Problem Statement:

Perform Exploratory Data Analysis (EDA) in order to generate insights that could help Netflix in deciding which type of shows or movies to produce and how they can grow the business in different countries.

In [1]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import plotly.express as px
```

In [ ]:

```
!python -m wget https://d2beiqkhq929f0.cloudfront.net/public_assets/assets/000/000/940/original/netflix.csv
```

In [2]:

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

In [3]:
```python
df.head()
```

Out[3]:

	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 [4]:

```
df.tail()
```

Out[4]:

	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...

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

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 8807 entries, 0 to 8806
Data columns (total 12 columns):
 #   Column        Non-Null Count  Dtype 
---  ------        --------------  ----- 
 0   show_id       8807 non-null   object
 1   type          8807 non-null   object
 2   title         8807 non-null   object
 3   director      6173 non-null   object
 4   cast          7982 non-null   object
 5   country       7976 non-null   object
 6   date_added    8797 non-null   object
 7   release_year  8807 non-null   int64 
 8   rating        8803 non-null   object
 9   duration      8804 non-null   object
 10  listed_in     8807 non-null   object
 11  description   8807 non-null   object
dtypes: int64(1), object(11)
memory usage: 825.8+ KB
```

In [6]:
```
df.describe()
```

Out[6]:

	release_year
count	8807.000000
mean	2014.180198
std	8.819312
min	1925.000000
25%	2013.000000
50%	2017.000000
75%	2019.000000
max	2021.000000

In [7]:
```
df.columns
```

Out[7]:
```
Index(['show_id', 'type', 'title', 'director', 'cast', 'country', 'date_added',
       'release_year', 'rating', 'duration', 'listed_in', 'description'],
      dtype='object')
```

In [8]:
```
df.shape
```

Out[8]:
```
(8807, 12)
```

In [9]:
```
df.isna().sum()
```

Out[9]:
```
show_id            0
type               0
title              0
director        2634
cast             825
country          831
date_added        10
release_year       0
rating             4
duration           3
listed_in          0
description        0
dtype: int64
```

Get percentage of missing values in columns of `df`

In [10]:

```

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 [11]:

```
df["rating"].value_counts()
```

Out[11]:

```
TV-MA       3207
TV-14       2160
TV-PG        863
R            799
PG-13        490
TV-Y7        334
TV-Y         307
PG           287
TV-G         220
NR            80
G             41
TV-Y7-FV       6
NC-17          3
UR             3
74 min         1
84 min         1
66 min         1
Name: rating, dtype: int64
```

```
In [ ]:
```

Drop the column `description` from dataframe `df` as we can not generate insights using this column in this case study.

```
In [12]: df.drop(columns=["description"], inplace = True)
```

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

```
Out[13]: Index(['show_id', 'type', 'title', 'director', 'cast', 'country', 'date_added',
               'release_year', 'rating', 'duration', 'listed_in'],
              dtype='object')
```

```
In [14]: df.shape
```

```
Out[14]: (8807, 11)
```

In [15]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 8807 entries, 0 to 8806
Data columns (total 11 columns):
 #   Column        Non-Null Count  Dtype 
---  ------        --------------  ----- 
 0   show_id       8807 non-null   object
 1   type          8807 non-null   object
 2   title         8807 non-null   object
 3   director      6173 non-null   object
 4   cast          7982 non-null   object
 5   country       7976 non-null   object
 6   date_added    8797 non-null   object
 7   release_year  8807 non-null   int64 
 8   rating        8803 non-null   object
 9   duration      8804 non-null   object
 10  listed_in     8807 non-null   object
dtypes: int64(1), object(10)
memory usage: 757.0+ KB
```

In [16]:

```
df.head()
```

Out[16]:

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in
0	s1	Movie	Dick Johnson Is Dead	Kirsten Johnson	NaN	United States	September 25, 2021	2020	PG-13	90 min	Documentaries
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
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...
3	s4	TV Show	Jailbirds New Orleans	NaN	NaN	NaN	September 24, 2021	2021	TV-MA	1 Season	Docuseries, Reality TV
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 [ ]:

Challanges in data pre-processing:

```
1. Normalise the dataframe to make data un-nested:
    - Use `split` and `stack` for columns `director`, `cast`, `country`, `listed_in`.
    - After then join the seperate dataframes together and then merge that final dataframe with original dataframe on column `title` to get whole data.
    - Remove duplicate columns from original dataframe `df`.
2. Update the datatypes of columns in `df` with correct types:
    - Update column `date_added` to `datetime` datatype.
3. Dealing with `NaN` values:
    - Use `mode` imputation for categorical values.
    - Use `median` imputation for numerical values.
4. Drop the rows which has mismatched values:
    -  e.g. `rating` column values
5. Drop the duplicate rows.
```

In [ ]:

1. Normalise the dataframe to make data un-nested:

```
- Use `split` and `stack` for columns `director`, `cast`, `country`, `listed_in`.
- After then join the seperate dataframes together and then merge that final dataframe with original dataframe on column `title` to get whole data.
- Remove duplicate columns from original dataframe `df`.
```

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

In [17]:
```
df.head()
```

Out[17]:

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in
0	s1	Movie	Dick Johnson Is Dead	Kirsten Johnson	NaN	United States	September 25, 2021	2020	PG-13	90 min	Documentaries
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
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...
3	s4	TV Show	Jailbirds New Orleans	NaN	NaN	NaN	September 24, 2021	2021	TV-MA	1 Season	Docuseries, Reality TV
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 [18]:
```
list_director = df["director"].apply(lambda x: str(x).split(", ")).tolist()
```

In [19]:
```
df_director = pd.DataFrame(list_director, index = df["title"])
```

In [20]:
```
df_director = df_director.stack()
```

In [21]:
```
df_director = pd.DataFrame(df_director)
```

In [22]:
```
df_director.reset_index(inplace= True)
```

In [23]:
```
df_director = df_director[["title", 0]]
```

In [24]:
```
df_director.rename(columns = {0: "director"}, inplace = True)
```

In [25]:
```
df_director.head()
```

Out[25]:

	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 [26]:
```
df.head()
```

Out[26]:

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in
0	s1	Movie	Dick Johnson Is Dead	Kirsten Johnson	NaN	United States	September 25, 2021	2020	PG-13	90 min	Documentaries
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
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...
3	s4	TV Show	Jailbirds New Orleans	NaN	NaN	NaN	September 24, 2021	2021	TV-MA	1 Season	Docuseries, Reality TV
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 [27]:
```
list_cast = df["cast"].apply(lambda x: str(x).split(", ")).tolist()
```

In [28]:
```
df_cast = pd.DataFrame(list_cast, index=df["title"])
```

In [29]:
```
df_cast = df_cast.stack()
```

In [30]:
```
df_cast=pd.DataFrame(df_cast)
```

In [31]:
```
df_cast.reset_index(inplace=True)
```

In [32]:
```
df_cast = df_cast[["title", 0]]
```

In [33]:
```
df_cast.rename(columns = {0:'cast'}, inplace = True)
```

In [34]:
```
df_cast.head()
```

Out[34]:

	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 [35]:
```
df.head()
```

Out[35]:

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in
0	s1	Movie	Dick Johnson Is Dead	Kirsten Johnson	NaN	United States	September 25, 2021	2020	PG-13	90 min	Documentaries
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
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...
3	s4	TV Show	Jailbirds New Orleans	NaN	NaN	NaN	September 24, 2021	2021	TV-MA	1 Season	Docuseries, Reality TV
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 [36]:
```
list_country = df["country"].apply(lambda x: str(x).split(", ")).tolist()
```

In [37]:
```
df_country = pd.DataFrame(list_country, index = df["title"])
```

In [38]:
```
df_country = df_country.stack()
```

In [39]:
```
df_country = pd.DataFrame(df_country)
```

In [40]:
```
df_country.reset_index(inplace = True)
```

In [41]:
```
df_country = df_country[["title", 0]]
```

In [42]:
```
df_country.rename(columns = {0: "country"}, inplace = True)
```

In [43]:
```
df_country.head()
```

Out[43]:

	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 [47]:
```
df.head()
```

Out[47]:

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in
0	s1	Movie	Dick Johnson Is Dead	Kirsten Johnson	NaN	United States	September 25, 2021	2020	PG-13	90 min	Documentaries
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
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...
3	s4	TV Show	Jailbirds New Orleans	NaN	NaN	NaN	September 24, 2021	2021	TV-MA	1 Season	Docuseries, Reality TV
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 [48]:
```
list_listed_in = df["listed_in"].apply(lambda x: str(x).split(", ")).tolist()
```

In [49]:
```
df_listed_in = pd.DataFrame(list_listed_in, index=df["title"])
```

In [50]:
```
df_listed_in = df_listed_in.stack()
```

In [51]:
```
df_listed_in = pd.DataFrame(df_listed_in)
```

In [52]:
```
df_listed_in.reset_index(inplace= True)
```

In [53]:
```
df_listed_in = df_listed_in[["title", 0]]
```

In [54]:
```
df_listed_in.rename(columns = {0: "listed_in"}, inplace= True)
```

In [55]:
```
df_listed_in.head()
```

Out[55]:

	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 [56]:
```
first_merge_df = pd.merge(df_director, df_cast, how='inner', on="title")
first_merge_df.head()
```

Out[56]:

	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

In [ ]:

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

In [57]:
```
second_merge_df = pd.merge(first_merge_df, df_country, how='inner', on="title")
second_merge_df.head()
```

Out[57]:

	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

In [ ]:

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

In [58]:

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

Out[58]:

	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

In [ ]:

```

```

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

In [59]:
```
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[59]:

	show_id	type	title	date_added	release_year	rating	duration	director	cast	country	listed_in
0	s1	Movie	Dick Johnson Is Dead	September 25, 2021	2020	PG-13	90 min	Kirsten Johnson	nan	United States	Documentaries
1	s2	TV Show	Blood & Water	September 24, 2021	2021	TV-MA	2 Seasons	nan	Ama Qamata	South Africa	International TV Shows
2	s2	TV Show	Blood & Water	September 24, 2021	2021	TV-MA	2 Seasons	nan	Ama Qamata	South Africa	TV Dramas
3	s2	TV Show	Blood & Water	September 24, 2021	2021	TV-MA	2 Seasons	nan	Ama Qamata	South Africa	TV Mysteries
4	s2	TV Show	Blood & Water	September 24, 2021	2021	TV-MA	2 Seasons	nan	Khosi Ngema	South Africa	International TV Shows
5	s2	TV Show	Blood & Water	September 24, 2021	2021	TV-MA	2 Seasons	nan	Khosi Ngema	South Africa	TV Dramas
6	s2	TV Show	Blood & Water	September 24, 2021	2021	TV-MA	2 Seasons	nan	Khosi Ngema	South Africa	TV Mysteries
7	s2	TV	Blood & Water	September 24,	2021	TV-	2	nan	Gail Mabalane	South	International TV

In [60]:
```
final_merge_df.replace(to_replace=["nan"], value=[np.nan], inplace=True)
```

In [61]:
```
df.columns.tolist()
```

Out[61]:
```
['show_id',
 'type',
 'title',
 'director',
 'cast',
 'country',
 'date_added',
 'release_year',
 'rating',
 'duration',
 'listed_in']
```

In [62]:
```
df_clean = final_merge_df[df.columns.tolist()]
df_clean.head(50)
```

Out[62]:

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in
0	s1	Movie	Dick Johnson Is Dead	Kirsten Johnson	NaN	United States	September 25, 2021	2020	PG-13	90 min	Documentaries
1	s2	TV Show	Blood & Water	NaN	Ama Qamata	South Africa	September 24, 2021	2021	TV-MA	2 Seasons	International TV Shows
2	s2	TV Show	Blood & Water	NaN	Ama Qamata	South Africa	September 24, 2021	2021	TV-MA	2 Seasons	TV Dramas
3	s2	TV Show	Blood & Water	NaN	Ama Qamata	South Africa	September 24, 2021	2021	TV-MA	2 Seasons	TV Mysteries
4	s2	TV Show	Blood & Water	NaN	Khosi Ngema	South Africa	September 24, 2021	2021	TV-MA	2 Seasons	International TV Shows
5	s2	TV Show	Blood & Water	NaN	Khosi Ngema	South Africa	September 24, 2021	2021	TV-MA	2 Seasons	TV Dramas
6	s2	TV Show	Blood & Water	NaN	Khosi Ngema	South Africa	September 24, 2021	2021	TV-MA	2 Seasons	TV Mysteries
7	s2	TV	Blood & Water	NaN	Gail Mabalane	South	September 24,	2021	TV-	2	International

In [ ]:

In [63]:
```
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   show_id       201991 non-null  object
 1   type          201991 non-null  object
 2   title         201991 non-null  object
 3   director      151348 non-null  object
 4   cast          199845 non-null  object
 5   country       190094 non-null  object
 6   date_added    201833 non-null  object
 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: int64(1), object(10)
memory usage: 18.5+ MB
```

In [64]:
```
df_clean.head()
```

Out[64]:

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in
0	s1	Movie	Dick Johnson Is Dead	Kirsten Johnson	NaN	United States	September 25, 2021	2020	PG-13	90 min	Documentaries
1	s2	TV Show	Blood & Water	NaN	Ama Qamata	South Africa	September 24, 2021	2021	TV-MA	2 Seasons	International TV Shows
2	s2	TV Show	Blood & Water	NaN	Ama Qamata	South Africa	September 24, 2021	2021	TV-MA	2 Seasons	TV Dramas
3	s2	TV Show	Blood & Water	NaN	Ama Qamata	South Africa	September 24, 2021	2021	TV-MA	2 Seasons	TV Mysteries
4	s2	TV Show	Blood & Water	NaN	Khosi Ngema	South Africa	September 24, 2021	2021	TV-MA	2 Seasons	International TV Shows

In [65]:
```
df_clean.tail()
```

Out[65]:

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in
201986	s8807	Movie	Zubaan	Mozez Singh	Anita Shabdish	India	March 2, 2019	2015	TV-14	111 min	International Movies
201987	s8807	Movie	Zubaan	Mozez Singh	Anita Shabdish	India	March 2, 2019	2015	TV-14	111 min	Music & Musicals
201988	s8807	Movie	Zubaan	Mozez Singh	Chittaranjan Tripathy	India	March 2, 2019	2015	TV-14	111 min	Dramas
201989	s8807	Movie	Zubaan	Mozez Singh	Chittaranjan Tripathy	India	March 2, 2019	2015	TV-14	111 min	International Movies
201990	s8807	Movie	Zubaan	Mozez Singh	Chittaranjan Tripathy	India	March 2, 2019	2015	TV-14	111 min	Music & Musicals

In [66]:
```
df_clean.shape
```

Out[66]:
```
(201991, 11)
```

In [ ]:
```

```

2. Update the datatypes of columns in df with correct types:

