Business Problem Statement:

Analyze the Company dataset to generate insights that could help Streaming_Service_Platform decide which type of shows/movies to produce and how they can grow the business in different countries.

To Do:

- Define problem statement and analyze basic metrics.
- Observe the shape of data, data types of all attributes, and handle missing values.
- Perform non-graphical analysis: value counts and unique attributes. Perform visual analysis - Univariate, Bivariate after pre-processing of the data.
- Check for missing values and outliers (treatment optional).
- Draw insights based on non-graphical and visual analysis.
- Provide business insights and give recommendations.

Dataset columns:

- Show_id: Unique ID for every Movie / Tv Show
- Type: Identifier - A Movie or TV Show
- Title: Title of the Movie / Tv Show
- Director: Director of the Movie
- Cast: Actors involved in the movie/show
- Country: Country where the movie/show was produced
- Date_added: Date it was added on Netflix
- Release_year: Actual Release year of the movie/show
- Rating: TV Rating of the movie/show
- Duration: Total Duration - in minutes or number of seasons
- Listed_in: Genre
- Description: The summary description

Importing required Libraries and Dataset:

In [1]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import plotly.express as px
import re
from scipy.stats import spearmanr

import warnings
warnings.filterwarnings('ignore')
```

In [2]:

```
### optional:
### for making matplotlib charts crip
import matplotlib_inline
matplotlib_inline.backend_inline.set_matplotlib_formats('svg')

### optional:
### for making jupyter botebook wider
from IPython.display import display, HTML
display(HTML("<style>.container { width:100% !important; }</style>"))
```

In [3]:

```
df = pd.read_csv("streaming_service_raw_data.csv")
df_original = df.copy()
```

In [4]:

```
df.head()
```

Out[4]:

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in	description
0	s1	Movie	Dick Johnson Is Dead	Kirsten Johnson	NaN	United States	September 25, 2021	2020	PG-13	90 min	Documentaries	As her father nears the end of his life, filmm...
1	s2	TV Show	Blood & Water	NaN	Ama Qamata, Khosi Ngema, Gail Mabalane, Thaban...	South Africa	September 24, 2021	2021	TV-MA	2 Seasons	International TV Shows, TV Dramas, TV Mysteries	After crossing paths at a party, a Cape Town t...
2	s3	TV Show	Ganglands	Julien Leclercq	Sami Bouajila, Tracy Gotoas, Samuel Jouy, Nabi...	NaN	September 24, 2021	2021	TV-MA	1 Season	Crime TV Shows, International TV Shows, TV Act...	To protect his family from a powerful drug lor...
3	s4	TV Show	Jailbirds New Orleans	NaN	NaN	NaN	September 24, 2021	2021	TV-MA	1 Season	Docuseries, Reality TV	Feuds, flirtations and toilet talk go down amo...
4	s5	TV Show	Kota Factory	NaN	Mayur More, Jitendra Kumar, Ranjan Raj, Alam K...	India	September 24, 2021	2021	TV-MA	2 Seasons	International TV Shows, Romantic TV Shows, TV ...	In a city of coaching centers known to train I...

In [5]:
```
df.tail()
```

Out[5]:

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in	description
8802	s8803	Movie	Zodiac	David Fincher	Mark Ruffalo, Jake Gyllenhaal, Robert Downey J...	United States	November 20, 2019	2007	R	158 min	Cult Movies, Dramas, Thrillers	A political cartoonist, a crime reporter and a...
8803	s8804	TV Show	Zombie Dumb	NaN	NaN	NaN	July 1, 2019	2018	TV-Y7	2 Seasons	Kids' TV, Korean TV Shows, TV Comedies	While living alone in a spooky town, a young g...
8804	s8805	Movie	Zombieland	Ruben Fleischer	Jesse Eisenberg, Woody Harrelson, Emma Stone, ...	United States	November 1, 2019	2009	R	88 min	Comedies, Horror Movies	Looking to survive in a world taken over by zo...
8805	s8806	Movie	Zoom	Peter Hewitt	Tim Allen, Courteney Cox, Chevy Chase, Kate Ma...	United States	January 11, 2020	2006	PG	88 min	Children & Family Movies, Comedies	Dragged from civilian life, a former superhero...
8806	s8807	Movie	Zubaan	Mozez Singh	Vicky Kaushal, Sarah-Jane Dias, Raaghav Chanan...	India	March 2, 2019	2015	TV-14	111 min	Dramas, International Movies, Music & Musicals	A scrappy but poor boy worms his way into a ty...

Dropping the unique row number identifier column "show_id". Also dropping the column "description" from dataframe as we can not generate useful insights using this column in this case study.

In [6]:
```
df.drop(columns=["show_id", "description"], inplace=True)
```

In [7]:
```
df.head()
```

Out[7]:

	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in
0	Movie	Dick Johnson Is Dead	Kirsten Johnson	NaN	United States	September 25, 2021	2020	PG-13	90 min	Documentaries
1	TV Show	Blood & Water	NaN	Ama Qamata, Khosi Ngema, Gail Mabalane, Thaban...	South Africa	September 24, 2021	2021	TV-MA	2 Seasons	International TV Shows, TV Dramas, TV Mysteries
2	TV Show	Ganglands	Julien Leclercq	Sami Bouajila, Tracy Gotoas, Samuel Jouy, Nabi...	NaN	September 24, 2021	2021	TV-MA	1 Season	Crime TV Shows, International TV Shows, TV Act...
3	TV Show	Jailbirds New Orleans	NaN	NaN	NaN	September 24, 2021	2021	TV-MA	1 Season	Docuseries, Reality TV
4	TV Show	Kota Factory	NaN	Mayur More, Jitendra Kumar, Ranjan Raj, Alam K...	India	September 24, 2021	2021	TV-MA	2 Seasons	International TV Shows, Romantic TV Shows, TV ...

In [8]:
```
df.tail()
```

Out[8]:

	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in
8802	Movie	Zodiac	David Fincher	Mark Ruffalo, Jake Gyllenhaal, Robert Downey J...	United States	November 20, 2019	2007	R	158 min	Cult Movies, Dramas, Thrillers
8803	TV Show	Zombie Dumb	NaN	NaN	NaN	July 1, 2019	2018	TV-Y7	2 Seasons	Kids' TV, Korean TV Shows, TV Comedies
8804	Movie	Zombieland	Ruben Fleischer	Jesse Eisenberg, Woody Harrelson, Emma Stone, ...	United States	November 1, 2019	2009	R	88 min	Comedies, Horror Movies
8805	Movie	Zoom	Peter Hewitt	Tim Allen, Courteney Cox, Chevy Chase, Kate Ma...	United States	January 11, 2020	2006	PG	88 min	Children & Family Movies, Comedies
8806	Movie	Zubaan	Mozez Singh	Vicky Kaushal, Sarah-Jane Dias, Raaghav Chanan...	India	March 2, 2019	2015	TV-14	111 min	Dramas, International Movies, Music & Musicals

Basic Statistical Summary of Dataset:

In [9]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 8807 entries, 0 to 8806
Data columns (total 10 columns):
 #   Column        Non-Null Count  Dtype 
---  ------        --------------  ----- 
 0   type          8807 non-null   object
 1   title         8807 non-null   object
 2   director      6173 non-null   object
 3   cast          7982 non-null   object
 4   country       7976 non-null   object
 5   date_added    8797 non-null   object
 6   release_year  8807 non-null   int64 
 7   rating        8803 non-null   object
 8   duration      8804 non-null   object
 9   listed_in     8807 non-null   object
dtypes: int64(1), object(9)
memory usage: 688.2+ KB
```

In [10]:
```
df.describe(include="all")
```

Out[10]:

	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in
count	8807	8807	6173	7982	7976	8797	8807.000000	8803	8804	8807
unique	2	8807	4528	7692	748	1767	NaN	17	220	514
top	Movie	Dick Johnson Is Dead	Rajiv Chilaka	David Attenborough	United States	January 1, 2020	NaN	TV-MA	1 Season	Dramas, International Movies
freq	6131	1	19	19	2818	109	NaN	3207	1793	362
mean	NaN	NaN	NaN	NaN	NaN	NaN	2014.180198	NaN	NaN	NaN
std	NaN	NaN	NaN	NaN	NaN	NaN	8.819312	NaN	NaN	NaN
min	NaN	NaN	NaN	NaN	NaN	NaN	1925.000000	NaN	NaN	NaN
25%	NaN	NaN	NaN	NaN	NaN	NaN	2013.000000	NaN	NaN	NaN
50%	NaN	NaN	NaN	NaN	NaN	NaN	2017.000000	NaN	NaN	NaN
75%	NaN	NaN	NaN	NaN	NaN	NaN	2019.000000	NaN	NaN	NaN
max	NaN	NaN	NaN	NaN	NaN	NaN	2021.000000	NaN	NaN	NaN

In [11]:
```
df.columns
```

Out[11]:
```
Index(['type', 'title', 'director', 'cast', 'country', 'date_added',
       'release_year', 'rating', 'duration', 'listed_in'],
      dtype='object')
```

In [12]:
```
df.shape
```

Out[12]:
```
(8807, 10)
```

Currently we have 8807 entries in the dataset with 10 features, which can be considered a relatively good dataset size.

Checking datatypes of columns in Dataset:

In [13]:
```
df.dtypes
```

Out[13]:
```
type            object
title           object
director        object
cast            object
country         object
date_added      object
release_year     int64
rating          object
duration        object
listed_in       object
dtype: object
```

Updating datatypes of some columns in Dataset:

In [14]:
```
df.head()
```

Out[14]:

	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in
0	Movie	Dick Johnson Is Dead	Kirsten Johnson	NaN	United States	September 25, 2021	2020	PG-13	90 min	Documentaries
1	TV Show	Blood & Water	NaN	Ama Qamata, Khosi Ngema, Gail Mabalane, Thaban...	South Africa	September 24, 2021	2021	TV-MA	2 Seasons	International TV Shows, TV Dramas, TV Mysteries
2	TV Show	Ganglands	Julien Leclercq	Sami Bouajila, Tracy Gotoas, Samuel Jouy, Nabi...	NaN	September 24, 2021	2021	TV-MA	1 Season	Crime TV Shows, International TV Shows, TV Act...
3	TV Show	Jailbirds New Orleans	NaN	NaN	NaN	September 24, 2021	2021	TV-MA	1 Season	Docuseries, Reality TV
4	TV Show	Kota Factory	NaN	Mayur More, Jitendra Kumar, Ranjan Raj, Alam K...	India	September 24, 2021	2021	TV-MA	2 Seasons	International TV Shows, Romantic TV Shows, TV ...

In [15]:
```
df["date_added"] = pd.to_datetime(df["date_added"])
```

In [16]:
```
df.columns
```

Out[16]:
```
Index(['type', 'title', 'director', 'cast', 'country', 'date_added',
       'release_year', 'rating', 'duration', 'listed_in'],
      dtype='object')
```

There is no need to update the names of columns in Dataset.

Checking for duplicate values in columns:

In [17]:
```
duplicate_data = df[df.duplicated()]
duplicate_data
```

Out[17]:

	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in

There are no duplicate rows in the dataset.

Checking for unique values in columns:

In [18]:
```
df.nunique()
```

Out[18]:
```
type               2
title           8807
director        4528
cast            7692
country          748
date_added      1714
release_year      74
rating            17
duration         220
listed_in        514
dtype: int64
```

Checking for null values in columns:

In [19]:
```
df.isna().sum()
```

Out[19]:
```
type               0
title              0
director        2634
cast             825
country          831
date_added        10
release_year       0
rating             4
duration           3
listed_in          0
dtype: int64
```

Calculate the percentage of missing values in columns:

In [20]:

```
print(f"Column Name  : Missing Value in %")
print("-"*35)
for col in df.columns.tolist():
    if df[col].isna().sum() > 0:
        print(f"{col:<12} : {(round((((df[col].isna().sum()) / df.shape[0]) * 100), 2)):0>5} %")
print("-"*35)
```

```
Column Name  : Missing Value in %
-----------------------------------
director     : 29.91 %
cast         : 09.37 %
country      : 09.44 %
date_added   : 00.11 %
rating       : 00.05 %
duration     : 00.03 %
-----------------------------------
```

In [21]:

```
df.columns
```

Out[21]:

```
Index(['type', 'title', 'director', 'cast', 'country', 'date_added',
       'release_year', 'rating', 'duration', 'listed_in'],
      dtype='object')
```

In [22]:

```
cat_cols = ["type", "country", "release_year", "rating", "duration"]

for col in cat_cols:
    print("\n")
    print(f"Column Name: {col}")
    print(f"Number of Unique Values: {df[col].nunique()}")
    print(f"Unique Values Percentage in Column {col}:\n")
    print((df[col].value_counts(normalize=True)*100).round(2))
    print("\n")
```

```
Column Name: type
Number of Unique Values: 2
Unique Values Percentage in Column type:

Movie      69.62
TV Show    30.38
Name: type, dtype: float64




Column Name: country
Number of Unique Values: 748
Unique Values Percentage in Column country:

United States                            35.33
India                                    12.19
United Kingdom                            5.25
Japan                                     3.07
South Korea                               2.49
                                         ...
Romania, Bulgaria, Hungary                0.01
Uruguay, Guatemala                        0.01
France, Senegal, Belgium                  0.01
Mexico, United States, Spain, Colombia    0.01
United Arab Emirates, Jordan              0.01
Name: country, Length: 748, dtype: float64




Column Name: release_year
Number of Unique Values: 74
Unique Values Percentage in Column release_year:

2018    13.02
2017    11.72
2019    11.70
2020    10.82
```

```
2016    10.24
        ...
1959     0.01
1925     0.01
1961     0.01
1947     0.01
1966     0.01
Name: release_year, Length: 74, dtype: float64




Column Name: rating
Number of Unique Values: 17
Unique Values Percentage in Column rating:

TV-MA       36.43
TV-14       24.54
TV-PG        9.80
R            9.08
PG-13        5.57
TV-Y7        3.79
TV-Y         3.49
PG           3.26
TV-G         2.50
NR           0.91
G            0.47
TV-Y7-FV     0.07
NC-17        0.03
UR           0.03
74 min       0.01
84 min       0.01
66 min       0.01
Name: rating, dtype: float64




Column Name: duration
Number of Unique Values: 220
Unique Values Percentage in Column duration:
```

```
1 Season     20.37
2 Seasons     4.83
3 Seasons     2.26
90 min        1.73
94 min        1.66
             ...
16 min        0.01
186 min       0.01
193 min       0.01
189 min       0.01
191 min       0.01
Name: duration, Length: 220, dtype: float64
```

In [ ]:

Challanges in data pre-processing of dataframe:

1. Normalize the DataFrame to un-nest data:

    - Use split and stack methods for the columns director, cast, country, and listed_in to separate multiple values.
    - Join the separate DataFrames together, then merge the final DataFrame with the original DataFrame using the title column to combine the data.
    - Remove duplicate columns from the original DataFrame df.

2. Deal with NaN values:

    - For categorical values, use mode imputation to fill missing data.
    - For numerical values, use median imputation to fill missing data.

3. Remove rows with mismatched values:

    - For example, delete rows with incorrect values in the rating column.
    - Remove duplicate rows from the DataFrame.

In [ ]:

```

```

1. Normalize the DataFrame to un-nest data:

- Use split and stack methods for the columns director, cast, country, and listed_in to separate multiple values.
- Join the separate DataFrames together, then merge the final DataFrame with the original DataFrame using the title column to combine the data.
- Remove duplicate columns from the original DataFrame df.

Use `split` and `stack` for column `director` and create `df_director` :

In [23]:

```
df.head()
```

Out[23]:

	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in
0	Movie	Dick Johnson Is Dead	Kirsten Johnson	NaN	United States	2021-09-25	2020	PG-13	90 min	Documentaries
1	TV Show	Blood & Water	NaN	Ama Qamata, Khosi Ngema, Gail Mabalane, Thaban...	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows, TV Dramas, TV Mysteries
2	TV Show	Ganglands	Julien Leclercq	Sami Bouajila, Tracy Gotoas, Samuel Jouy, Nabi...	NaN	2021-09-24	2021	TV-MA	1 Season	Crime TV Shows, International TV Shows, TV Act...
3	TV Show	Jailbirds New Orleans	NaN	NaN	NaN	2021-09-24	2021	TV-MA	1 Season	Docuseries, Reality TV
4	TV Show	Kota Factory	NaN	Mayur More, Jitendra Kumar, Ranjan Raj, Alam K...	India	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows, Romantic TV Shows, TV ...

In [24]:

```
list_director = df["director"].apply(lambda x: str(x).split(", ")).tolist()
```

In [25]:
```
df_director = pd.DataFrame(list_director, index = df["title"])
```

In [26]:
```
df_director = df_director.stack()
```

In [27]:
```
df_director = pd.DataFrame(df_director)
```

In [28]:
```
df_director.reset_index(inplace= True)
```

In [29]:
```
df_director = df_director[["title", 0]]
```

In [30]:
```
df_director.rename(columns = {0: "director"}, inplace = True)
```

In [31]:
```
df_director.head()
```

Out[31]:

	title	director
0	Dick Johnson Is Dead	Kirsten Johnson
1	Blood & Water	nan
2	Ganglands	Julien Leclercq
3	Jailbirds New Orleans	nan
4	Kota Factory	nan

In [ ]:
```

```

Use `split` and `stack` for column `cast` and create `df_cast` :

In [32]:
```
df.head()
```

Out[32]:

	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in
0	Movie	Dick Johnson Is Dead	Kirsten Johnson	NaN	United States	2021-09-25	2020	PG-13	90 min	Documentaries
1	TV Show	Blood & Water	NaN	Ama Qamata, Khosi Ngema, Gail Mabalane, Thaban...	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows, TV Dramas, TV Mysteries
2	TV Show	Ganglands	Julien Leclercq	Sami Bouajila, Tracy Gotoas, Samuel Jouy, Nabi...	NaN	2021-09-24	2021	TV-MA	1 Season	Crime TV Shows, International TV Shows, TV Act...
3	TV Show	Jailbirds New Orleans	NaN	NaN	NaN	2021-09-24	2021	TV-MA	1 Season	Docuseries, Reality TV
4	TV Show	Kota Factory	NaN	Mayur More, Jitendra Kumar, Ranjan Raj, Alam K...	India	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows, Romantic TV Shows, TV ...

In [33]:
```
list_cast = df["cast"].apply(lambda x: str(x).split(", ")).tolist()
```

In [34]:
```
df_cast = pd.DataFrame(list_cast, index=df["title"])
```

In [35]:
```
df_cast = df_cast.stack()
```

In [36]:
```
df_cast=pd.DataFrame(df_cast)
```

In [37]:
```
df_cast.reset_index(inplace=True)
```

In [38]:
```
df_cast = df_cast[["title", 0]]
```

In [39]:
```
df_cast.rename(columns = {0: 'cast'}, inplace = True)
```

In [40]:
```
df_cast.head()
```

Out[40]:

	title	cast
0	Dick Johnson Is Dead	nan
1	Blood & Water	Ama Qamata
2	Blood & Water	Khosi Ngema
3	Blood & Water	Gail Mabalane
4	Blood & Water	Thabang Molaba

In [ ]:
```

```

Use `split` and `stack` for column `country` and create `df_country` :

In [41]:
```
df.head()
```

Out[41]:

	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in
0	Movie	Dick Johnson Is Dead	Kirsten Johnson	NaN	United States	2021-09-25	2020	PG-13	90 min	Documentaries
1	TV Show	Blood & Water	NaN	Ama Qamata, Khosi Ngema, Gail Mabalane, Thaban...	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows, TV Dramas, TV Mysteries
2	TV Show	Ganglands	Julien Leclercq	Sami Bouajila, Tracy Gotoas, Samuel Jouy, Nabi...	NaN	2021-09-24	2021	TV-MA	1 Season	Crime TV Shows, International TV Shows, TV Act...
3	TV Show	Jailbirds New Orleans	NaN	NaN	NaN	2021-09-24	2021	TV-MA	1 Season	Docuseries, Reality TV
4	TV Show	Kota Factory	NaN	Mayur More, Jitendra Kumar, Ranjan Raj, Alam K...	India	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows, Romantic TV Shows, TV ...

In [42]:
```
list_country = df["country"].apply(lambda x: str(x).split(", ")).tolist()
```

In [43]:
```
df_country = pd.DataFrame(list_country, index = df["title"])
```

In [44]:
```
df_country = df_country.stack()
```

In [45]:
```
df_country = pd.DataFrame(df_country)
```

In [46]:
```
df_country.reset_index(inplace = True)
```

In [47]:
```
df_country = df_country[["title", 0]]
```

In [48]:
```
df_country.rename(columns = {0: "country"}, inplace = True)
```

In [49]:
```
df_country.head()
```

Out[49]:

	title	country
0	Dick Johnson Is Dead	United States
1	Blood & Water	South Africa
2	Ganglands	nan
3	Jailbirds New Orleans	nan
4	Kota Factory	India

In [ ]:
```

```

Use `split` and `stack` for column `list_listed` and create `df_listed_in` :

In [50]:
```
df.head()
```

Out[50]:

	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in
0	Movie	Dick Johnson Is Dead	Kirsten Johnson	NaN	United States	2021-09-25	2020	PG-13	90 min	Documentaries
1	TV Show	Blood & Water	NaN	Ama Qamata, Khosi Ngema, Gail Mabalane, Thaban...	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows, TV Dramas, TV Mysteries
2	TV Show	Ganglands	Julien Leclercq	Sami Bouajila, Tracy Gotoas, Samuel Jouy, Nabi...	NaN	2021-09-24	2021	TV-MA	1 Season	Crime TV Shows, International TV Shows, TV Act...
3	TV Show	Jailbirds New Orleans	NaN	NaN	NaN	2021-09-24	2021	TV-MA	1 Season	Docuseries, Reality TV
4	TV Show	Kota Factory	NaN	Mayur More, Jitendra Kumar, Ranjan Raj, Alam K...	India	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows, Romantic TV Shows, TV ...

In [51]:
```
list_listed_in = df["listed_in"].apply(lambda x: str(x).split(", ")).tolist()
```

In [52]:
```
df_listed_in = pd.DataFrame(list_listed_in, index=df["title"])
```

In [53]:
```
df_listed_in = df_listed_in.stack()
```

In [54]:
```
df_listed_in = pd.DataFrame(df_listed_in)
```

In [55]:
```
df_listed_in.reset_index(inplace= True)
```

In [56]:
```
df_listed_in = df_listed_in[["title", 0]]
```

In [57]:
```
df_listed_in.rename(columns = {0: "listed_in"}, inplace= True)
```

In [58]:

```
df_listed_in.head()
```

Out[58]:

	title	listed_in
0	Dick Johnson Is Dead	Documentaries
1	Blood & Water	International TV Shows
2	Blood & Water	TV Dramas
3	Blood & Water	TV Mysteries
4	Ganglands	Crime TV Shows

In [ ]:

```

```

Merge the normalised dataframe `df_director` with normalised dataframe `df_cast` on column `title` to get whole data:

In [59]:

```
first_merge_df = pd.merge(df_director, df_cast, how='inner', on="title")
first_merge_df.head()
```

Out[59]:

	title	director	cast
0	Dick Johnson Is Dead	Kirsten Johnson	nan
1	Blood & Water	nan	Ama Qamata
2	Blood & Water	nan	Khosi Ngema
3	Blood & Water	nan	Gail Mabalane
4	Blood & Water	nan	Thabang Molaba

Merge the dataframe `first_merge_df` with normalised dataframe `df_country` on column `title` to get whole data:

In [60]:

```
second_merge_df = pd.merge(first_merge_df, df_country, how='inner', on="title")
second_merge_df.head()
```

Out[60]:

	title	director	cast	country
0	Dick Johnson Is Dead	Kirsten Johnson	nan	United States
1	Blood & Water	nan	Ama Qamata	South Africa
2	Blood & Water	nan	Khosi Ngema	South Africa
3	Blood & Water	nan	Gail Mabalane	South Africa
4	Blood & Water	nan	Thabang Molaba	South Africa

Merge the dataframe `second_merge_df` with normalised dataframe `df_listed_in` on column `title` to get whole data:

In [61]:

```
third_merge_df = pd.merge(second_merge_df, df_listed_in, how='inner', on="title")
third_merge_df.head()
```

Out[61]:

	title	director	cast	country	listed_in
0	Dick Johnson Is Dead	Kirsten Johnson	nan	United States	Documentaries
1	Blood & Water	nan	Ama Qamata	South Africa	International TV Shows
2	Blood & Water	nan	Ama Qamata	South Africa	TV Dramas
3	Blood & Water	nan	Ama Qamata	South Africa	TV Mysteries
4	Blood & Water	nan	Khosi Ngema	South Africa	International TV Shows

Merge the dataframe `third_merge_df` with orginal dataframe `df` on column `title` to get whole data:

```
In [62]: final_merge_df = pd.merge(df, third_merge_df, how='inner', on="title")
         final_merge_df.drop(columns=["director_x", "cast_x", "country_x", "listed_in_x"], inplace = True)
         final_merge_df.rename(columns = {"director_y" : "director", "cast_y" : "cast", "country_y" : "country", "listed_in_y"
         final_merge_df.head(50)
```

Out[62]:

	type	title	date_added	release_year	rating	duration	director	cast	country	listed_in
0	Movie	Dick Johnson Is Dead	2021-09-25	2020	PG-13	90 min	Kirsten Johnson	nan	United States	Documentaries
1	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Ama Qamata	South Africa	International TV Shows
2	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Ama Qamata	South Africa	TV Dramas
3	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Ama Qamata	South Africa	TV Mysteries
4	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Khosi Ngema	South Africa	International TV Shows
5	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Khosi Ngema	South Africa	TV Dramas
6	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Khosi Ngema	South Africa	TV Mysteries
7	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Gail Mabalane	South Africa	International TV Shows
8	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Gail Mabalane	South Africa	TV Dramas
9	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Gail Mabalane	South Africa	TV Mysteries
10	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Thabang Molaba	South Africa	International TV Shows
11	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Thabang Molaba	South Africa	TV Dramas
12	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Thabang Molaba	South Africa	TV Mysteries
13	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Dillon Windvogel	South Africa	International TV Shows
14	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Dillon Windvogel	South Africa	TV Dramas
15	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Dillon Windvogel	South Africa	TV Mysteries

	type	title	date_added	release_year	rating	duration	director	cast	country	listed_in
16	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Natasha Thahane	South Africa	International TV Shows
17	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Natasha Thahane	South Africa	TV Dramas
18	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Natasha Thahane	South Africa	TV Mysteries
19	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Arno Greeff	South Africa	International TV Shows
20	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Arno Greeff	South Africa	TV Dramas
21	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Arno Greeff	South Africa	TV Mysteries
22	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Xolile Tshabalala	South Africa	International TV Shows
23	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Xolile Tshabalala	South Africa	TV Dramas
24	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Xolile Tshabalala	South Africa	TV Mysteries
25	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Getmore Sithole	South Africa	International TV Shows
26	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Getmore Sithole	South Africa	TV Dramas
27	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Getmore Sithole	South Africa	TV Mysteries
28	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Cindy Mahlangu	South Africa	International TV Shows
29	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Cindy Mahlangu	South Africa	TV Dramas
30	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Cindy Mahlangu	South Africa	TV Mysteries
31	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Ryle De Morny	South Africa	International TV Shows
32	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Ryle De Morny	South Africa	TV Dramas

	type	title	date_added	release_year	rating	duration	director	cast	country	listed_in
33	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Ryle De Morny	South Africa	TV Mysteries
34	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Greteli Fincham	South Africa	International TV Shows
35	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Greteli Fincham	South Africa	TV Dramas
36	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Greteli Fincham	South Africa	TV Mysteries
37	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Sello Maake Ka-Ncube	South Africa	International TV Shows
38	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Sello Maake Ka-Ncube	South Africa	TV Dramas
39	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Sello Maake Ka-Ncube	South Africa	TV Mysteries
40	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Odwa Gwanya	South Africa	International TV Shows
41	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Odwa Gwanya	South Africa	TV Dramas
42	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Odwa Gwanya	South Africa	TV Mysteries
43	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Mekaila Mathys	South Africa	International TV Shows
44	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Mekaila Mathys	South Africa	TV Dramas
45	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Mekaila Mathys	South Africa	TV Mysteries
46	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Sandi Schultz	South Africa	International TV Shows
47	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Sandi Schultz	South Africa	TV Dramas
48	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Sandi Schultz	South Africa	TV Mysteries
49	TV Show	Blood & Water	2021-09-24	2021	TV-MA	2 Seasons	nan	Duane Williams	South Africa	International TV Shows

In [63]:
```
final_merge_df.replace(to_replace=["nan"], value=[np.nan], inplace=True)
```

In [64]:
```
df.columns.tolist()
```

Out[64]:
```
['type',
 'title',
 'director',
 'cast',
 'country',
 'date_added',
 'release_year',
 'rating',
 'duration',
 'listed_in']
```

In [65]:

```
df_clean = final_merge_df[df.columns.tolist()]
df_clean.head(50)
```

Out[65]:

	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in
0	Movie	Dick Johnson Is Dead	Kirsten Johnson	NaN	United States	2021-09-25	2020	PG-13	90 min	Documentaries
1	TV Show	Blood & Water	NaN	Ama Qamata	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows
2	TV Show	Blood & Water	NaN	Ama Qamata	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Dramas
3	TV Show	Blood & Water	NaN	Ama Qamata	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Mysteries
4	TV Show	Blood & Water	NaN	Khosi Ngema	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows
5	TV Show	Blood & Water	NaN	Khosi Ngema	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Dramas
6	TV Show	Blood & Water	NaN	Khosi Ngema	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Mysteries
7	TV Show	Blood & Water	NaN	Gail Mabalane	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows
8	TV Show	Blood & Water	NaN	Gail Mabalane	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Dramas
9	TV Show	Blood & Water	NaN	Gail Mabalane	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Mysteries
10	TV Show	Blood & Water	NaN	Thabang Molaba	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows
11	TV Show	Blood & Water	NaN	Thabang Molaba	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Dramas
12	TV Show	Blood & Water	NaN	Thabang Molaba	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Mysteries
13	TV Show	Blood & Water	NaN	Dillon Windvogel	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows
14	TV Show	Blood & Water	NaN	Dillon Windvogel	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Dramas
15	TV Show	Blood & Water	NaN	Dillon Windvogel	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Mysteries

	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in
16	TV Show	Blood & Water	NaN	Natasha Thahane	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows
17	TV Show	Blood & Water	NaN	Natasha Thahane	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Dramas
18	TV Show	Blood & Water	NaN	Natasha Thahane	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Mysteries
19	TV Show	Blood & Water	NaN	Arno Greeff	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows
20	TV Show	Blood & Water	NaN	Arno Greeff	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Dramas
21	TV Show	Blood & Water	NaN	Arno Greeff	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Mysteries
22	TV Show	Blood & Water	NaN	Xolile Tshabalala	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows
23	TV Show	Blood & Water	NaN	Xolile Tshabalala	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Dramas
24	TV Show	Blood & Water	NaN	Xolile Tshabalala	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Mysteries
25	TV Show	Blood & Water	NaN	Getmore Sithole	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows
26	TV Show	Blood & Water	NaN	Getmore Sithole	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Dramas
27	TV Show	Blood & Water	NaN	Getmore Sithole	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Mysteries
28	TV Show	Blood & Water	NaN	Cindy Mahlangu	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows
29	TV Show	Blood & Water	NaN	Cindy Mahlangu	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Dramas
30	TV Show	Blood & Water	NaN	Cindy Mahlangu	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Mysteries
31	TV Show	Blood & Water	NaN	Ryle De Morny	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows
32	TV Show	Blood & Water	NaN	Ryle De Morny	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Dramas

	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in
33	TV Show	Blood & Water	NaN	Ryle De Morny	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Mysteries
34	TV Show	Blood & Water	NaN	Greteli Fincham	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows
35	TV Show	Blood & Water	NaN	Greteli Fincham	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Dramas
36	TV Show	Blood & Water	NaN	Greteli Fincham	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Mysteries
37	TV Show	Blood & Water	NaN	Sello Maake Ka-Ncube	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows
38	TV Show	Blood & Water	NaN	Sello Maake Ka-Ncube	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Dramas
39	TV Show	Blood & Water	NaN	Sello Maake Ka-Ncube	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Mysteries
40	TV Show	Blood & Water	NaN	Odwa Gwanya	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows
41	TV Show	Blood & Water	NaN	Odwa Gwanya	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Dramas
42	TV Show	Blood & Water	NaN	Odwa Gwanya	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Mysteries
43	TV Show	Blood & Water	NaN	Mekaila Mathys	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows
44	TV Show	Blood & Water	NaN	Mekaila Mathys	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Dramas
45	TV Show	Blood & Water	NaN	Mekaila Mathys	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Mysteries
46	TV Show	Blood & Water	NaN	Sandi Schultz	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows
47	TV Show	Blood & Water	NaN	Sandi Schultz	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Dramas
48	TV Show	Blood & Water	NaN	Sandi Schultz	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Mysteries
49	TV Show	Blood & Water	NaN	Duane Williams	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows

In [66]:

```
df_clean.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 201991 entries, 0 to 201990
Data columns (total 10 columns):
 #   Column        Non-Null Count   Dtype         
---  ------        --------------   -----         
 0   type          201991 non-null  object        
 1   title         201991 non-null  object        
 2   director      151348 non-null  object        
 3   cast          199845 non-null  object        
 4   country       190094 non-null  object        
 5   date_added    201833 non-null  datetime64[ns]
 6   release_year  201991 non-null  int64         
 7   rating        201924 non-null  object        
 8   duration      201988 non-null  object        
 9   listed_in     201991 non-null  object        
dtypes: datetime64[ns](1), int64(1), object(8)
memory usage: 17.0+ MB
```

In [67]:

```
df_clean.head()
```

Out[67]:

	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in
0	Movie	Dick Johnson Is Dead	Kirsten Johnson	NaN	United States	2021-09-25	2020	PG-13	90 min	Documentaries
1	TV Show	Blood & Water	NaN	Ama Qamata	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows
2	TV Show	Blood & Water	NaN	Ama Qamata	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Dramas
3	TV Show	Blood & Water	NaN	Ama Qamata	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Mysteries
4	TV Show	Blood & Water	NaN	Khosi Ngema	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows

In [68]:
```
df_clean.tail()
```

Out[68]:

	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in
201986	Movie	Zubaan	Mozez Singh	Anita Shabdish	India	2019-03-02	2015	TV-14	111 min	International Movies
201987	Movie	Zubaan	Mozez Singh	Anita Shabdish	India	2019-03-02	2015	TV-14	111 min	Music & Musicals
201988	Movie	Zubaan	Mozez Singh	Chittaranjan Tripathy	India	2019-03-02	2015	TV-14	111 min	Dramas
201989	Movie	Zubaan	Mozez Singh	Chittaranjan Tripathy	India	2019-03-02	2015	TV-14	111 min	International Movies
201990	Movie	Zubaan	Mozez Singh	Chittaranjan Tripathy	India	2019-03-02	2015	TV-14	111 min	Music & Musicals

In [69]:
```
df_clean.shape
```

Out[69]:
```
(201991, 10)
```

In [ ]:
```

```

2. Deal with NaN values:

- Add new column `year_added` to `df_clean` dataframe.
- For categorical values, use mode imputation to fill missing data.
- For numerical values, use median imputation to fill missing data.

Add new column year_added to df_clean dataframe.

In [70]:
```
df_clean.head()
```

Out[70]:

	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in
0	Movie	Dick Johnson Is Dead	Kirsten Johnson	NaN	United States	2021-09-25	2020	PG-13	90 min	Documentaries
1	TV Show	Blood & Water	NaN	Ama Qamata	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows
2	TV Show	Blood & Water	NaN	Ama Qamata	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Dramas
3	TV Show	Blood & Water	NaN	Ama Qamata	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Mysteries
4	TV Show	Blood & Water	NaN	Khosi Ngema	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows

In [71]:
```
df_clean["year_added"] = df_clean["date_added"].dt.year
```

In [72]:
```
df_clean["year_added"] = df_clean["year_added"].fillna(df_clean["year_added"].median())
df_clean["year_added"] = df_clean["year_added"].astype(np.int64)
```

In [73]:
```
df_clean.head()
```

Out[73]:

	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in	year_added
0	Movie	Dick Johnson Is Dead	Kirsten Johnson	NaN	United States	2021-09-25	2020	PG-13	90 min	Documentaries	2021
1	TV Show	Blood & Water	NaN	Ama Qamata	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows	2021
2	TV Show	Blood & Water	NaN	Ama Qamata	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Dramas	2021
3	TV Show	Blood & Water	NaN	Ama Qamata	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Mysteries	2021
4	TV Show	Blood & Water	NaN	Khosi Ngema	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows	2021

In [74]:
```
df_clean.columns.tolist()
```

Out[74]:
```
['type',
 'title',
 'director',
 'cast',
 'country',
 'date_added',
 'release_year',
 'rating',
 'duration',
 'listed_in',
 'year_added']
```

In [75]:
```
df_clean = df_clean[['type', 'title', 'director', 'cast', 'country', 'date_added', 'year_added', 'release_year', 'rati
```

In [76]:
```
df_clean.head()
```

Out[76]:

	type	title	director	cast	country	date_added	year_added	release_year	rating	duration	listed_in
0	Movie	Dick Johnson Is Dead	Kirsten Johnson	NaN	United States	2021-09-25	2021	2020	PG-13	90 min	Documentaries
1	TV Show	Blood & Water	NaN	Ama Qamata	South Africa	2021-09-24	2021	2021	TV-MA	2 Seasons	International TV Shows
2	TV Show	Blood & Water	NaN	Ama Qamata	South Africa	2021-09-24	2021	2021	TV-MA	2 Seasons	TV Dramas
3	TV Show	Blood & Water	NaN	Ama Qamata	South Africa	2021-09-24	2021	2021	TV-MA	2 Seasons	TV Mysteries
4	TV Show	Blood & Water	NaN	Khosi Ngema	South Africa	2021-09-24	2021	2021	TV-MA	2 Seasons	International TV Shows

In [77]:

```
df_clean.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 201991 entries, 0 to 201990
Data columns (total 11 columns):
 #   Column        Non-Null Count   Dtype         
---  ------        --------------   -----         
 0   type          201991 non-null  object        
 1   title         201991 non-null  object        
 2   director      151348 non-null  object        
 3   cast          199845 non-null  object        
 4   country       190094 non-null  object        
 5   date_added    201833 non-null  datetime64[ns]
 6   year_added    201991 non-null  int64         
 7   release_year  201991 non-null  int64         
 8   rating        201924 non-null  object        
 9   duration      201988 non-null  object        
 10  listed_in     201991 non-null  object        
dtypes: datetime64[ns](1), int64(2), object(8)
memory usage: 18.5+ MB
```

2. Deal with NaN values:

- For categorical values, use mode imputation to fill missing data.
- For numerical values, use median imputation to fill missing data.

```
In [78]: df_clean.isna().sum()
```

```
Out[78]: type                0
         title               0
         director        50643
         cast             2146
         country         11897
         date_added        158
         year_added          0
         release_year        0
         rating             67
         duration            3
         listed_in           0
         dtype: int64
```

Get percentage of missing values in columns of `df_clean`

```
In [79]: print(f"Column Name  : Missing Value in %")
         print("-"*35)
         for col in df_clean.columns.tolist():
             if df_clean[col].isna().sum() > 0:
                 print(f"{col:<12} : {(round((((df_clean[col].isna().sum()) / df_clean.shape[0]) * 100), 2)):0>5} %")
         print("-"*35)
```

```
Column Name  : Missing Value in %
-----------------------------------
director     : 25.07 %
cast         : 01.06 %
country      : 05.89 %
date_added   : 00.08 %
rating       : 00.03 %
duration     : 000.0 %
-----------------------------------
```

We have chosen to use 'Not Available' as the imputation value for the 'director' column since 25% of the rows are missing this information. In this context, employing mode-based imputation may not be appropriate or effective, as it could lead to an inaccurate representation of the underlying data.

In [80]:
```
df_clean["director"].fillna('Not Available', inplace = True)
```

In [81]:
```
df_clean.isna().sum()
```

Out[81]:
```
type                0
title               0
director            0
cast             2146
country         11897
date_added        158
year_added          0
release_year        0
rating             67
duration            3
listed_in           0
dtype: int64
```

In [ ]:

We have chosen to use 'Not Available' as the imputation value for the 'country' column since 5% of the rows are missing this information. In this context, employing mode-based imputation may not be appropriate or effective, as it could lead to an inaccurate representation of the underlying data.

In [82]:
```
df_clean["country"].fillna('Not Available', inplace = True)
```

In [83]:

```
df_clean.isna().sum()
```

Out[83]:

```
type               0
title              0
director           0
cast            2146
country            0
date_added       158
year_added         0
release_year       0
rating            67
duration           3
listed_in          0
dtype: int64
```

In [ ]:

```
```

3. Remove rows with mismatched values:

- For example, delete rows with incorrect values in the rating column.
- Remove duplicate rows from the DataFrame.

Get percentage of missing values in the columns of dataframe `df_clean` :

In [84]:

```
print(f"Column Name  : Missing Value in %")
print("-"*35)
for col in df_clean.columns.tolist():
    if df_clean[col].isna().sum() > 0:
        print(f"{col:<12} : {(round((((df_clean[col].isna().sum()) / df_clean.shape[0]) * 100), 2)):0>5} %")
print("-"*35)
```

```
Column Name  : Missing Value in %
-----------------------------------
cast         : 01.06 %
date_added   : 00.08 %
rating       : 00.03 %
duration     : 000.0 %
-----------------------------------
```

Less than 3% of the rows have missing values in the cast, date_added, rating, and duration columns. To maintain data integrity, we will remove rows with NaN values in these columns.

In [85]:

```
df_clean = df_clean[df_clean["cast"].notna()]
df_clean = df_clean[df_clean["date_added"].notna()]
df_clean = df_clean[df_clean["rating"].notna()]
df_clean = df_clean[df_clean["duration"].notna()]
```

In [86]:

```
df_clean.reset_index(inplace= True)
```

In [87]:

```
df_clean.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 199617 entries, 0 to 199616
Data columns (total 12 columns):
 #   Column        Non-Null Count   Dtype         
---  ------        --------------   -----         
 0   index         199617 non-null  int64         
 1   type          199617 non-null  object        
 2   title         199617 non-null  object        
 3   director      199617 non-null  object        
 4   cast          199617 non-null  object        
 5   country       199617 non-null  object        
 6   date_added    199617 non-null  datetime64[ns]
 7   year_added    199617 non-null  int64         
 8   release_year  199617 non-null  int64         
 9   rating        199617 non-null  object        
 10  duration      199617 non-null  object        
 11  listed_in     199617 non-null  object        
dtypes: datetime64[ns](1), int64(3), object(8)
memory usage: 18.3+ MB
```

In [88]:

```
df_clean.drop(['index'], axis=1, inplace=True)
```

In [89]:

```
df_clean.isna().sum()
```

Out[89]:

```
type            0
title           0
director        0
cast            0
country         0
date_added      0
year_added      0
release_year    0
rating          0
duration        0
listed_in       0
dtype: int64
```

In [90]:
```
df_clean["rating"].value_counts()
```

Out[90]:
```
TV-MA       72945
TV-14       43332
R           25843
PG-13       16201
TV-PG       14545
PG          10905
TV-Y7        6247
TV-Y         3607
TV-G         2674
G            1528
NR           1475
NC-17         149
UR             86
TV-Y7-FV       80
Name: rating, dtype: int64
```

Drop the duplicate rows from dataframe `df_clean` :

In [91]:

```
df_clean.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 199617 entries, 0 to 199616
Data columns (total 11 columns):
 #   Column        Non-Null Count   Dtype         
---  ------        --------------   -----         
 0   type          199617 non-null  object        
 1   title         199617 non-null  object        
 2   director      199617 non-null  object        
 3   cast          199617 non-null  object        
 4   country       199617 non-null  object        
 5   date_added    199617 non-null  datetime64[ns]
 6   year_added    199617 non-null  int64         
 7   release_year  199617 non-null  int64         
 8   rating        199617 non-null  object        
 9   duration      199617 non-null  object        
 10  listed_in     199617 non-null  object        
dtypes: datetime64[ns](1), int64(2), object(8)
memory usage: 16.8+ MB
```

In [92]:

```
df_clean.shape
```

Out[92]:

```
(199617, 11)
```

In [93]:

```
df_clean.drop_duplicates(keep="first", inplace=True)
```

In [94]:

```
df_clean.reset_index(inplace= True)
```

In [95]:

```
df_clean.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 199562 entries, 0 to 199561
Data columns (total 12 columns):
 #   Column        Non-Null Count   Dtype         
---  ------        --------------   -----         
 0   index         199562 non-null  int64         
 1   type          199562 non-null  object        
 2   title         199562 non-null  object        
 3   director      199562 non-null  object        
 4   cast          199562 non-null  object        
 5   country       199562 non-null  object        
 6   date_added    199562 non-null  datetime64[ns]
 7   year_added    199562 non-null  int64         
 8   release_year  199562 non-null  int64         
 9   rating        199562 non-null  object        
 10  duration      199562 non-null  object        
 11  listed_in     199562 non-null  object        
dtypes: datetime64[ns](1), int64(3), object(8)
memory usage: 18.3+ MB
```

In [96]:

```
df_clean.shape
```

Out[96]:

```
(199562, 12)
```

In [97]:

```
df_clean.drop(['index'], axis=1, inplace=True)
```

In [98]:
```
df_clean.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 199562 entries, 0 to 199561
Data columns (total 11 columns):
 #   Column        Non-Null Count   Dtype
---  ------        --------------   -----
 0   type          199562 non-null  object
 1   title         199562 non-null  object
 2   director      199562 non-null  object
 3   cast          199562 non-null  object
 4   country       199562 non-null  object
 5   date_added    199562 non-null  datetime64[ns]
 6   year_added    199562 non-null  int64
 7   release_year  199562 non-null  int64
 8   rating        199562 non-null  object
 9   duration      199562 non-null  object
 10  listed_in     199562 non-null  object
dtypes: datetime64[ns](1), int64(2), object(8)
memory usage: 16.7+ MB
```

In [99]:
```
df_clean.head()
```

Out[99]:

	type	title	director	cast	country	date_added	year_added	release_year	rating	duration	listed_in
0	TV Show	Blood & Water	Not Available	Ama Qamata	South Africa	2021-09-24	2021	2021	TV-MA	2 Seasons	International TV Shows
1	TV Show	Blood & Water	Not Available	Ama Qamata	South Africa	2021-09-24	2021	2021	TV-MA	2 Seasons	TV Dramas
2	TV Show	Blood & Water	Not Available	Ama Qamata	South Africa	2021-09-24	2021	2021	TV-MA	2 Seasons	TV Mysteries
3	TV Show	Blood & Water	Not Available	Khosi Ngema	South Africa	2021-09-24	2021	2021	TV-MA	2 Seasons	International TV Shows
4	TV Show	Blood & Water	Not Available	Khosi Ngema	South Africa	2021-09-24	2021	2021	TV-MA	2 Seasons	TV Dramas

Create deep copy `df_final` from `df_clean` , which will be used for visualization.

In [100]:
```
df_final = df_clean.copy()
```

In [101]:
```
df_final.head()
```

Out[101]:

	type	title	director	cast	country	date_added	year_added	release_year	rating	duration	listed_in
0	TV Show	Blood & Water	Not Available	Ama Qamata	South Africa	2021-09-24	2021	2021	TV-MA	2 Seasons	International TV Shows
1	TV Show	Blood & Water	Not Available	Ama Qamata	South Africa	2021-09-24	2021	2021	TV-MA	2 Seasons	TV Dramas
2	TV Show	Blood & Water	Not Available	Ama Qamata	South Africa	2021-09-24	2021	2021	TV-MA	2 Seasons	TV Mysteries
3	TV Show	Blood & Water	Not Available	Khosi Ngema	South Africa	2021-09-24	2021	2021	TV-MA	2 Seasons	International TV Shows
4	TV Show	Blood & Water	Not Available	Khosi Ngema	South Africa	2021-09-24	2021	2021	TV-MA	2 Seasons	TV Dramas

In [102]:
```
df_final.columns.tolist()
```

Out[102]:
```
['type',
 'title',
 'director',
 'cast',
 'country',
 'date_added',
 'year_added',
 'release_year',
 'rating',
 'duration',
 'listed_in']
```

In [103]:

```
def process_duration_column(df, column_name):
    # Create empty columns for duration_minutes and duration_seasons
    df['duration_minutes'] = -1
    df['duration_seasons'] = -1

    # Iterate through the rows in the DataFrame
    for index, row in df.iterrows():
        value = str(row[column_name]).lower()

        # Check if the value contains 'min' or 'seasons' (ignoring case)
        if 'min' in value:
            # Extract the number and store it in the duration_minutes column
            df.at[index, 'duration_minutes'] = int(''.join(filter(str.isdigit, value)))
        elif 'seasons' in value:
            # Extract the number and store it in the duration_seasons column
            df.at[index, 'duration_seasons'] = int(''.join(filter(str.isdigit, value)))

    # Delete the original column
    df = df.drop(column_name, axis=1)

    return df
```

In [104]:

```
df_final = process_duration_column(df_final, 'duration')
```

In [105]:
```
df_final.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 199562 entries, 0 to 199561
Data columns (total 12 columns):
 #   Column             Non-Null Count   Dtype
---  ------             --------------   -----
 0   type               199562 non-null  object
 1   title              199562 non-null  object
 2   director           199562 non-null  object
 3   cast               199562 non-null  object
 4   country            199562 non-null  object
 5   date_added         199562 non-null  datetime64[ns]
 6   year_added         199562 non-null  int64
 7   release_year       199562 non-null  int64
 8   rating             199562 non-null  object
 9   listed_in          199562 non-null  object
 10  duration_minutes   199562 non-null  int64
 11  duration_seasons   199562 non-null  int64
dtypes: datetime64[ns](1), int64(4), object(7)
memory usage: 18.3+ MB
```

In [106]:
```
df_final.shape
```

Out[106]:
```
(199562, 12)
```

In [107]:
```
df_final.head()
```

Out[107]:

	type	title	director	cast	country	date_added	year_added	release_year	rating	listed_in	duration_minutes	duration_seasons
0	TV Show	Blood & Water	Not Available	Ama Qamata	South Africa	2021-09-24	2021	2021	TV-MA	International TV Shows	-1	2
1	TV Show	Blood & Water	Not Available	Ama Qamata	South Africa	2021-09-24	2021	2021	TV-MA	TV Dramas	-1	2
2	TV Show	Blood & Water	Not Available	Ama Qamata	South Africa	2021-09-24	2021	2021	TV-MA	TV Mysteries	-1	2
3	TV Show	Blood & Water	Not Available	Khosi Ngema	South Africa	2021-09-24	2021	2021	TV-MA	International TV Shows	-1	2
4	TV Show	Blood & Water	Not Available	Khosi Ngema	South Africa	2021-09-24	2021	2021	TV-MA	TV Dramas	-1	2

In [108]:
```
df_final.tail()
```

Out[108]:

	type	title	director	cast	country	date_added	year_added	release_year	rating	listed_in	duration_minutes	duration_seas
199557	Movie	Zubaan	Mozez Singh	Anita Shabdish	India	2019-03-02	2019	2015	TV-14	International Movies	111	
199558	Movie	Zubaan	Mozez Singh	Anita Shabdish	India	2019-03-02	2019	2015	TV-14	Music & Musicals	111	
199559	Movie	Zubaan	Mozez Singh	Chittaranjan Tripathy	India	2019-03-02	2019	2015	TV-14	Dramas	111	
199560	Movie	Zubaan	Mozez Singh	Chittaranjan Tripathy	India	2019-03-02	2019	2015	TV-14	International Movies	111	
199561	Movie	Zubaan	Mozez Singh	Chittaranjan Tripathy	India	2019-03-02	2019	2015	TV-14	Music & Musicals	111	

In [109]:
```
df_final.describe(include="all")
```

Out[109]:

	type	title	director	cast	country	date_added	year_added	release_year	rating	listed_in	duration_minutes	duration_sea
count	199562	199562	199562	199562	199562	199562	199562.000000	199562.000000	199562	199562	199562.000000	199562.00
unique	2	7965	4528	36392	120	1663	NaN	NaN	14	42	NaN	
top	Movie	Kahlil Gibran's The Prophet	Not Available	Liam Neeson	United States	2020-01-01 00:00:00	NaN	NaN	TV-MA	Dramas	NaN	
freq	144448	700	49687	161	58495	3733	NaN	NaN	72897	29736	NaN	
first	NaN	NaN	NaN	NaN	NaN	2008-01-01 00:00:00	NaN	NaN	NaN	NaN	NaN	
last	NaN	NaN	NaN	NaN	NaN	2021-09-24 00:00:00	NaN	NaN	NaN	NaN	NaN	
mean	NaN	NaN	NaN	NaN	NaN	NaN	2018.969298	2013.421132	NaN	NaN	77.242787	-0.53
std	NaN	NaN	NaN	NaN	NaN	NaN	1.550009	9.008441	NaN	NaN	52.658881	1.53
min	NaN	NaN	NaN	NaN	NaN	NaN	2008.000000	1942.000000	NaN	NaN	-1.000000	-1.00
25%	NaN	NaN	NaN	NaN	NaN	NaN	2018.000000	2012.000000	NaN	NaN	-1.000000	-1.00
50%	NaN	NaN	NaN	NaN	NaN	NaN	2019.000000	2016.000000	NaN	NaN	95.000000	-1.00
75%	NaN	NaN	NaN	NaN	NaN	NaN	2020.000000	2019.000000	NaN	NaN	112.000000	-1.00
max	NaN	NaN	NaN	NaN	NaN	NaN	2021.000000	2021.000000	NaN	NaN	312.000000	17.00

In [110]:
```
df_final.nunique()
```

Out[110]:
```
type                    2
title                7965
director             4528
cast                36392
country               120
date_added           1663
year_added             14
release_year           72
rating                 14
listed_in              42
duration_minutes      202
duration_seasons       15
dtype: int64
```

In [111]:

```
cat_cols = df_final.columns.tolist()

for col in cat_cols:
    print("\n")
    print(f"Column Name: {col}")
    print(f"Number of Unique Values: {df_final[col].nunique()}")
    print(f"Unique Values Percentage in Column (Top 10) {col}:\n")
    print((df_final[col].value_counts(normalize=True)*100).head(10).round(2))
    if df_final[col].nunique() < 500:
      print(f"Unique Values in Column: {df_final[col].unique()}")
    print("\n")
```

```
Column Name: type
Number of Unique Values: 2
Unique Values Percentage in Column (Top 10) type:

Movie      72.38
TV Show    27.62
Name: type, dtype: float64
Unique Values in Column: ['TV Show' 'Movie']




Column Name: title
Number of Unique Values: 7965
Unique Values Percentage in Column (Top 10) title:

Kahlil Gibran's The Prophet    0.35
Holidays                       0.25
Movie 43                       0.23
The Eddy                       0.21
Narcos                         0.19
Cloud Atlas                    0.18
Sincerely Yours, Dhaka         0.17
Kon-Tiki                       0.15
Olmo & the Seagull             0.15
HALO Legends                   0.14
Name: title, dtype: float64




Column Name: director
Number of Unique Values: 4528
Unique Values Percentage in Column (Top 10) director:

Not Available          24.90
Martin Scorsese         0.21
Youssef Chahine         0.20
Cathy Garcia-Molina     0.18
```

```
Steven Spielberg        0.18
Lars von Trier          0.17
Raja Gosnell            0.15
Tom Hooper              0.15
McG                     0.15
David Dhawan            0.14
Name: director, dtype: float64




Column Name: cast
Number of Unique Values: 36392
Unique Values Percentage in Column (Top 10) cast:

Liam Neeson         0.08
Alfred Molina       0.08
John Krasinski      0.07
Salma Hayek         0.07
Frank Langella      0.06
Anupam Kher         0.06
John Rhys-Davies    0.06
Shah Rukh Khan      0.05
Naseeruddin Shah    0.05
Radhika Apte        0.05
Name: cast, dtype: float64




Column Name: country
Number of Unique Values: 120
Unique Values Percentage in Column (Top 10) country:

United States     29.31
India             11.38
United Kingdom     6.36
Not Available      5.80
Japan              4.30
France             4.09
Canada             3.93
Spain              2.63
```

```
South Korea        2.52
Germany            2.17
Name: country, dtype: float64
Unique Values in Column: ['South Africa' 'Not Available' 'India' 'United States' 'Ghana'
 'Burkina Faso' 'United Kingdom' 'Germany' 'Ethiopia' 'Czech Republic'
 'Mexico' 'Turkey' 'Australia' 'France' 'Finland' 'China' 'Canada' 'Japan'
 'Nigeria' 'Spain' 'Belgium' 'South Korea' 'Singapore' 'Italy' 'Romania'
 'Argentina' 'Venezuela' 'Hong Kong' 'Russia' '' 'Ireland' 'Nepal'
 'New Zealand' 'Brazil' 'Greece' 'Jordan' 'Colombia' 'Switzerland'
 'Israel' 'Taiwan' 'Bulgaria' 'Algeria' 'Poland' 'Saudi Arabia' 'Thailand'
 'Indonesia' 'Kuwait' 'Netherlands' 'Egypt' 'Malaysia' 'Vietnam' 'Hungary'
 'Sweden' 'Lebanon' 'Syria' 'Philippines' 'Iceland' 'Denmark'
 'United Arab Emirates' 'Norway' 'Qatar' 'Mauritius' 'Austria' 'Cameroon'
 'United Kingdom,' 'Kenya' 'Chile' 'Luxembourg' 'Cambodia' 'Bangladesh'
 'Portugal' 'Cayman Islands' 'Senegal' 'Serbia' 'Malta' 'Namibia' 'Angola'
 'Uruguay' 'Peru' 'Mozambique' 'Cambodia,' 'Belarus' 'Zimbabwe'
 'Puerto Rico' 'Cyprus' 'Guatemala' 'Pakistan' 'Malawi' 'Paraguay'
 'Croatia' 'Iran' 'West Germany' 'Albania' 'Soviet Union' 'Georgia'
 'Morocco' 'Slovakia' 'Bermuda' 'Ecuador' 'Bahamas' 'Sri Lanka' 'Latvia'
 'Liechtenstein' 'Cuba' 'Nicaragua' 'Poland,' 'Slovenia'
 'Dominican Republic' 'Azerbaijan' 'Iraq' 'Vatican City' 'Ukraine'
 'Jamaica' 'Lithuania' 'Afghanistan' 'Somalia' 'Sudan' 'Panama'
 'East Germany' 'Montenegro']




Column Name: date_added
Number of Unique Values: 1663
Unique Values Percentage in Column (Top 10) date_added:

2020-01-01    1.87
2019-11-01    1.13
2021-07-01    1.11
2017-10-01    0.94
2021-09-01    0.88
2018-03-01    0.87
2019-12-31    0.85
2019-10-01    0.77
2018-10-01    0.70
2021-06-02    0.63
Name: date_added, dtype: float64
```

```
Column Name: year_added
Number of Unique Values: 14
Unique Values Percentage in Column (Top 10) year_added:

2019    23.30
2020    22.87
2021    18.12
2018    17.73
2017    12.43
2016     4.19
2015     0.76
2014     0.22
2011     0.22
2013     0.10
Name: year_added, dtype: float64
Unique Values in Column: [2021 2020 2019 2018 2017 2016 2015 2014 2013 2012 2011 2009 2008 2010]




Column Name: release_year
Number of Unique Values: 72
Unique Values Percentage in Column (Top 10) release_year:

2018    12.09
2019    10.81
2017    10.12
2020     9.71
2016     9.11
2015     6.99
2021     5.83
2014     4.51
2013     3.81
2012     3.16
Name: release_year, dtype: float64
Unique Values in Column: [2021 1993 2020 2018 1996 1998 1997 2010 2013 2017 1975 1978 1983 1987
 2012 2001 2014 2002 2003 2004 2011 2008 2009 2007 2005 2006 1994 2019
 2016 2015 1982 1989 1990 1991 1999 1986 1992 1984 1980 1961 2000 1995
 1985 1976 1959 1988 1981 1972 1964 1954 1979 1958 1956 1963 1970 1973
 1974 1960 1966 1971 1962 1969 1977 1967 1968 1965 1945 1946 1955 1942
 1947 1944]




Column Name: rating
Number of Unique Values: 14
Unique Values Percentage in Column (Top 10) rating:

TV-MA    36.53
TV-14    21.71
R        12.95
PG-13     8.12
TV-PG     7.29
PG        5.46
TV-Y7     3.13
TV-Y      1.81
TV-G      1.34
G         0.77
Name: rating, dtype: float64
Unique Values in Column: ['TV-MA' 'PG' 'TV-14' 'PG-13' 'TV-PG' 'TV-Y' 'TV-Y7' 'R' 'TV-G' 'G'
 'NC-17' 'NR' 'TV-Y7-FV' 'UR']




Column Name: listed_in
Number of Unique Values: 42
Unique Values Percentage in Column (Top 10) listed_in:

Dramas                      14.90
International Movies        13.96
Comedies                    10.43
International TV Shows       6.36
Action & Adventure           6.12
Independent Movies           4.92
Children & Family Movies     4.87
TV Dramas                    4.47
Thrillers                    3.56
Romantic Movies              3.21
```

```
Name: listed_in, dtype: float64
Unique Values in Column: ['International TV Shows' 'TV Dramas' 'TV Mysteries' 'Crime TV Shows'
 'TV Action & Adventure' 'Romantic TV Shows' 'TV Comedies' 'TV Horror'
 'Children & Family Movies' 'Dramas' 'Independent Movies'
 'International Movies' 'British TV Shows' 'Reality TV' 'Comedies'
 'Spanish-Language TV Shows' 'Thrillers' 'Romantic Movies' 'Docuseries'
 'Music & Musicals' 'Horror Movies' 'Sci-Fi & Fantasy' 'TV Thrillers'
 "Kids' TV" 'Action & Adventure' 'TV Sci-Fi & Fantasy' 'Classic Movies'
 'Anime Features' 'Documentaries' 'Sports Movies' 'Anime Series'
 'Korean TV Shows' 'Teen TV Shows' 'Cult Movies' 'TV Shows'
 'Faith & Spirituality' 'LGBTQ Movies' 'Stand-Up Comedy' 'Movies'
 'Stand-Up Comedy & Talk Shows' 'Classic & Cult TV' 'Science & Nature TV']




Column Name: duration_minutes
Number of Unique Values: 202
Unique Values Percentage in Column (Top 10) duration_minutes:

-1      27.62
 94      2.17
 106     2.02
 97      1.81
 95      1.78
 96      1.72
 93      1.72
 90      1.63
 105     1.60
 107     1.55
Name: duration_minutes, dtype: float64
Unique Values in Column: [ -1  91 125 104 127  94 161  61 166 147 103  97 106 111 110 105  96 124
 116  98 115 122  99  88 100 102  93  95  85  83 113  13 182  48 145  87
  90 117 128 119 143 114 118 108  63 121 142 154 120  82 109 101  86 229
  76  89 156 112 107 129  92 135 136 165 150 133  84 140  64  59 139 148
 189 141 130 138 132 123  65  68  67  66  62  69  70  74 131  39  46 126
 155 159 137  12 273  36  34  77  49  72  78 204 212  25  47  81  32  35
  71 149  33  15  54  58  80 224 162  60  37  75  79  55 158 164 173 181
 185  73  24  51 151  42  22 134 177  52  53   8  57  28  50  26  45 171
  27  44  29 146 157 203  21  30 194 233 237 230 195 253 152 190 160  23
 208 180 144 174 170 192 209 187 172 186  11 193 176  17  56 169  40  20
  10 168 312 153 214  31 163  19  14 179  38  43 200 196 167  41 178 228
  18 205 201 191]




Column Name: duration_seasons
Number of Unique Values: 15
Unique Values Percentage in Column (Top 10) duration_seasons:

-1     89.57
 2      4.71
 3      2.52
 4      1.06
 5      0.85
 7      0.42
 6      0.32
 8      0.14
 9      0.13
 10     0.10
Name: duration_seasons, dtype: float64
Unique Values in Column: [ 2 -1  9  4  5  3  6  7 10  8 17 13 15 12 11]
```

In [112]:

```
df_final["director"].value_counts().head(20)
```

Out[112]:

```
Not Available          49687
Martin Scorsese          419
Youssef Chahine          409
Cathy Garcia-Molina      356
Steven Spielberg         355
Lars von Trier           336
Raja Gosnell             308
Tom Hooper               306
McG                      293
David Dhawan             270
Wilson Yip               260
Don Michael Paul         255
Martin Campbell          248
Noah Baumbach            242
Olivier Assayas          240
Anurag Kashyap           234
Yorgos Lanthimos         231
Umesh Mehra              228
Yılmaz Erdoğan           227
Lana Wachowski           226
Name: director, dtype: int64
```

```
In [113]: df_final["country"].value_counts().head(20)
```

```
Out[113]: United States     58495
          India             22717
          United Kingdom    12693
          Not Available     11578
          Japan              8575
          France             8170
          Canada             7849
          Spain              5249
          South Korea        5035
          Germany            4335
          Mexico             3905
          China              3309
          Turkey             2714
          Australia          2554
          Nigeria            2446
          Hong Kong          2355
          Egypt              2313
          Indonesia          2121
          Taiwan             2102
          Belgium            2031
          Name: country, dtype: int64
```

```
In [ ]:
```

In [114]:
```
df_final.head()
```

Out[114]:

	type	title	director	cast	country	date_added	year_added	release_year	rating	listed_in	duration_minutes	duration_seasons
0	TV Show	Blood & Water	Not Available	Ama Qamata	South Africa	2021-09-24	2021	2021	TV-MA	International TV Shows	-1	2
1	TV Show	Blood & Water	Not Available	Ama Qamata	South Africa	2021-09-24	2021	2021	TV-MA	TV Dramas	-1	2
2	TV Show	Blood & Water	Not Available	Ama Qamata	South Africa	2021-09-24	2021	2021	TV-MA	TV Mysteries	-1	2
3	TV Show	Blood & Water	Not Available	Khosi Ngema	South Africa	2021-09-24	2021	2021	TV-MA	International TV Shows	-1	2
4	TV Show	Blood & Water	Not Available	Khosi Ngema	South Africa	2021-09-24	2021	2021	TV-MA	TV Dramas	-1	2

In [115]:

```
df_final
```

Out[115]:

	type	title	director	cast	country	date_added	year_added	release_year	rating	listed_in	duration_minutes	duration_seas
0	TV Show	Blood & Water	Not Available	Ama Qamata	South Africa	2021-09-24	2021	2021	TV-MA	International TV Shows	-1	
1	TV Show	Blood & Water	Not Available	Ama Qamata	South Africa	2021-09-24	2021	2021	TV-MA	TV Dramas	-1	
2	TV Show	Blood & Water	Not Available	Ama Qamata	South Africa	2021-09-24	2021	2021	TV-MA	TV Mysteries	-1	
3	TV Show	Blood & Water	Not Available	Khosi Ngema	South Africa	2021-09-24	2021	2021	TV-MA	International TV Shows	-1	
4	TV Show	Blood & Water	Not Available	Khosi Ngema	South Africa	2021-09-24	2021	2021	TV-MA	TV Dramas	-1	
...	...	...	...	...	...	...	...	...	...	...	...	
199557	Movie	Zubaan	Mozez Singh	Anita Shabdish	India	2019-03-02	2019	2015	TV-14	International Movies	111	
199558	Movie	Zubaan	Mozez Singh	Anita Shabdish	India	2019-03-02	2019	2015	TV-14	Music & Musicals	111	
199559	Movie	Zubaan	Mozez Singh	Chittaranjan Tripathy	India	2019-03-02	2019	2015	TV-14	Dramas	111	
199560	Movie	Zubaan	Mozez Singh	Chittaranjan Tripathy	India	2019-03-02	2019	2015	TV-14	International Movies	111	
199561	Movie	Zubaan	Mozez Singh	Chittaranjan Tripathy	India	2019-03-02	2019	2015	TV-14	Music & Musicals	111	

199562 rows × 12 columns

Create `streaming_service_data_final.csv` file from df_final dataframe.

In [116]:

```
df_final.to_csv("streaming_service_data_final.csv", index=False)
```

In [ ]:

```

```

Exploratory Data Analysis (EDA):

Defining important functions for performing EDA:

In [117]:

```
def display_normalized_value_counts(data, col):
    print(data[col].value_counts(normalize=True).round(4)*100)
```

In [118]:

```
def display_cumulative_value_counts(data, col):
    print((data[col].value_counts(normalize=True).round(4)*100).cumsum())
```

In [119]:

```
def display_countplot(data, col, order=False, order_list=None, rot=False):
    if order:
        order = order_list if order_list else sorted(data[col].astype('int').unique().tolist())
        sns.countplot(data=data, x=col, order=order)
    else:
        sns.countplot(data=data, x=col)
    if rot:
        plt.xticks(rotation=45)
    plt.show()
```

In [120]:

```
def display_countplot_top_k_categories(data, col, k, include_na=False, rot=False):
    if not include_na:
        data=data.loc[((~data[col].isna()) & (data[col]!='NA'))]
    top_k_categories = data[col].value_counts()[:k].index.tolist()
    sns.countplot(data=data.loc[data[col].isin(top_k_categories)], x=col, order=top_k_categories)
    if rot:
        plt.xticks(rotation=45)
    plt.show()
```

In [121]:

```
def display_countplot_with_hue(data, col_x, col_hue):
    sns.countplot(data=data, x=col_x, hue=col_hue)
    plt.show()
```

In [122]:

```
def display_kde_plot(data, col):
    sns.kdeplot(data=data, x=col)
    plt.grid()
    plt.show()
```

In [123]:

```
def display_kde_plot_with_hue(data, col_x, col_hue, hue_order=None):
    sns.kdeplot(data=data, x=col_x, hue=col_hue, hue_order=hue_order)
    plt.grid()
    plt.show()
```

In [124]:

```
def display_two_kde_plots(data, col1, col2, xlabel=None):
    sns.kdeplot(data=data, x=col1, label=col1)
    sns.kdeplot(data=data, x=col2, label=col2)
    if xlabel:
        plt.xlabel(xlabel)
    plt.legend()
    plt.grid()
    plt.show()
```

In [125]:

```
def display_cdf_plot(data, col):
    sns.ecdfplot(data=data, x=col)
    plt.yticks(np.arange(0, 1.1, 0.1))
    plt.grid()
    plt.show()
```

In [126]:

```
def display_box_plot(data, col):
    sns.boxplot(data=data, x=col)
    plt.grid()
    plt.show()
```

In [127]:

```
def display_box_plot_2d(data, col_x, col_y, col_order=None):
    sns.boxplot(data=data, x=col_x, y=col_y, order=col_order)
    plt.grid()
    plt.show()
```

In [128]:

```
def display_two_box_plots(data, col1, col2):
    plt.subplot(211)
    sns.boxplot(data=data, x=col1, color='r')
    plt.subplot(212)
    sns.boxplot(data=data, x=col2, color='b')
    plt.show()
```

In [129]:

```
def display_bar_plot(data, col1, col2, rot=False, grid=True):
    sns.barplot(data=data, x=col1, y=col2)
    if grid:
        plt.grid()
    if rot:
        plt.xticks(rotation=60)
    plt.show()
```

In [130]:

```python
def display_scatter_plot(data, col_x, col_y, grid=True):
    sns.scatterplot(data=data, x=col_x, y=col_y)
    if grid:
        plt.grid()
    plt.show()
```

In [131]:

```python
def display_pearson_corr_coef(data, x, y):
    print(f"PCC between '{x}' and '{y}' = {np.corrcoef(data[x], data[y]).round(3)[0, 1]}")
```

In [132]:

```python
def display_spearman_rank_corr_coef(data, x, y):
    print(f"SRCC between '{x}' and '{y}' = {round(spearmanr(data[x], data[y])[0], 3)}")
```

In [133]:

```python
def display_correlation_plot(df):
    sns.heatmap(df.corr(), annot=True, fmt='.2f')
```

In [ ]:

Univariate Analysis:

In [134]:

```
df = pd.read_csv("streaming_service_data_final.csv")
df.head(10)
```

Out[134]:

	type	title	director	cast	country	date_added	year_added	release_year	rating	listed_in	duration_minutes	duration_seasons
0	TV Show	Blood & Water	Not Available	Ama Qamata	South Africa	2021-09-24	2021	2021	TV-MA	International TV Shows	-1	2
1	TV Show	Blood & Water	Not Available	Ama Qamata	South Africa	2021-09-24	2021	2021	TV-MA	TV Dramas	-1	2
2	TV Show	Blood & Water	Not Available	Ama Qamata	South Africa	2021-09-24	2021	2021	TV-MA	TV Mysteries	-1	2
3	TV Show	Blood & Water	Not Available	Khosi Ngema	South Africa	2021-09-24	2021	2021	TV-MA	International TV Shows	-1	2
4	TV Show	Blood & Water	Not Available	Khosi Ngema	South Africa	2021-09-24	2021	2021	TV-MA	TV Dramas	-1	2
5	TV Show	Blood & Water	Not Available	Khosi Ngema	South Africa	2021-09-24	2021	2021	TV-MA	TV Mysteries	-1	2
6	TV Show	Blood & Water	Not Available	Gail Mabalane	South Africa	2021-09-24	2021	2021	TV-MA	International TV Shows	-1	2
7	TV Show	Blood & Water	Not Available	Gail Mabalane	South Africa	2021-09-24	2021	2021	TV-MA	TV Dramas	-1	2
8	TV Show	Blood & Water	Not Available	Gail Mabalane	South Africa	2021-09-24	2021	2021	TV-MA	TV Mysteries	-1	2
9	TV Show	Blood & Water	Not Available	Thabang Molaba	South Africa	2021-09-24	2021	2021	TV-MA	International TV Shows	-1	2

In [135]:

```
plt.rcParams["figure.figsize"] = (18,6)
```

In [136]:

```
df.columns
```

Out[136]:

```
Index(['type', 'title', 'director', 'cast', 'country', 'date_added',
       'year_added', 'release_year', 'rating', 'listed_in', 'duration_minutes',
       'duration_seasons'],
      dtype='object')
```

In [137]:

```
df.nunique()
```

Out[137]:

```
type                    2
title                7965
director             4528
cast                36392
country               119
date_added           1663
year_added             14
release_year           72
rating                 14
listed_in              42
duration_minutes      202
duration_seasons       15
dtype: int64
```

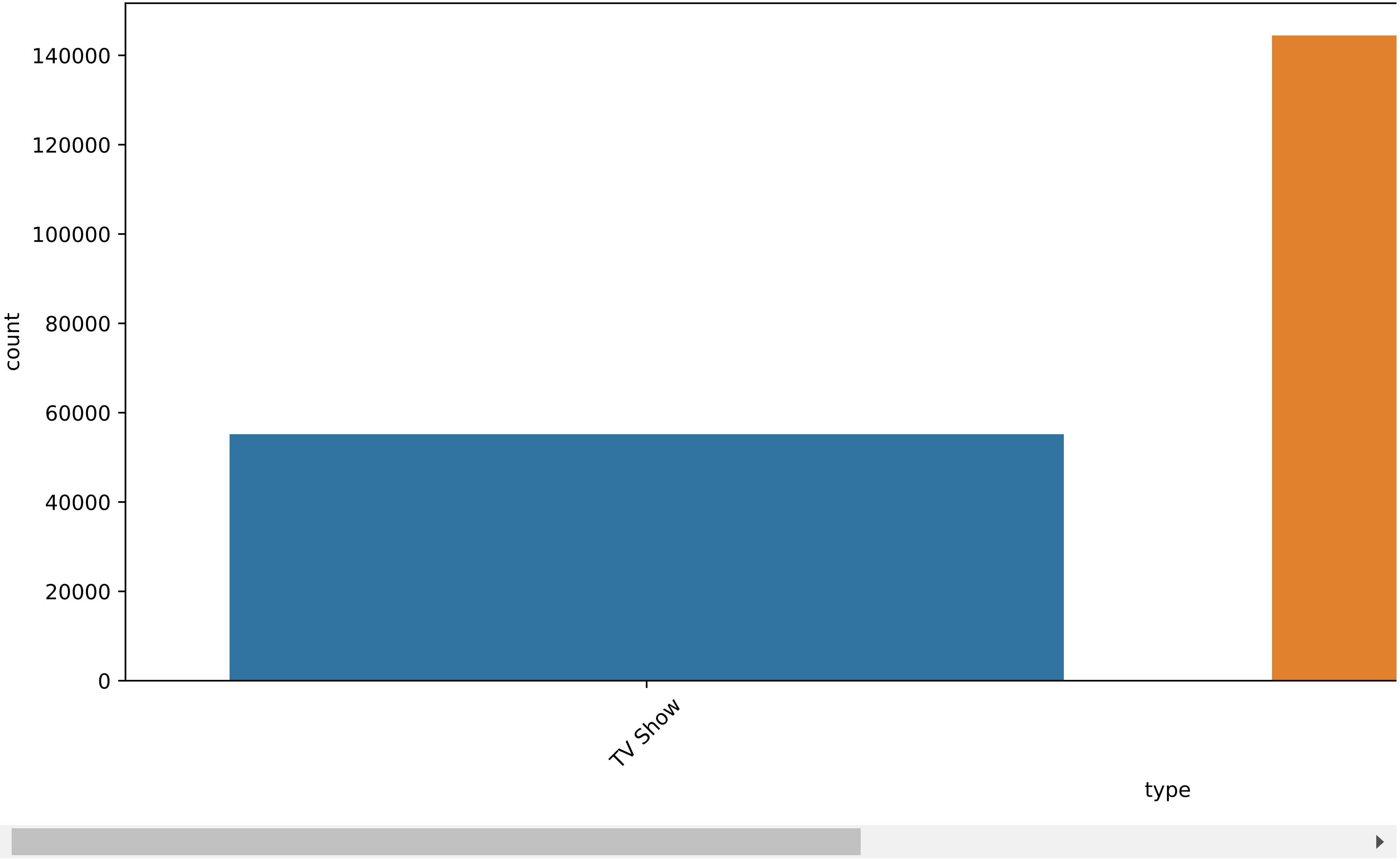
type:

In [138]:

```
display_normalized_value_counts(df, 'type')
```

```
Movie      72.38
TV Show    27.62
Name: type, dtype: float64
```

In [139]:
```
display_countplot(df, 'type', rot=True)
```



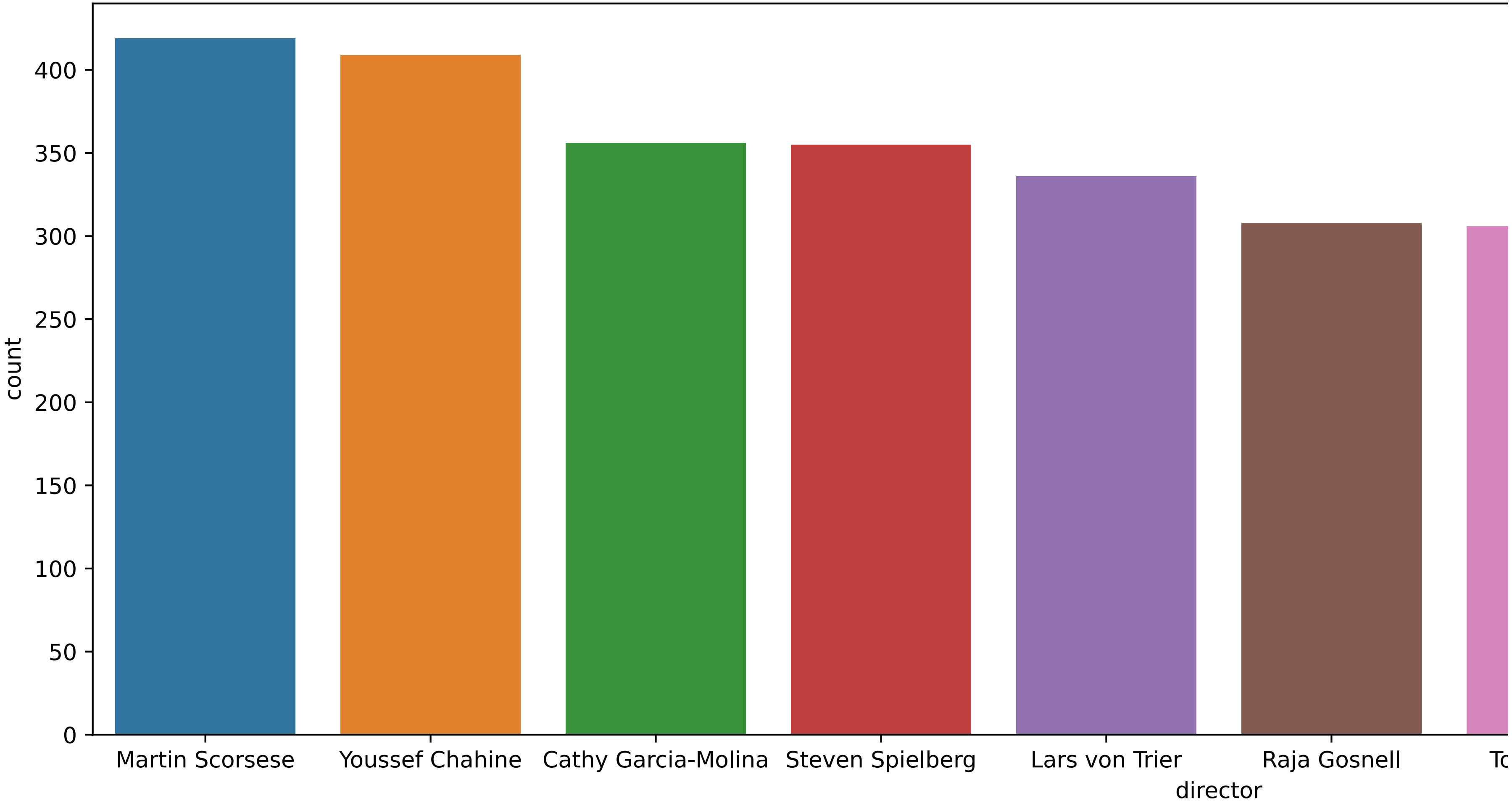
Analysis shows a strong preference for movies, with 72.38% of all content being feature films. TV shows still hold a significant representation at 27.62%. This balanced distribution of movie and TV show genres offers a diverse range of viewing options for audiences.

director:

```
In [140]: display_normalized_value_counts(df[df["director"] != "Not Available"], 'director')
```

```
Martin Scorsese          0.28
Youssef Chahine          0.27
Cathy Garcia-Molina      0.24
Steven Spielberg         0.24
Lars von Trier           0.22
                         ... 
Jake Paltrow             0.00
Alphonso J. Wesson       0.00
Doesjka van Hoogdalem    0.00
Natalia Valdebenito      0.00
Keegan Kuhn              0.00
Name: director, Length: 4527, dtype: float64
```

In [141]:
```
display_countplot_top_k_categories(df[df["director"] != "Not Available"], 'director', 10)
```



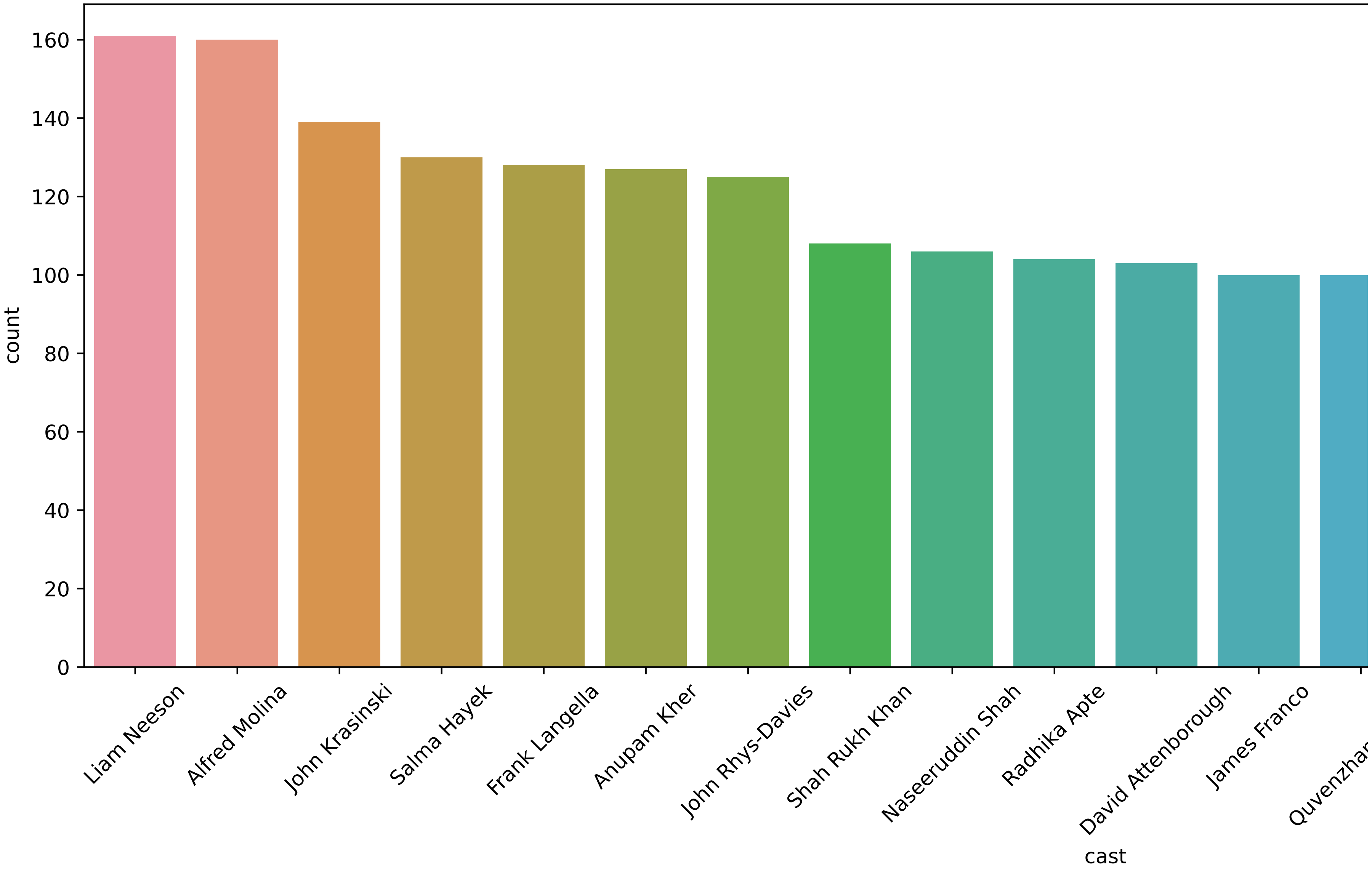
Analysis of the streaming service platform has uncovered the top 10 directors in terms of content representation. Martin Scorsese leads the pack, followed closely by Youssef Chahine and Cathy Garcia-Molina. Steven Spielberg and Lars von Trier round out the top 5. Other notable names in the top 10 include Raja Gosnell, Tom Hooper, McG, David Dhavan, and Wilson Yip. This data provides valuable insight into the platform's content offerings and highlights the diversity of filmmaking styles and techniques represented.

cast:

```
In [142]: display_normalized_value_counts(df, 'cast')
```

```
Liam Neeson        0.08
Alfred Molina      0.08
John Krasinski     0.07
Salma Hayek        0.07
Frank Langella     0.06
                   ...
Remy Munasifi      0.00
Kara Hayward       0.00
Sana Serrai        0.00
Richard Newman     0.00
Alice Taglioni     0.00
Name: cast, Length: 36392, dtype: float64
```

```
In [143]: display_countplot_top_k_categories(df, 'cast', 20, rot=True)
```



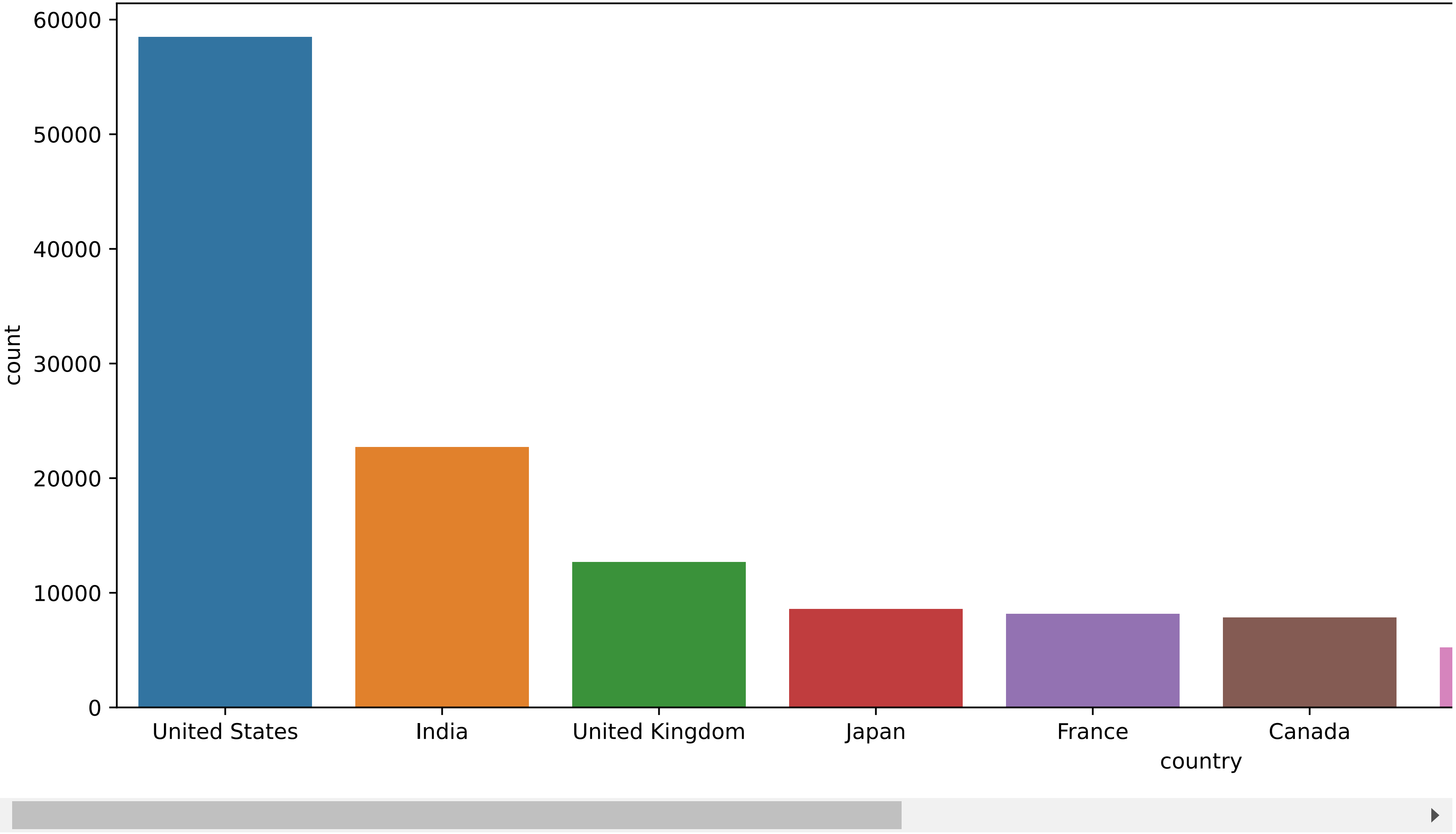
Analysis of the streaming service platform's content has revealed the top 10 actors in terms of representation. Liam Neeson leads the list, followed by Alfred Molina and John Krasinski. Salma Hayek and Frank Langella complete the top 5. Other notable actors in the top 10 include Anupam Kher, John Rhys Davis, Shah Rukh Khan, Naseeruddin Shah, and Radhika Apte. This information provides valuable insight into the platform's casting choices and highlights the diversity of acting talent represented

country:

```
In [144]: display_normalized_value_counts(df[df["country"] != "Not Available"], 'country')
```

```
United States     31.12
India             12.09
United Kingdom     6.75
Japan              4.56
France             4.35
                  ...  
Vatican City       0.00
Afghanistan        0.00
Panama             0.00
Sri Lanka          0.00
Nicaragua          0.00
Name: country, Length: 118, dtype: float64
```

```
In [145]: display_countplot_top_k_categories(df[df["country"] != "Not Available"], 'country', 10)
```



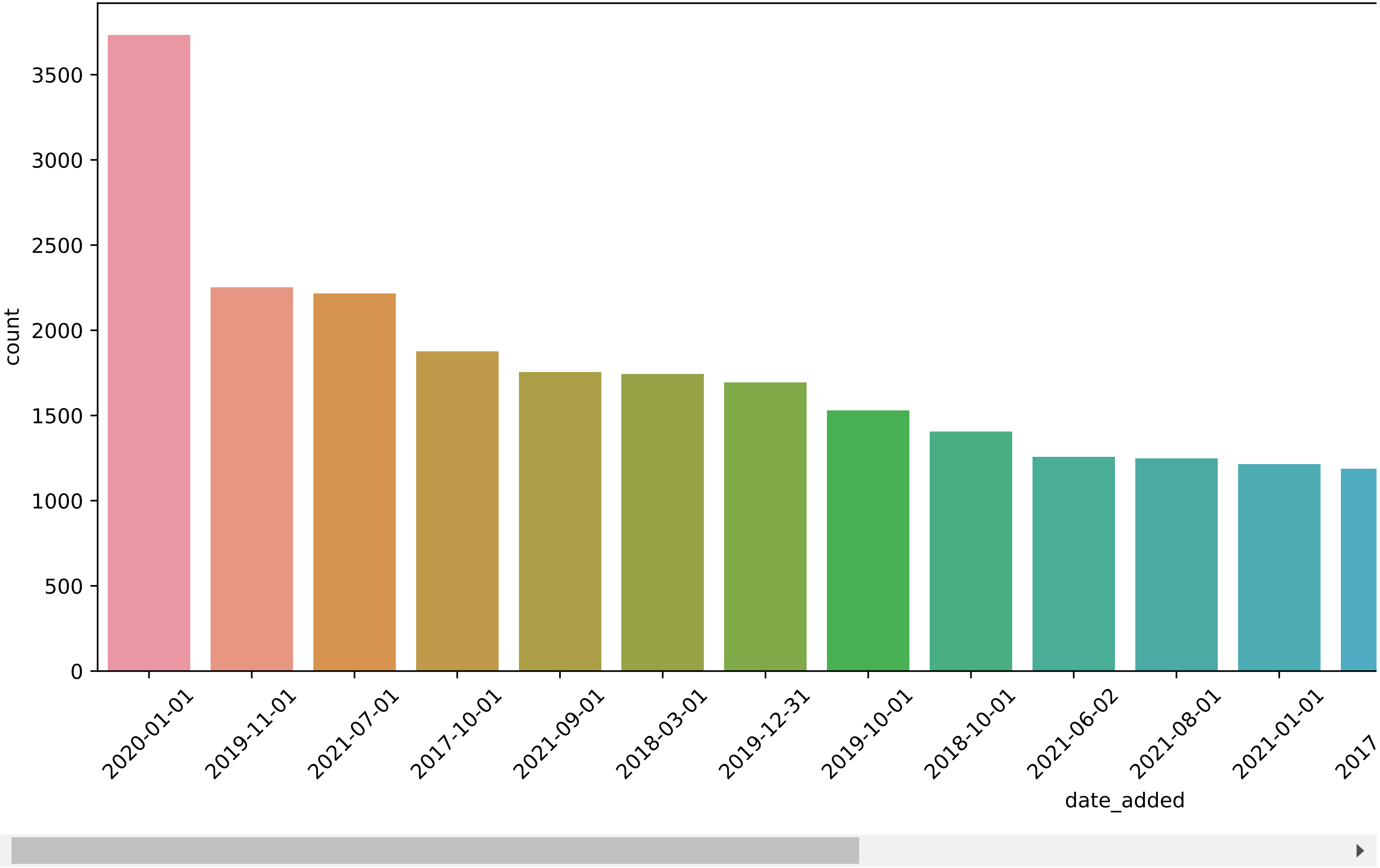
Analysis of the streaming service platform's content reveals the top 5 countries of origin for movies and TV shows. The United States dominates the list with 31.12% of all content being produced there. India comes in second with 12.09% representation, followed by the United Kingdom at 6.75%. Japan and France round out the top 5 with 4.56% and 4.35% representation, respectively. This data provides insight into the platform's geographical diversity of content, and highlights the significance of these top 5 countries in the world of film and television production.

date_added:

```
In [161]: display_normalized_value_counts(df, 'date_added')
```

```
2020-01-01    1.87
2019-11-01    1.13
2021-07-01    1.11
2017-10-01    0.94
2021-09-01    0.88
              ...
2015-07-10    0.00
2015-06-29    0.00
2017-06-27    0.00
2019-03-26    0.00
2014-12-05    0.00
Name: date_added, Length: 1663, dtype: float64
```

```
In [146]: display_countplot_top_k_categories(df, 'date_added', 20, rot=True)
```



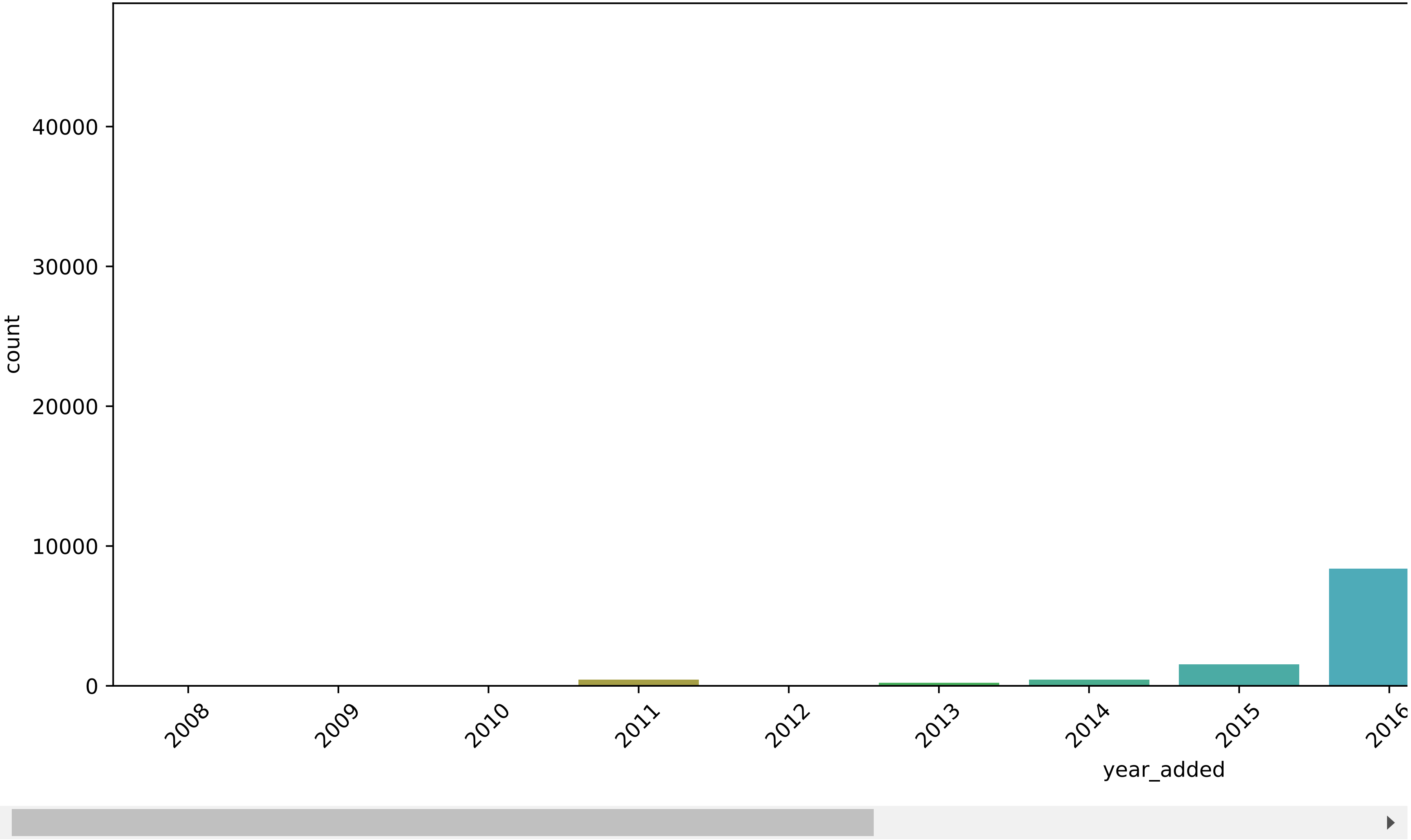
```
In [ ]:
```

year_added:

```
In [147]: display_normalized_value_counts(df, 'year_added')
```

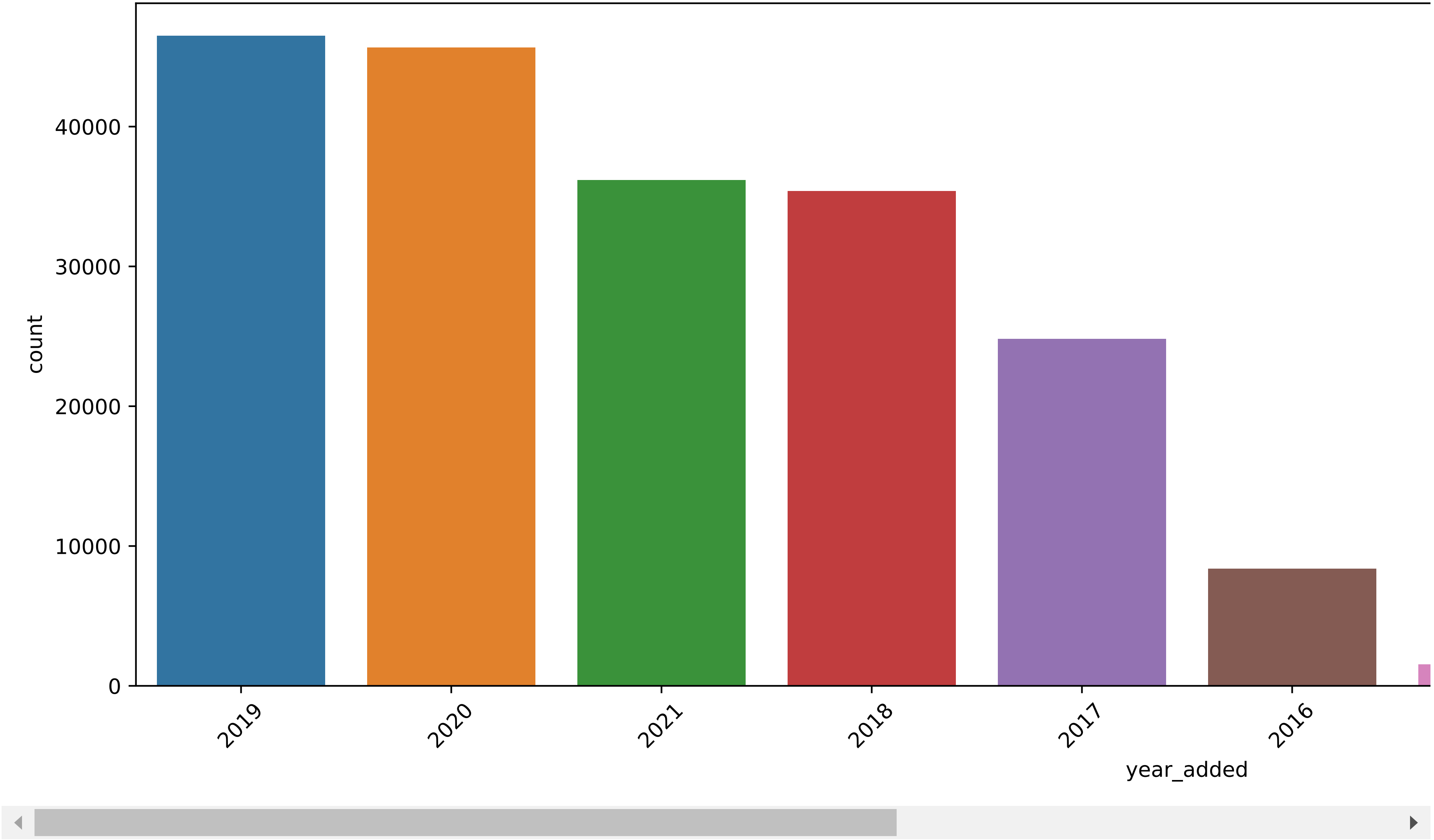
```
2019    23.30
2020    22.87
2021    18.12
2018    17.73
2017    12.43
2016     4.19
2015     0.76
2014     0.22
2011     0.22
2013     0.10
2012     0.02
2009     0.02
2010     0.01
2008     0.01
Name: year_added, dtype: float64
```

In [148]:
```
display_countplot(df, 'year_added', rot=True)
```



Analysis of the streaming service platform's content reveals a clear trend in the years when movies and TV shows were added to the platform, with the majority of content being added from the years 2017, 2018, 2019, 2020, and 2021. This highlights the significance of these years in terms of content additions and provides valuable insight into the platform's content acquisition trends over time.

In [149]:
```
display_countplot_top_k_categories(df, 'year_added', 10, rot=True)
```



Nearly 94% of all Movies and TV Shows on the streaming service platform were added between the years 2017 to 2021, with the majority being added in 2019 and 2020.

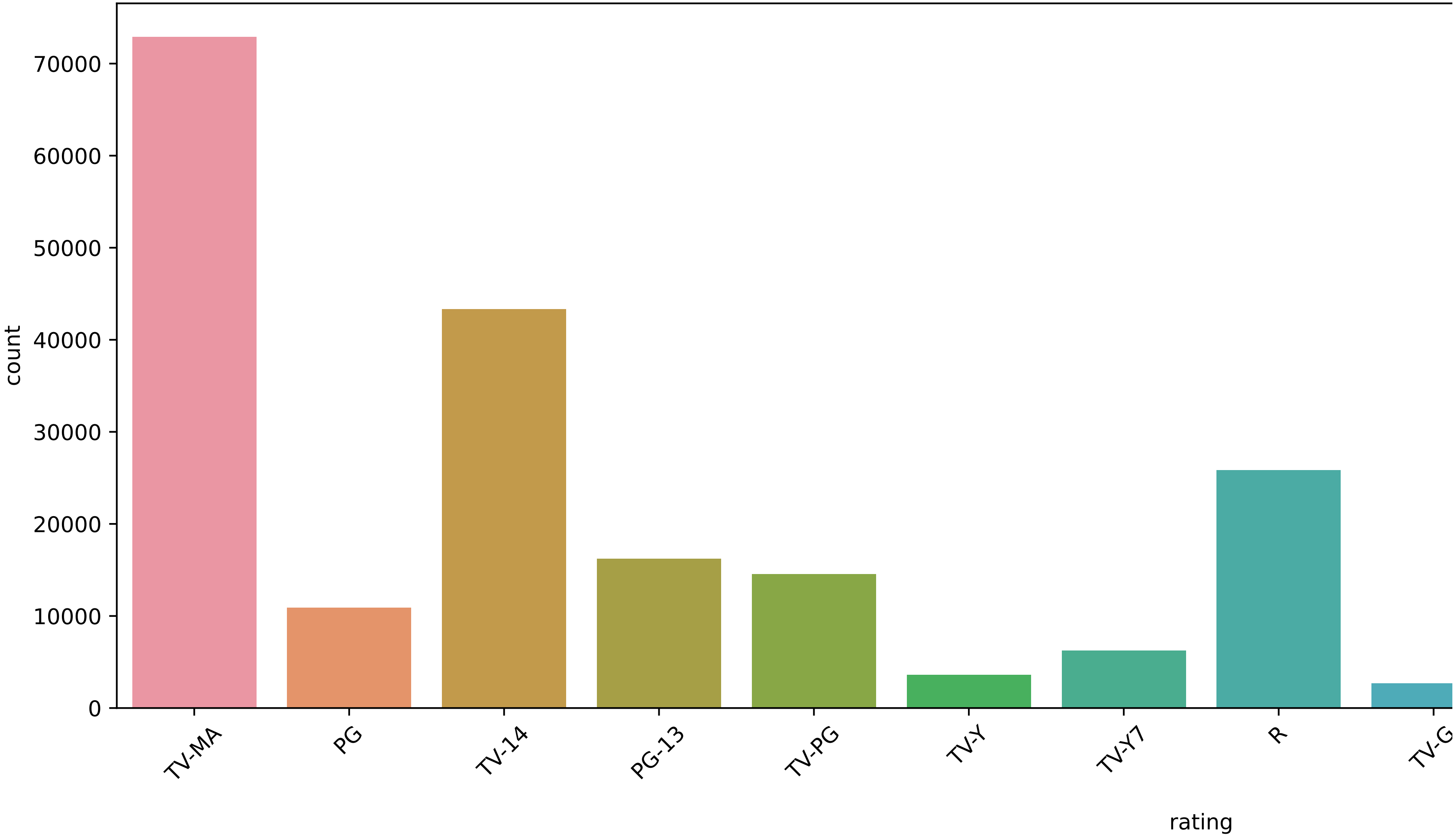
rating:

In [150]:

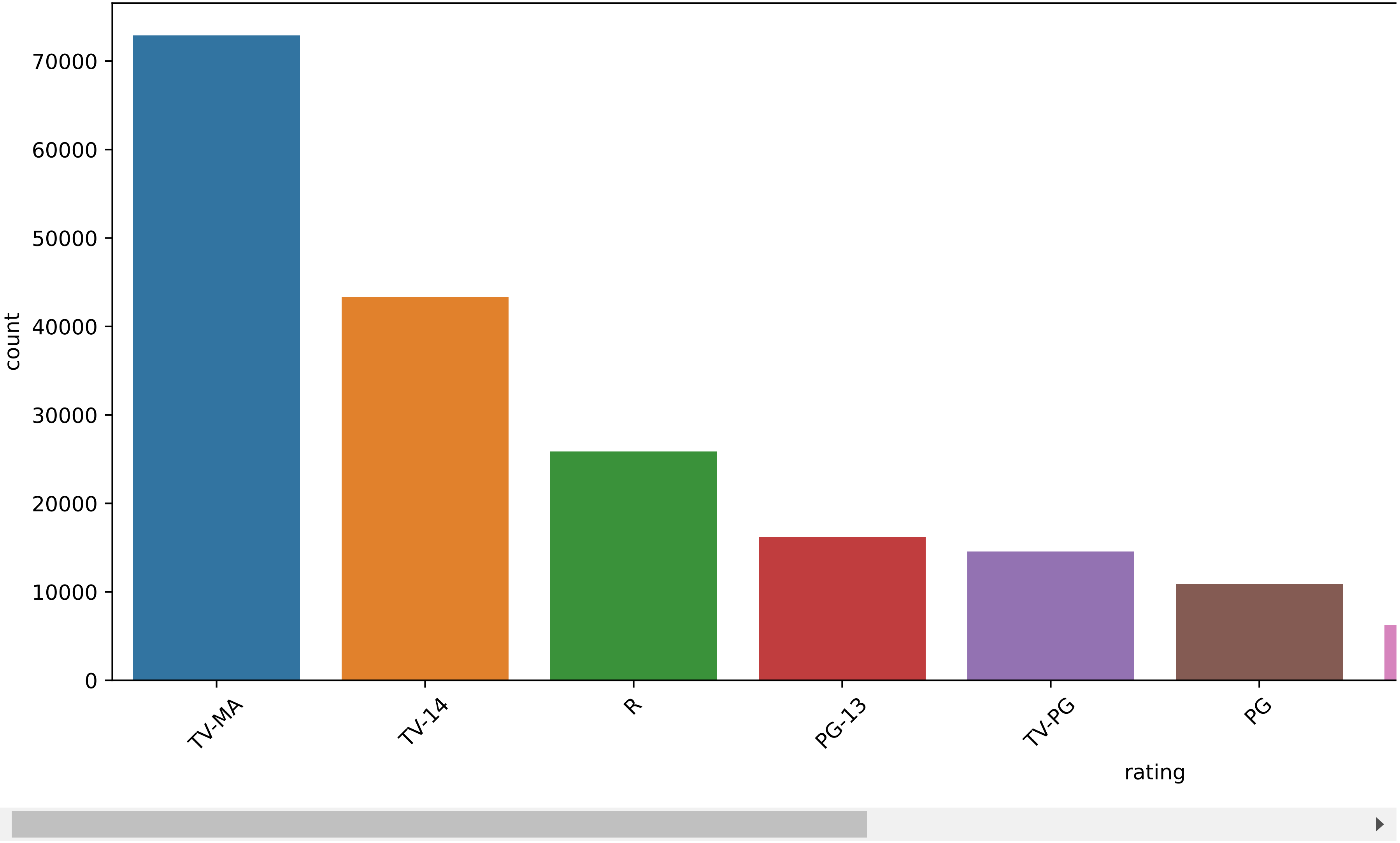
```
display_normalized_value_counts(df, 'rating')
```

```
TV-MA       36.53
TV-14       21.71
R           12.95
PG-13        8.12
TV-PG        7.29
PG           5.46
TV-Y7        3.13
TV-Y         1.81
TV-G         1.34
G            0.77
NR           0.74
NC-17        0.07
UR           0.04
TV-Y7-FV     0.04
Name: rating, dtype: float64
```

```
In [151]: display_countplot(df, 'rating', rot=True)
```



In [152]:
```
display_countplot_top_k_categories(df, 'rating', 10, rot=True)
```



Analysis of the streaming service platform's content reveals a clear preference for mature content, with the majority of shows and movies having a TV-MA rating at 36.53%. TV-14 rated content comes in second with 21.71% representation. The remaining ratings, including R, PG-13, and TV-PG, have comparatively lower representation, with the highest being TV-MA rated content at 36.53% and the lowest being TV-Y7-FV rated content at 0.04%.

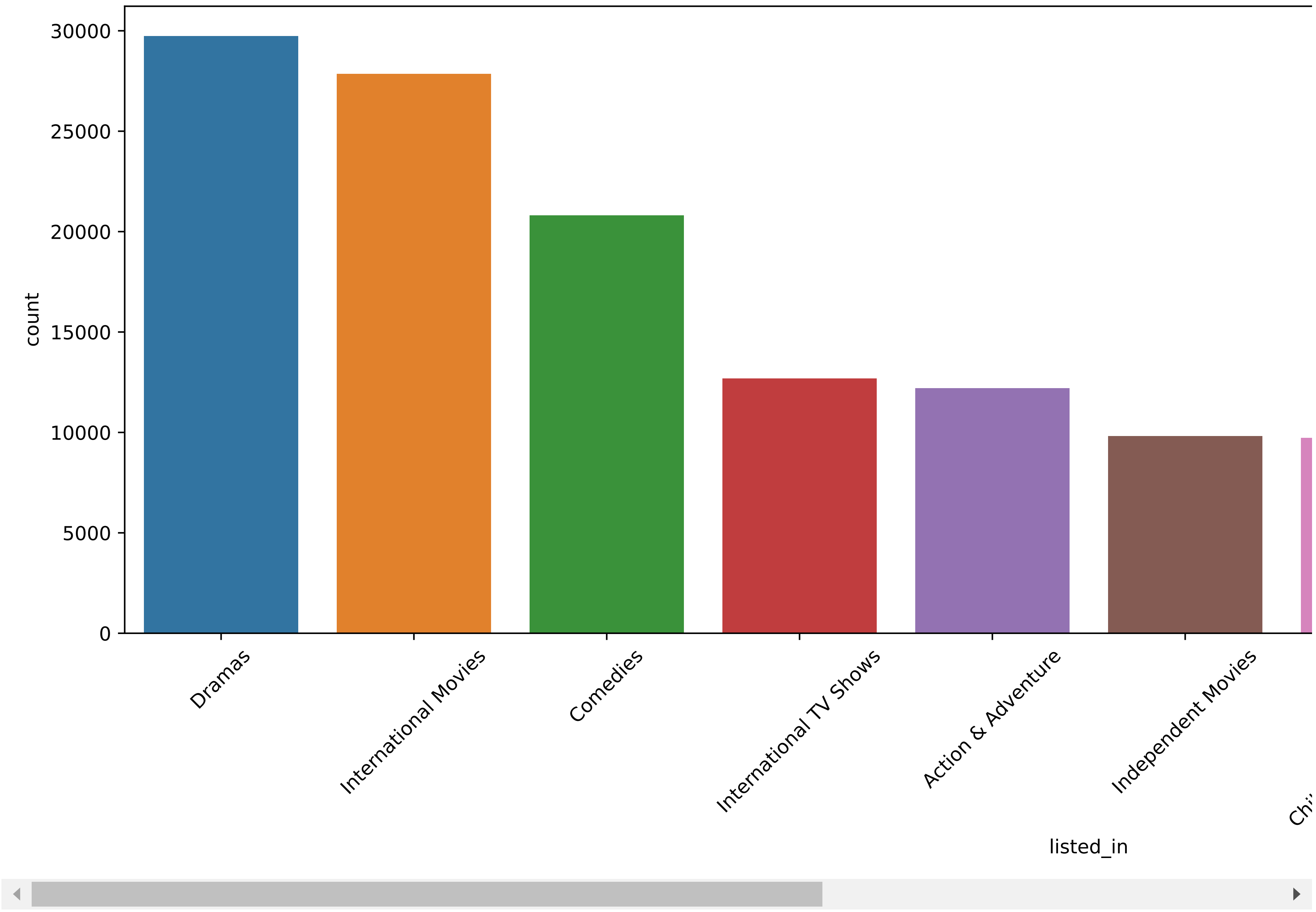
listed_in:

```
In [153]: display_normalized_value_counts(df, 'listed_in')
```

```
Dramas                          14.90
International Movies            13.96
Comedies                        10.43
International TV Shows           6.36
Action & Adventure               6.12
Independent Movies               4.92
Children & Family Movies         4.87
TV Dramas                        4.47
Thrillers                        3.56
Romantic Movies                  3.21
TV Comedies                      2.45
Crime TV Shows                   2.32
Horror Movies                    2.29
Kids' TV                         2.26
Sci-Fi & Fantasy                 2.02
Romantic TV Shows                1.52
Music & Musicals                 1.52
TV Action & Adventure            1.14
Anime Series                     1.14
Spanish-Language TV Shows        1.05
British TV Shows                 0.88
Documentaries                    0.86
Sports Movies                    0.72
Classic Movies                   0.72
TV Mysteries                     0.64
Korean TV Shows                  0.56
Cult Movies                      0.54
Anime Features                   0.52
TV Sci-Fi & Fantasy              0.52
TV Horror                        0.47
LGBTQ Movies                     0.41
TV Thrillers                     0.38
Teen TV Shows                    0.37
Faith & Spirituality             0.36
Reality TV                       0.32
Docuseries                       0.29
Stand-Up Comedy                  0.27
Movies                           0.20
TV Shows                         0.16
Stand-Up Comedy & Talk Shows     0.13
Classic & Cult TV                0.13
```

```
Science & Nature TV              0.06
Name: listed_in, dtype: float64
```

In [154]:
```
display_countplot_top_k_categories(df, 'listed_in', 10, rot=True)
```



Analysis of the streaming service platform's content highlights the following insights: Dramas lead with 14.90%, followed by International Movies at 13.96%, and Comedies at 10.43%. Other genres, including International TV Shows (6.36%), Action & Adventure (6.12%), Independent Movies (4.92%), Children & Family Movies (4.87%), TV Dramas (4.47%), Thrillers (3.56%), and Romantic Movies (3.21%), showcase the platform's diverse content offerings, catering to a wide range of viewer preferences.

duration_minutes:

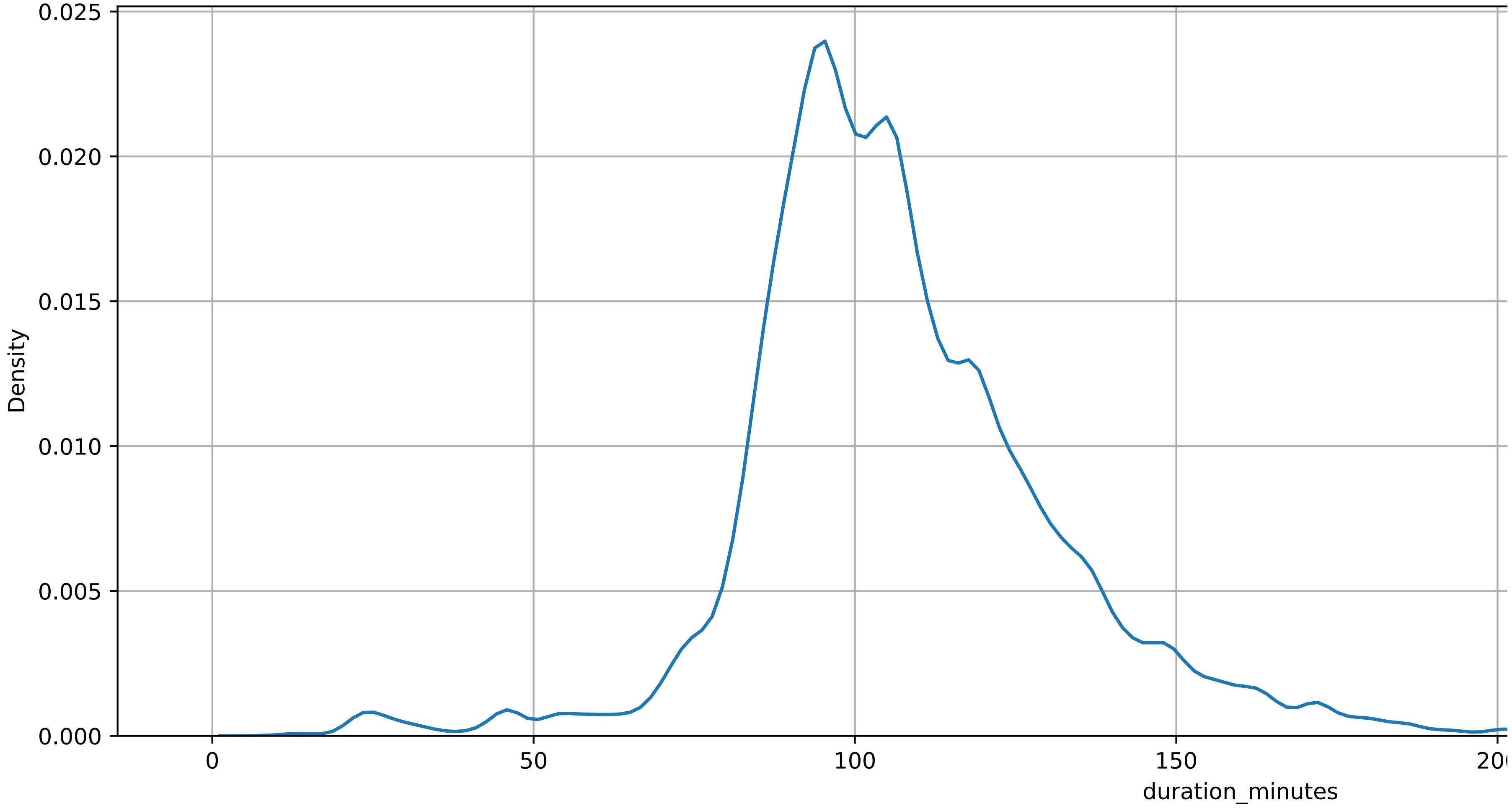
In [155]:

```
df[df["duration_minutes"] != -1]['duration_minutes'].describe()
```

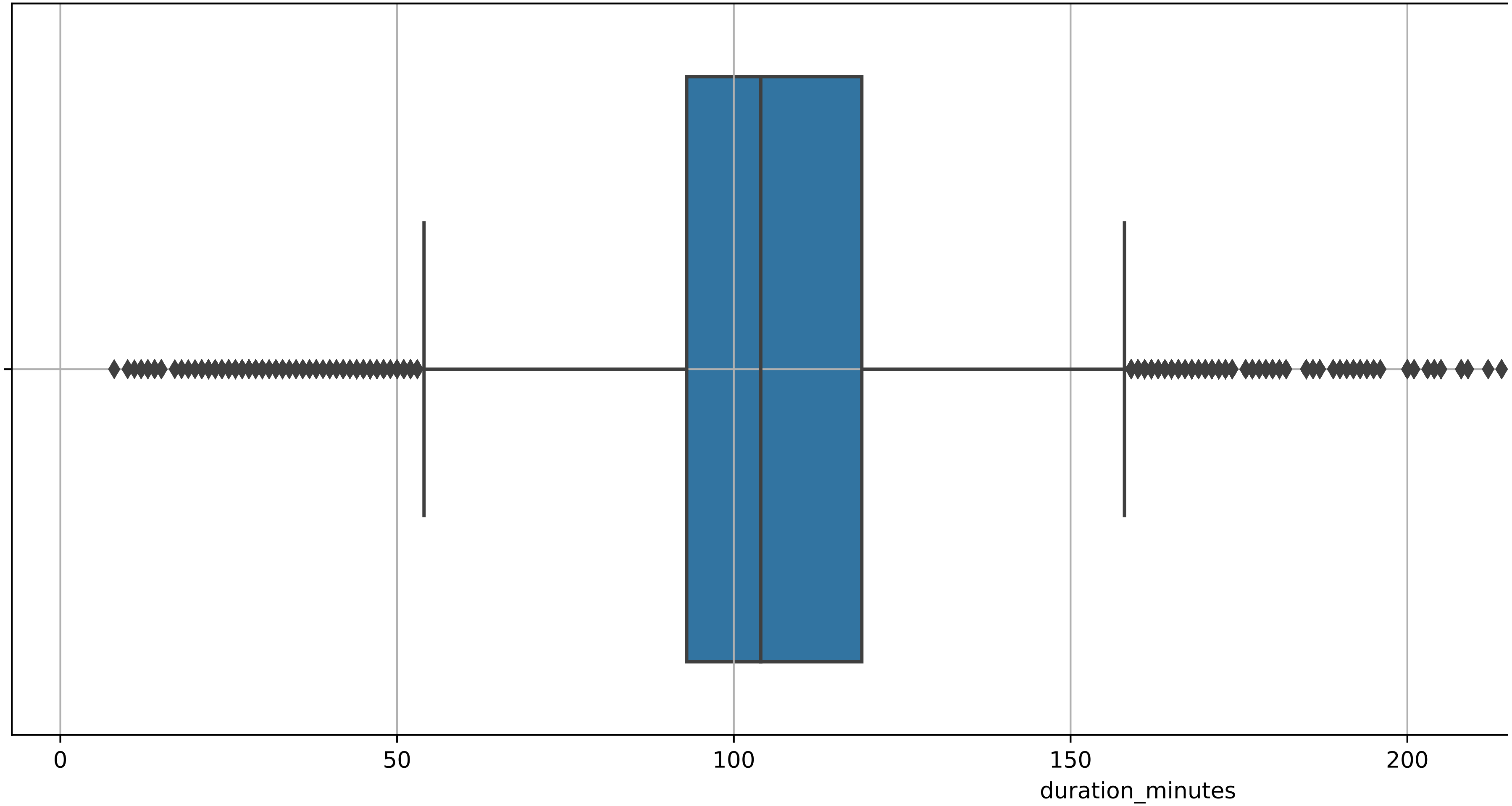
Out[155]:

```
count    144448.000000
mean        107.096249
std          24.574679
min           8.000000
25%          93.000000
50%         104.000000
75%         119.000000
max         312.000000
Name: duration_minutes, dtype: float64
```

```
In [156]: display_kde_plot(df[df["duration_minutes"] != -1], 'duration_minutes')
```



```
In [157]: display_box_plot(df[df["duration_minutes"] != -1], 'duration_minutes')
```



Analyzing the movie duration data in minutes, we observe the following insights:

```
- The platform offers a diverse range of movie lengths, from 8 minutes to 312 minutes.
- The average movie duration is approximately 107 minutes, with most movies hovering around this length.
- The median movie duration is 104 minutes, signifying a relatively symmetrical distribution.
```

duration_seasons:

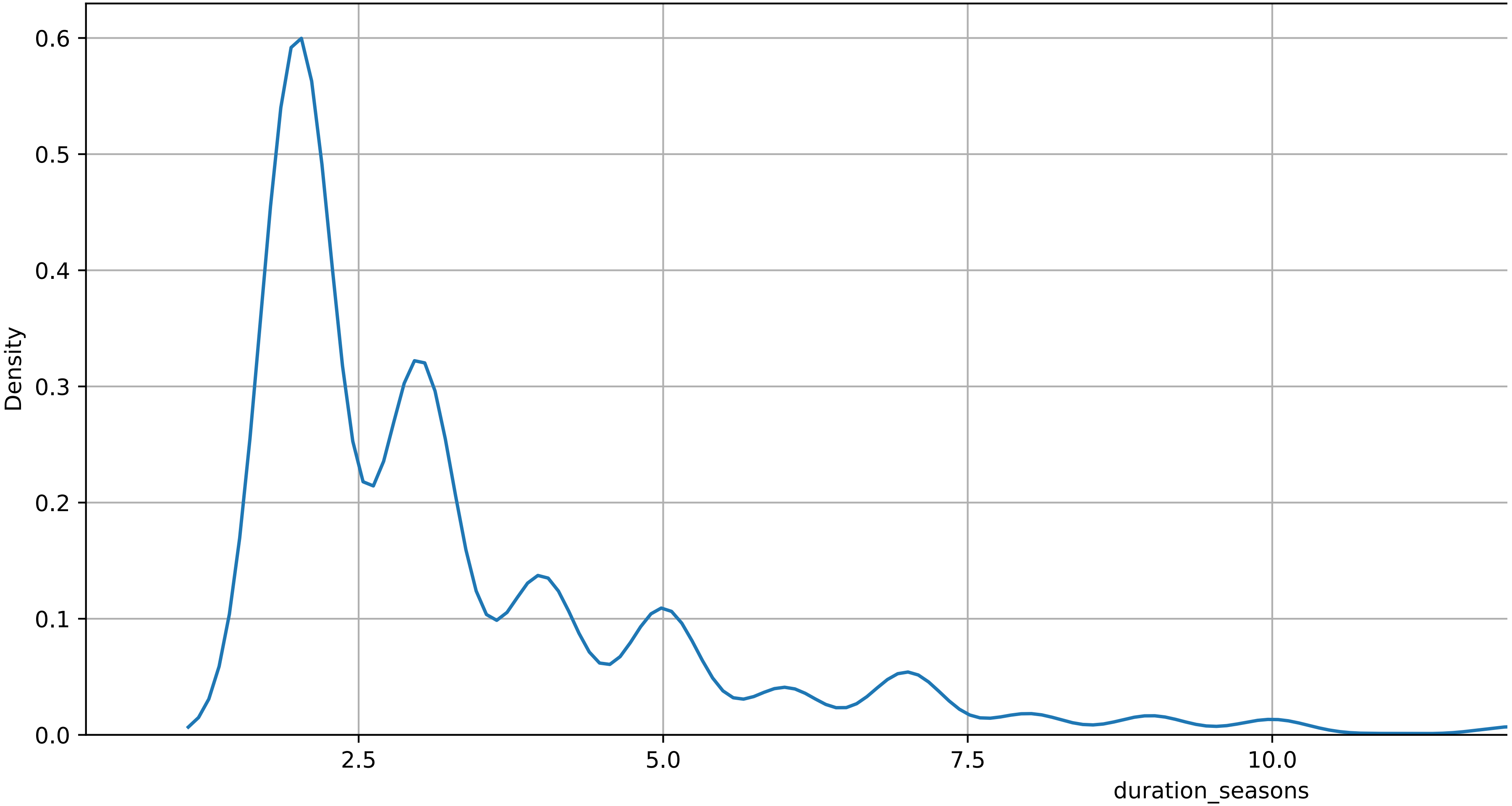
In [158]:

```
df[df["duration_seasons"] != -1]['duration_seasons'].describe()
```

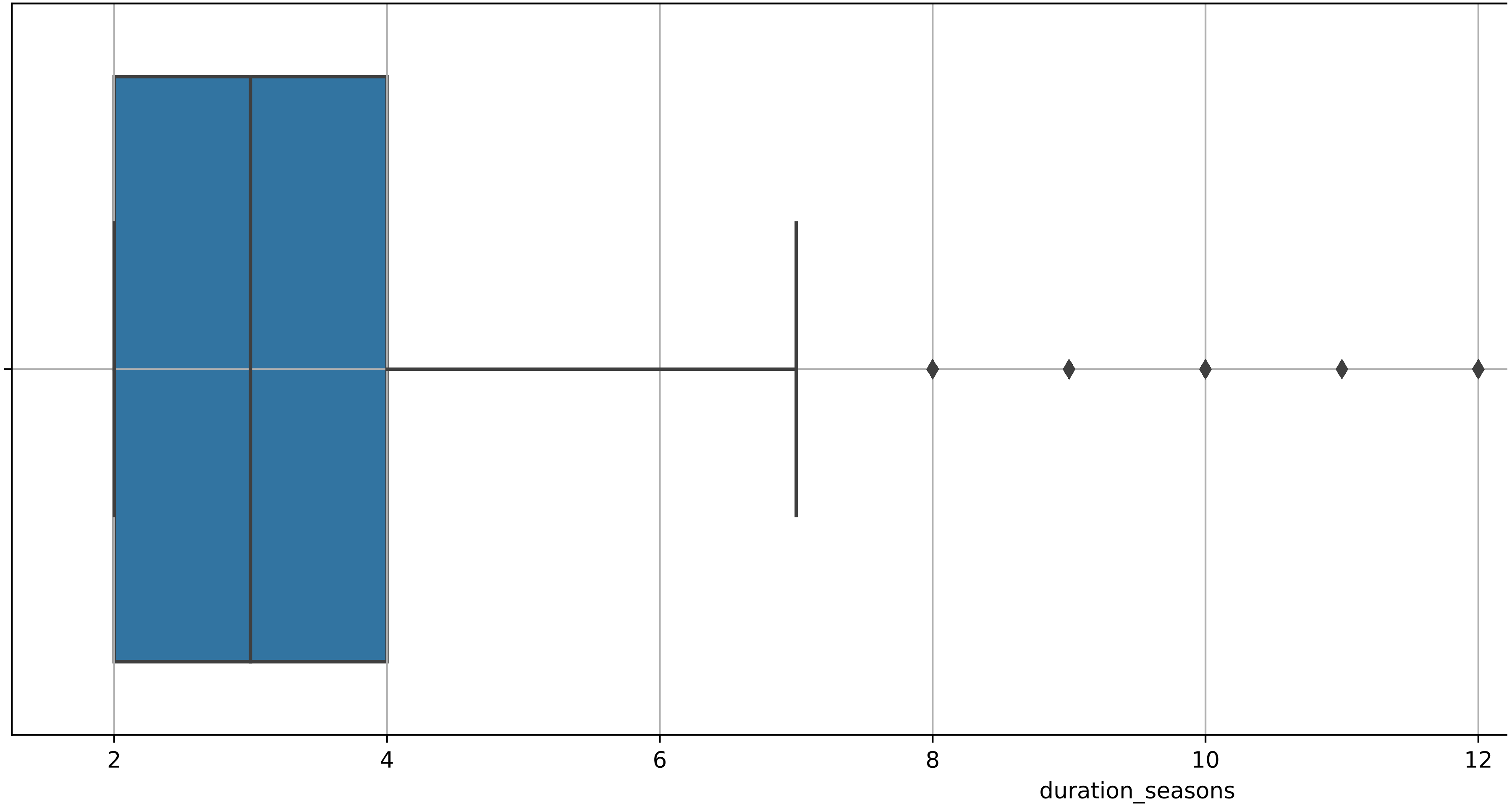
Out[158]:

```
count    20813.000000
mean         3.458319
std          2.188339
min          2.000000
25%          2.000000
50%          3.000000
75%          4.000000
max         17.000000
Name: duration_seasons, dtype: float64
```

In [159]:
```
display_kde_plot(df[df["duration_seasons"] != -1], 'duration_seasons')
```



In [160]:
```
display_box_plot(df[df["duration_seasons"] != -1], 'duration_seasons')
```



Analyzing the number of seasons data, we can derive the following insights about TV shows on the platform:

```
    - The platform offers TV shows with a varying number of seasons, ranging from 2 to 17 seasons.
    - The average number of seasons is approximately 3.46, indicating that most shows have around 3 to 4 seasons.
    - The median number of seasons is 3, signifying a relatively balanced distribution.
    - 50% of the TV shows have between 2 seasons (25th percentile) and 4 seasons (75th percentile).
```

- In summary, the platform primarily features TV shows with 2 to 4 seasons, catering to viewers who enjoy short to medium-length series.

Bivariate Analysis:

In [161]:

```
plt.rcParams["figure.figsize"] = (18,6)
```

In [162]:

```
df.columns
```

Out[162]:

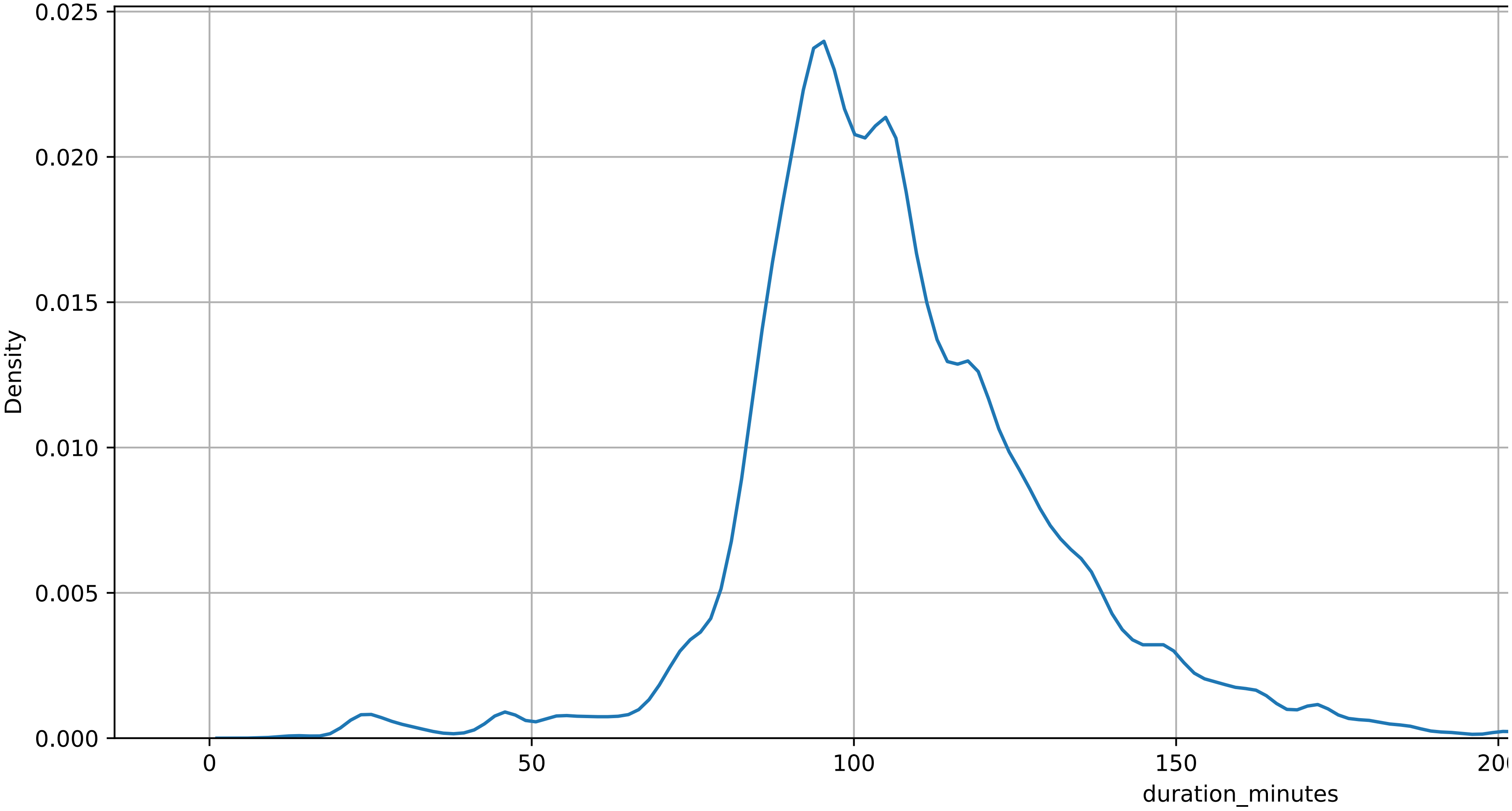
```
Index(['type', 'title', 'director', 'cast', 'country', 'date_added',
       'year_added', 'release_year', 'rating', 'listed_in', 'duration_minutes',
       'duration_seasons'],
      dtype='object')
```

In [ ]:

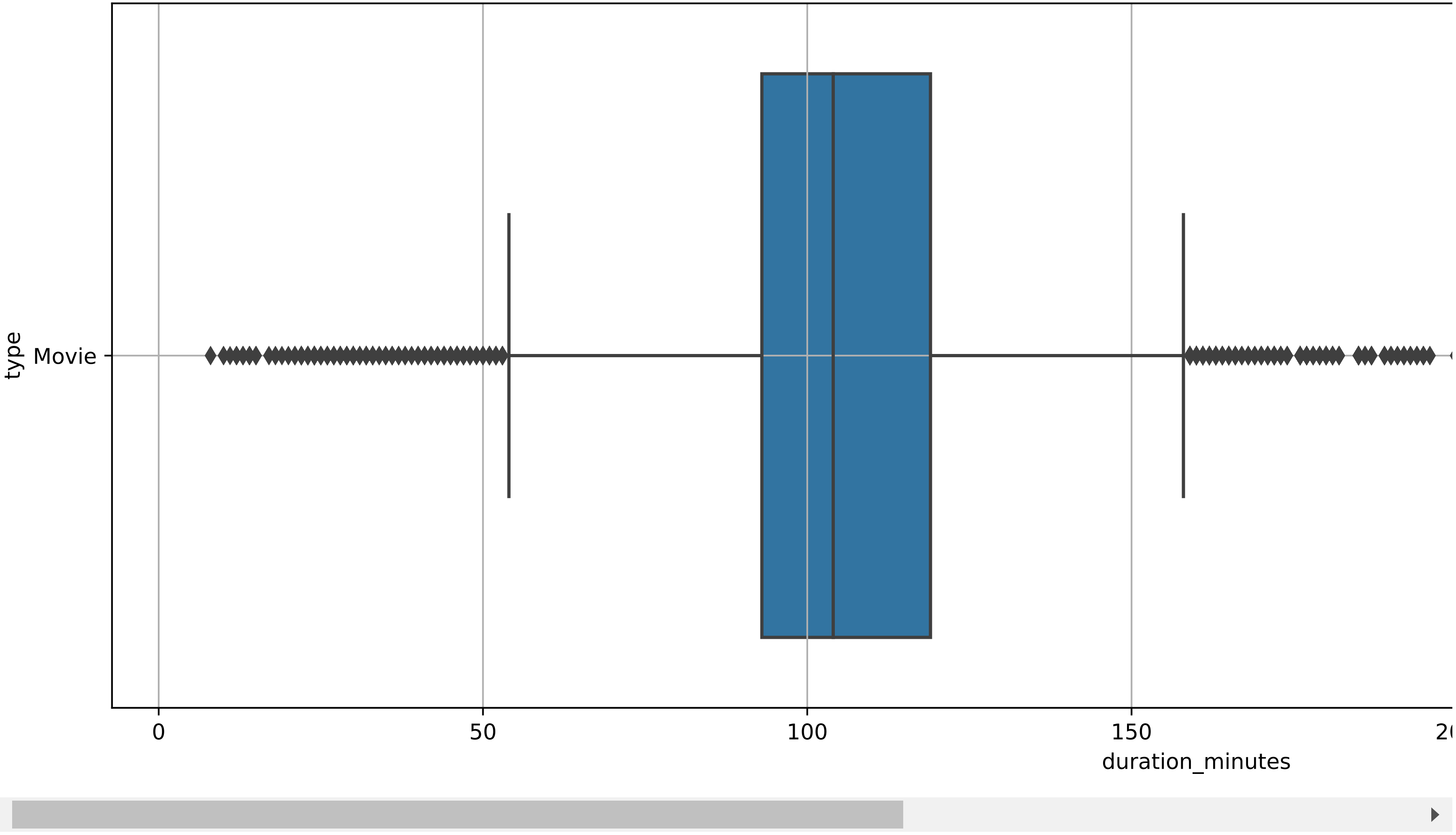
```

```

'type' vs 'duration_minutes':

```
In [163]: display_kde_plot_with_hue(df[df["type"] == "Movie"], 'duration_minutes', 'type')
```



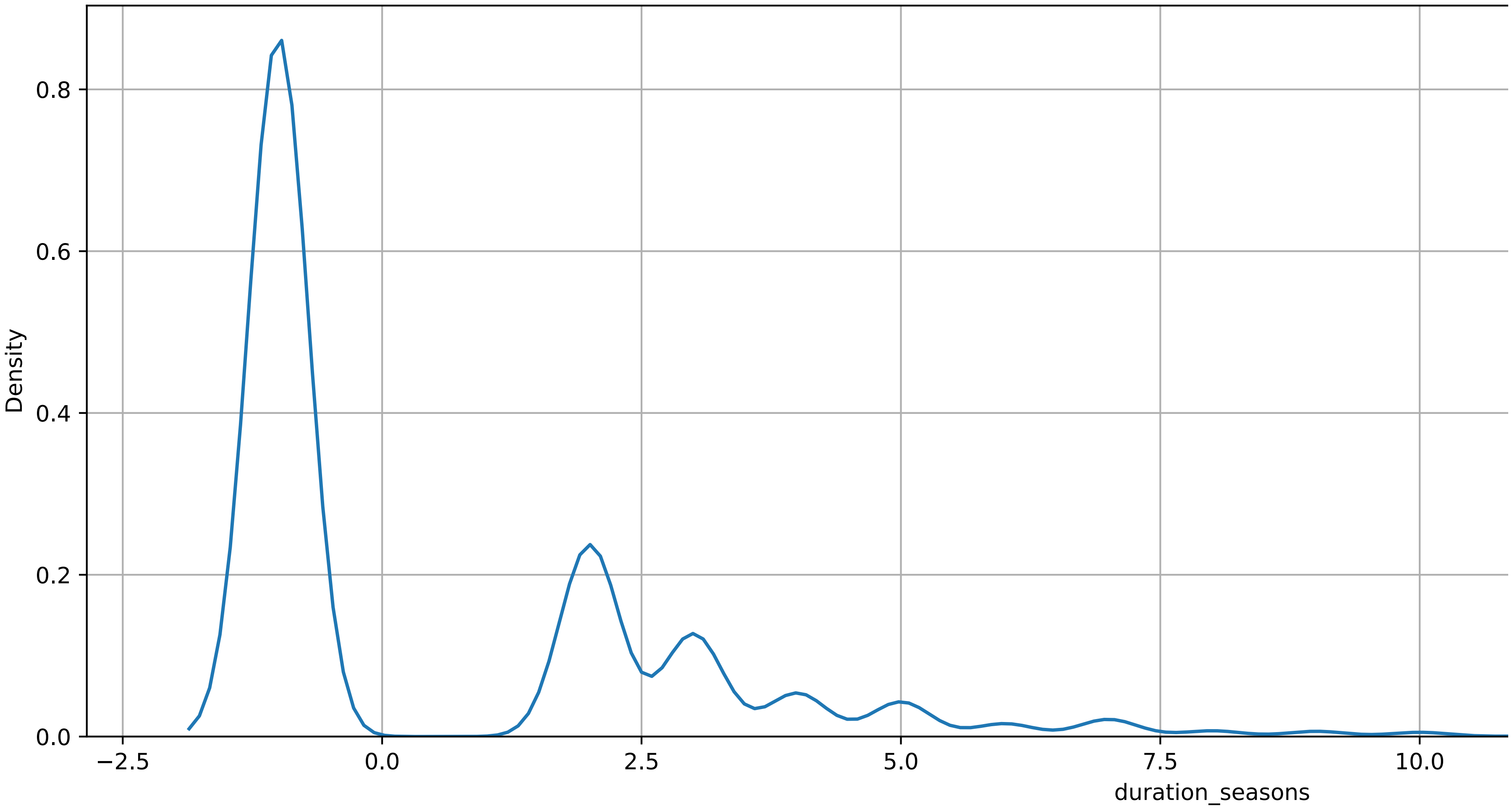
```
In [164]: display_box_plot_2d(df[df["type"] == "Movie"],'duration_minutes', 'type')
```



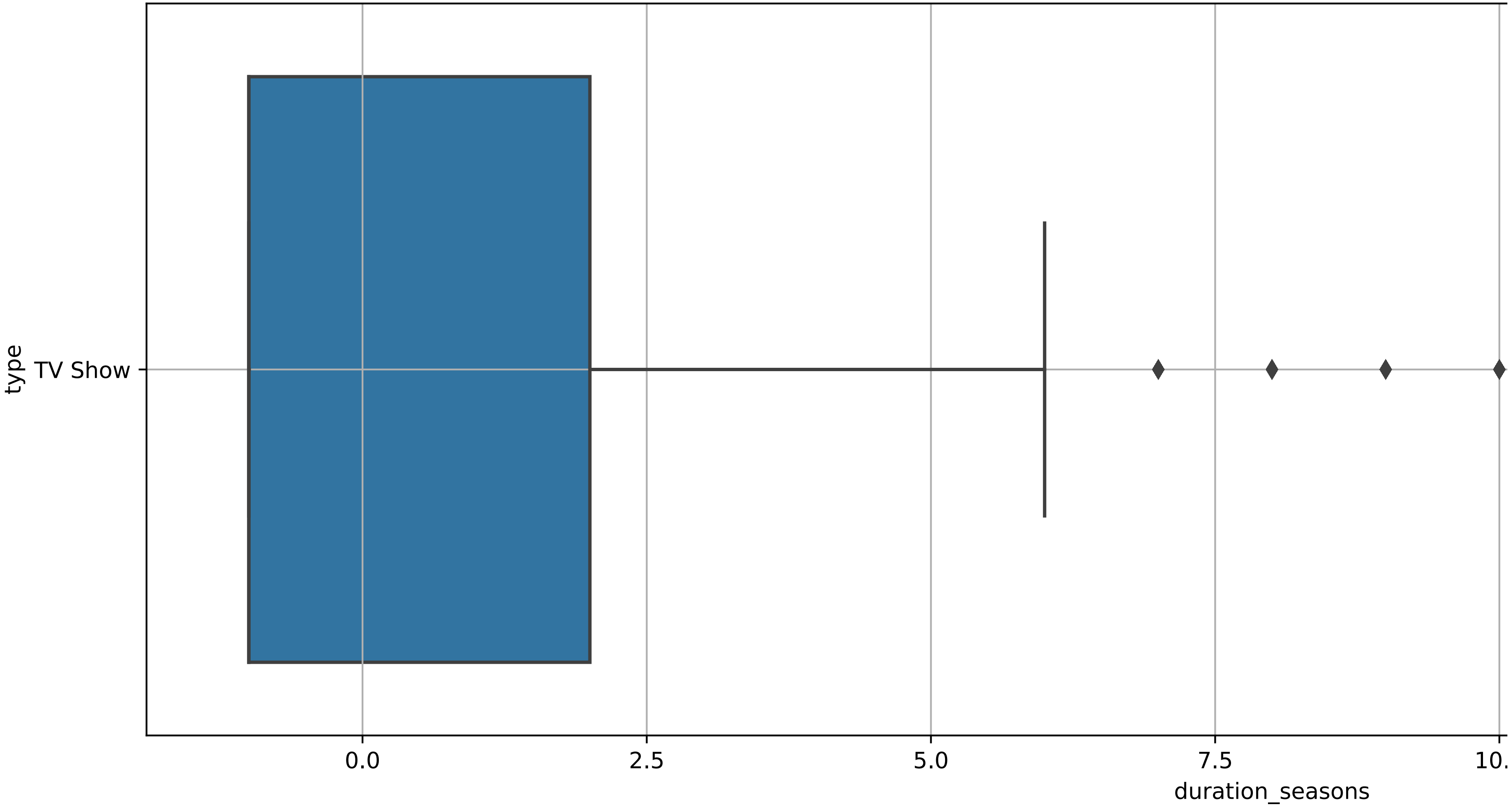
```
In [ ]:
```

'type' vs 'duration_seasons':

In [165]:
```
display_kde_plot_with_hue(df[df["type"] == "TV Show"], 'duration_seasons', 'type')
```



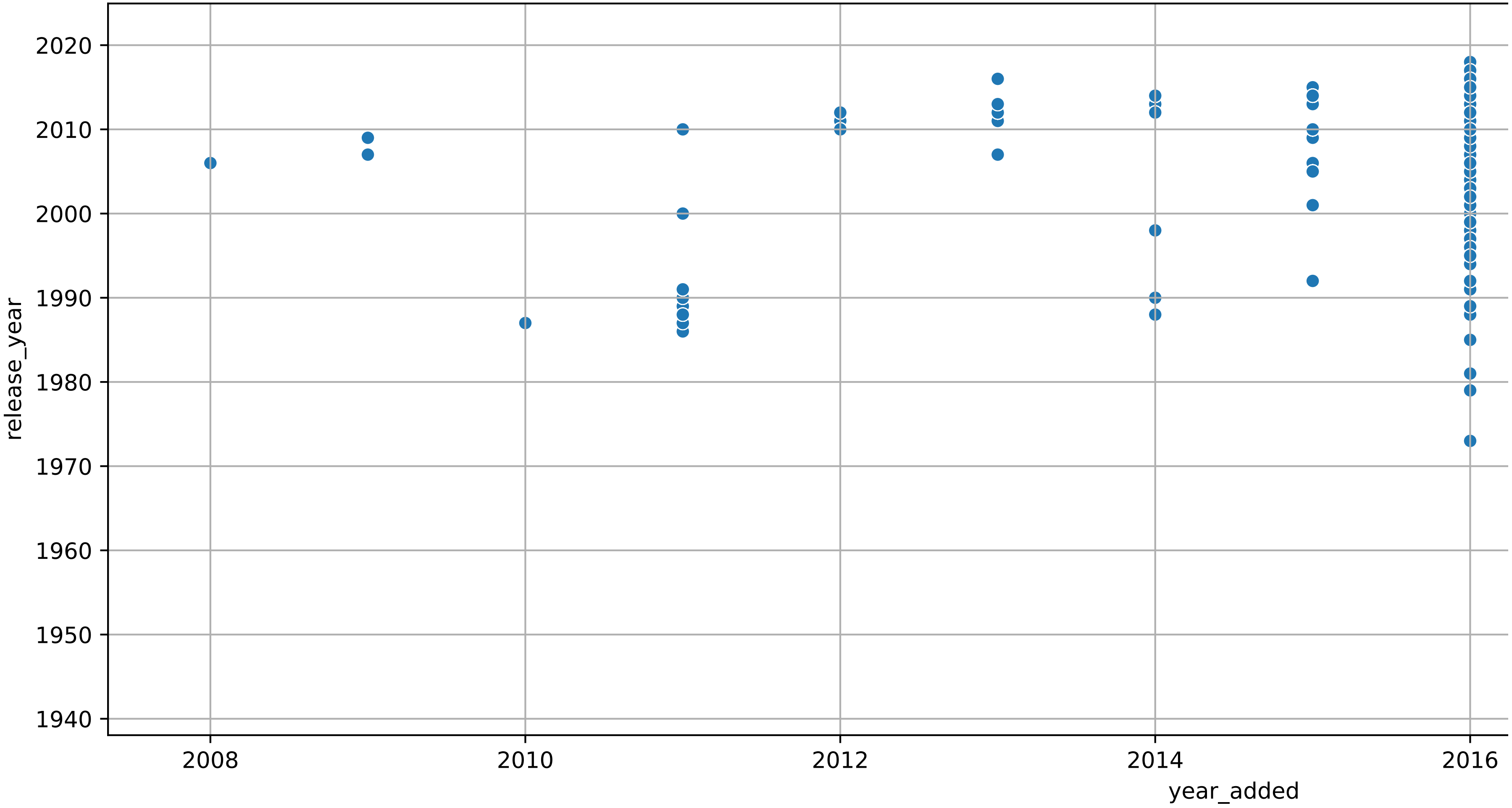
In [166]:
```
display_box_plot_2d(df[df["type"] == "TV Show"],'duration_seasons', 'type')
```



In [ ]:
```

```

'year_added' vs 'release_year':

In [167]:
```
display_scatter_plot(df, "year_added", "release_year")
```



In [168]:
```
display_pearson_corr_coef(df, "year_added", "release_year")
```

```
PCC between 'year_added' and 'release_year' = 0.051
```

In [169]:
```
display_spearman_rank_corr_coef(df, "year_added", "release_year")
```

```
SRCC between 'year_added' and 'release_year' = 0.263
```

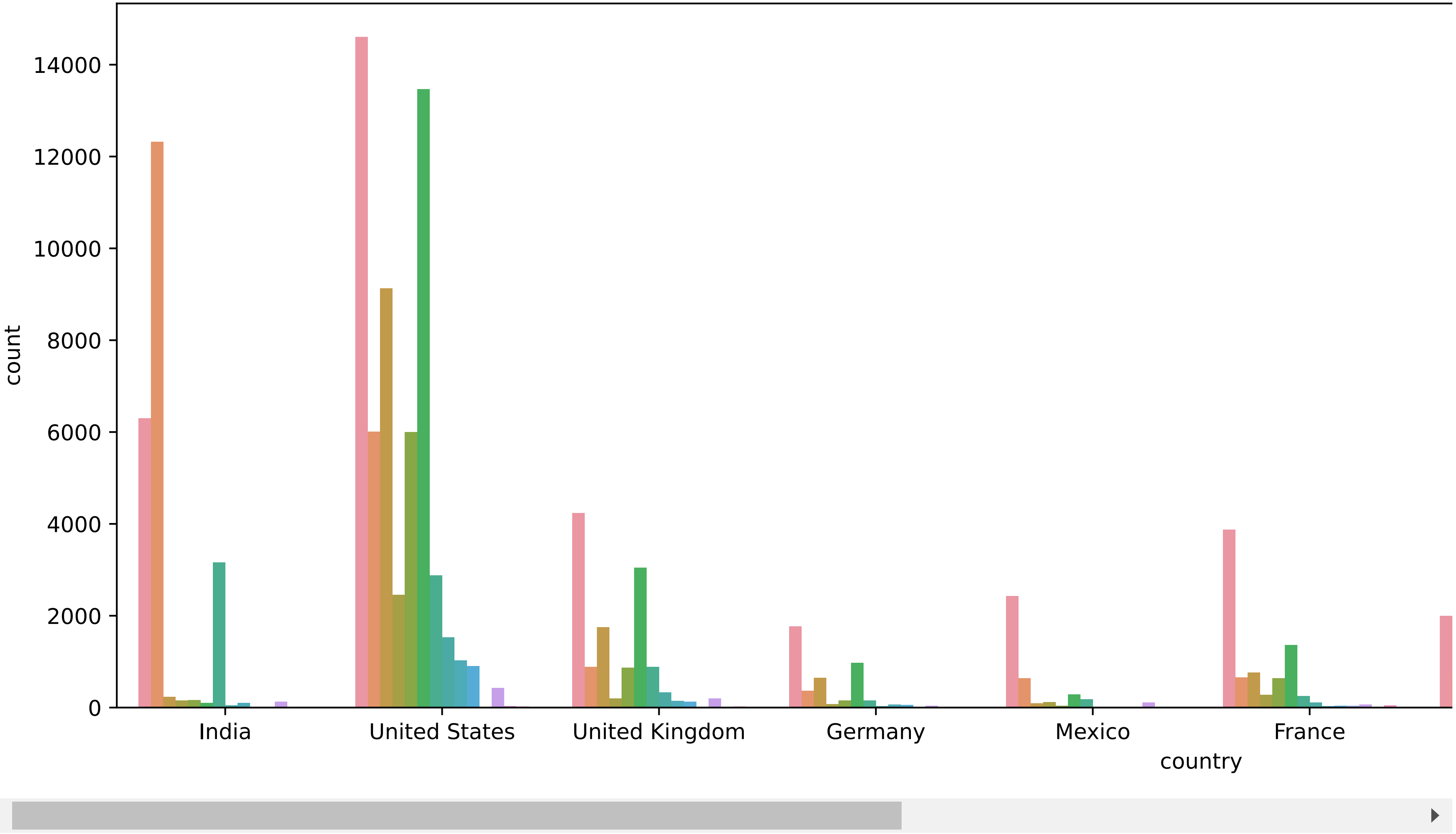
Analyzing the plot between 'year_added' and 'release_year' along with the provided correlation coefficients, we can derive the following insights:

```
- The platform predominantly added content between 2017 and 2021, with a significant portion of movies and sh
ows being added in 2017.
- The content added to the platform spans a wide range of release years, from the 1950s to the 2020s, indicat
ing a diverse selection of content that caters to various viewer preferences and interests.
- Despite the weak positive correlation between the year of release and the year of addition to the platform,
the platform's content acquisition strategy appears to focus on maintaining a diverse catalog, which includes
both classic movies from the 1950s and more recent releases.
```

- In summary, the platform has primarily added content between 2017 and 2021, with most movies being added in 2017. The content covers a wide range of release years, from the 1950s to the 2020s, showcasing the platform's commitment to offering a diverse selection of movies and shows for its viewers.

'country' vs 'rating':

In [170]:
```
df_temp = df[df["country"] != "Not Available"]
top_k_countries = df_temp['country'].value_counts().nlargest(10).index
filtered_df = df[df['country'].isin(top_k_countries)]

plt.rcParams["figure.figsize"] = (18,6)
display_countplot_with_hue(filtered_df, 'country', 'rating')
```



Based on the provided chart, we can derive insights about content consumption preferences in the United States, India, and the United Kingdom:

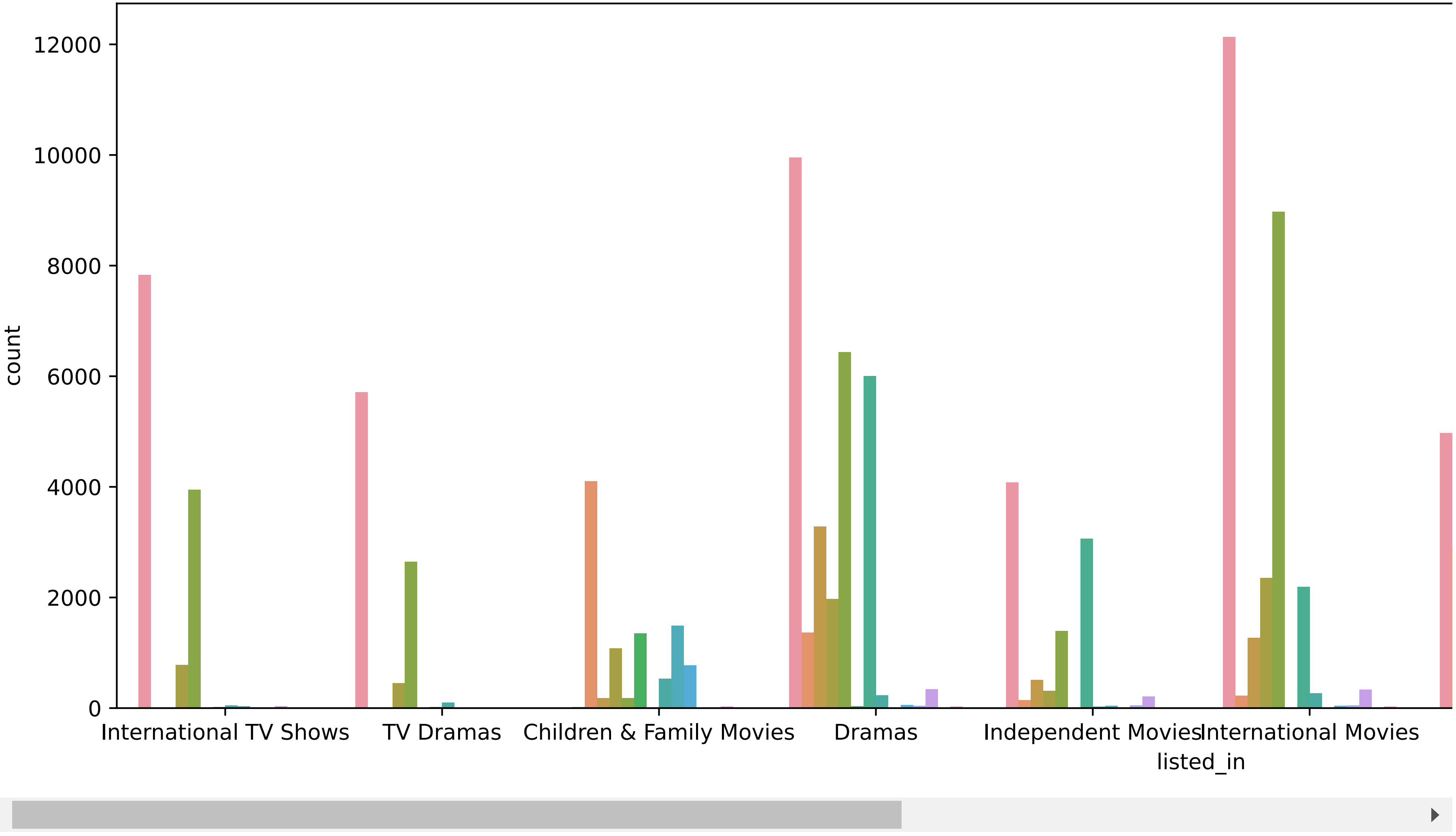
```
- In the United States, the most consumed content is rated TV-MA (Mature Audience Only), followed by R rated,
PG-13, TV-14, and PG. This suggests that US viewers prefer content with mature themes and explicit material.

- In India, the most consumed content is rated TV-14 (Parents Strongly Cautioned), followed by TV-MA and R ra
ted. This indicates that Indian viewers tend to prefer content with moderate maturity levels, though there is
still a significant interest in mature and restricted content.

- In the United Kingdom, the most consumed content is rated TV-MA, followed by R rated and PG-13. This shows
that UK viewers, similar to those in the US, prefer content with mature themes and explicit material.
```

- These insights can help streaming platforms tailor their content offerings to better cater to the preferences of viewers in each country, potentially leading to increased viewer engagement and satisfaction.

'listed_in' vs 'rating':

In [171]:

```
top_k_listed_ins = df['listed_in'].value_counts().nlargest(10).index
filtered_df = df[df['listed_in'].isin(top_k_listed_ins)]

plt.rcParams["figure.figsize"] = (18,6)
display_countplot_with_hue(filtered_df, 'listed_in', 'rating')
```



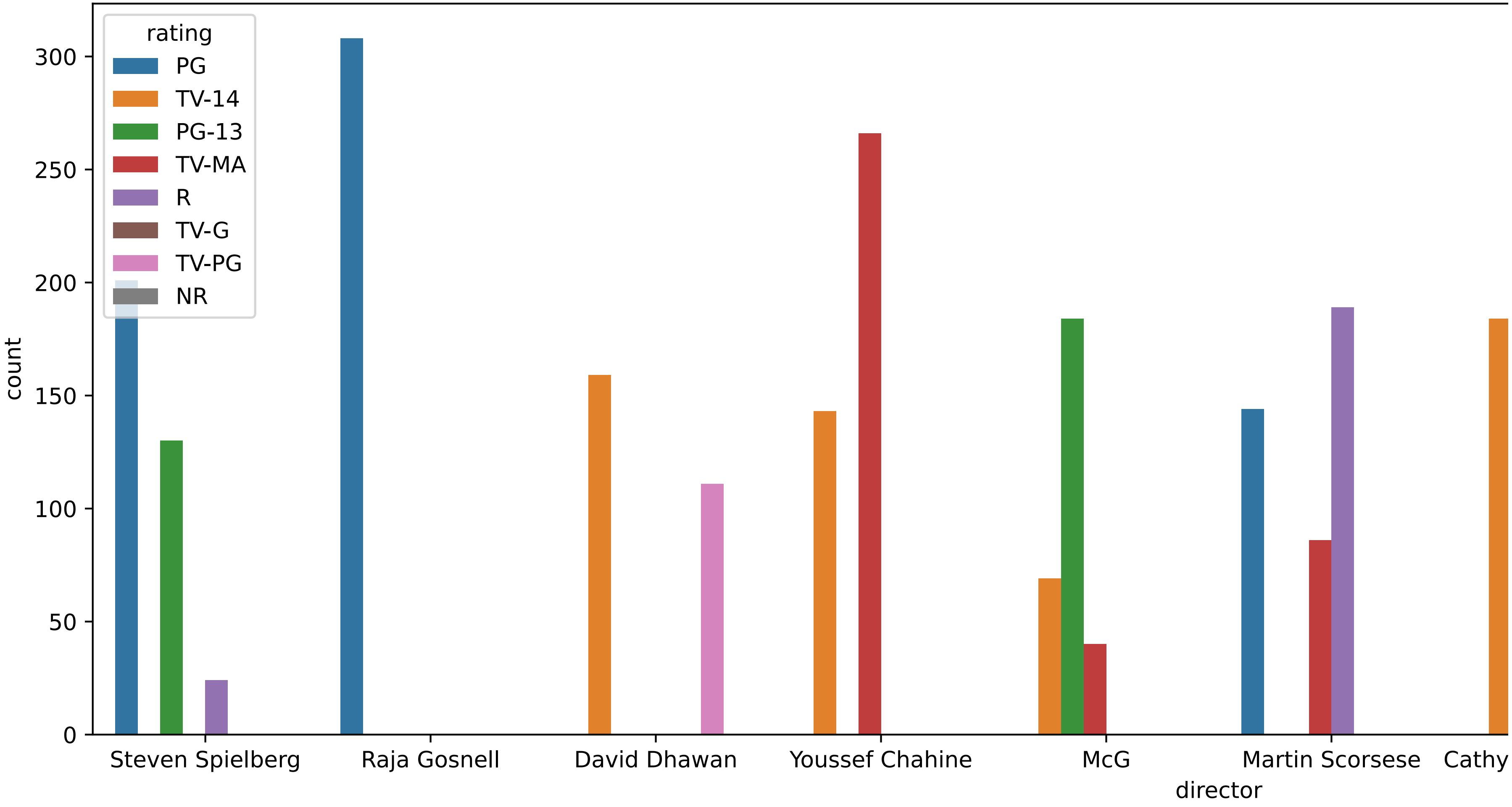
Analyzing the plot between 'listed_in' (genre) and 'rating' for the content present on the platform, we can derive the following insights:

```
- International shows and International movies: The platform has a higher concentration of shows with ratings
TV-MA and TV-14 in these genres, catering to viewers who prefer content with moderate to mature themes and ex
plicit material.

- Action & Adventure: The platform offers more shows with ratings R, TV-14, and PG-13 in this genre, providin
g a mix of restricted, moderately mature, and slightly less explicit content to satisfy diverse action and ad
venture preferences.

- Dramas: The platform features a wide range of shows with ratings TV-MA, TV-14, R, and PG-13 in this genre,
catering to viewers who appreciate various levels of maturity in dramatic content.

- Comedies: The platform predominantly hosts shows with ratings TV-MA, TV-14, and R in this genre, targeting
viewers who enjoy mature and moderately mature comedy content with explicit material.
```

- These insights can inform the streaming platform's content acquisition and production strategies, enabling them to maintain and expand their offerings in line with viewer preferences across different genres and ratings.

'director' vs 'rating':

In [172]:
```
df_temp = df[df["director"] != "Not Available"]
top_k_directors = df_temp['director'].value_counts().nlargest(10).index
filtered_df = df_temp[df_temp['director'].isin(top_k_directors)]

plt.rcParams["figure.figsize"] = (18,6)
display_countplot_with_hue(filtered_df, 'director', 'rating')
```



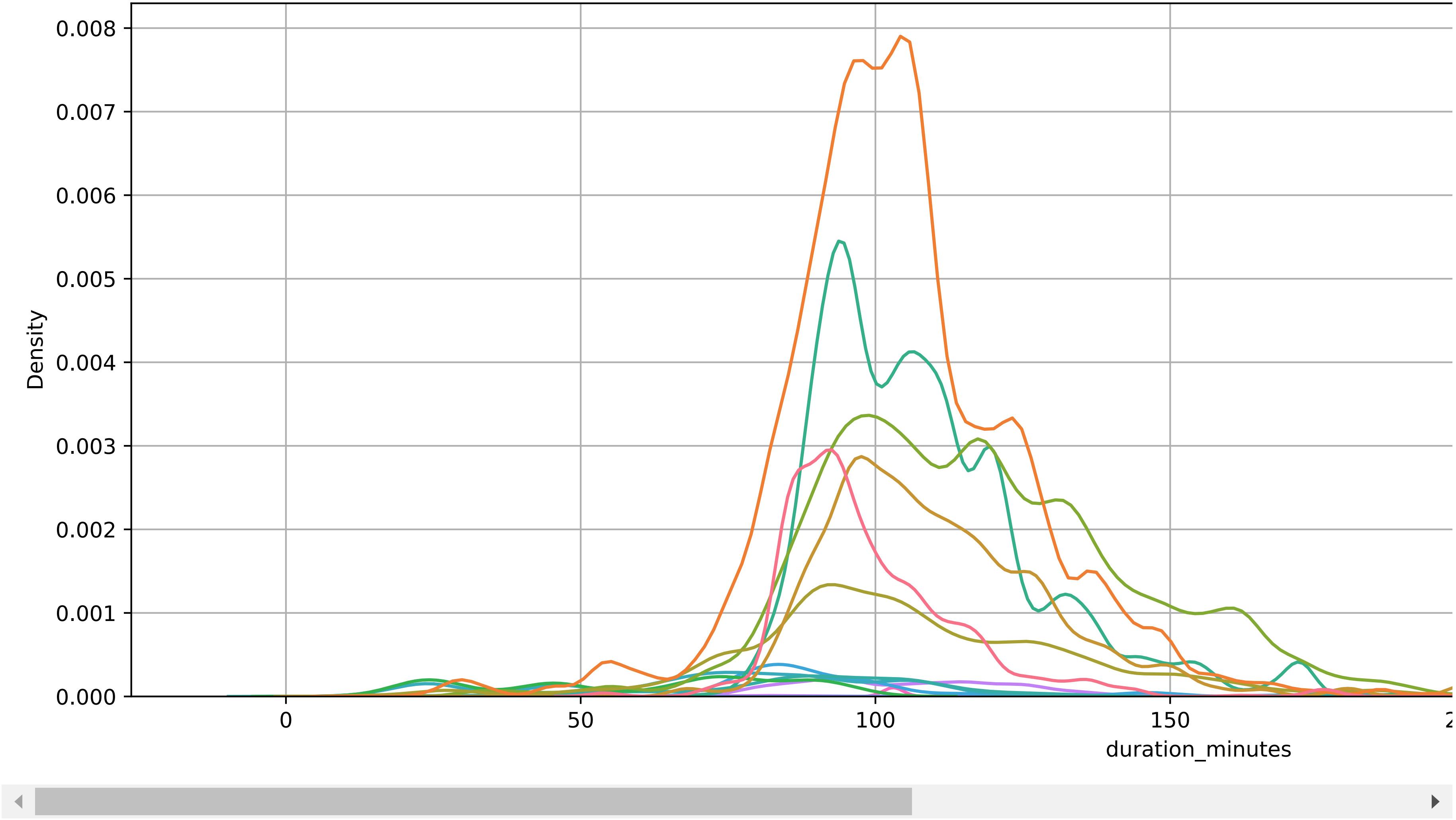
Analyzing the plot between 'director' and 'rating' for the top 10 directors and their movies present on the platform, we can derive the following insights:

```
- Steven Spielberg prefers making movies with ratings PG and PG-13, catering to a wide audience that includes children and teenagers.

- Raja Gosnell's movies generally have a PG rating, targeting family-friendly content suitable for all ages.

- David Dhavan creates movies with ratings TV-14 and TV-PG, focusing on moderately mature content that appeals to a broad range of viewers.

- Youssef Chahine's movies usually have ratings TV-14 and TV-MA, indicating a preference for moderate to mature themes and explicit material.

- McG's movies are predominantly rated PG-13, catering to a slightly older audience interested in moderately mature content.

- Martin Scorsese creates movies with ratings PG, R, and TV-MA, showcasing a diverse range of content from family-friendly to mature and explicit material.

- Cathy Garcia-Molina's movies have ratings TV-14, TV-MA, and TV-PG, highlighting a mix of content targeting different maturity levels.

- Tom Hooper's movies generally have ratings R and PG-13, focusing on restricted and moderately mature content.

- Lars von Trier's movies are typically rated TV-MA and NR (Not Rated), indicating a preference for mature themes and explicit material.
```

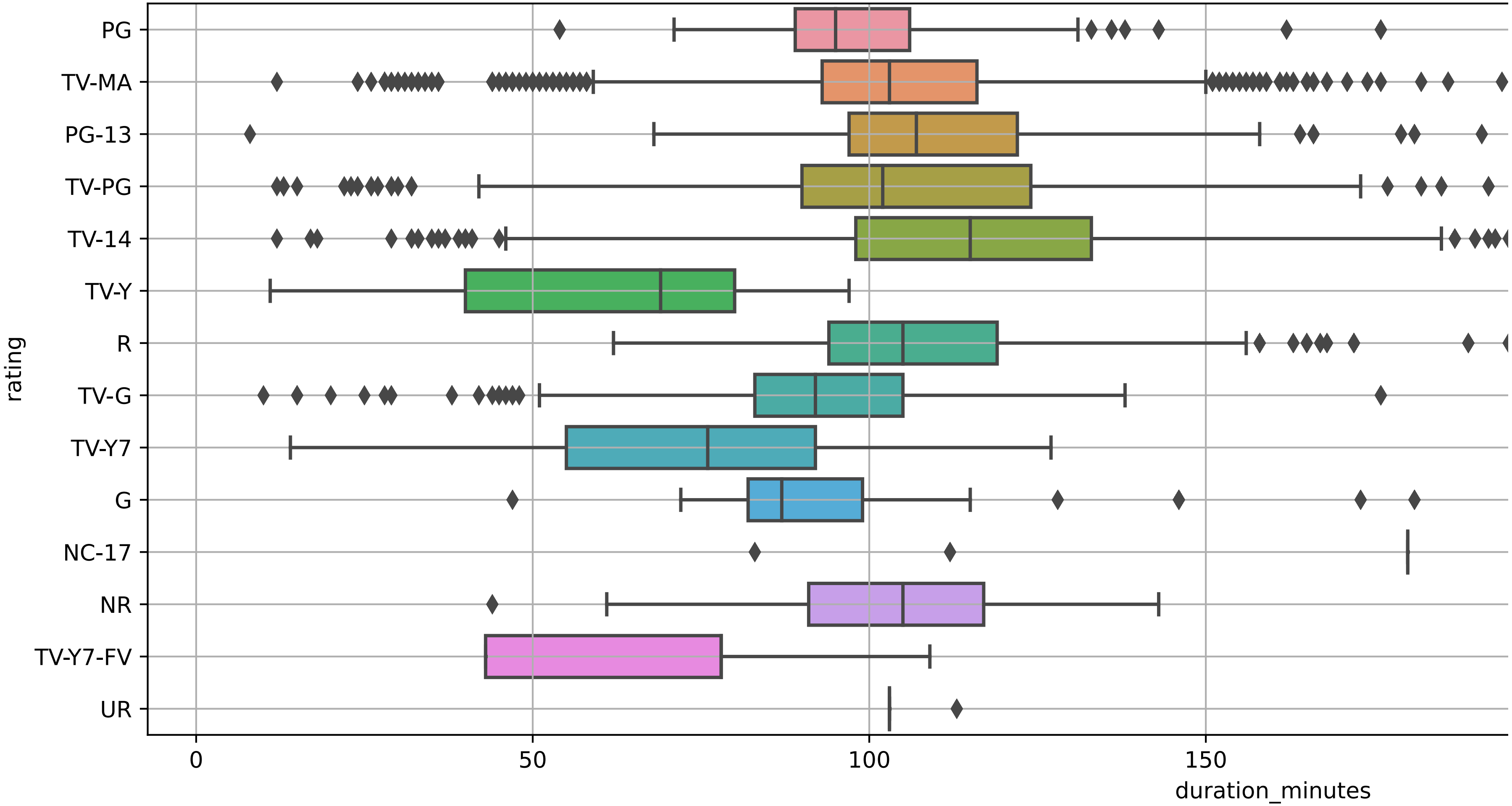
- These insights into the top director's content preferences can help the streaming platform to understand their audience's preferences better and provide more targeted recommendations and content.

'duration_minutes' vs 'rating':

```
In [173]: display_kde_plot_with_hue(df[df["duration_minutes"] != -1], 'duration_minutes', 'rating')
```



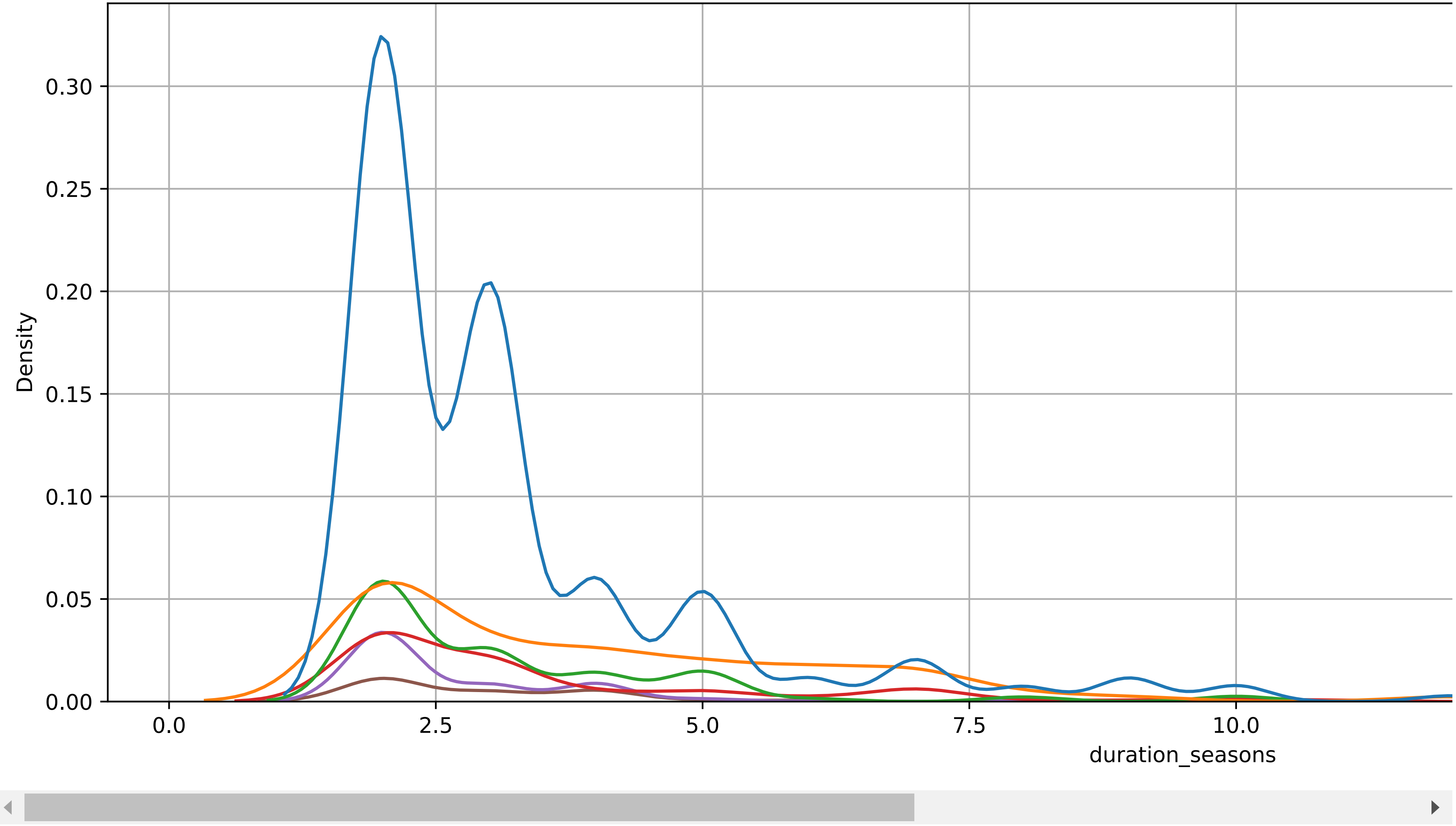
In [174]:
```
display_box_plot_2d(df[df["duration_minutes"] != -1],'duration_minutes', 'rating')
```



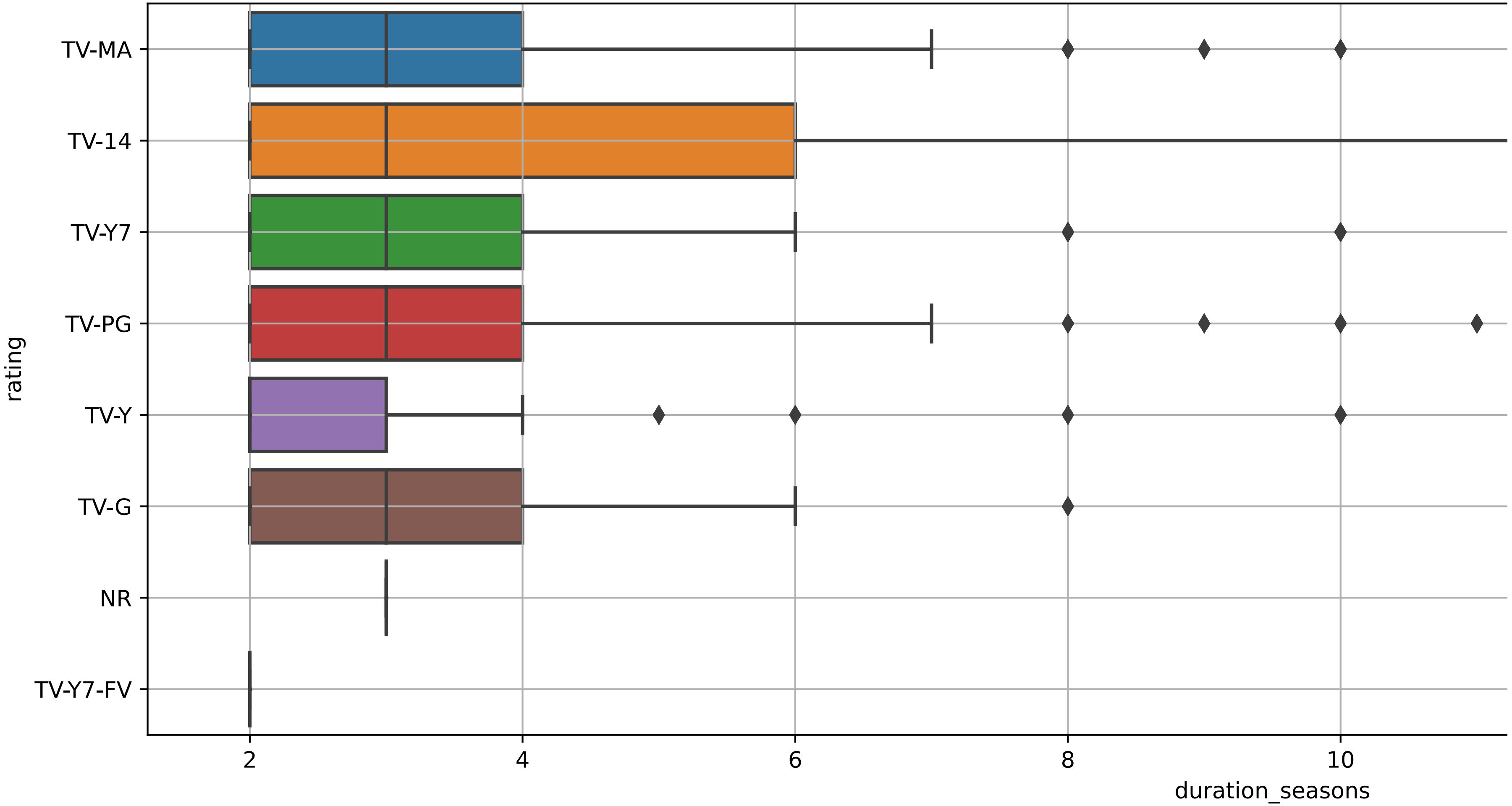
In [ ]:

'duration_seasons' vs 'rating':

```
In [175]: display_kde_plot_with_hue(df[df["duration_seasons"] != -1], 'duration_seasons', 'rating')
```



```
In [176]: display_box_plot_2d(df[df["duration_seasons"] != -1],'duration_seasons', 'rating')
```

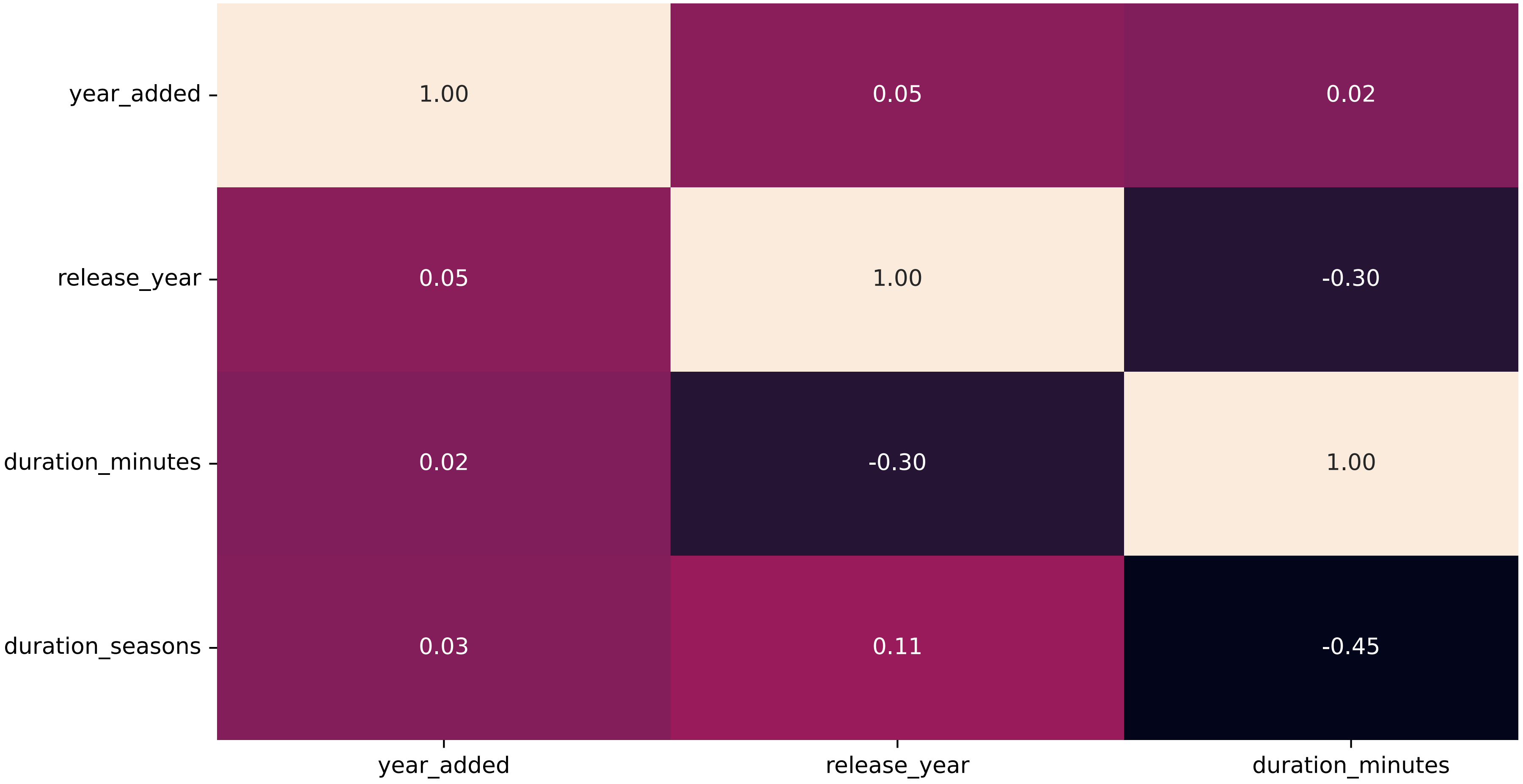


```
In [ ]:
```

Correlation Heatmap:

In [177]:

```
display_correlation_plot(df)
```



In [ ]: