))
```

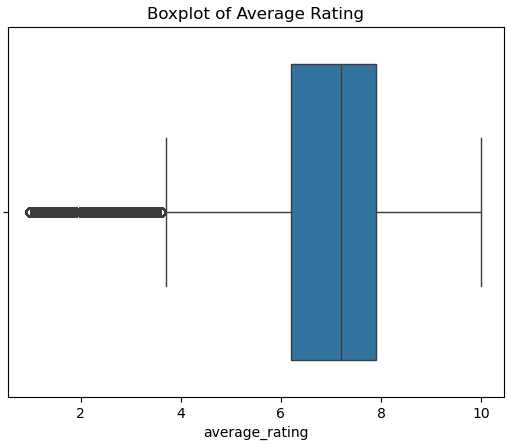
```
Number of rows before removing duplicates: 8538187
Number of rows after removing duplicates: 8538187
```

In [212…
```
print("Number of rows before removing duplicates:", len(title_akas_clean))
title_akas_clean = title_akas_clean.drop_duplicates()
print("Number of rows after removing duplicates:", len(title_akas_clean))
```

```
Number of rows before removing duplicates: 47171461
Number of rows after removing duplicates: 47171459
```

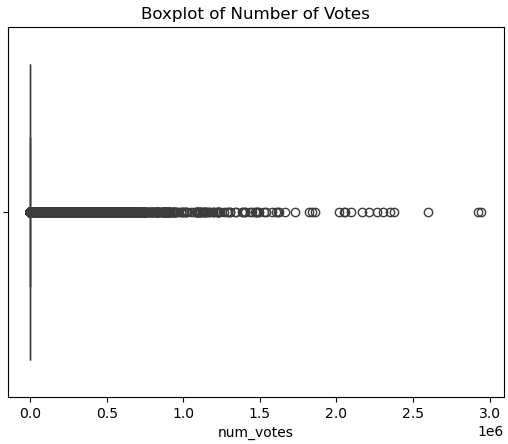
1.19 Handled outliers and validated numerical data.

In [214…
```
sns.boxplot(x=title_data['average_rating'])
plt.title('Boxplot of Average Rating')
plt.show()
```



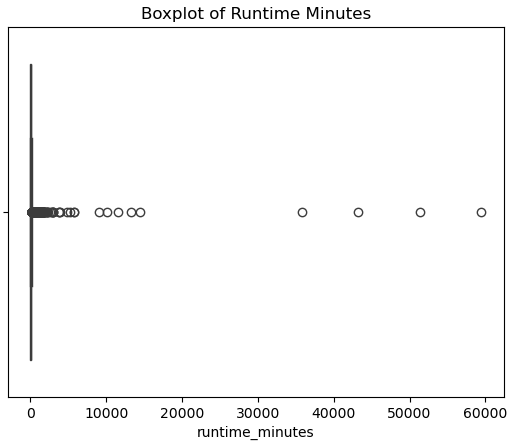
There are no invalid entries in average_rating (0 or greater, 10 or lower).

In [216…
```
sns.boxplot(x=title_data['num_votes'])
plt.title('Boxplot of Number of Votes')
plt.show()
```



There are no invalid entries in num_votes (negative values).

In [218…
```
sns.boxplot(x=title_data['runtime_minutes'])
plt.title('Boxplot of Runtime Minutes')
plt.show()
```



There are five natural outliers in num_votes and four extreme outliers could indicate possible errors. After confirming these runtimes as accurate and not errors, I left them in the data.

In [220…
```
runtime_outliers = title_data[title_data['runtime_minutes'] > 10000]
print(runtime_outliers)
```

```
           tconst  title_type                          primary_title  \
510806   tt10844900       Movie                                     Qw
560333   tt11707418  TV Special                  Svalbard Minute by Minute
581734   tt12095652       Video  The Longest Video on YouTube: 596.5 Hours
995702    tt2659636       Movie                       Modern Times Forever
1048925  tt29302558       Movie                                        100
1065940  tt30325465       Video      La Media Inglesa: Directo Extensible
1152092   tt3854496       Movie                                  Ambiancé
1403803   tt8273150       Movie                                 Logistics

                              original_title  is_adult start_year  \
510806                                    Qw     False 2019-01-01
560333                 Svalbard minutt for minutt     False 2020-01-01
581734   The Longest Video on YouTube: 596.5 Hours     False 2011-01-01
995702                     Modern Times Forever     False 2011-01-01
1048925                                   100     False 2019-01-01
1065940      La Media Inglesa: Directo Extensible     False 2023-01-01
1152092                                Ambiancé     False 2020-01-01
1403803                                Logistics     False 2012-01-01

          end_year  runtime_minutes                genres      genre_1  \
510806  2262-01-01          10062.0                 Drama        Drama
560333  2262-01-01          13319.0  Adventure,Documentary    Adventure
581734  2262-01-01          35791.0               Unknown      Unknown
995702  2262-01-01          14400.0           Documentary  Documentary
1048925 2262-01-01          59460.0             Animation    Animation
1065940 2262-01-01          11541.0       Sport,Talk-Show        Sport
1152092 2262-01-01          43200.0           Documentary  Documentary
1403803 2262-01-01          51420.0           Documentary  Documentary

            genre_2 genre_3  average_rating  num_votes      director_name  \
510806          None    None             6.9         38       Marco Romano
560333   Documentary    None             8.1         22            Unknown
581734          None    None             8.2         45  Jonathan Harchick
995702          None    None             6.3        101            Unknown
1048925         None    None             6.9          8       Marco Romano
1065940    Talk-Show    None            10.0         51            Unknown
1152092         None    None             3.1        134      Anders Weberg
1403803         None    None             6.7        267            Unknown

          writer_name
510806    Marco Romano
560333         Unknown
581734         Unknown
995702         Unknown
1048925   Marco Romano
1065940        Unknown
1152092  Anders Weberg
1403803        Unknown
```

In [221…
```
invalid_title_dates = title_data[(title_data['start_year'] < '1678-01-01') |
                           (title_data['start_year'] > '2262-01-01') |
                           (title_data['end_year'] < '1678-01-01') |
                           (title_data['end_year'] > '2262-01-01')]
print(f'Invalid Dates Count: {invalid_title_dates.shape[0]}')
```

```
Invalid Dates Count: 0
```

In [222…
```
invalid_name_dates = name_basics_clean[(name_basics_clean['birth_year'] < '1678-01-01') |
                           (name_basics_clean['birth_year'] > '2262-01-01') |
                           (name_basics_clean['death_year'] < '1678-01-01') |
                           (name_basics_clean['death_year'] > '2262-01-01')]
print(f'Invalid Dates Count: {invalid_name_dates.shape[0]}')
```

```
Invalid Dates Count: 0
```

1.20 Dropped unneeded columns and refined formatting.

In [224…
```
title_data = title_data[['tconst', 'title_type', 'primary_title', 'original_title', 'director_name', 'writer_name', 'start_year', 'end_year', 'runtime_minutes', 'genre_1', 'genre_2', 'genre_3', 'average_rating', 'num_votes', 'is_adult']]
# Dropped 'genres' and reordered df
title_data.head()
```

Out[224…

	tconst	title_type	primary_title	original_title	director_name	writer_name	start_year	end_year	runtime_minutes	genre_1	genre_2	genre_3	average_rating	num_votes	is_adult
0	tt0000001	Short	Carmencita	Carmencita	William K.L. Dickson	Unknown	1894-01-01	2262-01-01	1.0	Documentary	Short	None	5.7	2089	False
1	tt0000002	Short	Le clown et ses chiens	Le clown et ses chiens	Émile Reynaud	Unknown	1892-01-01	2262-01-01	5.0	Animation	Short	None	5.6	283	False
2	tt0000003	Short	Pauvre Pierrot	Pauvre Pierrot	Émile Reynaud	Unknown	1892-01-01	2262-01-01	5.0	Animation	Comedy	Romance	6.5	2096	False
3	tt0000004	Short	Un bon bock	Un bon bock	Émile Reynaud	Unknown	1892-01-01	2262-01-01	12.0	Animation	Short	None	5.4	183	False
4	tt0000005	Short	Blacksmith Scene	Blacksmith Scene	William K.L. Dickson	Unknown	1893-01-01	2262-01-01	1.0	Comedy	Short	None	6.2	2832	False

In [225…
```
name_basics_clean = name_basics_clean[['nconst', 'primary_name', 'birth_year', 'death_year', 'known_for_titles', 'profession_1', 'profession_2', 'profession_3']]
# Dropped 'primary_profession' and reordered df
name_basics_clean.head()
```

Out[225…

	nconst	primary_name	birth_year	death_year	known_for_titles	profession_1	profession_2	profession_3
0	nm0000001	Fred Astaire	1899-01-01	1987-01-01	The Towering Inferno, Funny Face, On the Beach...	Actor	Miscellaneous	Producer
1	nm0000002	Lauren Bacall	1924-01-01	2014-01-01	To Have and Have Not, The Shootist, The Mirror...	Actress	Soundtrack	Archive Footage
2	nm0000003	Brigitte Bardot	1934-01-01	2262-01-01	Contempt, ...And God Created Woman, Love on a ...	Actress	Music Department	Producer
3	nm0000004	John Belushi	1949-01-01	1982-01-01	Saturday Night Live, National Lampoon's Animal...	Actor	Writer	Music Department
4	nm0000005	Ingmar Bergman	1918-01-01	2007-01-01	Wild Strawberries, Fanny and Alexander, The Se...	Writer	Director	Actor

In [226…
```
title_principals_clean.rename(columns={
    'primary_title': 'title_name',
    'primary_name': 'principal_name',
    'category': 'job_category',
}, inplace=True)
```

In [227…
```
title_principals_clean = title_principals_clean[['tconst', 'title_name', 'nconst', 'principal_name', 'job_category', 'job', 'characters']]
# Dropped 'primary_profession' and reordered df
title_principals_clean.head()
```

Out[227…

	tconst	title_name	nconst	principal_name	job_category	job	characters
0	tt0000001	Carmencita	nm1588970	Carmencita	Self	Unknown	["Self"]
1	tt0000001	Carmencita	nm0005690	William K.L. Dickson	Director	Unknown	Unknown
2	tt0000001	Carmencita	nm0005690	William K.L. Dickson	Producer	Producer	Unknown
3	tt0000001	Carmencita	nm0374658	William Heise	Cinematographer	Director Of Photography	Unknown
4	tt0000002	Le clown et ses chiens	nm0721526	Émile Reynaud	Director	Unknown	Unknown

1.21 Duplicated datasets for further manipulation and analysis.

In [229…
```
title_names = title_data.copy() # Combined title_basics, title_crew, title_ratings, and name_basics data
akas = title_akas_clean.copy()
episodes = title_episode_clean.copy()
principals = title_principals_clean.copy()
name_data = name_basics_clean.copy()
```

1.22 Reviewed data structure and saved cleaned copies as CSV files.

In [231…
```
print(title_names.info())
print(title_names.describe())
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1468993 entries, 0 to 1468992
Data columns (total 15 columns):
 #   Column           Non-Null Count    Dtype
---  ------           --------------    -----
 0   tconst           1468993 non-null  object
 1   title_type       1468993 non-null  object
 2   primary_title    1468993 non-null  object
 3   original_title   1468993 non-null  object
 4   director_name    1468993 non-null  object
 5   writer_name      1468993 non-null  object
 6   start_year       1468993 non-null  datetime64[ns]
 7   end_year         1468993 non-null  datetime64[ns]
 8   runtime_minutes  1468993 non-null  float64
 9   genre_1          1468993 non-null  object
 10  genre_2          1468993 non-null  object
 11  genre_3          1468993 non-null  object
 12  average_rating   1468993 non-null  float64
 13  num_votes        1468993 non-null  int64
 14  is_adult         1468993 non-null  bool
dtypes: bool(1), datetime64[ns](2), float64(2), int64(1), object(9)
memory usage: 158.3+ MB
None
                          start_year                       end_year  \
count                        1468993                        1468993
mean   2003-07-08 19:57:27.206351616  2252-03-06 17:27:59.796434944
min              1678-01-01 00:00:00            1925-01-01 00:00:00
25%              1997-01-01 00:00:00            2262-01-01 00:00:00
50%              2011-01-01 00:00:00            2262-01-01 00:00:00
75%              2018-01-01 00:00:00            2262-01-01 00:00:00
max              2025-01-01 00:00:00            2262-01-01 00:00:00
std                              NaN                            NaN

       runtime_minutes  average_rating     num_votes
count     1.468993e+06    1.468993e+06  1.468993e+06
mean      3.925042e+01    6.962686e+00  1.040038e+03
min       0.000000e+00    1.000000e+00  5.000000e+00
25%       0.000000e+00    6.200000e+00  1.200000e+01
50%       2.500000e+01    7.200000e+00  2.600000e+01
75%       6.100000e+01    7.900000e+00  1.020000e+02
max       5.946000e+04    1.000000e+01  2.946446e+06
std       9.433879e+01    1.376480e+00  1.783884e+04
```

In [232…
```
print(akas.info())
print(akas.describe())
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 47171459 entries, 0 to 47171460
Data columns (total 7 columns):
 #   Column             Dtype
---  ------             -----
 0   title_id           object
 1   title              object
 2   region             object
 3   language           object
 4   attributes         object
 5   is_original_title  bool
 6   types              object
dtypes: bool(1), object(6)
memory usage: 2.5+ GB
None
         title_id          title    region  language attributes  \
count    47171459       47171459  47171459  47171459   47171459
unique   10504625        6843683       248       109        185
top     tt0088814  Episodio #1.1   Unknown   Unknown    Unknown
freq          251          98171  10583136  15672598   46891370

       is_original_title     types
count           47171459  47171459
unique                 2        24
top                False   Unknown
freq            36666841  32596283
```

In [233…
```
print(episodes.info())
print(episodes.describe())
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 8538187 entries, 0 to 8538186
Data columns (total 4 columns):
 #   Column          Dtype
---  ------          -----
 0   tconst          object
 1   parent_tconst   object
 2   season_number   int64
 3   episode_number  int64
dtypes: int64(2), object(2)
memory usage: 260.6+ MB
None
       season_number  episode_number
count   8.538187e+06    8.538187e+06
mean    3.030700e+00    3.394592e+02
std     2.219434e+01    1.210049e+03
min     0.000000e+00    0.000000e+00
25%     1.000000e+00    2.000000e+00
50%     1.000000e+00    1.300000e+01
75%     2.000000e+00    1.020000e+02
max     2.024000e+03    9.133400e+04
```

In [234…
```
print(principals.info())
print(principals.describe())
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 86007873 entries, 0 to 86305807
Data columns (total 7 columns):
 #   Column          Dtype
---  ------          -----
 0   tconst          object
 1   title_name      object
 2   nconst          object
 3   principal_name  object
 4   job_category    object
 5   job             object
 6   characters      object
dtypes: object(7)
memory usage: 5.1+ GB
None
             tconst    title_name     nconst principal_name job_category  \
count     86007873      85997301   86007873       86006584     86007873
unique     9849750       4402836    6345681        5276515           13
top     tt5734258  Episode #1.1  nm0438471    Ekta Kapoor        Actor
freq           57        461936      32747          32747     20469389

            job characters
count   86007873   86007873
unique     41970    4097102
top      Unknown    Unknown
freq    69763723   44371051
```

In [235…
```
print(name_data.info())
print(name_data.describe())
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 13846512 entries, 0 to 13846511
Data columns (total 8 columns):
 #   Column            Dtype
---  ------            -----
 0   nconst            object
 1   primary_name      object
 2   birth_year        datetime64[ns]
 3   death_year        datetime64[ns]
 4   known_for_titles  object
 5   profession_1      object
 6   profession_2      object
 7   profession_3      object
dtypes: datetime64[ns](2), object(6)
memory usage: 845.1+ MB
None
                          birth_year                    death_year
count                       13846512                      13846512
mean   1690-06-28 22:27:38.049908736  2257-06-19 12:21:53.716894720
min              1678-01-01 00:00:00           1679-01-01 00:00:00
25%              1678-01-01 00:00:00           2262-01-01 00:00:00
50%              1678-01-01 00:00:00           2262-01-01 00:00:00
75%              1678-01-01 00:00:00           2262-01-01 00:00:00
max              2024-01-01 00:00:00           2262-01-01 00:00:00
```

In [236…
```
title_names.to_csv('title_names.csv', index=False)
akas.to_csv('akas.csv', index=False)
episodes.to_csv('episodes.csv', index=False)
principals.to_csv('principals.csv', index=False)
name_data.to_csv('name_data.csv', index=False)
```

2. Exploratory Analysis of IMDb Data Sets

2.1 Reviewed data set rows.

My exploratory analyis focuses on titles, genres, and principals (cast and crew), so I am primarily using dfs title_names, name_data, and principals.

In [265…
```
print(title_names.shape)
title_names.head()
```

```
(1468993, 15)
```

Out[265…

	tconst	title_type	primary_title	original_title	director_name	writer_name	start_year	end_year	runtime_minutes	genre_1	genre_2	genre_3	average_rating	num_votes	is_adult
0	tt0000001	Short	Carmencita	Carmencita	William K.L. Dickson	Unknown	1894-01-01	2262-01-01	1.0	Documentary	Short	None	5.7	2089	False
1	tt0000002	Short	Le clown et ses chiens	Le clown et ses chiens	Émile Reynaud	Unknown	1892-01-01	2262-01-01	5.0	Animation	Short	None	5.6	283	False
2	tt0000003	Short	Pauvre Pierrot	Pauvre Pierrot	Émile Reynaud	Unknown	1892-01-01	2262-01-01	5.0	Animation	Comedy	Romance	6.5	2096	False
3	tt0000004	Short	Un bon bock	Un bon bock	Émile Reynaud	Unknown	1892-01-01	2262-01-01	12.0	Animation	Short	None	5.4	183	False
4	tt0000005	Short	Blacksmith Scene	Blacksmith Scene	William K.L. Dickson	Unknown	1893-01-01	2262-01-01	1.0	Comedy	Short	None	6.2	2832	False

In [266…
```
print(principals.shape)
principals.head()
```

```
(86007873, 7)
```

Out[266…

	tconst	title_name	nconst	principal_name	job_category	job	characters
0	tt0000001	Carmencita	nm1588970	Carmencita	Self	Unknown	["Self"]
1	tt0000001	Carmencita	nm0005690	William K.L. Dickson	Director	Unknown	Unknown
2	tt0000001	Carmencita	nm0005690	William K.L. Dickson	Producer	Producer	Unknown
3	tt0000001	Carmencita	nm0374658	William Heise	Cinematographer	Director Of Photography	Unknown
4	tt0000002	Le clown et ses chiens	nm0721526	Émile Reynaud	Director	Unknown	Unknown

In [267…
```
print(name_data.shape)
name_data.head()
```

```
(13846512, 8)
```

Out[267…

	nconst	primary_name	birth_year	death_year	known_for_titles	profession_1	profession_2	profession_3
0	nm0000001	Fred Astaire	1899-01-01	1987-01-01	The Towering Inferno, Funny Face, On the Beach...	Actor	Miscellaneous	Producer
1	nm0000002	Lauren Bacall	1924-01-01	2014-01-01	To Have and Have Not, The Shootist, The Mirror...	Actress	Soundtrack	Archive Footage
2	nm0000003	Brigitte Bardot	1934-01-01	2262-01-01	Contempt, ...And God Created Woman, Love on a ...	Actress	Music Department	Producer
3	nm0000004	John Belushi	1949-01-01	1982-01-01	Saturday Night Live, National Lampoon's Animal...	Actor	Writer	Music Department
4	nm0000005	Ingmar Bergman	1918-01-01	2007-01-01	Wild Strawberries, Fanny and Alexander, The Se...	Writer	Director	Actor

2.2 Identified top-rated directors.

I began by running statistics on director title counts, then calculated the average rating for each director (based on all their films). These directors may be good investments for future projects due to previous highly-rated projects.

In [270…
```
titles_per_director = title_names['director_name'].value_counts() # Counted the number of titles per director
print("Descriptive Statistics for Number of Titles per Director:")
print(titles_per_director.describe())
```

```
Descriptive Statistics for Number of Titles per Director:
count    205088.000000
mean          7.162745
std         945.561383
min           1.000000
25%           1.000000
50%           1.000000
75%           3.000000
max      428136.000000
Name: count, dtype: float64
```

In [271…
```
titles_principals = title_names.merge(principals[['tconst', 'principal_name', 'job_category']],
                                      how='left',
                                      on='tconst')
```

In [272…
```
directors_data = titles_principals[titles_principals['job_category'] == 'Director']
director_ratings = directors_data.groupby('principal_name')['average_rating'].mean().reset_index()
top_directors = director_ratings.sort_values(by='average_rating', ascending=False) # Displayed highest rated directors first
print(top_directors.head(10))
```

```
         principal_name  average_rating
104267         Jin Pang            10.0
69535    Fidel Arizmendi            10.0
64695        Eric Espino            10.0
1960           Adam Kiss            10.0
146459   Matison LeBlanc            10.0
15633         Ankit Gola            10.0
166920       Nuclear Xav            10.0
165070  Nikhil Shirbhate            10.0
180761      Rahul Dhiman            10.0
107479      John Haycock            10.0
```

In [273…
```
director_votes = directors_data.groupby('principal_name').apply( # Calculated weighted average
    lambda x: (x['average_rating'] * x['num_votes']).sum() / x['num_votes'].sum()
).reset_index(name='weighted_avg_rating')
top_director_votes = director_votes.sort_values(by='weighted_avg_rating', ascending=False)
print(top_director_votes.head(25))
```

```
                    principal_name  weighted_avg_rating
218069                Thomas Reyna                 10.0
145301              Maryam Yadegari                10.0
62451              Elizabeth Tobias                10.0
95377                James Peverill                10.0
220970              Tom Neunzerling                10.0
162274                   Ned Harris                10.0
162198                   Neal Gavyn                10.0
89821                    Inpyo Hong                10.0
162152                 Nazila Azizi                10.0
119168           Kary Hyunjeong Rho                10.0
145849        Mashrukur Rahman Khan                10.0
162752             Nenad Teofilovic                10.0
195910               Sam Swainsbury                10.0
162074                        Navin                10.0
145928  Massimiliano Oliva Bartolozz                10.0
201785              Shachar Cherkez                10.0
162059                   Naveen.N                10.0
42073                Clarete Bomfim                10.0
162050                    Naveen Mu                10.0
145936        Massimiliano Tedeschi                10.0
128670                 Lauren Noone                10.0
95431                  James Rasile                10.0
146122          Mateo Merchán Lopera                10.0
224240     Tymika Chambliss-Williams                10.0
61694           Eleftherios Kostans                 10.0
```

2.3 Identified top-rated actors.

As with directors, I ran statistics on actor title counts, then calculated the average rating. These actors may also be good investments for future projects.

In [276…
```
actor_titles = principals[principals['job_category'].isin(['Actor', 'Actress'])]
actor_counts = actor_titles['principal_name'].value_counts()
print("Descriptive Statistics for Number of Titles per Actor:")
print(actor_counts.describe())
print(actor_counts)
```

```
Descriptive Statistics for Number of Titles per Actor:
count    2.935684e+06
mean     1.218927e+01
std      8.424910e+01
min      1.000000e+00
25%      1.000000e+00
50%      1.000000e+00
75%      3.000000e+00
max      1.097300e+04
Name: count, dtype: float64
principal_name
Kenjirô Ishimaru     10973
Sameera Sherief      10436
Vic Sotto            10404
Tito Sotto            9758
Joel de Leon          9707
                     ...
Sarah Widman             1
Leon Pulvermacher        1
Jean Malaquais           1
Paige Knutson            1
Adrian Iselin            1
Name: count, Length: 2935684, dtype: int64
```

In [277…
```
actors_data = titles_principals[(titles_principals['job_category'] == 'Actor') |
                                (titles_principals['job_category'] == 'Actress')]
actor_ratings = actors_data.groupby('principal_name')['average_rating'].mean().reset_index()
top_actors = actor_ratings.sort_values(by='average_rating', ascending=False)
print(top_actors.head(10))
```

```
            principal_name  average_rating
1239306        Taryd Makal            10.0
653950        Julia Eisfeld           10.0
1088893      Robert Larcara            10.0
43057    Alexandra Kulikova            10.0
362278         Elijah Blowes           10.0
779495          Louis Lavoie           10.0
588069       Jennifer López            10.0
724130       Krutika Jadhav            10.0
1040805         Puji Sofian            10.0
844071      Marlo di Angelo            10.0
```

In [278…
```
actor_votes = actors_data.groupby('principal_name').apply(
    lambda x: (x['average_rating'] * x['num_votes']).sum() / x['num_votes'].sum()
).reset_index(name='weighted_avg_rating')
top_actor_votes = actor_votes.sort_values(by='weighted_avg_rating', ascending=False)
print(top_actor_votes.head(10))
```

```
                  principal_name  weighted_avg_rating
828363          Mariane Filomeno                 10.0
191146              Busboy Bobby                 10.0
246706       Christopher M. King                 10.0
762096             Liliana Adam                 10.0
304686       David Santo Vásquez                 10.0
84232              Angela Barrow                 10.0
1184528    Simon Valeur Lundberg                 10.0
474677      Gustavo Daniel Bueno                 10.0
317868             Derek M. Puma                 10.0
983170   Olha Mykhaylivna Chendej                10.0
```

2.4 Examined genre distribution.

In [280…
```
all_genres = pd.concat([title_names['genre_1'], title_names['genre_2'], title_names['genre_3']])
unique_genres = all_genres.nunique()
print(f"There are {unique_genres} unique genres.")
```

```
There are 30 unique genres.
```

Excluding the variables representing null genres (None and Unknown), there are 28 genres.

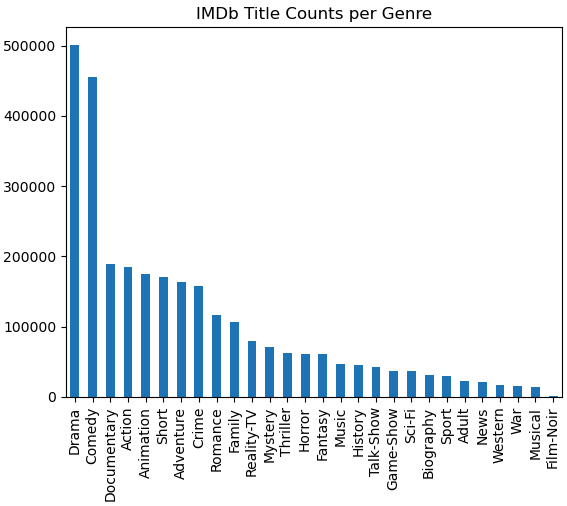
In [282…
```
all_genres = pd.Series(all_genres) # Converted to series
title_genres = all_genres[~all_genres.isin(['None', 'Unknown'])]
```

In [283…
```
genre_counts = title_genres.value_counts()
print(genre_counts)
```

```
Drama          501074
Comedy         455748
Documentary    188346
Action         184766
Animation      174823
Short          170242
Adventure      164028
Crime          158300
Romance        116023
Family         106238
Reality-TV      80045
Mystery         70324
Thriller        61940
Horror          61581
Fantasy         60850
Music           47059
History         44659
Talk-Show       42354
Game-Show       37028
Sci-Fi          36801
Biography       30703
Sport           29239
Adult           22353
News            20438
Western         16928
War             15792
Musical         13737
Film-Noir         873
Name: count, dtype: int64
```

In [284…
```
genre_counts.plot(kind='bar', title='IMDb Title Counts per Genre')
```

Out[284… `<Axes: title={'center': 'IMDb Title Counts per Genre'}>`



Drama and Comedy are the leading genres by far, followed by Documentary, Action, and Animation.

3. Genre and Average Rating Analysis

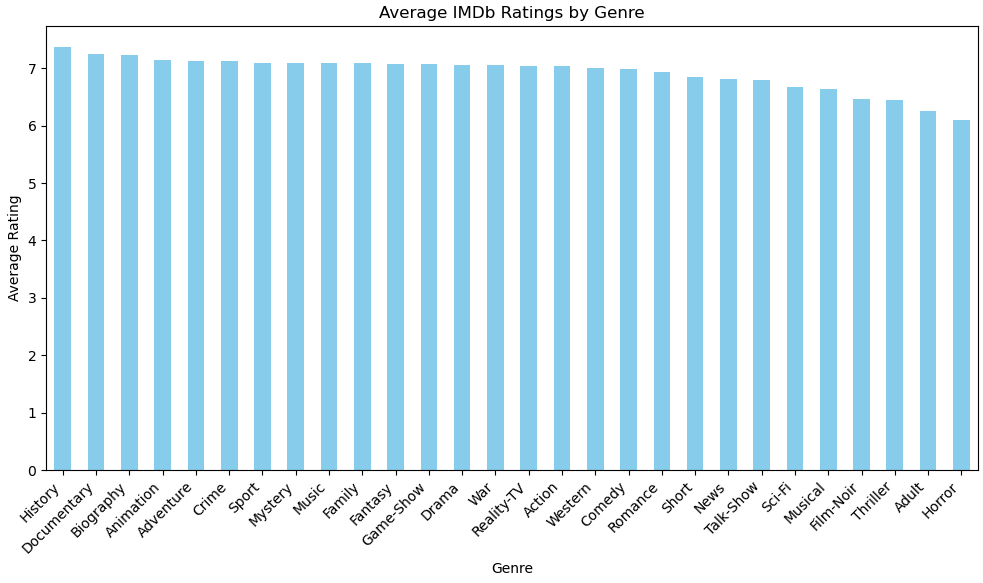
After completing my exploratory analysis of the datasets, I decided to focus on genre and examine it's relationship to average ratings.

3.1 Calculated average ratings per genre and created bar charts.

In [290…
```
genre_ratings = title_names.melt(id_vars='average_rating', # Melted genres into one column
                                 value_vars=['genre_1', 'genre_2', 'genre_3'],
                                 var_name='genre_column',
                                 value_name='genre')
genre_ratings = genre_ratings[~genre_ratings['genre'].isin(['None', 'Unknown'])] # Filtered null genres
avg_genre_ratings = genre_ratings.groupby('genre')['average_rating'].mean().sort_values(ascending=False)
print(avg_genre_ratings)
```

```
genre
History        7.362581
Documentary    7.249891
Biography      7.223802
Animation      7.143446
Adventure      7.128809
Crime          7.122136
Sport          7.098622
Mystery        7.094264
Music          7.089141
Family         7.088637
Fantasy        7.078669
Game-Show      7.077903
Drama          7.057982
War            7.055313
Reality-TV     7.046766
Action         7.038350
Western        7.004401
Comedy         6.989156
Romance        6.932597
Short          6.846570
News           6.807794
Talk-Show      6.787805
Sci-Fi         6.674052
Musical        6.630305
Film-Noir      6.459107
Thriller       6.443539
Adult          6.259916
Horror         6.106970
Name: average_rating, dtype: float64
```

In [292…
```
plt.figure(figsize=(10, 6))
avg_genre_ratings.plot(kind='bar', color='skyblue')
plt.title('Average IMDb Ratings by Genre')
plt.xlabel('Genre')
plt.ylabel('Average Rating')
plt.xticks(rotation=45, ha='right')
plt.tight_layout()
plt.show()
```



3.2 Generated statistics for genres.

In [302…
```
genre_melt = title_names.melt(value_vars=['genre_1', 'genre_2', 'genre_3'],  # Melted genres alone for statistics
                              var_name='genre_column',
                              value_name='genre')
```

In [304…
```
genre_melt = genre_melt[~genre_melt['genre'].isin(['None', 'Unknown'])]
titles_per_genre = genre_melt['genre'].value_counts()
print("Descriptive Statistics for Number of Titles per Genre:")
print(titles_per_genre.describe())
```

```
Descriptive Statistics for Number of Titles per Genre:
count        28.000000
mean     104010.428571
std      121197.032403
min         873.000000
25%       30337.000000
50%       61215.500000
75%      159732.000000
max      501074.000000
Name: count, dtype: float64
```

I also combined the average ratings and title counts for genres.

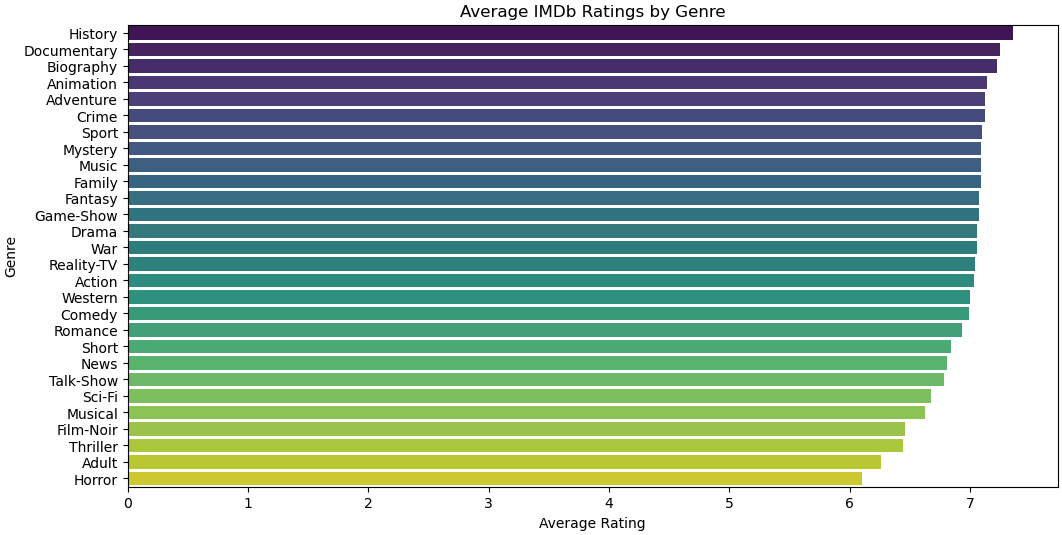
In [306…
```
genre_stats = genre_ratings.groupby('genre').agg(
    average_rating=('average_rating', 'mean'),
    title_count=('average_rating', 'count')
).reset_index()
genre_stats.sort_values(by='average_rating', ascending=False, inplace=True)
```

In [307…
```
print(genre_stats)
```

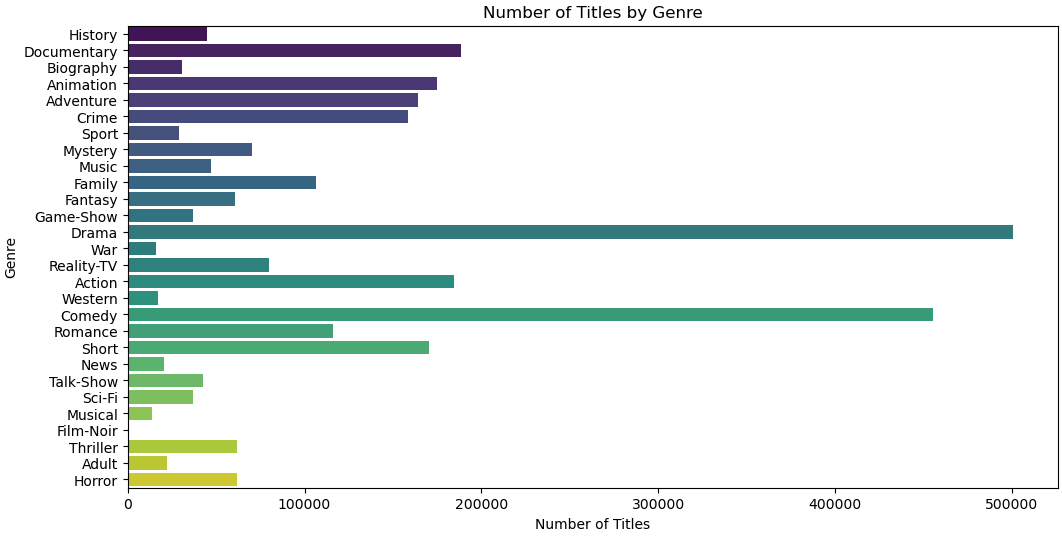
	genre	average_rating	title_count
13	History	7.362581	44659
7	Documentary	7.249891	188346
4	Biography	7.223802	30703
3	Animation	7.143446	174823
2	Adventure	7.128809	164028
6	Crime	7.122136	158300
23	Sport	7.098622	29239
17	Mystery	7.094264	70324
15	Music	7.089141	47059
9	Family	7.088637	106238
10	Fantasy	7.078669	60850
12	Game-Show	7.077903	37028
8	Drama	7.057982	501074
26	War	7.055313	15792
19	Reality-TV	7.046766	80045
0	Action	7.038350	184766
27	Western	7.004401	16928
5	Comedy	6.989156	455748
20	Romance	6.932597	116023
22	Short	6.846570	170242
18	News	6.807794	20438
24	Talk-Show	6.787805	42354
21	Sci-Fi	6.674052	36801
16	Musical	6.630305	13737
11	Film-Noir	6.459107	873
25	Thriller	6.443539	61940
1	Adult	6.259916	22353
14	Horror	6.106970	61581

3.3 Created horizontal bar charts for average ratings.

In [312…
```
# Bar Chart for Average Ratings per Genre
plt.figure(figsize=(12, 6))
sns.barplot(data=genre_stats, x='average_rating', y='genre', palette='viridis')
plt.title('Average IMDb Ratings by Genre')
plt.xlabel('Average Rating')
plt.ylabel('Genre')
plt.show()
```

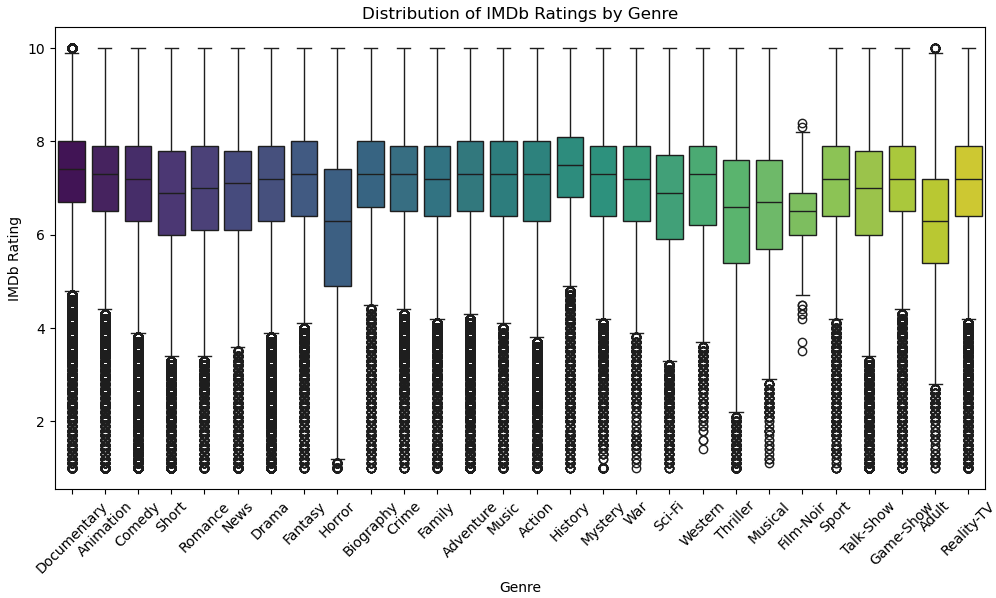


In [313…
```
# Bar Chart for Title Counts per Genre
plt.figure(figsize=(12, 6))
sns.barplot(data=genre_stats, x='title_count', y='genre', palette='viridis')
plt.title('Number of Titles by Genre')
plt.xlabel('Number of Titles')
plt.ylabel('Genre')
plt.show()
```



In [321…
```
# Box Plot for Average IMDb Ratings by Genre
plt.figure(figsize=(12, 6))
sns.boxplot(data=genre_ratings, x='genre', y='average_rating', palette='viridis')
plt.xticks(rotation=45)
plt.title('Distribution of IMDb Ratings by Genre')
plt.xlabel('Genre')
```

```
plt.ylabel('IMDb Rating')
plt.show()
```

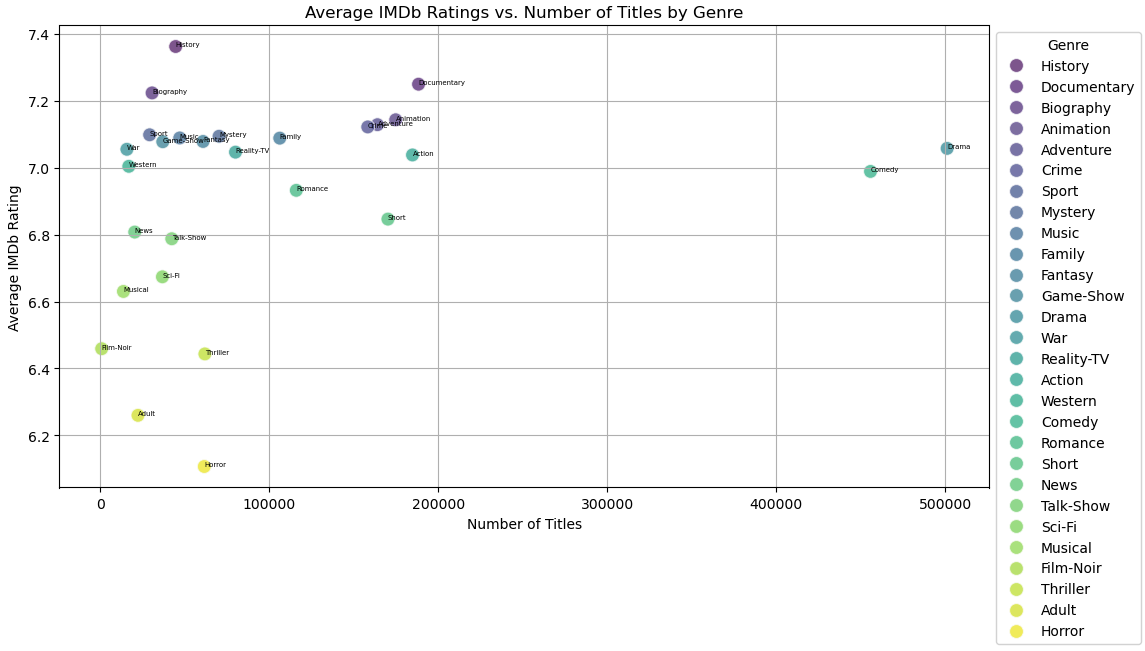


3.4 Created a scatter plot for the genre/rating relationship.

This plots the number of titles versus the average rating for each genre.

In [323…

```
plt.figure(figsize=(12, 6))
scatter_plot = sns.scatterplot(data=genre_stats, x='title_count', y='average_rating', hue='genre', palette='viridis', s=100, alpha=0.7)
for line in range(0, genre_stats.shape[0]):
    scatter_plot.text(
        genre_stats.title_count.iloc[line],
        genre_stats.average_rating.iloc[line],
        genre_stats.genre.iloc[line],
        horizontalalignment='left',
        size='5',
        color='black',
        weight='normal'
    )
plt.title('Average IMDb Ratings vs. Number of Titles by Genre')
plt.xlabel('Number of Titles')
plt.ylabel('Average IMDb Rating')
plt.legend(loc='upper left', bbox_to_anchor=(1, 1), title='Genre')
plt.grid(True)
plt.show()
```



3.5 Examined average ratings for multiple genre combinations.

In [325…

```
genre_dummies = pd.get_dummies(title_names[['genre_1', 'genre_2', 'genre_3']], prefix='', prefix_sep='') # Created dummies for genres (binary: FALSE if title isn't genre, TRUE if title is genr
df_genres = pd.concat([title_names['average_rating'], genre_dummies], axis=1) # Combined with average rating
def get_genre_combination(row): # Created function to return combination as string
    genres = genre_dummies.columns[row == True].tolist()
    return ', '.join(genres) if genres else 'None'
df_genres['genre_combination'] = genre_dummies.apply(get_genre_combination, axis=1) # Apply to each row
average_rating_by_genre_combination = df_genres.groupby('genre_combination')['average_rating'].mean().reset_index()
average_rating_by_genre_combination.sort_values(by='average_rating', ascending=False, inplace=True)
print(average_rating_by_genre_combination)
```

```
                   genre_combination  average_rating
1369  Documentary, Musical, Reality-TV        9.500000
746     Animation, Musical, Reality-TV        9.400000
1859        Horror, Mystery, Talk-Show        9.300000
2011      Reality-TV, Short, Talk-Show        9.254762
1931                 Music, War, None        9.250000
...                               ...             ...
2043            Sci-Fi, Thriller, War        3.200000
1999                 News, Short, War        2.700000
1135               Comedy, Sport, War        2.500000
909       Biography, Reality-TV, Sport        2.300000
1427          Drama, Family, Game-Show        1.700000

[2070 rows x 2 columns]
```

In [326…
```
average_rating_by_genre_combination.head(25)
```

Out[326…

	genre_combination	average_rating
1369	Documentary, Musical, Reality-TV	9.500000
746	Animation, Musical, Reality-TV	9.400000
1859	Horror, Mystery, Talk-Show	9.300000
2011	Reality-TV, Short, Talk-Show	9.254762
1931	Music, War, None	9.250000
1025	Comedy, Game-Show, Musical	9.218182
810	Biography, Crime, Reality-TV	9.200000
1157	Crime, Documentary, Talk-Show	9.200000
1795	History, Music, News	9.200000
1608	Family, History, Talk-Show	9.200000
1973	Mystery, Sci-Fi, Talk-Show	9.200000
1596	Family, Game-Show, Romance	9.166667
1810	History, News, None	9.017391
1755	Game-Show, History, Music	9.000000
1006	Comedy, Fantasy, Game-Show	9.000000
1318	Documentary, Fantasy, Reality-TV	9.000000
481	Adventure, Documentary, Talk-Show	9.000000
1385	Documentary, News, Sci-Fi	9.000000
1374	Documentary, Musical, War	9.000000
910	Biography, Reality-TV, Talk-Show	8.990000
704	Animation, Family, War	8.963636
561	Adventure, Music, Mystery	8.950000
1177	Crime, Drama, Talk-Show	8.933333
1906	Music, News, Sport	8.900000
857	Biography, Family, Mystery	8.900000

3.6 Identified top titles per genre.

In [328…
```
title_names_melted = pd.melt(title_names,
                             id_vars=['primary_title', 'average_rating'],
                             value_vars=['genre_1', 'genre_2', 'genre_3'],
                             var_name='genre_column',
                             value_name='genre')
title_names_melted = title_names_melted[title_names_melted['genre'].notnull()]
title_names_melted = title_names_melted[title_names_melted['genre'] != 'Unknown']
top_titles_by_genre = title_names_melted.loc[title_names_melted.groupby('genre')['average_rating'].idxmax()]
top_titles_by_genre = top_titles_by_genre[['primary_title', 'average_rating', 'genre']].sort_values(by='average_rating', ascending=False)
print(top_titles_by_genre)
```

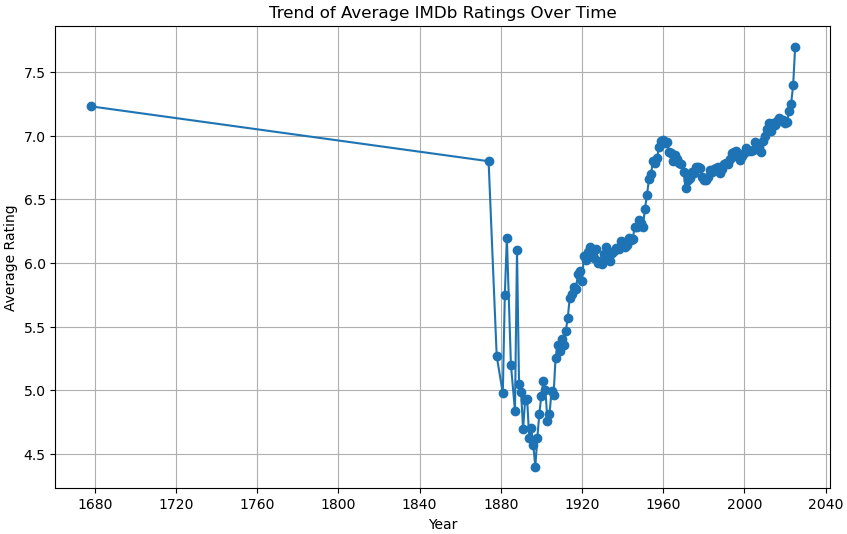
```
                                        primary_title  average_rating  \
511876   I challenge the Ender Dragon in Minecraft (End...            10.0
198567   The Unbroken Circle: A Tribute to Mother Maybe...            10.0
2624932                                The Ghost Soldier            10.0
630744                               The Lady Masquerade            10.0
589815                             Sinbad: Feed the Hungry            10.0
610489               Los Angeles Raiders vs. Detroit Lions            10.0
172778                               Closed for Business            10.0
1070936                                        BMW Ahead            10.0
407865                                            Grapes            10.0
527808   How to Spot a Crowdfunding Scam: Ed the Sock &...            10.0
1546602                                All I Know Is            10.0
465819                 The Truth About 'Russian Collusion'            10.0
657721                                      The Cassette            10.0
259203                                        Feet Afire            10.0
484036                                        Demon Boss            10.0
95760                                       Renegades 2            10.0
545053                                  Power in Denmark            10.0
667341                                      Episode #1.1            10.0
629705                                Ransacking The Earth            10.0
261970                                             Whoosh            10.0
77609                                   All I Know Is                10.0
103997                                  A View of Bosnia            10.0
605925                                             Tyler            10.0
231610                                  El mariachi loco            10.0
533550                                          Maestro             10.0
1211608                                That's My Bus!               10.0
474403                                         Yasenova             10.0
2214819                                    Aqua Brava               10.0
1494038                                 Sunset Boulevard             8.4

              genre
511876       Action
198567        Music
2624932         War
630744      Thriller
589815     Talk-Show
610489         Sport
172778         Short
1070936       Sci-Fi
407865       Romance
527808    Reality-TV
1546602         None
465819          News
657721       Mystery
259203       Musical
484036        Horror
95760          Adult
545053       History
667341     Game-Show
629705       Fantasy
261970        Family
77609          Drama
103997   Documentary
605925         Crime
231610        Comedy
533550     Biography
1211608    Animation
474403     Adventure
2214819      Western
1494038    Film-Noir
```

4. Genre Trends

4.1 Plotted average rating for all films.

In [331…

```
title_names_filtered = title_names[(title_names['start_year'] != 1678)] # Filter out 'unknown' stand in date
temporal_trend = title_names_filtered.groupby('start_year')['average_rating'].mean().reset_index()
plt.figure(figsize=(10,6))
plt.plot(temporal_trend['start_year'], temporal_trend['average_rating'], marker='o')
plt.title('Trend of Average IMDb Ratings Over Time')
plt.xlabel('Year')
plt.ylabel('Average Rating')
plt.grid(True)
plt.show()
```

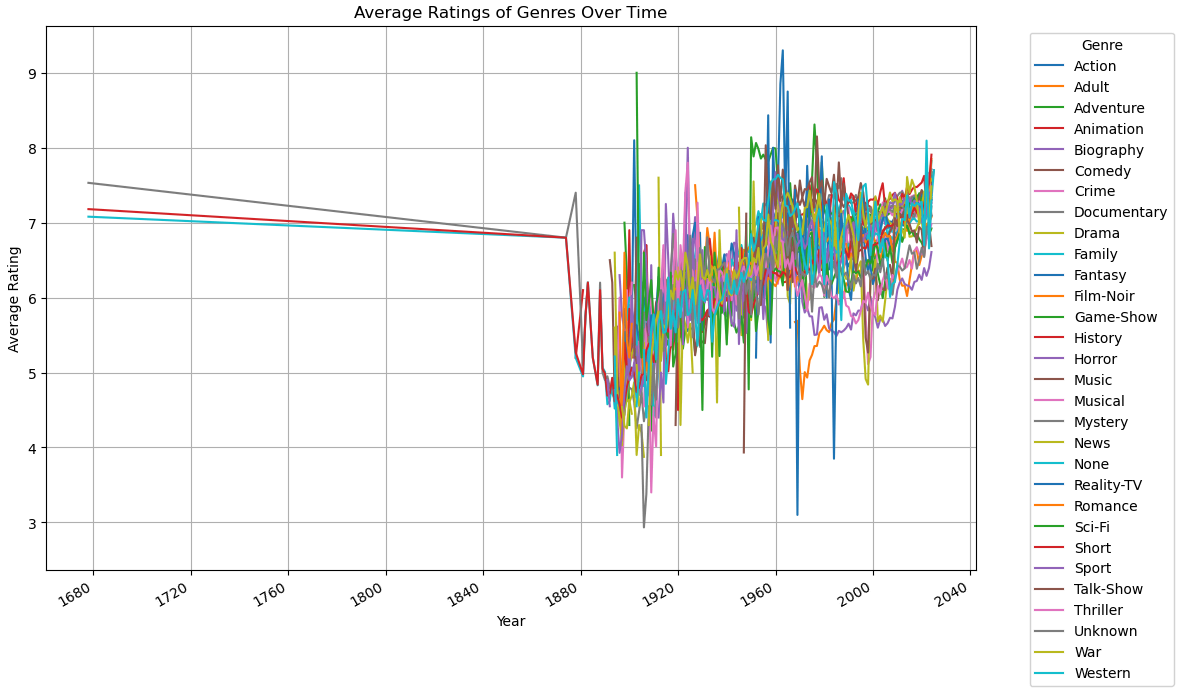


4.2 Plotted average rating by genre.

In [382…

```
title_names_melted = pd.melt(title_names,
                             id_vars=['primary_title', 'start_year', 'average_rating'],
                             value_vars=['genre_1', 'genre_2', 'genre_3'],
                             var_name='genre_column',
                             value_name='genre')
genre_evolution = title_names_melted.groupby(['start_year', 'genre'])['average_rating'].mean().reset_index()
```

```
genre_pivot = genre_evolution.pivot(index='start_year', columns='genre', values='average_rating') # Pivoted for easier plotting
genre_pivot.plot(figsize=(12, 8))
plt.title('Average Ratings of Genres Over Time')
plt.xlabel('Year')
plt.ylabel('Average Rating')
plt.legend(title='Genre', bbox_to_anchor=(1.05, 1), loc='upper left')
plt.grid()
plt.show()
```



While these line charts show the full span of dates in the dataset, they are hard to read. I will shorten the interval and replot.

These line charts reveal that most of the films in the data set before 1880 don't have a genre listed or it's simply identified as a short. This is where I will begin the interval for the next plots.

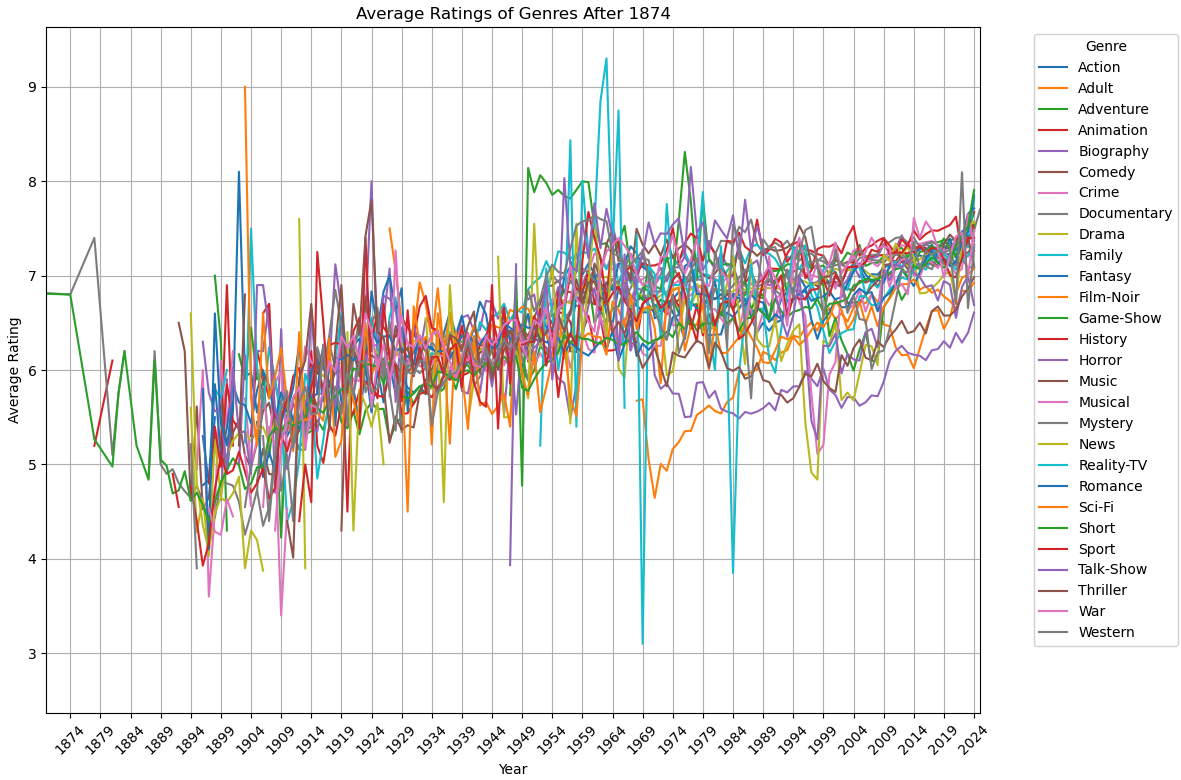
In [386…
```
title_names_melted = title_names_melted[~(title_names_melted[['genre']].isin(['Unknown', 'None']).any(axis=1))] # Removed missing genre categories
```

In [387…
```
title_names_melted['start_year'] = pd.to_datetime(title_names_melted['start_year'], errors='coerce').dt.year
```

In [388…
```
print(title_names_melted.head())
```

```
           primary_title  start_year  average_rating genre_column  \
0              Carmencita        1894             5.7      genre_1
1  Le clown et ses chiens        1892             5.6      genre_1
2          Pauvre Pierrot        1892             6.5      genre_1
3             Un bon bock        1892             5.4      genre_1
4        Blacksmith Scene        1893             6.2      genre_1

        genre
0  Documentary
1    Animation
2    Animation
3    Animation
4       Comedy
```

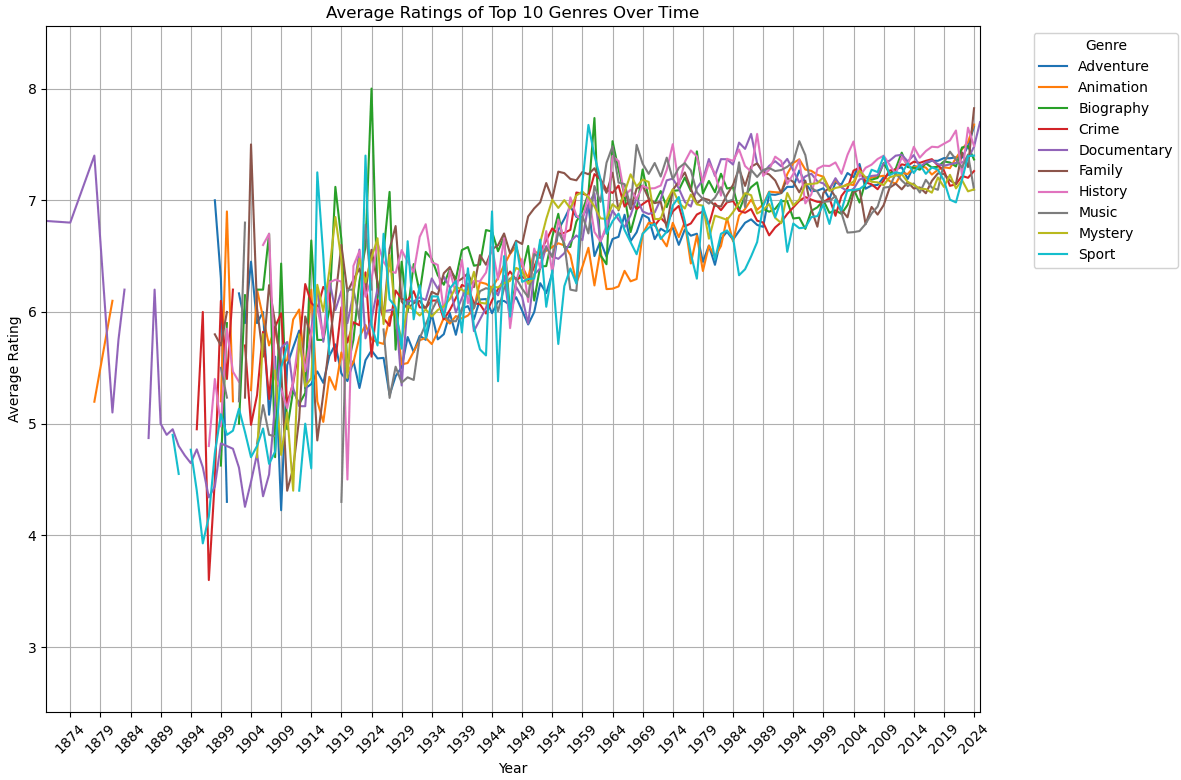
In [419…
```
genre_evolution_rating = title_names_melted.groupby(['start_year', 'genre'])['average_rating'].mean().reset_index()
genre_pivot_rating = genre_evolution_rating.pivot(index='start_year', columns='genre', values='average_rating') # Pivoted for easier plotting
genre_pivot_rating.plot(figsize=(12, 8))
plt.title('Average Ratings of Genres After 1874')
plt.xlabel('Year')
plt.ylabel('Average Rating')
plt.legend(title='Genre', bbox_to_anchor=(1.05, 1), loc='upper left')
plt.xticks(ticks=range(1874, title_names_melted['start_year'].max() + 1, 5), rotation=45) # Adjusted interval
plt.xlim(left=1870, right=2025)
plt.tight_layout()
plt.grid()
plt.show()
```



Since the chart is still crowded with so many genres, I will isolate the 10 genres with the highest ratings.

In [420…

```
genre_avg_rating = title_names_melted.groupby('genre')['average_rating'].mean().reset_index()
top_10_genres = genre_avg_rating.nlargest(10, 'average_rating')['genre']
title_names_melted_top = title_names_melted[title_names_melted['genre'].isin(top_10_genres)]
genre_evolution_top = title_names_melted_top.groupby(['start_year', 'genre'])['average_rating'].mean().reset_index()
genre_pivot_top = genre_evolution_top.pivot(index='start_year', columns='genre', values='average_rating')
genre_pivot_top.plot(figsize=(12, 8))
plt.title('Average Ratings of Top 10 Genres Over Time')
plt.xlabel('Year')
plt.ylabel('Average Rating')
plt.legend(title='Genre', bbox_to_anchor=(1.05, 1), loc='upper left')
plt.xticks(ticks=range(1874, title_names_melted['start_year'].max() + 1, 5), rotation=45) # Adjusted interval
plt.xlim(left=1870, right=2025)
plt.tight_layout()
plt.grid()
plt.show()
```

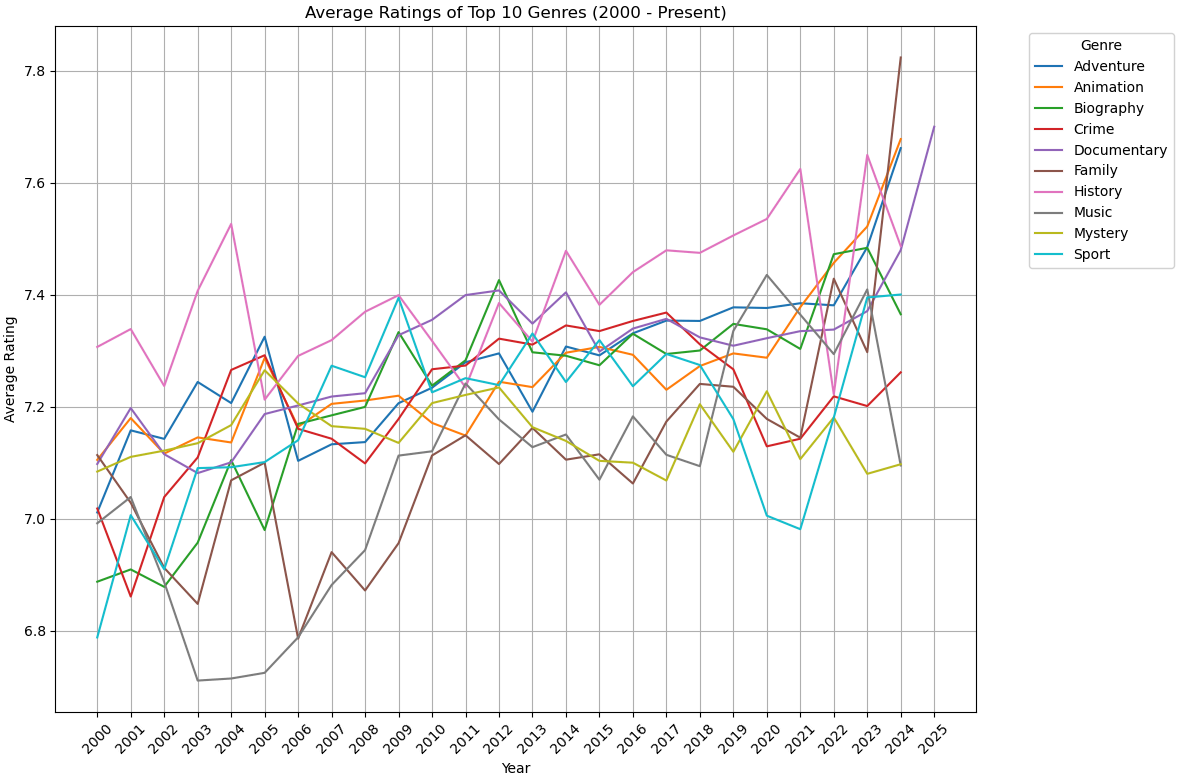


To get an even closer look into recent genre trends, I will look at average ratings from 2000 on.

In [413…

```
recent_top_genres = title_names_melted_top[title_names_melted_top['start_year'] >= 2000]
genre_evolution_recent = recent_top_genres.groupby(['start_year', 'genre'])['average_rating'].mean().reset_index()
genre_pivot_recent = genre_evolution_recent.pivot(index='start_year', columns='genre', values='average_rating')
genre_pivot_recent.plot(figsize=(12, 8))
plt.title('Average Ratings of Top 10 Genres (2000 - Present)')
```

```
plt.xlabel('Year')
plt.ylabel('Average Rating')
plt.legend(title='Genre', bbox_to_anchor=(1.05, 1), loc='upper left')
plt.xticks(ticks=range(2000, title_names_melted_top['start_year'].max() + 1, 1), rotation=45)
plt.tight_layout()
plt.grid()
plt.show()
```



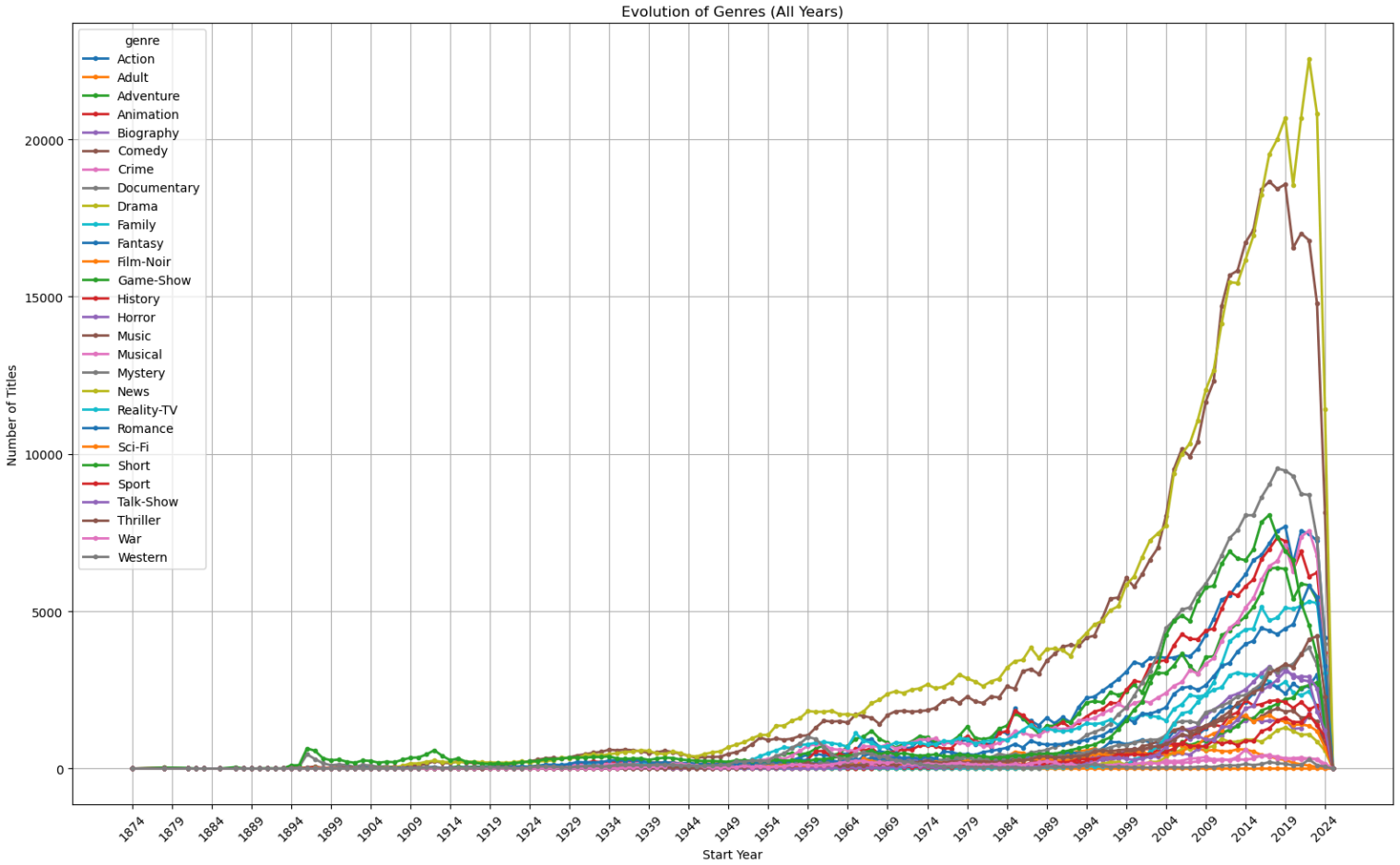
This line chart gives me a clear view of recent trends in popular genres. Documentary, Adventure, and Animation have seen increases in average ratings in recent years. Family films saw a drastic increase in average ratings from 2023-2024.

4.3 Plotted genre count trends.

In [432…
```
# title_names_melted['start_year'] = pd.to_datetime(title_names_melted['start_year'], errors='coerce', format='%Y') # Reconverted back to datetime
# title_names_melted['start_year'] = title_names_melted['start_year'].dt.year # Converted to year alone for filtering
title_names_melted = title_names_melted[(title_names_melted['start_year'] != 1678)]
```

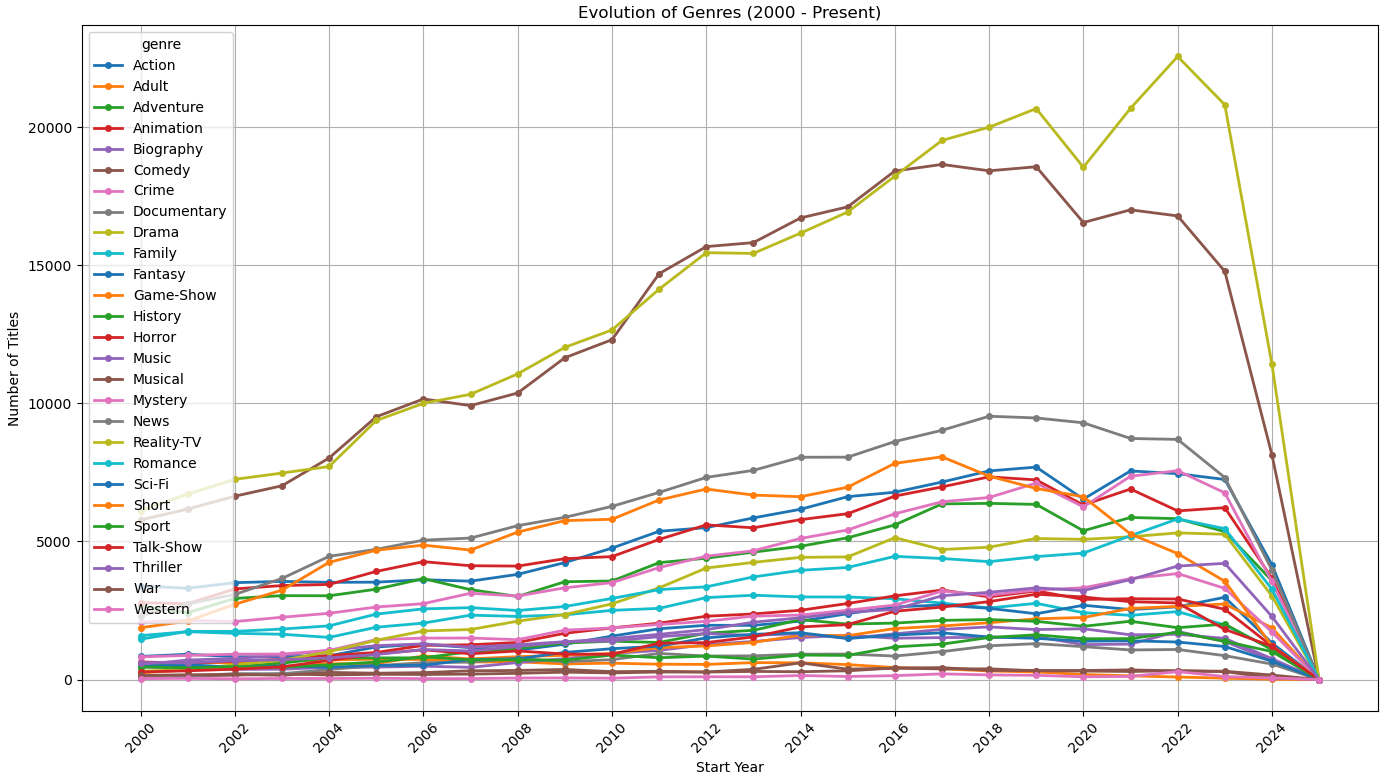
In [433…
```
plt.figure(figsize=(16, 10)) # Increased size
genre_evolution_full = title_names_melted.groupby(['start_year', 'genre']).size().unstack(fill_value=0)
genre_evolution_full.plot(kind='line', lw=2, figsize=(16, 10), marker='o', markersize=3)
plt.title('Evolution of Genres (All Years)')
plt.xlabel('Start Year')
plt.ylabel('Number of Titles')
plt.grid(True)
plt.xticks(ticks=range(title_names_melted['start_year'].min(), title_names_melted['start_year'].max()+1, 5), rotation=45) # Adjusted interval
plt.tight_layout()
plt.show()
```

```
<Figure size 1600x1000 with 0 Axes>
```



In [434…
```
recent_years = title_names_melted[title_names_melted['start_year'] >= 2000] # Limit years
genre_evolution_recent = recent_years.groupby(['start_year', 'genre']).size().unstack(fill_value=0)
plt.figure(figsize=(12, 8))  # Increased size
genre_evolution_recent.plot(kind='line', lw=2, figsize=(14, 8), marker='o', markersize=4)
plt.title('Evolution of Genres (2000 - Present)')
plt.xlabel('Start Year')
plt.ylabel('Number of Titles')
plt.grid(True)
plt.xticks(ticks=range(2000, recent_years['start_year'].max()+1, 2), rotation=45) # Adjusted x-axis ticks to avoid overcrowding
plt.tight_layout()
plt.show()
```

```
<Figure size 1200x800 with 0 Axes>
```



The decrease in 2024 can be explained by a limited number of films contained in the data set (since the year is not through). It will be disregarded for analysis.

These charts show how different genres have grown in popularity over the years. Drama and Comedy have consistently stayed the most popular genres, while Short Films have seen a decline.

5. Results and Findings

Key Insights:

- History, Documentary, and Biography (all non-fiction genres) have the highest average ratings.
- Along with the non-fiction genres, Action and Adventure have seen an increase in ratings in the past few years.
- Drama, Comedy, Documentary, and Action are the most popular genres based on title counts alone. Most film and TV shows fall into the Drama or Comedy category.
- Horror movies and Thrillers currently have the worst average ratings on IMDb.
- There are fewer titles being made in History, Documentary, and Biography genres yet they tend to have high ratings. This could suggest viewers are more interested in and appreciative of non-fiction projects, and with fewer films overall, less competition in these genres to stand out.
- Short films have seen a decrease in popularity and have an average rating lower than other genres. This suggests feature films and TV shows are more profitable now.
- Most genre combinations that have high average ratings include at least one non-fiction genre.

6. Recommendations

Based on this analysis, I recommend the following actions for project selection:

- Invest in Documentary, Historical, or Biographical films to increase the likelihood of critical success.
- Invest in projects with genre combinations that bring multiple popular genres together. If one of those genres is non-fiction, it may increase critical success.
- Dramas and Comedies are more common genres and generally tend to rate lower than other genres. Combining a non-fiction genre like History or Biography with genres like Comedy and Drama to create Historical Fiction pieces could be a method for ensuring higher ratings and a wider audience. Invest in films that combine successful genres in unique ways.
- Invest in feature-length films and TV shows rather than short films.

7. References

1. IMDb Non-Commerical Datasets