```
- Update column `date_added` to `datetime` datatype.
- Add new column `year_added` to `df_clean` dataframe
```

Update datatype of `release_year` to appropriate format.

In [67]:
```
df_clean["date_added"] = pd.to_datetime(df_clean["date_added"])
```

In [68]:

```
df_clean.head()
```

Out[68]:

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in
0	s1	Movie	Dick Johnson Is Dead	Kirsten Johnson	NaN	United States	2021-09-25	2020	PG-13	90 min	Documentaries
1	s2	TV Show	Blood & Water	NaN	Ama Qamata	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows
2	s2	TV Show	Blood & Water	NaN	Ama Qamata	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Dramas
3	s2	TV Show	Blood & Water	NaN	Ama Qamata	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Mysteries
4	s2	TV Show	Blood & Water	NaN	Khosi Ngema	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows

In [69]:

```
df_clean["year_added"] = df_clean["date_added"].dt.year
```

In [70]:

```
df_clean.head()
```

Out[70]:

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in	year_added
0	s1	Movie	Dick Johnson Is Dead	Kirsten Johnson	NaN	United States	2021-09-25	2020	PG-13	90 min	Documentaries	2021.0
1	s2	TV Show	Blood & Water	NaN	Ama Qamata	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows	2021.0
2	s2	TV Show	Blood & Water	NaN	Ama Qamata	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Dramas	2021.0
3	s2	TV Show	Blood & Water	NaN	Ama Qamata	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Mysteries	2021.0
4	s2	TV Show	Blood & Water	NaN	Khosi Ngema	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows	2021.0

In [71]:
```
df_clean.columns.tolist()
```

Out[71]:
```
['show_id',
 'type',
 'title',
 'director',
 'cast',
 'country',
 'date_added',
 'release_year',
 'rating',
 'duration',
 'listed_in',
 'year_added']
```

In [72]:
```
df_clean = df_clean[['show_id', 'type', 'title', 'director', 'cast', 'country', 'date_added', 'year_added', 'release_yea
```

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

Out[73]:

	show_id	type	title	director	cast	country	date_added	year_added	release_year	rating	duration	listed_in
0	s1	Movie	Dick Johnson Is Dead	Kirsten Johnson	NaN	United States	2021-09-25	2021.0	2020	PG-13	90 min	Documentaries
1	s2	TV Show	Blood & Water	NaN	Ama Qamata	South Africa	2021-09-24	2021.0	2021	TV-MA	2 Seasons	International TV Shows
2	s2	TV Show	Blood & Water	NaN	Ama Qamata	South Africa	2021-09-24	2021.0	2021	TV-MA	2 Seasons	TV Dramas
3	s2	TV Show	Blood & Water	NaN	Ama Qamata	South Africa	2021-09-24	2021.0	2021	TV-MA	2 Seasons	TV Mysteries
4	s2	TV Show	Blood & Water	NaN	Khosi Ngema	South Africa	2021-09-24	2021.0	2021	TV-MA	2 Seasons	International TV Shows

In [74]:

```
df_clean.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 201991 entries, 0 to 201990
Data columns (total 12 columns):
 #   Column        Non-Null Count   Dtype
---  ------        --------------   -----
 0   show_id       201991 non-null  object
 1   type          201991 non-null  object
 2   title         201991 non-null  object
 3   director      151348 non-null  object
 4   cast          199845 non-null  object
 5   country       190094 non-null  object
 6   date_added    201833 non-null  datetime64[ns]
 7   year_added    201833 non-null  float64
 8   release_year  201991 non-null  int64
 9   rating        201924 non-null  object
 10  duration      201988 non-null  object
 11  listed_in     201991 non-null  object
dtypes: datetime64[ns](1), float64(1), int64(1), object(9)
memory usage: 20.0+ MB
```

In [75]:

```
df_clean["date_added"].value_counts()
```

Out[75]:

```
2020-01-01    3748
2019-11-01    2258
2021-07-01    2219
2017-10-01    1899
2021-09-01    1756
              ...
2014-11-14       1
2017-01-24       1
2020-11-18       1
2017-01-23       1
2021-09-25       1
Name: date_added, Length: 1714, dtype: int64
```

In [ ]:

3. Dealing with `NaN` values:

```
- Use `mode` imputation for categorical values.
- Use `median` or `mean` imputation for numerical values.
```

In [76]:

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

Out[76]:

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

Get percentage of missing values in columns of `df_clean`

In [77]:

```
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 %
year_added   : 00.08 %
rating       : 00.03 %
duration     : 000.0 %
-----------------------------------
```

In [ ]:

Use `mode` imputation for filling `NaN` values in `director` column.

In [78]:

```
df_clean["director"].mode().tolist()[0]
```

Out[78]:

```
'Martin Scorsese'
```

In [79]:

```
df_clean["director"].fillna(df_clean["director"].mode().tolist()[0], inplace = True)
```

In [80]:
```
df_clean.isna().sum()
```

Out[80]:
```
show_id             0
type                0
title               0
director            0
cast             2146
country         11897
date_added        158
year_added        158
release_year        0
rating             67
duration            3
listed_in           0
dtype: int64
```

In [81]:
```
df_clean.head(50)
```

Out[81]:

	show_id	type	title	director	cast	country	date_added	year_added	release_year	rating	duration	listed_in
0	s1	Movie	Dick Johnson Is Dead	Kirsten Johnson	NaN	United States	2021-09-25	2021.0	2020	PG-13	90 min	Documentaries
1	s2	TV Show	Blood & Water	Martin Scorsese	Ama Qamata	South Africa	2021-09-24	2021.0	2021	TV-MA	2 Seasons	International TV Shows
2	s2	TV Show	Blood & Water	Martin Scorsese	Ama Qamata	South Africa	2021-09-24	2021.0	2021	TV-MA	2 Seasons	TV Dramas
3	s2	TV Show	Blood & Water	Martin Scorsese	Ama Qamata	South Africa	2021-09-24	2021.0	2021	TV-MA	2 Seasons	TV Mysteries
4	s2	TV Show	Blood & Water	Martin Scorsese	Khosi Ngema	South Africa	2021-09-24	2021.0	2021	TV-MA	2 Seasons	International TV Shows
5	s2	TV Show	Blood & Water	Martin Scorsese	Khosi Ngema	South Africa	2021-09-24	2021.0	2021	TV-MA	2 Seasons	TV Dramas
6	s2	TV Show	Blood & Water	Martin Scorsese	Khosi Ngema	South Africa	2021-09-24	2021.0	2021	TV-MA	2 Seasons	TV Mysteries
7	s2	TV	Blood &	Martin	Gail Mabalane	South	2021-09-24	2021.0	2021	TV-	2	International

In [ ]:

Use `mode` imputation for filling `NaN` values in `country` column.

In [82]:
```
df_clean["country"].mode().tolist()[0]
```

Out[82]:
```
'United States'
```

In [83]:
```
df_clean["country"].fillna(df_clean["country"].mode().tolist()[0], inplace = True)
```

In [84]:
```
df_clean.isna().sum()
```

Out[84]:
```
show_id            0
type               0
title              0
director           0
cast            2146
country            0
date_added       158
year_added       158
release_year       0
rating            67
duration           3
listed_in          0
dtype: int64
```

In [85]:
```
df_clean.head(50)
```

Out[85]:

	show_id	type	title	director	cast	country	date_added	year_added	release_year	rating	duration	listed_in
0	s1	Movie	Dick Johnson Is Dead	Kirsten Johnson	NaN	United States	2021-09-25	2021.0	2020	PG-13	90 min	Documentaries
1	s2	TV Show	Blood & Water	Martin Scorsese	Ama Qamata	South Africa	2021-09-24	2021.0	2021	TV-MA	2 Seasons	International TV Shows
2	s2	TV Show	Blood & Water	Martin Scorsese	Ama Qamata	South Africa	2021-09-24	2021.0	2021	TV-MA	2 Seasons	TV Dramas
3	s2	TV Show	Blood & Water	Martin Scorsese	Ama Qamata	South Africa	2021-09-24	2021.0	2021	TV-MA	2 Seasons	TV Mysteries
4	s2	TV Show	Blood & Water	Martin Scorsese	Khosi Ngema	South Africa	2021-09-24	2021.0	2021	TV-MA	2 Seasons	International TV Shows
5	s2	TV Show	Blood & Water	Martin Scorsese	Khosi Ngema	South Africa	2021-09-24	2021.0	2021	TV-MA	2 Seasons	TV Dramas
6	s2	TV Show	Blood & Water	Martin Scorsese	Khosi Ngema	South Africa	2021-09-24	2021.0	2021	TV-MA	2 Seasons	TV Mysteries
7	s2	TV	Blood &	Martin	Gail Mabalane	South	2021-09-24	2021.0	2021	TV-	2	International

In [ ]:

4. Drop the rows which has mismatched values:

```
- e.g. `rating` column values
```

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

In [86]:

```
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 %
year_added   : 00.08 %
rating       : 00.03 %
duration     : 000.0 %
-----------------------------------
```

Missing values for in columns `cast`, `date_added`, `rating` and `duration` are less than 3%.

Drop the rows where column value for `cast`, `date_added`, `rating` and `duration` is `NaN`.

In [87]:

```
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 [88]:

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

In [89]:

```
df_clean.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 199617 entries, 0 to 199616
Data columns (total 13 columns):
 #   Column        Non-Null Count   Dtype         
---  ------        --------------   -----         
 0   index         199617 non-null  int64         
 1   show_id       199617 non-null  object        
 2   type          199617 non-null  object        
 3   title         199617 non-null  object        
 4   director      199617 non-null  object        
 5   cast          199617 non-null  object        
 6   country       199617 non-null  object        
 7   date_added    199617 non-null  datetime64[ns]
 8   year_added    199617 non-null  float64       
 9   release_year  199617 non-null  int64         
 10  rating        199617 non-null  object        
 11  duration      199617 non-null  object        
 12  listed_in     199617 non-null  object        
dtypes: datetime64[ns](1), float64(1), int64(2), object(9)
memory usage: 19.8+ MB
```

In [90]:

```
df_clean.columns.tolist()
```

Out[90]:

```
['index',
 'show_id',
 'type',
 'title',
 'director',
 'cast',
 'country',
 'date_added',
 'year_added',
 'release_year',
 'rating',
 'duration',
 'listed_in']
```

In [91]:

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

In [92]:

```
df_clean.head()
```

Out[92]:

	show_id	type	title	director	cast	country	date_added	year_added	release_year	rating	duration	listed_in
0	s2	TV Show	Blood & Water	Martin Scorsese	Ama Qamata	South Africa	2021-09-24	2021.0	2021	TV-MA	2 Seasons	International TV Shows
1	s2	TV Show	Blood & Water	Martin Scorsese	Ama Qamata	South Africa	2021-09-24	2021.0	2021	TV-MA	2 Seasons	TV Dramas
2	s2	TV Show	Blood & Water	Martin Scorsese	Ama Qamata	South Africa	2021-09-24	2021.0	2021	TV-MA	2 Seasons	TV Mysteries
3	s2	TV Show	Blood & Water	Martin Scorsese	Khosi Ngema	South Africa	2021-09-24	2021.0	2021	TV-MA	2 Seasons	International TV Shows
4	s2	TV Show	Blood & Water	Martin Scorsese	Khosi Ngema	South Africa	2021-09-24	2021.0	2021	TV-MA	2 Seasons	TV Dramas

In [93]:

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

Out[93]:

```
show_id         0
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 [94]:
```
df_clean["rating"].value_counts()
```

Out[94]:
```
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
```

In [ ]:
```

```

5. Drop the duplicate rows from dataframe `df_clean`

In [95]:
```
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   show_id       199617 non-null  object        
 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  float64       
 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), float64(1), int64(1), object(9)
memory usage: 18.3+ MB
```

In [96]:
```
df_clean.shape
```

Out[96]:
```
(199617, 12)
```

In [97]:

```
df_clean.columns.tolist()
```

Out[97]:

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

In [98]:

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

In [99]:

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

In [100]:

```
df_clean.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 199562 entries, 0 to 199561
Data columns (total 13 columns):
 #   Column        Non-Null Count   Dtype
---  ------        --------------   -----
 0   index         199562 non-null  int64
 1   show_id       199562 non-null  object
 2   type          199562 non-null  object
 3   title         199562 non-null  object
 4   director      199562 non-null  object
 5   cast          199562 non-null  object
 6   country       199562 non-null  object
 7   date_added    199562 non-null  datetime64[ns]
 8   year_added    199562 non-null  float64
 9   release_year  199562 non-null  int64
 10  rating        199562 non-null  object
 11  duration      199562 non-null  object
 12  listed_in     199562 non-null  object
dtypes: datetime64[ns](1), float64(1), int64(2), object(9)
memory usage: 19.8+ MB
```

In [101]:

```
df_clean.shape
```

Out[101]:

```
(199562, 13)
```

In [102]:

```
df_clean.columns.tolist()
```

Out[102]:

```
['index',
 'show_id',
 'type',
 'title',
 'director',
 'cast',
 'country',
 'date_added',
 'year_added',
 'release_year',
 'rating',
 'duration',
 'listed_in']
```

In [103]:

```
df_clean.head()
```

Out[103]:

	index	show_id	type	title	director	cast	country	date_added	year_added	release_year	rating	duration	listed_in
0	0	s2	TV Show	Blood & Water	Martin Scorsese	Ama Qamata	South Africa	2021-09-24	2021.0	2021	TV-MA	2 Seasons	International TV Shows
1	1	s2	TV Show	Blood & Water	Martin Scorsese	Ama Qamata	South Africa	2021-09-24	2021.0	2021	TV-MA	2 Seasons	TV Dramas
2	2	s2	TV Show	Blood & Water	Martin Scorsese	Ama Qamata	South Africa	2021-09-24	2021.0	2021	TV-MA	2 Seasons	TV Mysteries
3	3	s2	TV Show	Blood & Water	Martin Scorsese	Khosi Ngema	South Africa	2021-09-24	2021.0	2021	TV-MA	2 Seasons	International TV Shows
4	4	s2	TV Show	Blood & Water	Martin Scorsese	Khosi Ngema	South Africa	2021-09-24	2021.0	2021	TV-MA	2 Seasons	TV Dramas

In [104]:

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

In [105]:

```
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   show_id       199562 non-null  object        
 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  float64       
 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), float64(1), int64(1), object(9)
memory usage: 18.3+ MB
```

In [106]:

```
df_clean.head()
```

Out[106]:

	show_id	type	title	director	cast	country	date_added	year_added	release_year	rating	duration	listed_in
0	s2	TV Show	Blood & Water	Martin Scorsese	Ama Qamata	South Africa	2021-09-24	2021.0	2021	TV-MA	2 Seasons	International TV Shows
1	s2	TV Show	Blood & Water	Martin Scorsese	Ama Qamata	South Africa	2021-09-24	2021.0	2021	TV-MA	2 Seasons	TV Dramas
2	s2	TV Show	Blood & Water	Martin Scorsese	Ama Qamata	South Africa	2021-09-24	2021.0	2021	TV-MA	2 Seasons	TV Mysteries
3	s2	TV Show	Blood & Water	Martin Scorsese	Khosi Ngema	South Africa	2021-09-24	2021.0	2021	TV-MA	2 Seasons	International TV Shows
4	s2	TV Show	Blood & Water	Martin Scorsese	Khosi Ngema	South Africa	2021-09-24	2021.0	2021	TV-MA	2 Seasons	TV Dramas

In [107]:

```
df_clean.tail()
```

Out[107]:

	show_id	type	title	director	cast	country	date_added	year_added	release_year	rating	duration	listed_in
199557	s8807	Movie	Zubaan	Mozez Singh	Anita Shabdish	India	2019-03-02	2019.0	2015	TV-14	111 min	International Movies
199558	s8807	Movie	Zubaan	Mozez Singh	Anita Shabdish	India	2019-03-02	2019.0	2015	TV-14	111 min	Music & Musicals
199559	s8807	Movie	Zubaan	Mozez Singh	Chittaranjan Tripathy	India	2019-03-02	2019.0	2015	TV-14	111 min	Dramas
199560	s8807	Movie	Zubaan	Mozez Singh	Chittaranjan Tripathy	India	2019-03-02	2019.0	2015	TV-14	111 min	International Movies
199561	s8807	Movie	Zubaan	Mozez Singh	Chittaranjan Tripathy	India	2019-03-02	2019.0	2015	TV-14	111 min	Music & Musicals

In [108]:

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

Out[108]:

```
show_id         0
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 [109]:

```
df_clean["year_added"] = df_clean["year_added"].astype(np.int64)
```

In [110]:
```
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   show_id       199562 non-null  object        
 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(2), object(9)
memory usage: 18.3+ MB
```

In [111]:
```
df_clean.head()
```

Out[111]:

	show_id	type	title	director	cast	country	date_added	year_added	release_year	rating	duration	listed_in
0	s2	TV Show	Blood & Water	Martin Scorsese	Ama Qamata	South Africa	2021-09-24	2021	2021	TV-MA	2 Seasons	International TV Shows
1	s2	TV Show	Blood & Water	Martin Scorsese	Ama Qamata	South Africa	2021-09-24	2021	2021	TV-MA	2 Seasons	TV Dramas
2	s2	TV Show	Blood & Water	Martin Scorsese	Ama Qamata	South Africa	2021-09-24	2021	2021	TV-MA	2 Seasons	TV Mysteries
3	s2	TV Show	Blood & Water	Martin Scorsese	Khosi Ngema	South Africa	2021-09-24	2021	2021	TV-MA	2 Seasons	International TV Shows
4	s2	TV Show	Blood & Water	Martin Scorsese	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 [112]:
```
df_final = df_clean.copy()
```

Create `netflix_final.csv` file from df_final dataframe.

In [113]:
```
df_final.to_csv('netflix_final.csv')
```

In [ ]:
```

```

Exploratory Data Analysis (EDA)

In [2]:
```
df_final = pd.read_csv("netflix_final.csv")
```

In [3]:
```
df_final.head()
```

Out[3]:

	Unnamed: 0	show_id	type	title	director	cast	country	date_added	year_added	release_year	rating	duration	listed_in
0	0	s2	TV Show	Blood & Water	Martin Scorsese	Ama Qamata	South Africa	2021-09-24	2021	2021	TV-MA	2 Seasons	International TV Shows
1	1	s2	TV Show	Blood & Water	Martin Scorsese	Ama Qamata	South Africa	2021-09-24	2021	2021	TV-MA	2 Seasons	TV Dramas
2	2	s2	TV Show	Blood & Water	Martin Scorsese	Ama Qamata	South Africa	2021-09-24	2021	2021	TV-MA	2 Seasons	TV Mysteries
3	3	s2	TV Show	Blood & Water	Martin Scorsese	Khosi Ngema	South Africa	2021-09-24	2021	2021	TV-MA	2 Seasons	International TV Shows
4	4	s2	TV Show	Blood & Water	Martin Scorsese	Khosi Ngema	South Africa	2021-09-24	2021	2021	TV-MA	2 Seasons	TV Dramas

In [4]:
```
df_final.columns.tolist()
```

Out[4]:
```
['Unnamed: 0',
 'show_id',
 'type',
 'title',
 'director',
 'cast',
 'country',
 'date_added',
 'year_added',
 'release_year',
 'rating',
 'duration',
 'listed_in']
```

In [5]:
```
df_final.drop(['Unnamed: 0'], axis=1, inplace=True)
```

In [7]:
```
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   show_id       199562 non-null  object
 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       199530 non-null  object
 6   date_added    199562 non-null  object
 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: int64(2), object(10)
memory usage: 18.3+ MB
```

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

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

In [13]:
```
df_final.columns
```

Out[13]:
```
Index(['show_id', 'type', 'title', 'director', 'cast', 'country', 'date_added',
       'year_added', 'release_year', 'rating', 'duration', 'listed_in'],
      dtype='object')
```

In [8]:
```
df_final.head()
```

Out[8]:

	show_id	type	title	director	cast	country	date_added	year_added	release_year	rating	duration	listed_in
0	s2	TV Show	Blood & Water	Martin Scorsese	Ama Qamata	South Africa	2021-09-24	2021	2021	TV-MA	2 Seasons	International TV Shows
1	s2	TV Show	Blood & Water	Martin Scorsese	Ama Qamata	South Africa	2021-09-24	2021	2021	TV-MA	2 Seasons	TV Dramas
2	s2	TV Show	Blood & Water	Martin Scorsese	Ama Qamata	South Africa	2021-09-24	2021	2021	TV-MA	2 Seasons	TV Mysteries
3	s2	TV Show	Blood & Water	Martin Scorsese	Khosi Ngema	South Africa	2021-09-24	2021	2021	TV-MA	2 Seasons	International TV Shows
4	s2	TV Show	Blood & Water	Martin Scorsese	Khosi Ngema	South Africa	2021-09-24	2021	2021	TV-MA	2 Seasons	TV Dramas

In [9]:

```
df_final.tail()
```

Out[9]:

	show_id	type	title	director	cast	country	date_added	year_added	release_year	rating	duration	listed_in
199557	s8807	Movie	Zubaan	Mozez Singh	Anita Shabdish	India	2019-03-02	2019	2015	TV-14	111 min	International Movies
199558	s8807	Movie	Zubaan	Mozez Singh	Anita Shabdish	India	2019-03-02	2019	2015	TV-14	111 min	Music & Musicals
199559	s8807	Movie	Zubaan	Mozez Singh	Chittaranjan Tripathy	India	2019-03-02	2019	2015	TV-14	111 min	Dramas
199560	s8807	Movie	Zubaan	Mozez Singh	Chittaranjan Tripathy	India	2019-03-02	2019	2015	TV-14	111 min	International Movies
199561	s8807	Movie	Zubaan	Mozez Singh	Chittaranjan Tripathy	India	2019-03-02	2019	2015	TV-14	111 min	Music & Musicals

In [ ]:

In [10]:

```
df_final.describe()
```

Out[10]:

	year_added	release_year
count	199562.000000	199562.000000
mean	2018.969298	2013.421132
std	1.550009	9.008441
min	2008.000000	1942.000000
25%	2018.000000	2012.000000
50%	2019.000000	2016.000000
75%	2020.000000	2019.000000
max	2021.000000	2021.000000

In [11]:

```
df_final.nunique()
```

Out[11]:

```
show_id          7965
type                2
title            7965
director         4527
cast            36392
country           118
date_added       1663
year_added         14
release_year       72
rating             14
duration          216
listed_in          42
dtype: int64
```

In [118]:

```
df_final["type"].value_counts()
```

Out[118]:

```
Movie      144448
TV Show     55114
Name: type, dtype: int64
```

In [119]:

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

Out[119]:

```
Martin Scorsese        50106
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
Lilly Wachowski          226
Lana Wachowski           226
Name: director, dtype: int64
```

In [120]:

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

Out[120]:

```
Liam Neeson           161
Alfred Molina         160
John Krasinski        139
Salma Hayek           130
Frank Langella        128
Anupam Kher           127
John Rhys-Davies      125
Shah Rukh Khan        108
Naseeruddin Shah      106
Radhika Apte          104
David Attenborough    103
James Franco          100
Quvenzhané Wallis     100
Tara Strong            94
James Faulkner         93
Jim Broadbent          92
Paresh Rawal           91
Akshay Kumar           91
Om Puri                90
Ben Whishaw            89
Name: cast, dtype: int64
```

```
In [121]: df_final["country"].value_counts().head(20)
```

```
Out[121]: United States     70073
          India             22717
          United Kingdom    12693
          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
          Thailand           1929
          Name: country, dtype: int64
```

In [122]:

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

Out[122]:

```
2018    24136
2019    21568
2017    20200
2020    19375
2016    18182
2015    13944
2021    11637
2014     9001
2013     7609
2012     6306
2010     5088
2009     4778
2011     4567
2008     3752
2006     2517
2007     2478
2005     2232
2004     2080
2003     1910
2002     1777
Name: release_year, dtype: int64
```

In [123]:

```
df_final["rating"].value_counts()
```

Out[123]:

```
TV-MA       72897
TV-14       43326
R           25842
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
```

In [124]:

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

Out[124]:

```
Dramas                      29736
International Movies        27858
Comedies                    20814
International TV Shows      12691
Action & Adventure          12206
Independent Movies           9815
Children & Family Movies     9728
TV Dramas                    8926
Thrillers                    7106
Romantic Movies              6405
TV Comedies                  4883
Crime TV Shows               4626
Horror Movies                4567
Kids' TV                     4509
Sci-Fi & Fantasy             4024
Romantic TV Shows            3035
Music & Musicals             3024
TV Action & Adventure        2275
Anime Series                 2270
Spanish-Language TV Shows    2103
Name: listed_in, dtype: int64
```

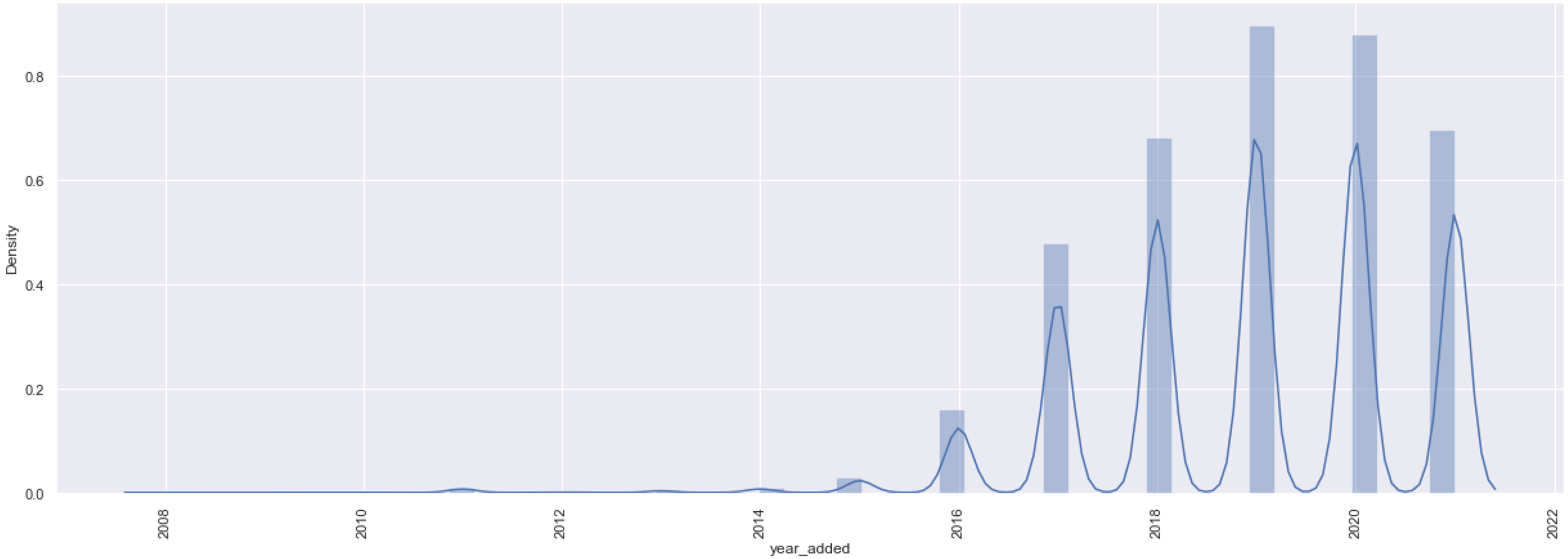
In [ ]:

Visual analysis using Plots and Graphs:

In [ ]:

In [125]:
```
sns.set(rc = {'figure.figsize':(21, 7)})
fig = sns.distplot(a=df_final["year_added"], hist=True, kde=True)
fig.tick_params(axis='x', rotation=90)
plt.savefig('1_distplot_year_added.png')
```

```
C:\Users\amit1\anaconda3\lib\site-packages\seaborn\distributions.py:2619: FutureWarning: `distplot` is a deprecated fun
ction and will be removed in a future version. Please adapt your code to use either `displot` (a figure-level function
with similar flexibility) or `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```

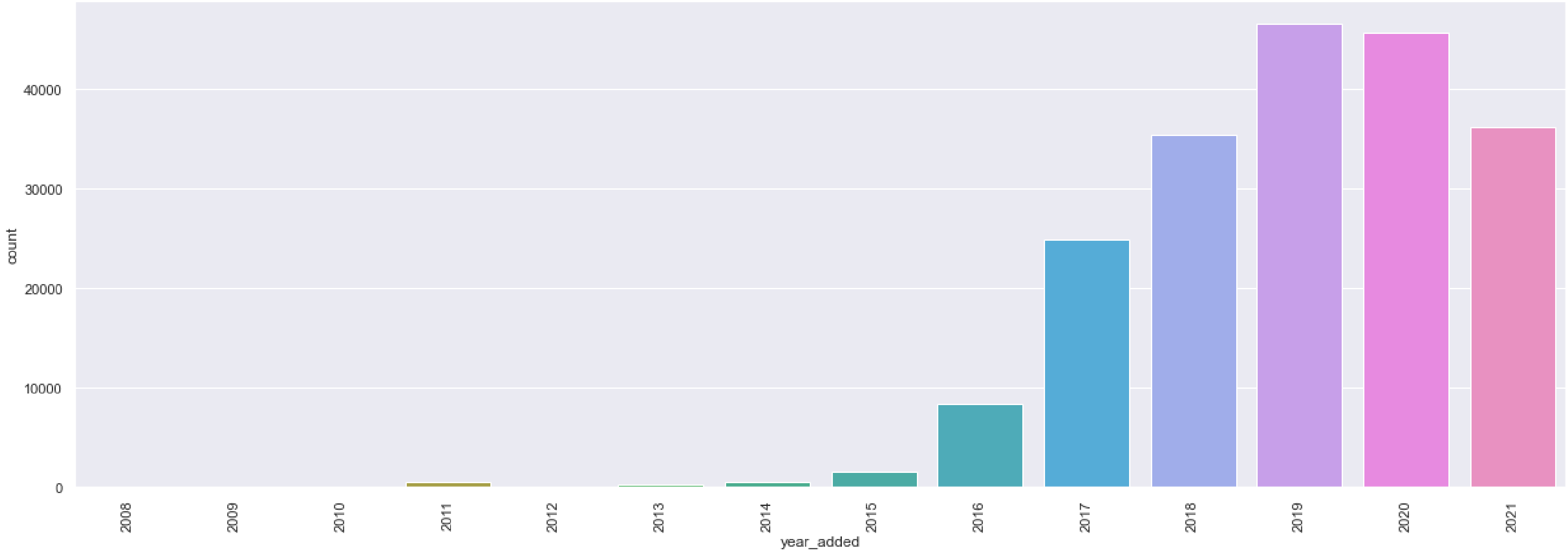


Most of the movies were added on netflix between year `2016` to `2021`

In [ ]:

In [126]:

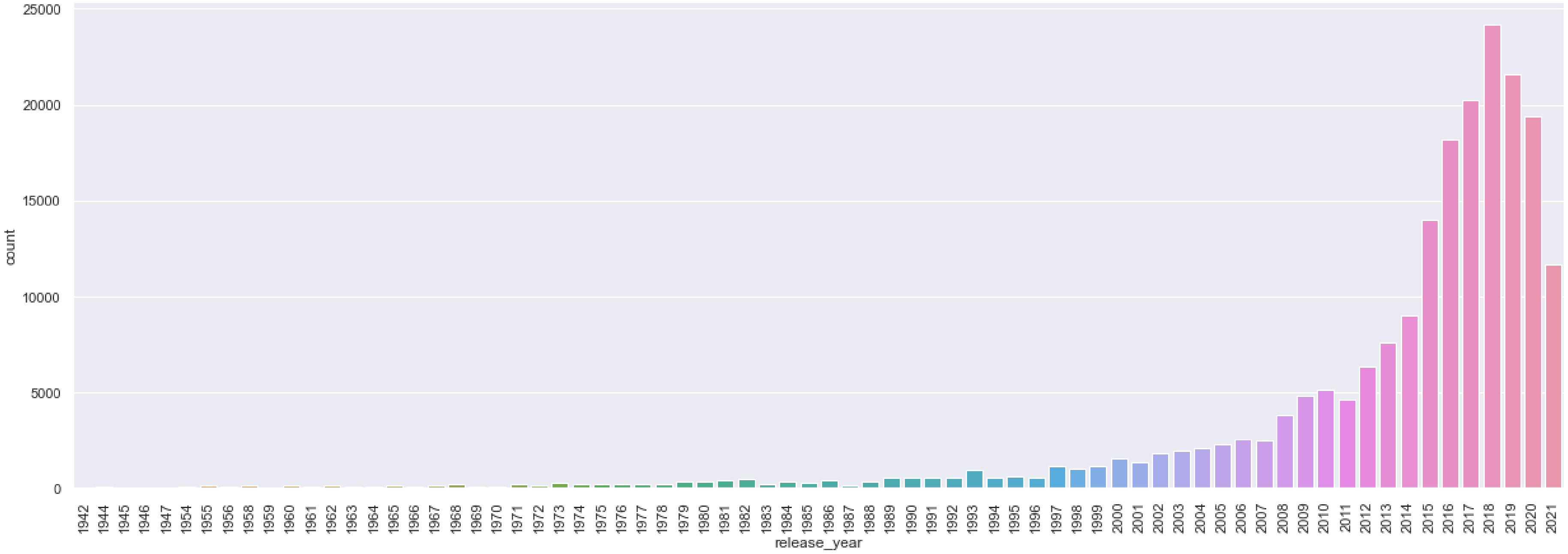
```
sns.set(rc = {'figure.figsize':(21, 7)})
fig = sns.countplot(data=df_final, x="year_added", orient="h")
fig.tick_params(axis='x', rotation=90)
plt.savefig('2_countplot_year_added.png')
```



In [ ]:

In [ ]:

In [127]:
```
sns.set(rc = {'figure.figsize':(21, 7)})
fig = sns.countplot(data=df_final, x="release_year", orient="h")
fig.tick_params(axis='x', rotation=90)
plt.savefig('3_countplot_release_year.png')
```

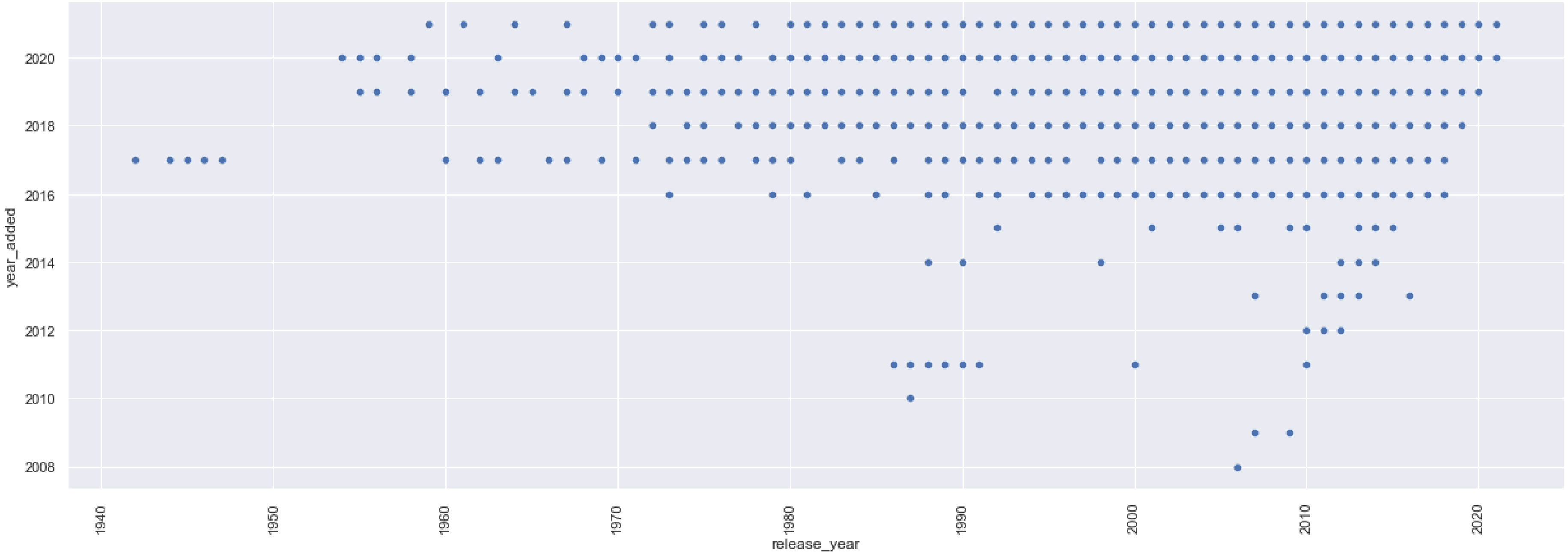


Most of the movies that are on Netflix were released in last 2 decades i.e. between `2000` to `2020`

In [ ]:

In [128]:

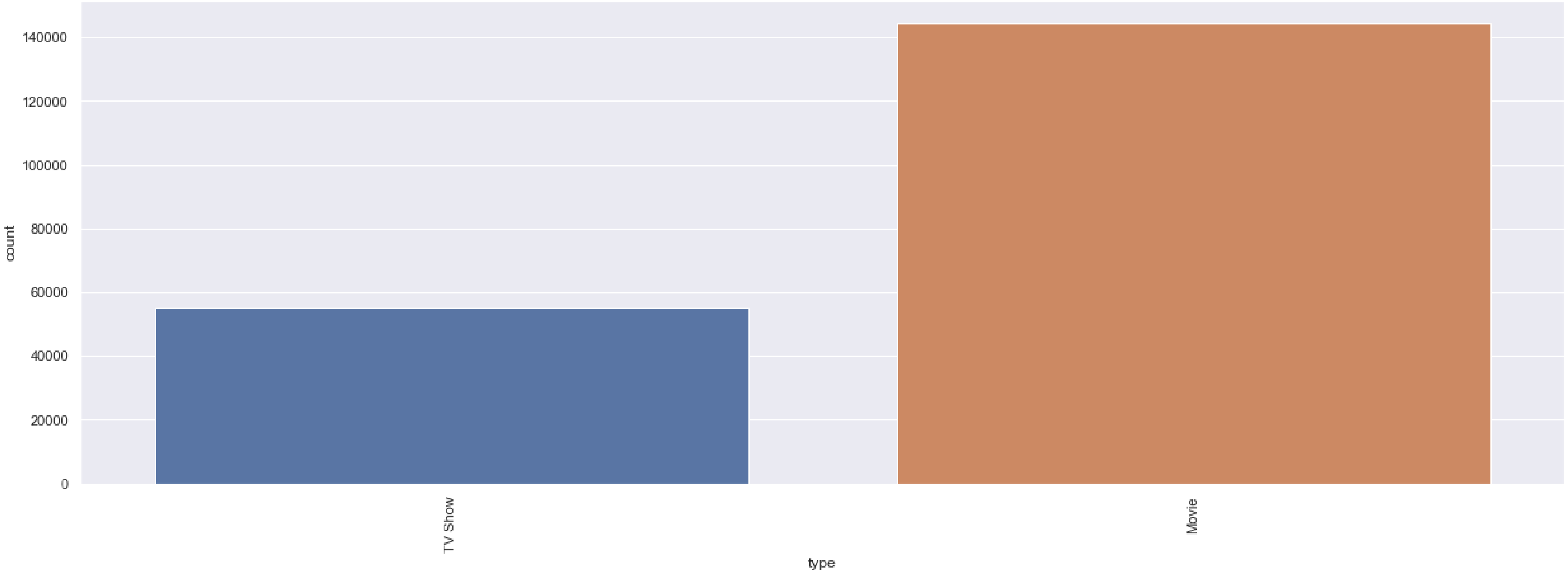
```
sns.set(rc = {'figure.figsize':(21, 7)})
fig = sns.scatterplot(data=df_final, x="release_year", y="year_added")
fig.tick_params(axis='x', rotation=90)
plt.savefig('4_scatterplot_release_year_year_added.png')
```



Netflix started to add more `Movies` to their platform after year `2016` onwards.

In [ ]:

In [129]:
```
sns.set(rc = {'figure.figsize':(21,7)})
fig = sns.countplot(data=df_final, x="type")
fig.tick_params(axis='x', rotation=90)
plt.savefig('5_countplot_type.png')
```



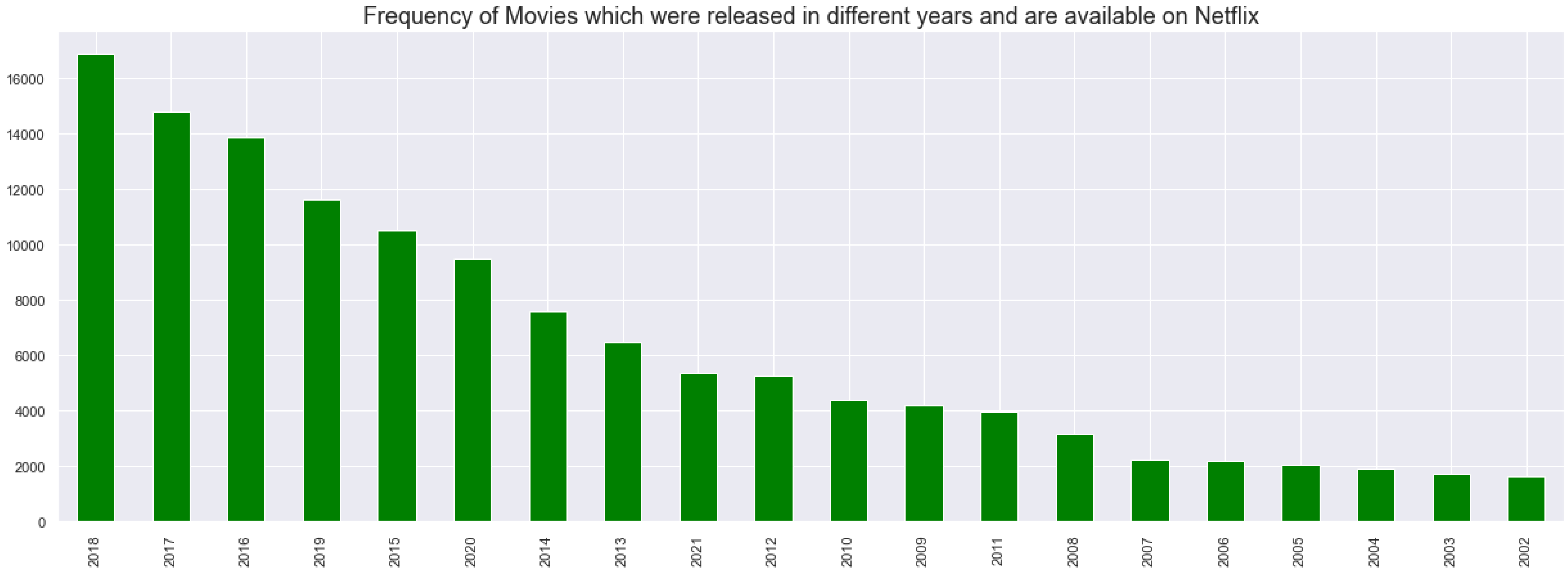
Currently there are more number of `Movies` on Netflix than `TV Shows` .

Netflix should increase the number of `TV Shows` on their platform to get more viewers and retain more customers.

In [ ]:

In [130]:

```
sns.set(rc = {'figure.figsize':(21,7)})
fig = df_final[df_final["type"]=="Movie"]["release_year"].value_counts()[:20].plot(kind="bar",color="green")
plt.title("Frequency of Movies which were released in different years and are available on Netflix", size=18)
fig.tick_params(axis='x', rotation=90)
plt.savefig('6_barplot_type_movie_release_year.png')
```



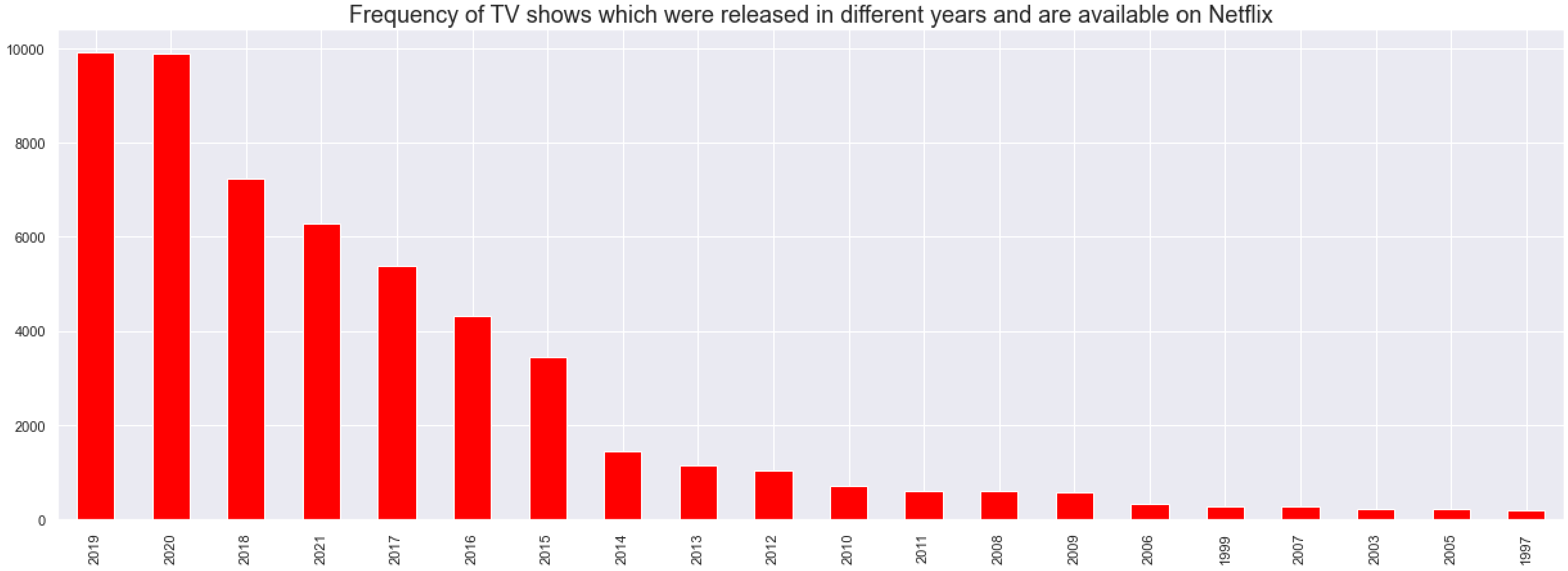
Most number of `Movies` on Netflix were released on year `2018`

Netflix should increase the number of available `Movies` from last 3 years i.e. `2019` to `2021` as people like to watch more recently released movies.

In [ ]:

In [131]:

```
sns.set(rc = {'figure.figsize':(21,7)})
fig = df_final[df_final["type"]=="TV Show"]["release_year"].value_counts()[:20].plot(kind="bar",color="red")
plt.title("Frequency of TV shows which were released in different years and are available on Netflix", size=18)
fig.tick_params(axis='x', rotation=90)
plt.savefig('7_barplot_type_tv_show_release_year.png')
```



Most number of `TV Shows` on Netflix were released on year `2019`

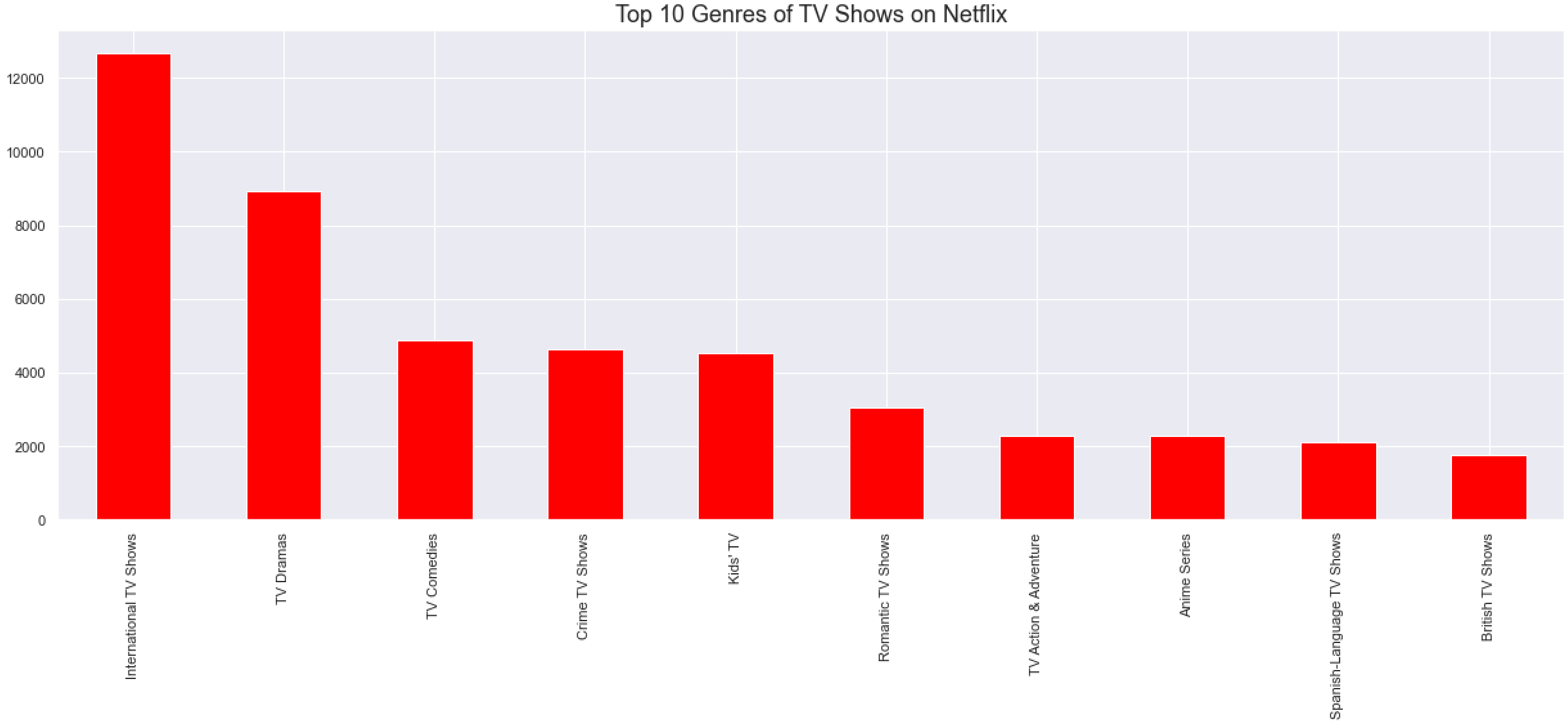
Netflix should increase the number of available `TV Shows` from last 3 years i.e. `2019` to `2021` as most of the people like to watch more recently released and fresh `TV Shows`

In [ ]:

```
```

In [132]:

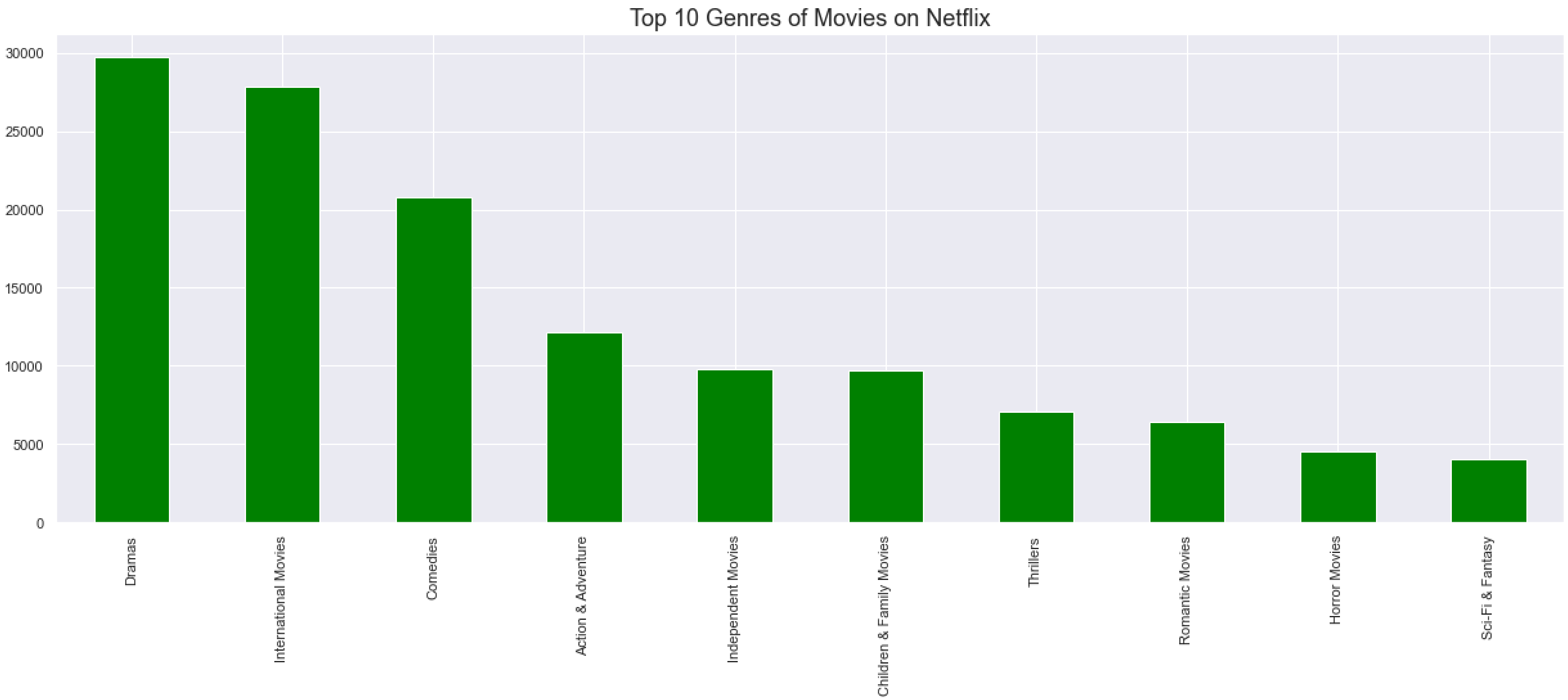
```
sns.set(rc = {'figure.figsize':(21,7)})
fig = df_final[df_final["type"]=="TV Show"]["listed_in"].value_counts()[:10].plot(kind="bar",color="red")
plt.title("Top 10 Genres of TV Shows on Netflix", size=18)
fig.tick_params(axis='x', rotation=90)
plt.savefig('8_barplot_type_tv_show_listed_in.png')
```



Most number of `TV Shows` on Netflix are in genre `International TV Shows` , `TV Drama`

Netflix should increase the number of available `TV Shows` in genre `TV Drama` , `TV Comdeies` , `Kids' TV` `TV Action & Adventure` and `Anime Series` as it will attract more young people and retain more viewers.

In [133]:
```
sns.set(rc = {'figure.figsize':(21,7)})
fig = df_final[df_final["type"]=="Movie"]["listed_in"].value_counts()[:10].plot(kind="bar",color="green")
plt.title("Top 10 Genres of Movies on Netflix", size=18)
fig.tick_params(axis='x', rotation=90)
plt.savefig('9_barplot_type_movie_listed_in.png')
```



Most number of `Movies` on Netflix are in genre `Dramas` and `International Movies`

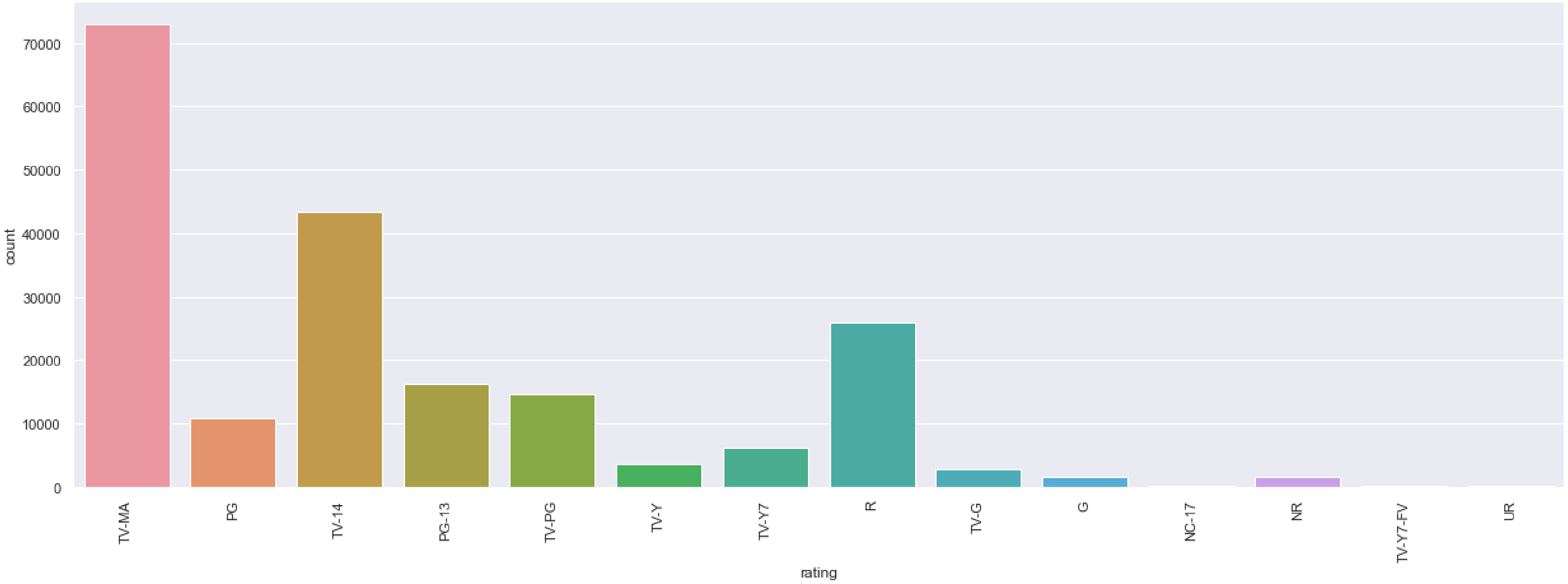
Netflix should increase the number of available `Movies` in genres `Comedies` , `Action & Adventure` , `Children & Family Movies` and as it will attract more young people.

Netflix should also look forward to increase available movies from `Sci-Fi & Fantasy` and `Horror Movies` genres as in past decade more `Animated` and movies which heavily used `CGI` used made more money and became hit.

In [ ]:

In [134]:

```
sns.set(rc = {'figure.figsize':(21,7)})
fig = sns.countplot(data=df_final, x="rating")
fig.tick_params(axis='x', rotation=90)
plt.savefig('10_countplot_rating.png')
```



Netflix currently has more `TV Shows` and `Movies` with rating `TV-MA: Mature Audience Only`, `TV-14: Parents Strongly Cautioned`, `R: Restricted`

Most of the `Movies` and `TV Shows` from these genres can only be seen alone due to `Adult` scenes or `Mature` content.

Netflix should look forward to add shows which can be watched together or can be watched by either elder or younger people.

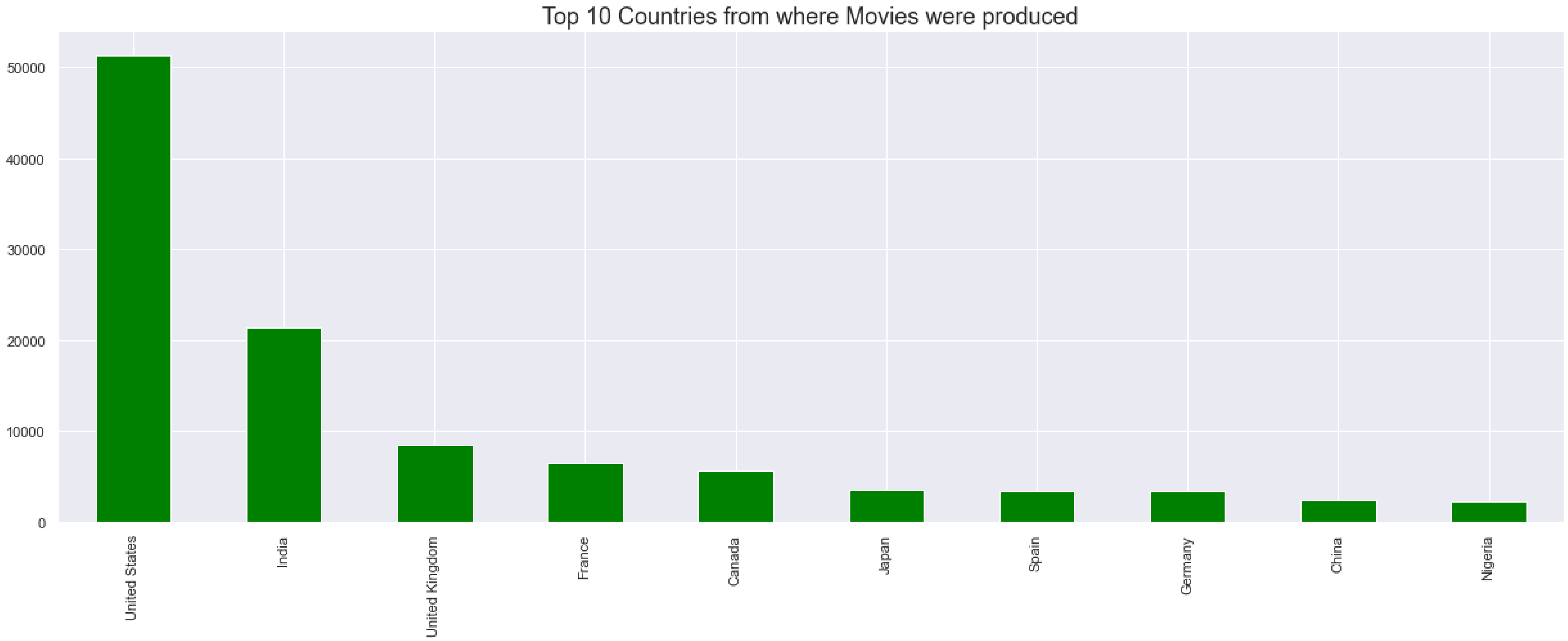
Netflix should slowly add more `Movies` and `TV Shows` with rating `TV-Y: All Children`, `TV-G: General Audience`, `G: General Audiences`

In [ ]:

```
```

In [135]:

```
sns.set(rc = {'figure.figsize':(21,7)})
fig = df_final[df_final["type"]=="Movie"]["country"].value_counts()[:10].plot(kind="bar",color="green")
plt.title("Top 10 Countries from where Movies were produced", size=18)
fig.tick_params(axis='x', rotation=90)
plt.savefig('11_barplot_type_movie_country.png')
```



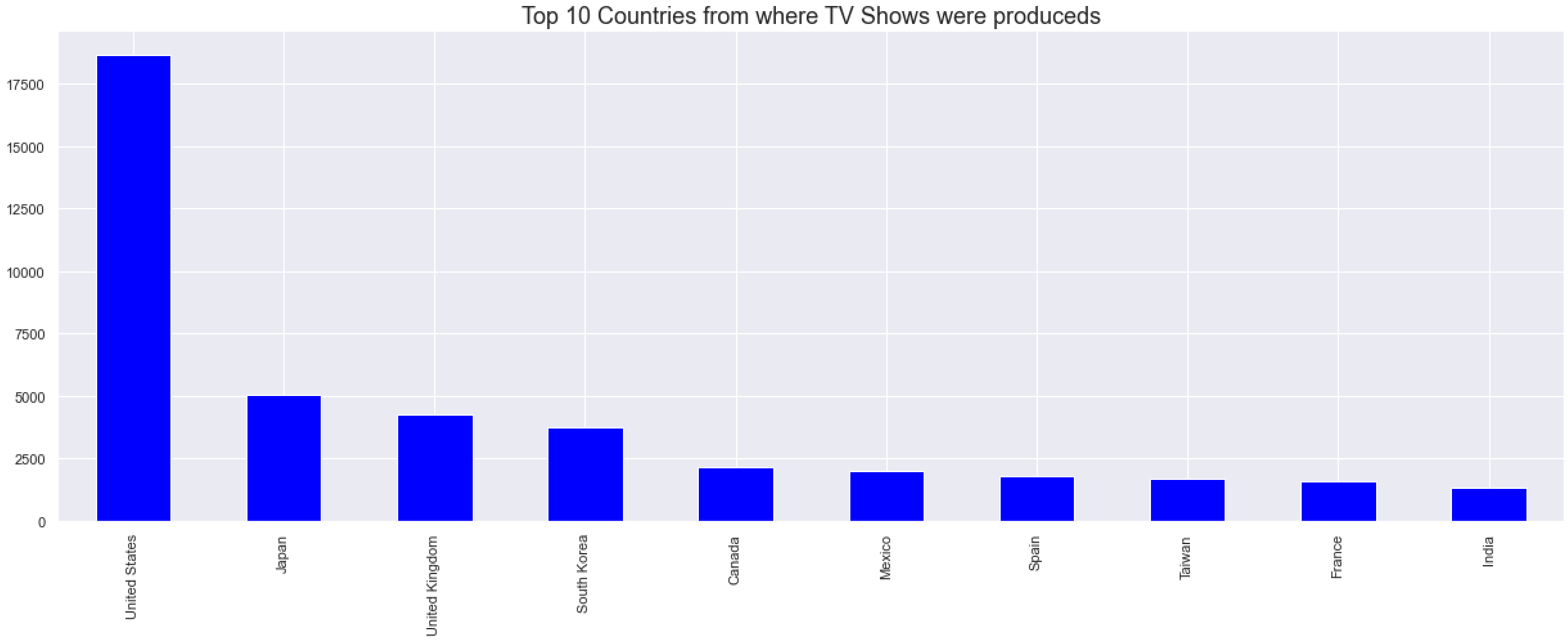
Currently Netflix has most of its `Movies` which were released in countries like `United States` and also from `European` countries i.e. `United Kingdom` , `France` , `Germany` , `Spain` , etc.

Considering the growth opportunities and good market in `Asia` , Netflix should also increase adding `Movies` that were released in `India` , `China` , `Japan` , etc.

In [ ]:

In [136]:

```
sns.set(rc = {'figure.figsize':(21,7)})
fig = df_final[df_final["type"]=="TV Show"]["country"].value_counts()[:10].plot(kind="bar",color="blue")
plt.title("Top 10 Countries from where TV Shows were produceds", size=18)
fig.tick_params(axis='x', rotation=90)
plt.savefig('12_barplot_type_tv_shows_country.png')
```

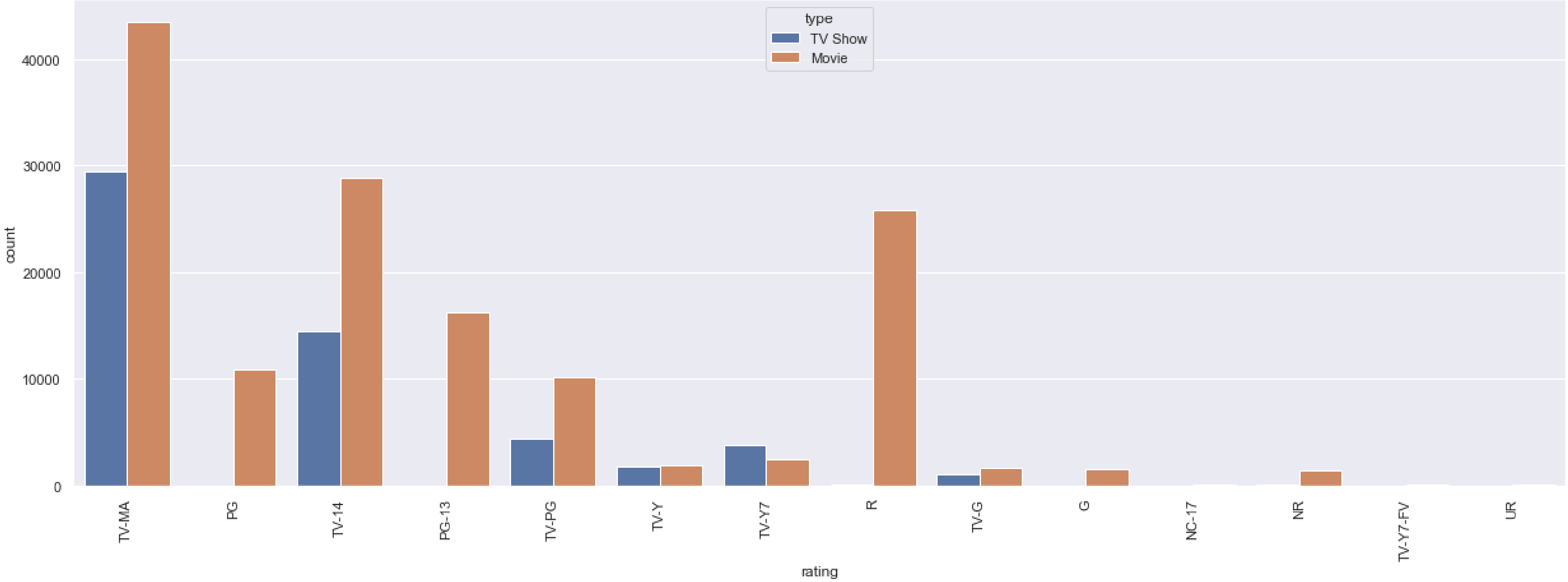


Currently Netflix has most of its `TV Shows` which were released in countries like `United States`, `Japan` and also from `European` countries i.e. `United Kingdom`, `Germany`

Considering the growth opportunities and good market in `Asia`, Netflix should also increase adding `TV Shows` that were released in `India`, `South Korea`, etc.

In [ ]:

In [137]:
```
sns.set(rc = {'figure.figsize':(21,7)})
fig = sns.countplot(data = df_final, x='rating', hue='type')
fig.tick_params(axis='x', rotation=90)
plt.savefig('13_countplot_rating_type.png')
```



Netflix has more number of `Movies` with different rating than number of `TV Shows`

Most of number of `Movies` on Netflix are rated `TV-MA: Mature Audience Only`, `TV-14: Parents Strongly Cautioned`, `PG-13: Parents Strongly Cautioned` and `R: Restricted` which can only be watched by people who are `18+` years old.

Netflix should look forward to increase the `TV Shows` and `Movies` with rating `TV-Y7: Directed to Older Children`, `TV-G: General Audience` and `G: General Audiences` so that they can also be watched together with family and friends.

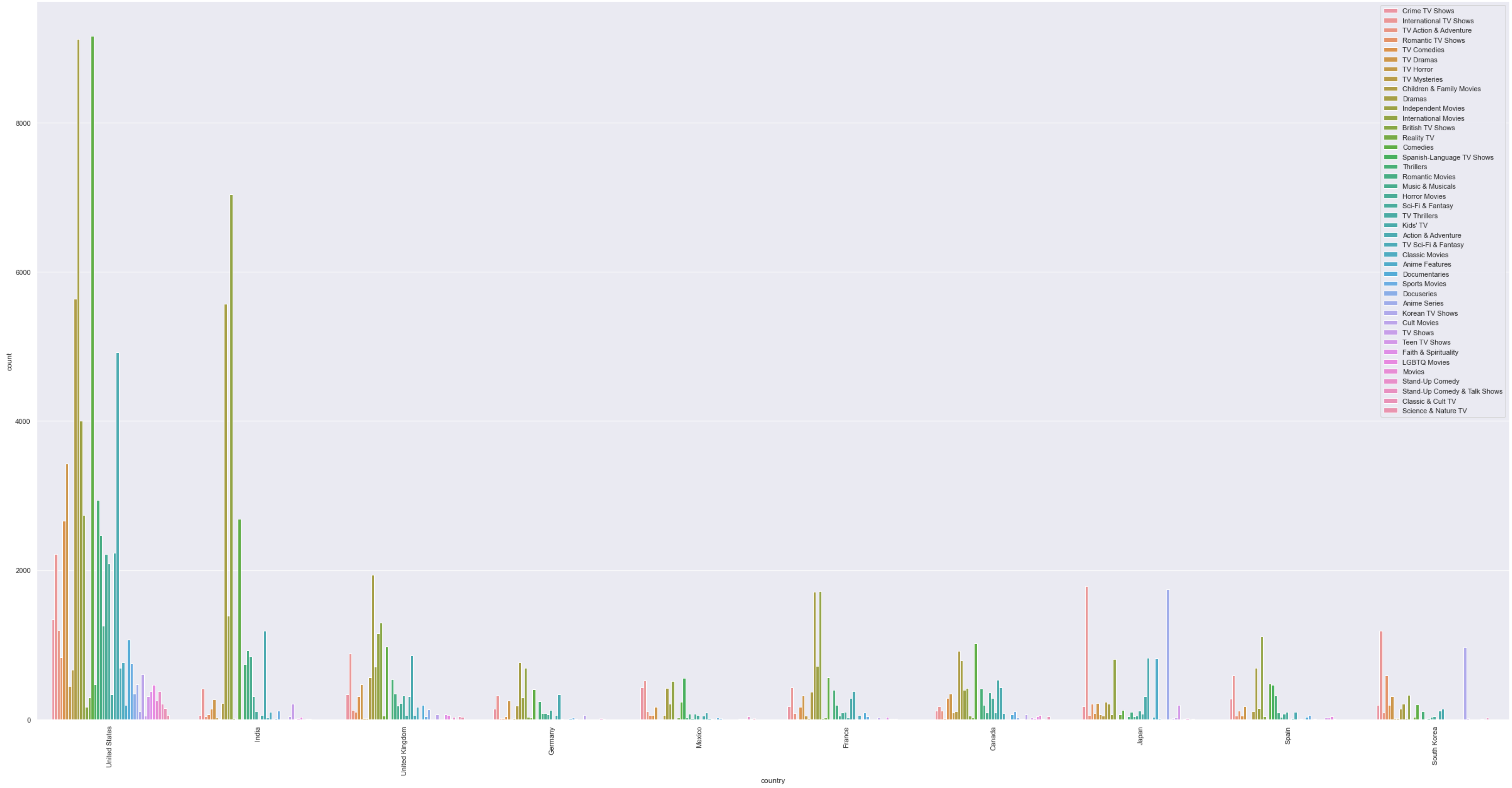
In [ ]:

In [ ]:

In [86]:

```
df_top_countries = df_final[df_final["country"].isin(["United States", "India", "United Kingdom", "Japan", "France", "Ca

sns.set(rc = {'figure.figsize':(42,21)})
fig = sns.countplot(x="country", hue="listed_in",data=df_top_countries)
fig.legend(loc='upper right')
fig.tick_params(axis='x', rotation=90)
plt.savefig('14_countplot_genres_in_top_ten_Countries.png')
```

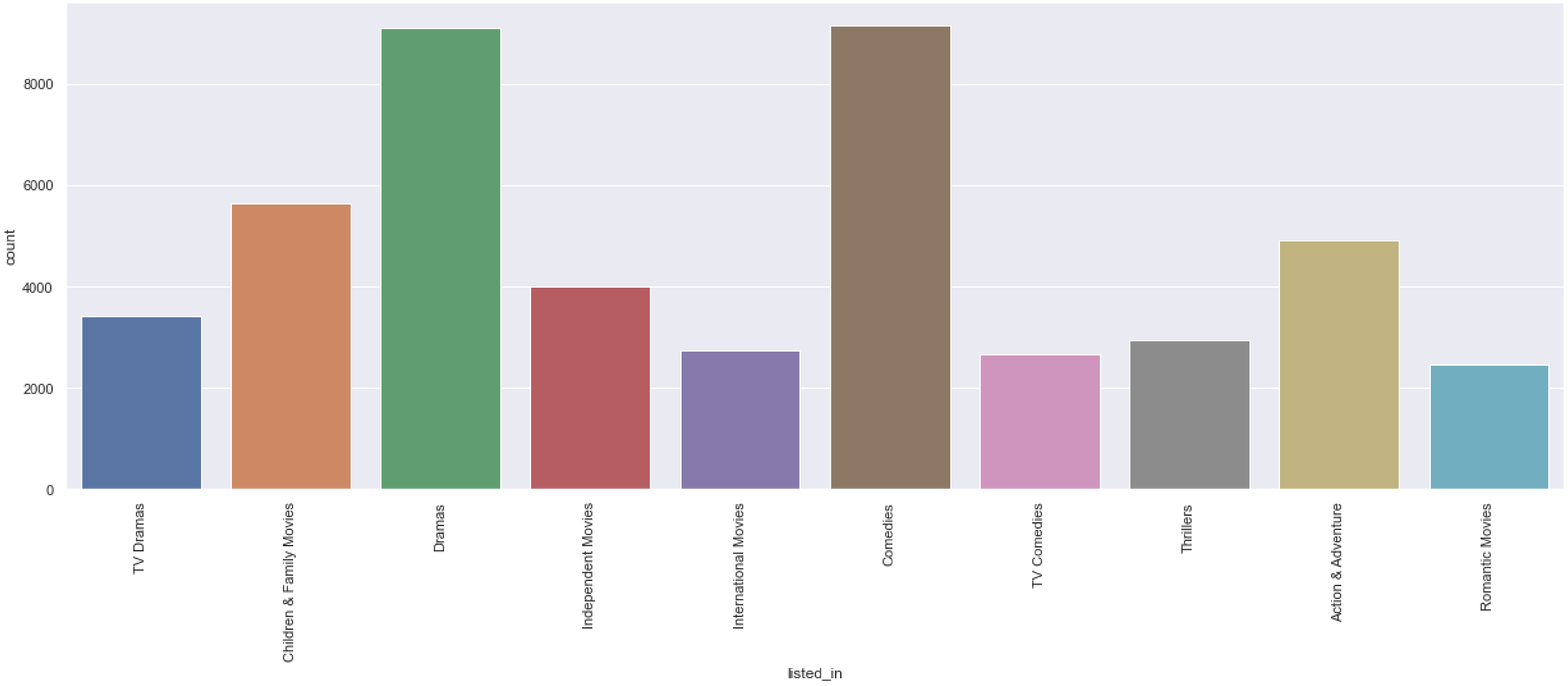


In [ ]:

In [88]:

```
df_united_states = df_top_countries[df_top_countries["country"] == "United States"]
df_top_united_states_genres = df_united_states[df_united_states["listed_in"].isin(["Comedies", "Dramas", "Children & Fam


sns.set(rc = {'figure.figsize':(21,7)})
fig = sns.countplot(x="listed_in",data=df_top_united_states_genres)
fig.tick_params(axis='x', rotation=90)
plt.savefig('15_countplot_top_genres_in_united_states.png')
```



Netflix has more number of `Movies` and `TV Shows` in United States with genres `Dramas` , `Comedies`

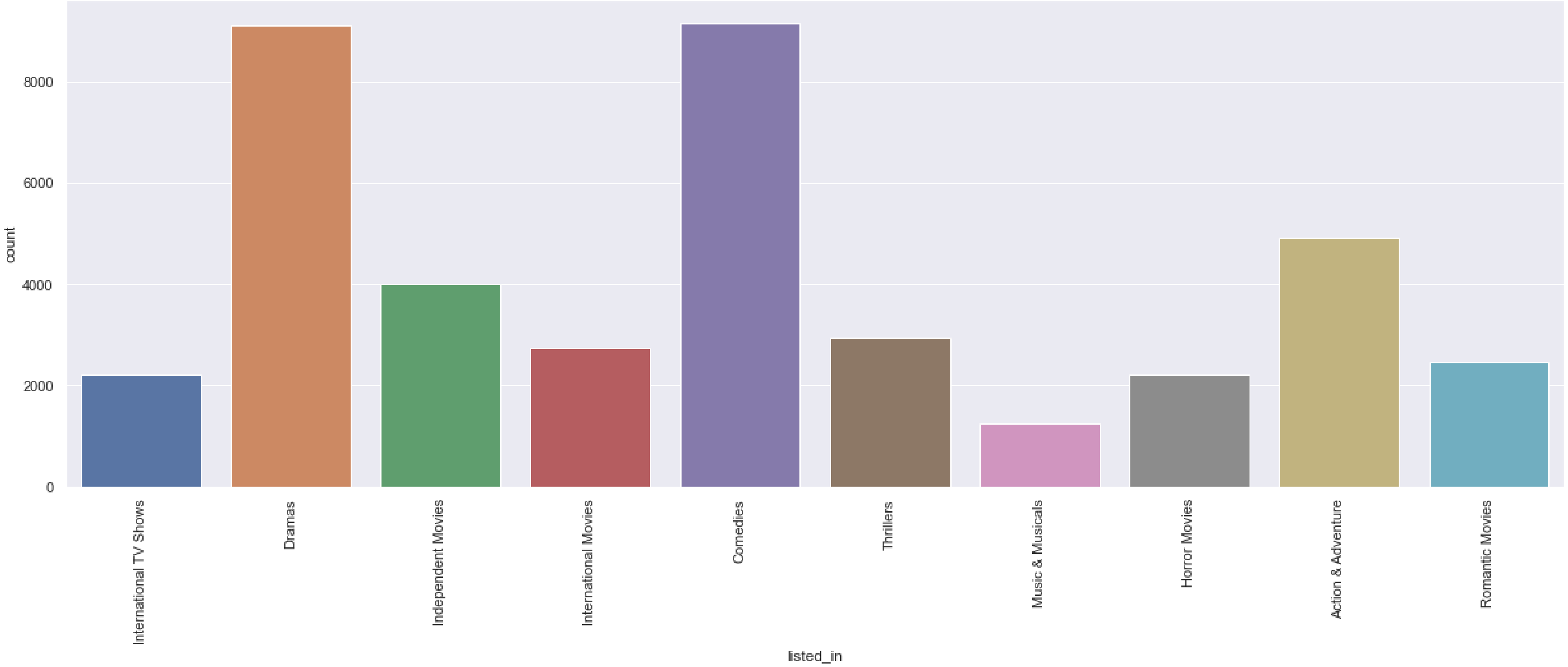
Netflix should look forward to add more number of `Movies` and `TV Shows` in United States with genres `Dramas` , `Comedies` as well as `TV Dramas` , `Children & Family Movies` , `Action & Adventure`

In [ ]:

In [89]:

```
df_india = df_top_countries[df_top_countries["country"] == "India"]
df_top_india = df_united_states[df_united_states["listed_in"].isin(["International Movies", "Dramas", "Comedies", "Indepe

sns.set(rc = {'figure.figsize':(21,7)})
fig = sns.countplot(x="listed_in",data=df_top_india)
fig.tick_params(axis='x', rotation=90)
plt.savefig('16_countplot_top_genres_in_india.png')
```



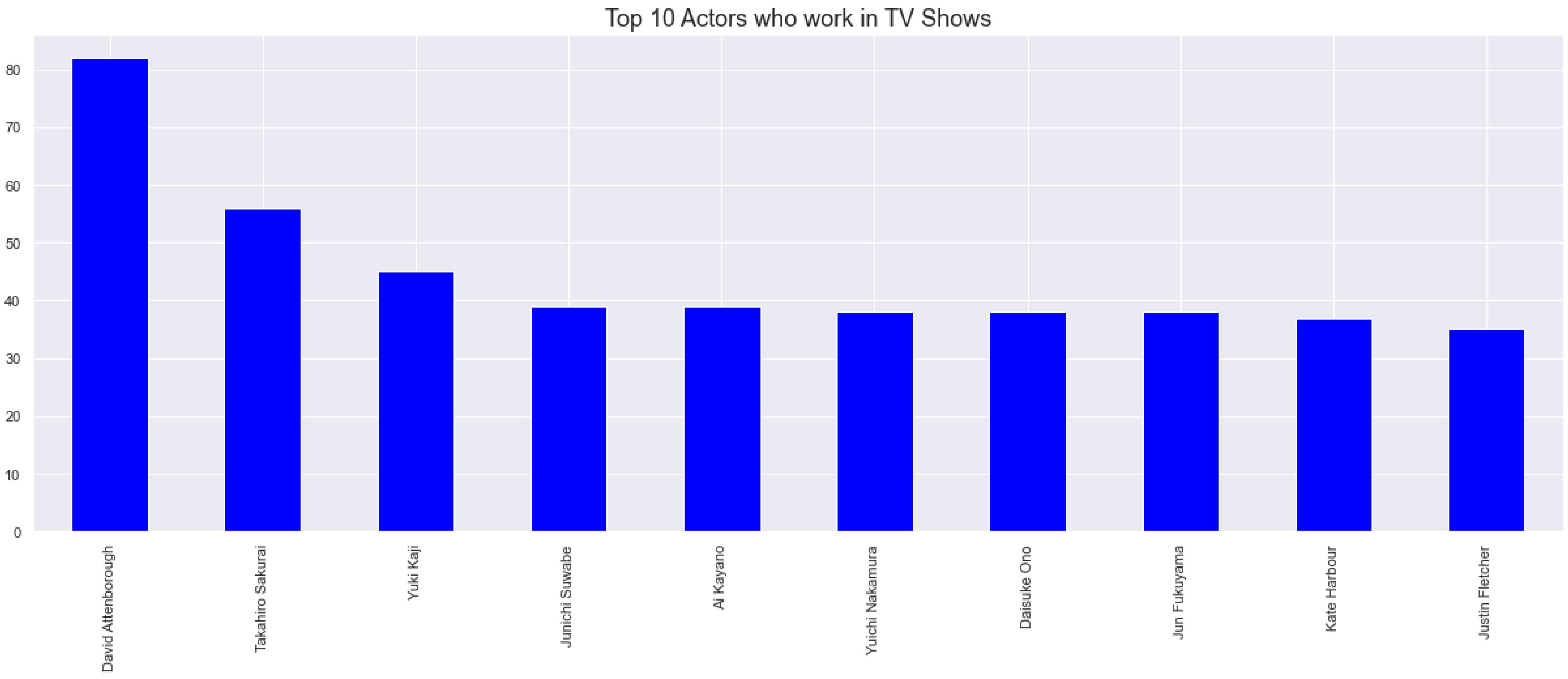
Netflix has more number of `Movies` and `TV Shows` in India with genres `Dramas` , `Comedies`

Netflix should look forward to add more number of `Movies` and `TV Shows` in India with genres `Dramas` , `Comedies` as well as `Independent Movies` , `Romantic Movies` , `Action & Adventure`

In [ ]:

In [94]:

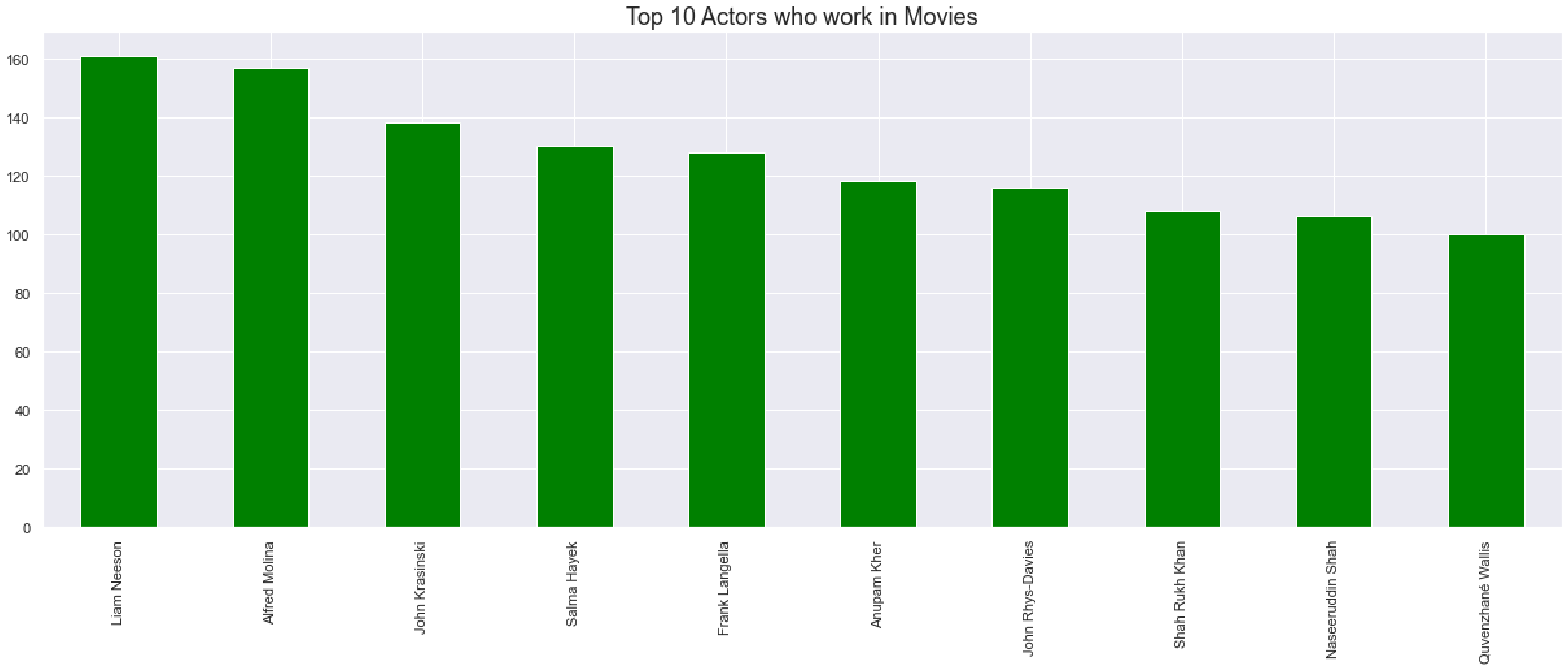
```
sns.set(rc = {'figure.figsize':(21,7)})
fig = df_final[df_final["type"]=="TV Show"]["cast"].value_counts()[:10].plot(kind="bar",color="blue")
plt.title("Top 10 Actors who work in TV Shows", size=18)
fig.tick_params(axis='x', rotation=90)
plt.savefig('17_barplot_top_actor_tv_show.png')
```



In [ ]:

In [95]:

```
sns.set(rc = {'figure.figsize':(21,7)})
fig = df_final[df_final["type"]=="Movie"]["cast"].value_counts()[:10].plot(kind="bar",color="green")
plt.title("Top 10 Actors who work in Movies", size=18)
fig.tick_params(axis='x', rotation=90)
plt.savefig('18_barplot_top_actor_movie.png')
```



In [ ]:

In [ ]: