Resizing the output box

from IPython.display import Javascript def resize_colab_cell(): display(Javascript('google.colab.output.setIframeHeight(0, true, {maxHeight: 5000})')) get_ipython().events.register('pre_run_cell', resize_colab_cell)

Business Case: Netflix - Data Exploration and Visualisation

Problem Statement

Analyze the data to recommend Netflix the kind of shows and movies to produce, where and when to produce/release them so as to grow the business.

Assumption:

There are no details provided in the data to obtain enagement or monetory trends, so have made a prior assumption that whatever information we gain from the data, is in sync with what Netflix will work for Netflix in future. Accordingly recommendations are made.

Importing libraries for analysis

Libraries

1. Library pandas will be required to work with data in tabular representation.
2. Library numpy will be required to round the data in the correlation matrix.
3. Library matplotlib, seaborn, plotly required for data visualization.
4. Library missingno will be required to visualize missing values in the data.
5. Library warnings to disable any FurtureWarning in the data.

In [1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import plotly.express as px
from plotly.subplots import make_subplots
import plotly.graph_objects as go
import missingno
import warnings
warnings.filterwarnings('ignore')
warnings.simplefilter(action = 'ignore', category = FutureWarning)
```

Reading the data

In [2]:
```
df = pd.read_csv(r"https://d2beiqkhq929f0.cloudfront.net/public_assets/assets/000/000/940/original/netflix.csv")
```

Data Description

3.1 The Dimensions Of The Data

In [3]:
```
print(f'\nThe Data-Set Contain \033[1m{df.shape[0]} Rows\033[0m and\033[1m {df.shape[1]} Columns\033[0m.')
```

```
The Data-Set Contain 8807 Rows and 12 Columns.
```

3.2 Fetching top twenty rows from the dataframe df to get a view of data imported

In [4]:
```
1 df.head(10)
```

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...
5	s6	TV Show	Midnight Mass	Mike Flanagan	Kate Siegel, Zach Gilford, Hamish Linklater, H...	NaN	September 24, 2021	2021	TV-MA	1 Season	TV Dramas, TV Horror, TV Mysteries	The arrival of a charismatic young priest brin...
6	s7	Movie	My Little Pony: A New Generation	Robert Cullen, José Luis Ucha	Vanessa Hudgens, Kimiko Glenn, James Marsden, ...	NaN	September 24, 2021	2021	PG	91 min	Children & Family Movies	Equestria's divided. But a bright-eyed hero be...

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in	description
7	s8	Movie	Sankofa	Haile Gerima	Kofi Ghanaba, Oyafunmike Ogunlano, Alexandra D...	United States, Ghana, Burkina Faso, United Kin...	September 24, 2021	1993	TV-MA	125 min	Dramas, Independent Movies, International Movies	On a photo shoot in Ghana, an American model s...
8	s9	TV Show	The Great British Baking Show	Andy Devonshire	Mel Giedroyc, Sue Perkins, Mary Berry, Paul Ho...	United Kingdom	September 24, 2021	2021	TV-14	9 Seasons	British TV Shows, Reality TV	A talented batch of amateur bakers face off in...
9	s10	Movie	The Starling	Theodore Melfi	Melissa McCarthy, Chris O'Dowd, Kevin Kline, T...	United States	September 24, 2021	2021	PG-13	104 min	Comedies, Dramas	A woman adjusting to life after a loss contend...

Initial observations from the data.

1. The data has **some columns with NaN values**. Need to either replace them with appropriate values, or drop the rows/columns altogether.
2. **Columns like director, cast, country and listed_in** have multiple **values separated by comma**. We will need to unnest these multi-value columns.

3.3 Columns in the dataset

In [5]:
```
1 df.columns
```

Out[5]:
```
Index(['show_id', 'type', 'title', 'director', 'cast', 'country', 'date_added',
       'release_year', 'rating', 'duration', 'listed_in', 'description'],
      dtype='object')
```

Feature description:

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

Renaming the column **listed_in** to **genre** for more clarity

In [6]:
```
1 # Renaming the column listed_in to clarity
2 df.rename(columns = {'listed_in':'genre'}, inplace = True)
3 df.head(1)
```

Out[6]:

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	genre	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...

3.4 Information about the dataframe

In [7]:
```
print("\n\033[1mSize of the original dataset :\033[0m",df.size)
print()

print("\033[1mInformation provided in the original dataset :\033[0m")
print()
print(df.info())
```

Size of the original dataset : 105684

Information provided in the original dataset :

```
<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  genre         8807 non-null   object
 11  description   8807 non-null   object
dtypes: int64(1), object(11)
memory usage: 825.8+ KB
None
```

Initial observations from the data.

1. **Majority of the columns** have data type as **string/object**
2. Only column **release_year**, has **numeric value**
3. The data type of column **date_added** is **not datetime**

In [8]:
```
print('\n\033[1mTotal Unique values corresponding to each column: \033[0m')
df.nunique()
```

Total Unique values corresponding to each column:

Out[8]:
```
show_id         8807
type               2
title           8807
director        4528
cast            7692
country          748
date_added      1767
release_year      74
rating            17
duration         220
genre            514
description     8775
dtype: int64
```

In [9]:
```
# Statistical description on the dataframe - column Release Year(only numeric value)
print('\n\033[1mStatistical description on the dataframe: \033[0m \n\n',df.describe())
```

Statistical description on the dataframe:

```
        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
```

Insights : The data captured in the dataset for **released year** is from **1925-2021.**

Information about NAN(not a number)/NULL and Duplicate values in the dataset

In [10]:
```
print('\n\033[1mThe total count of Null values: \033[0m',df.isnull().sum().sum())
print('\n\033[1mSeggregation of Null values: \033[0m\n')
print(df.isnull().sum())
print('\n\033[1mNumber of Null values in the dataset are: \033[0m',df.duplicated().sum())
```

```
The total count of Null values:  4307

Seggregation of Null values:

show_id            0
type               0
title              0
director        2634
cast             825
country          831
date_added        10
release_year       0
rating             4
duration           3
genre              0
description        0
dtype: int64

Number of Null values in the dataset are:  0
```

Initial observations from the data.

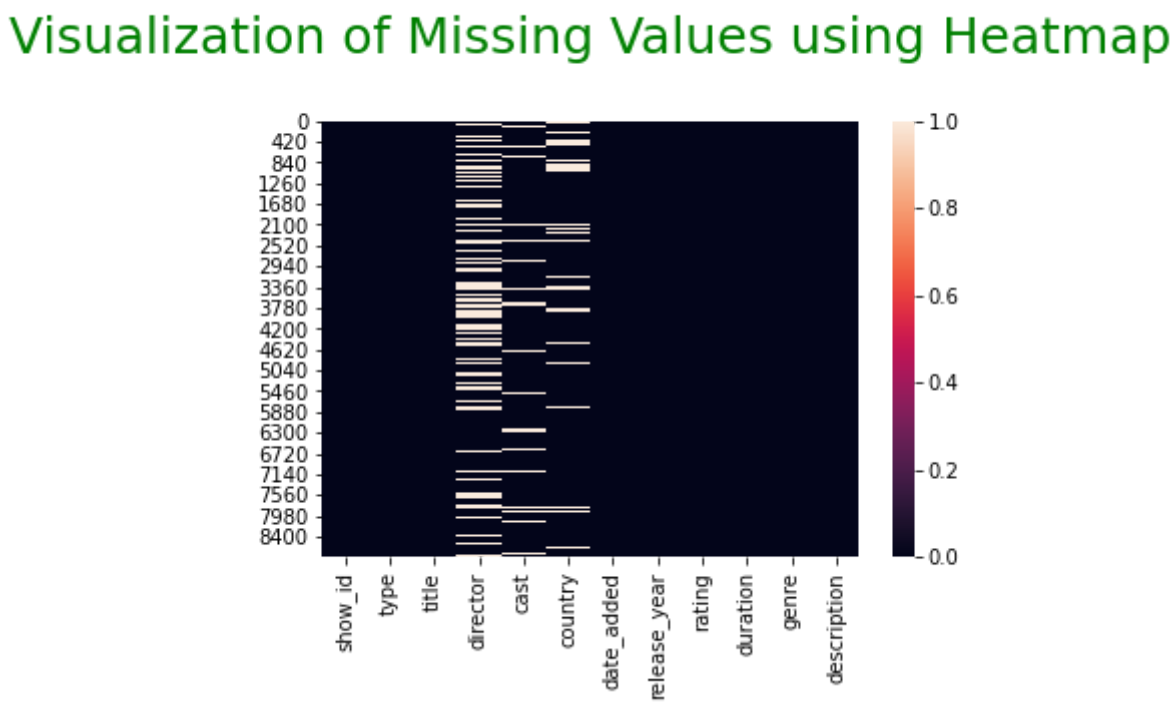
1. Only few rows in date_added, rating and duration columns have null
2. There are no duplicated rows

Type *Markdown* and LaTeX: α^2

Analysis of missing values in the dataset

7.1 Getting summary of missing value percentage

In [11]:
```
# Visualization of Missing Values using Heatmap
sns.heatmap(df.isnull())
plt.title("\nVisualization of Missing Values using Heatmap\n",fontsize=25,color="green")
plt.show()
```



Observation :

- The above distribution helps in visualizing that **maximun values** are missed under the **attribute Director followed by Country and then Cast**.

In [12]:
```
print("\n\033[1mSummary of missing value in percentage is as below:\033[0m\n")
print("\033[1mColumn\033[0m".ljust(19),"\033[1mData Availability\033[0m")
for column in df.columns:
    print(f"{column}:".ljust(20),f"{round(len(df[~df[column].isnull()])*100/len(df[column]), 2)}%")
```

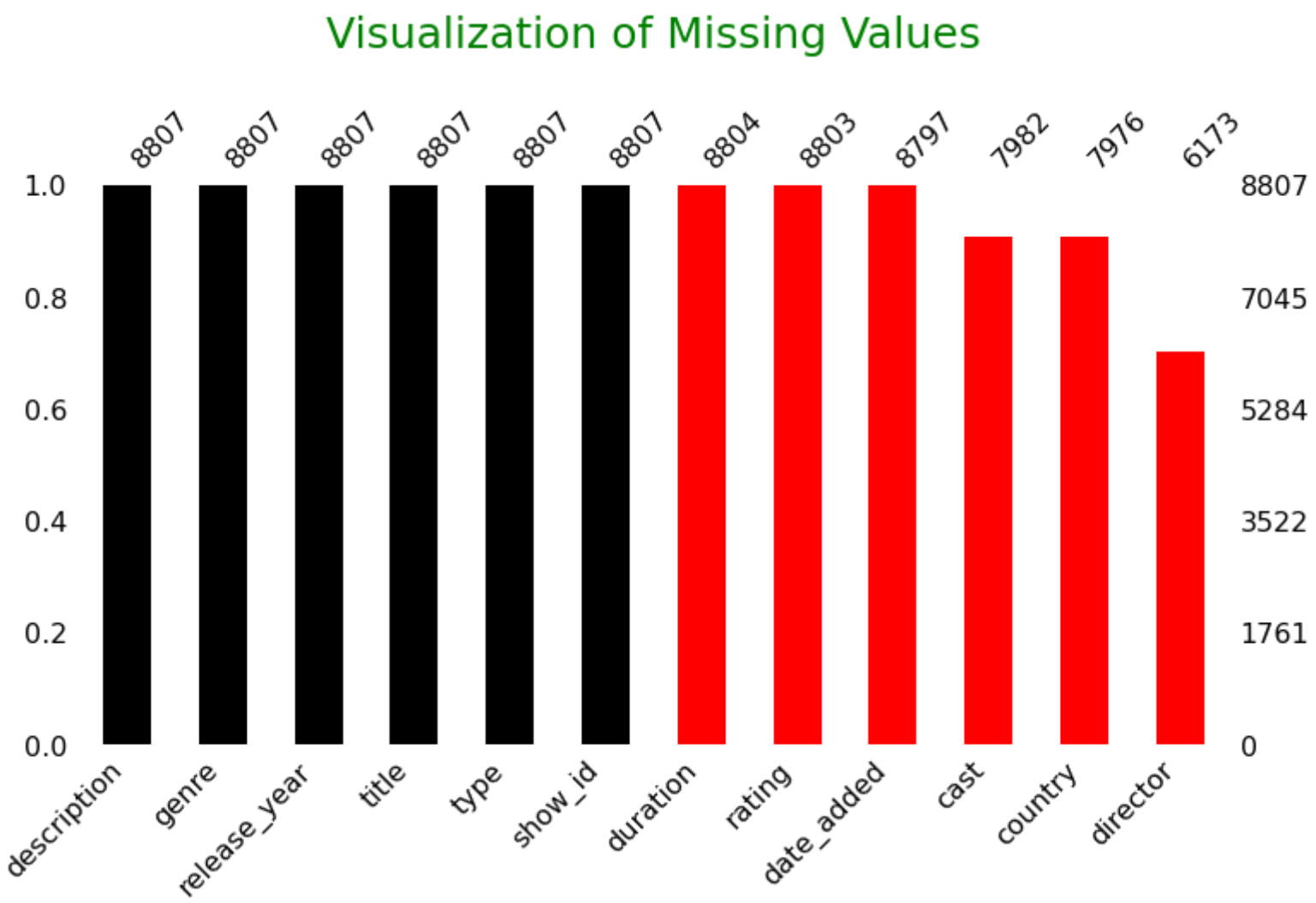
Summary of missing value in percentage is as below:

Column	Data Availability
show_id:	100.0%
type:	100.0%
title:	100.0%
director:	70.09%
cast:	90.63%
country:	90.56%
date_added:	99.89%
release_year:	100.0%
rating:	99.95%
duration:	99.97%
genre:	100.0%
description:	100.0%

Initial observations from the data.

1. The data has **some columns with NaN values**. Need to either replace them with appropriate values, or drop the rows/columns altogether.
2. **Columns like director, cast, country and listed_in** have multiple **values separated by comma**. We will need to unnest these multi-value columns.
3. Only **few rows in date_added, rating and duration columns** have **null**.

In [13]:
```
# Visualization of Missing Values
color = ['black','black','black','black','black','black','red','red','red','red','red','red']
missingno.bar(df,fontsize =16, color = color, sort = 'descending', figsize = (12,6))
plt.title("Visualization of Missing Values\n",fontsize=25,color="green")
print()
plt.show()
```



7.2 Filling up missing values

Date_added, rating and Duration columns have **NULL Values with less than 0.5% of records, so removing them.**

In [14]:
```
df = df.loc[~df['date_added'].isnull()] # Date_added column
df = df.loc[~df['rating'].isnull()]     # Rating column
df = df.loc[~df['duration'].isnull()]   # Duration column
```

Filling rest of the missing values with string "Unknown" as each movie is entirely different and filling wrong values can be a problem

In [15]:
```
# fill NAN values with unknow
df["director"].fillna(value="Unknown", inplace=True)
df["cast"].fillna(value="Unknown", inplace=True)
df["country"].fillna(value="Unknown",inplace=True)
```

Cross checking for any null values in the column

In [16]:
```
df.isna().sum().sum()
```

Out[16]: 0

No NULL values are present in dataframe

7.3 Unnesting of Director, Cast, Country and Genre columns

Data is present in **nested format** in few cells of **cast, director, country** and **genre** columns too. So, we need to Melt the data in these columns

In [17]:
```
director = pd.DataFrame(pd.DataFrame(df['director'].apply(lambda x: str(x).split(', ')).to_list(), index=df['sho
cast = pd.DataFrame(pd.DataFrame(df['cast'].apply(lambda x: str(x).split(', ')).to_list(), index=df['show_id']).
country = pd.DataFrame(pd.DataFrame(df['country'].apply(lambda x: str(x).split(', ')).to_list(), index=df['show_
genre = pd.DataFrame(pd.DataFrame(df['genre'].apply(lambda x: str(x).split(', ')).to_list(), index=df['show_id']
df = director.merge(cast, on='show_id').merge(country, on='show_id').merge(genre, on='show_id').merge(df.drop(['
```

Observation: From the above descriptive statistics we get a general summary of the data. The inference are:

- **Description** is also another such column in this dataset which **makes sense not to have repeating elements**.

7.4 Checking for duplicate values in the dataset

In [18]:
```
df.duplicated().sum()
```

Out[18]: 55

In [19]:
```
duplicateCheck = df.duplicated()
df[duplicateCheck].where(df['cast'] == 'Oscar Martínez').head(7)
```

Out[19]:

	show_id	director	cast	country	genre	type	title	date_added	release_year	rating	duration	description
39336	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
88516	s3719	Miguel Cohan	Oscar Martínez	Argentina	Dramas	Movie	Blood Will Tell	June 21, 2019	2019.0	TV-MA	113 min	Family patriarch Elías begins to unravel after...
88517	s3719	Miguel Cohan	Oscar Martínez	Argentina	Independent Movies	Movie	Blood Will Tell	June 21, 2019	2019.0	TV-MA	113 min	Family patriarch Elías begins to unravel after...
88518	s3719	Miguel Cohan	Oscar Martínez	Argentina	International Movies	Movie	Blood Will Tell	June 21, 2019	2019.0	TV-MA	113 min	Family patriarch Elías begins to unravel after...
88519	s3719	Miguel Cohan	Oscar Martínez	United States	Dramas	Movie	Blood Will Tell	June 21, 2019	2019.0	TV-MA	113 min	Family patriarch Elías begins to unravel after...
88520	s3719	Miguel Cohan	Oscar Martínez	United States	Independent Movies	Movie	Blood Will Tell	June 21, 2019	2019.0	TV-MA	113 min	Family patriarch Elías begins to unravel after...
88521	s3719	Miguel Cohan	Oscar Martínez	United States	International Movies	Movie	Blood Will Tell	June 21, 2019	2019.0	TV-MA	113 min	Family patriarch Elías begins to unravel after...

There are **55 duplicate values after unnesting/melting the dataset**, on further analysis as above these are found to be **redundant therefore dropping such values**

Dropping the duplicate values as these are redundant

In [20]:
```
df = df.drop_duplicates()
df.duplicated().sum()
```

Out[20]: 0

Standardizing values in the dataset

8.1 Analysing Description column

In [21]:
```
df[df['description'] == df['description'].value_counts().reset_index()['index'][0]].head(10)
```

Out[21]:

	show_id	director	cast	country	genre	type	title	date_added	release_year	rating	duration	description
162673	s7165	Roger Allers	Liam Neeson	United States	Children & Family Movies	Movie	Kahlil Gibran's The Prophet	October 1, 2017	2014	PG	85 min	A troubled young girl and her mother find sola...
162674	s7165	Roger Allers	Liam Neeson	United States	Dramas	Movie	Kahlil Gibran's The Prophet	October 1, 2017	2014	PG	85 min	A troubled young girl and her mother find sola...
162675	s7165	Roger Allers	Liam Neeson	France	Children & Family Movies	Movie	Kahlil Gibran's The Prophet	October 1, 2017	2014	PG	85 min	A troubled young girl and her mother find sola...
162676	s7165	Roger Allers	Liam Neeson	France	Dramas	Movie	Kahlil Gibran's The Prophet	October 1, 2017	2014	PG	85 min	A troubled young girl and her mother find sola...
162677	s7165	Roger Allers	Liam Neeson	Canada	Children & Family Movies	Movie	Kahlil Gibran's The Prophet	October 1, 2017	2014	PG	85 min	A troubled young girl and her mother find sola...
162678	s7165	Roger Allers	Liam Neeson	Canada	Dramas	Movie	Kahlil Gibran's The Prophet	October 1, 2017	2014	PG	85 min	A troubled young girl and her mother find sola...
162679	s7165	Roger Allers	Liam Neeson	Lebanon	Children & Family Movies	Movie	Kahlil Gibran's The Prophet	October 1, 2017	2014	PG	85 min	A troubled young girl and her mother find sola...
162680	s7165	Roger Allers	Liam Neeson	Lebanon	Dramas	Movie	Kahlil Gibran's The Prophet	October 1, 2017	2014	PG	85 min	A troubled young girl and her mother find sola...
162681	s7165	Roger Allers	Liam Neeson	Qatar	Children & Family Movies	Movie	Kahlil Gibran's The Prophet	October 1, 2017	2014	PG	85 min	A troubled young girl and her mother find sola...

	show_id	director	cast	country	genre	type	title	date_added	release_year	rating	duration	description
162682	s7165	Roger Allers	Liam Neeson	Qatar	Dramas	Movie	Kahlil Gibran's The Prophet	October 1, 2017	2014	PG	85 min	A troubled young girl and her mother find sola...

Observation:

- The reason for having **non unique descriptions** is because, the **description tends to remain the same for movies which have been released in multiple langauges based on the country of origin**.
- Since we are not using NLP in this case study, we won't be able to obtain insights from the description column. Hence, we will **drop the description** column.

In [22]:
```
df.drop(['description'], axis=1, inplace=True)
print(f'The Data-Set Contain \033[1m{df.shape[0]} Rows\033[0m and \033[1m{df.shape[1]} Columns\033[0m.')
```

```
The Data-Set Contain 201708 Rows and 11 Columns.
```

8.2 Analysing Duration column

In [23]:
```
1 print(df['duration'].unique())
```

```
['90 min' '2 Seasons' '1 Season' '91 min' '125 min' '9 Seasons' '104 min'
 '127 min' '4 Seasons' '67 min' '94 min' '5 Seasons' '161 min' '61 min'
 '166 min' '147 min' '103 min' '97 min' '106 min' '111 min' '3 Seasons'
 '110 min' '105 min' '96 min' '124 min' '116 min' '98 min' '23 min'
 '115 min' '122 min' '99 min' '88 min' '100 min' '6 Seasons' '102 min'
 '93 min' '95 min' '85 min' '83 min' '113 min' '13 min' '182 min' '48 min'
 '145 min' '87 min' '92 min' '80 min' '117 min' '128 min' '119 min'
 '143 min' '114 min' '118 min' '108 min' '63 min' '121 min' '142 min'
 '154 min' '120 min' '82 min' '109 min' '101 min' '86 min' '229 min'
 '76 min' '89 min' '156 min' '112 min' '107 min' '129 min' '135 min'
 '136 min' '165 min' '150 min' '133 min' '70 min' '84 min' '140 min'
 '78 min' '7 Seasons' '64 min' '59 min' '139 min' '69 min' '148 min'
 '189 min' '141 min' '130 min' '138 min' '81 min' '132 min' '10 Seasons'
 '123 min' '65 min' '68 min' '66 min' '62 min' '74 min' '131 min' '39 min'
 '46 min' '38 min' '8 Seasons' '17 Seasons' '126 min' '155 min' '159 min'
 '137 min' '12 min' '273 min' '36 min' '34 min' '77 min' '60 min' '49 min'
 '58 min' '72 min' '204 min' '212 min' '25 min' '73 min' '29 min' '47 min'
 '32 min' '35 min' '71 min' '149 min' '33 min' '15 min' '54 min' '224 min'
 '162 min' '37 min' '75 min' '79 min' '55 min' '158 min' '164 min'
 '173 min' '181 min' '185 min' '21 min' '24 min' '51 min' '151 min'
 '42 min' '22 min' '134 min' '177 min' '13 Seasons' '52 min' '14 min'
 '53 min' '8 min' '57 min' '28 min' '50 min' '9 min' '26 min' '45 min'
 '171 min' '27 min' '44 min' '146 min' '20 min' '157 min' '17 min'
 '203 min' '41 min' '30 min' '194 min' '15 Seasons' '233 min' '237 min'
 '230 min' '195 min' '253 min' '152 min' '190 min' '160 min' '208 min'
 '180 min' '144 min' '5 min' '174 min' '170 min' '192 min' '209 min'
 '187 min' '172 min' '16 min' '186 min' '11 min' '193 min' '176 min'
 '56 min' '169 min' '40 min' '10 min' '3 min' '168 min' '312 min'
 '153 min' '214 min' '31 min' '163 min' '19 min' '12 Seasons' '179 min'
 '11 Seasons' '43 min' '200 min' '196 min' '167 min' '178 min' '228 min'
 '18 min' '205 min' '201 min' '191 min']
```

Observation :

The duration column has either the **total number of minutes for movies or the total number of seasons for a TV show**

8.3 Column Rating

In [24]:
```
print(df['rating'].unique())
```

```
['PG-13' 'TV-MA' 'PG' 'TV-14' 'TV-PG' 'TV-Y' 'TV-Y7' 'R' 'TV-G' 'G'
 'NC-17' 'NR' 'TV-Y7-FV' 'UR']
```

In [25]:
```
# Categorising rating into groups of Kids, Older Kids, Teens, and Adults
ratings_ages = {
    'TV-PG': 'Older Kids',
    'TV-MA': 'Adults',
    'TV-Y7-FV': 'Older Kids',
    'TV-Y7': 'Older Kids',
    'TV-14': 'Teens',
    'R': 'Adults',
    'TV-Y': 'Kids',
    'NR': 'Adults',
    'PG-13': 'Teens',
    'TV-G': 'Kids',
    'PG': 'Older Kids',
    'G': 'Kids',
    'UR': 'Adults',
    'NC-17': 'Adults'
}
df["ratings_ages"]=df["rating"].replace(ratings_ages)
```

8.4 Standardizing and separating duration values.

In [26]:
```
def get_duration_in_minutes(input_str):
    if 'min' in input_str.lower():
        return int(input_str.split()[0])
    return 0

def get_season_counts(input_str):
    if 'season' in input_str.lower():
        return int(input_str.split()[0])
    return 0

df['duration_in_minutes'] = df['duration'].apply(get_duration_in_minutes)
df['seasons'] = df['duration'].apply(get_season_counts)
#df.drop('duration', axis=1, inplace=True)
print(df.columns.to_list())
```

```
['show_id', 'director', 'cast', 'country', 'genre', 'type', 'title', 'date_added', 'release_year', 'rating', 'durat
ion', 'ratings_ages', 'duration_in_minutes', 'seasons']
```

8.5 Standardizing and separating date_added values.

In [27]:
```
df.dropna(inplace=True)
month_map = {'January':1, 'February':2, 'March':3, 'April':4, 'May':5, 'June':6, 'July':7,\
             'August':8, 'September':9, 'October':10, 'November':11, 'December':12}
df['year_added'] = df['date_added'].str.split().apply(lambda x: int(x[2]))
df['day_added'] = df['date_added'].str.split().apply(lambda x: int(x[1].split(',')[0]))
df['month_added'] = df['date_added'].str.split().apply(lambda x: month_map[x[0]])
df['weekday_added'] = df.apply(lambda x: pd.Timestamp(x['year_added'], x['month_added'],\
                                                      x['day_added']), axis=1).dt.weekday
df['is_weekend_added'] = df.apply(lambda x: pd.Timestamp(x['year_added'], x['month_added'],\
                                                      x['day_added']), axis=1).dt.weekday.apply(lambda x: 1 i
print(df.columns.to_list())
```

```
['show_id', 'director', 'cast', 'country', 'genre', 'type', 'title', 'date_added', 'release_year', 'rating', 'durat
ion', 'ratings_ages', 'duration_in_minutes', 'seasons', 'year_added', 'day_added', 'month_added', 'weekday_added',
'is_weekend_added']
```

Data Analysis on the dataset

9.1 Initial analysis of data distribution for columns Movie type, Release year, Genres, Ratings, Country and Duration

The following output shows disribution of data in integer percentages for multiple tables.
Observations :

1. Movies constitute a major chunk **(72.3%)** of the content on Netflix. **Rest 27.7%** are tv shows.
2. Majority **(70%)** of the content being streamed on Netflix was released after **2014**.
   We can see a sudden drop in the content being released **since 2019** , which probably shows the effect of Covid-19 on the production and release of movies/tv-shows.
3. Rating column has some invalid values, which needs to be fixed. Also, some ratings are redundant and need to be grouped together.
4. Duration column has movie duration (in minutes) and tv-show season counts together. Need to separate them.
   Also, there's a need to convert these values to numeric values for better analysis.
5. International movies, Dramas and Comedies constitute a major chunk **(34%)** of the content on Netflix.
6. A huge part **(43%)** of the content on Netflix is produced only in the United States and India.

9.1.1 Most watched on Netflix

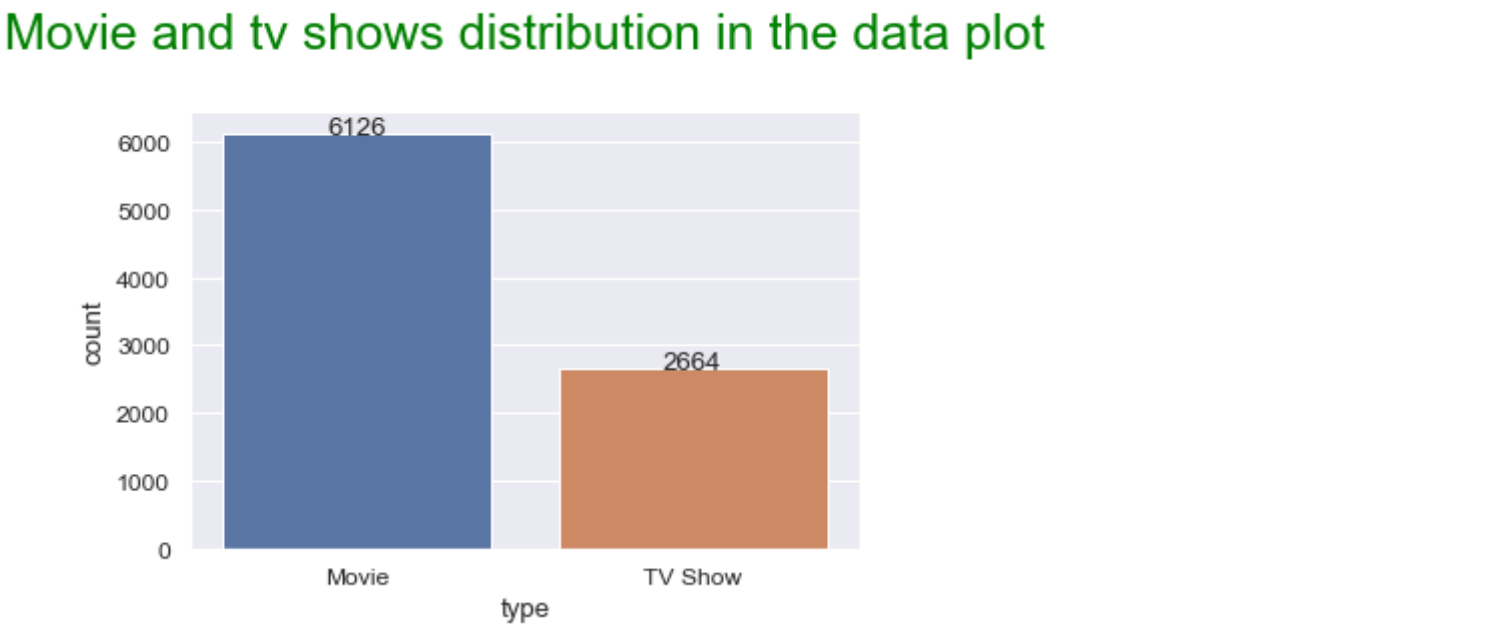
This chart plot tells us what the audience prefers to watch. So Netflix can decide what type of content they should publish to make the audience happy.

In [28]:

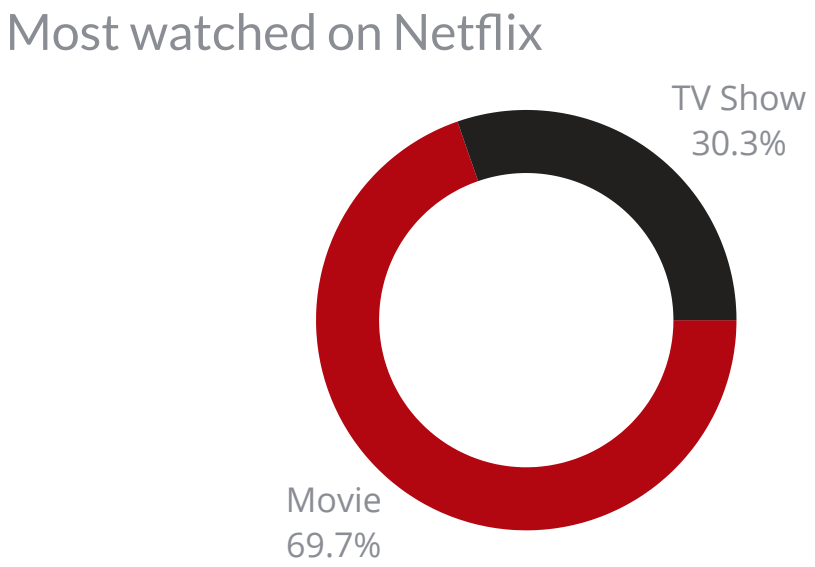
```
def show_values_on_bars(axs, h_v="v", space=1):
    def _show_on_single_plot(ax):
        if h_v == "v":
            for p in ax.patches:
                _x = p.get_x() + p.get_width() / 2
                _y = p.get_y() + p.get_height()
                value = int(p.get_height())
                ax.text(_x, _y, value, ha="center")
        elif h_v == "h":
            for p in ax.patches:
                _x = p.get_x() + p.get_width() + float(space)
                _y = p.get_y() + p.get_height()
                value = int(p.get_width())
                ax.text(_x, _y, value, ha="left")

    if isinstance(axs, np.ndarray):
        for idx, ax in np.ndenumerate(axs):
            _show_on_single_plot(ax)
    else:
        _show_on_single_plot(axs)
```

In [29]:

```
sns.set(font_scale = 1.1)
types = sns.countplot(data = df[['show_id','type']].drop_duplicates() , x = "type")
plt.title("\nMovie and tv shows distribution in the data plot\n",fontsize=25,color="green")
show_values_on_bars(types,h_v="v",space=1)
```



In [30]:
```
donut = px.pie(df[['show_id','type']].drop_duplicates(), names='type', height=300, width=600, hole=0.7,title='Mo
                    color_discrete_sequence=['#b20710', '#221f1f'])

donut.update_traces(hovertemplate=None, textposition='outside',textinfo='percent+label', rotation=90)

donut.update_layout(margin=dict(t=60, b=30, l=0, r=0), showlegend=False,plot_bgcolor='#333',
                        paper_bgcolor='#333',title_font=dict(size=25, color='#8a8d93', family="Lato, sans-serif"
                        font=dict(size=17, color='#8a8d93'),
                        hoverlabel=dict(bgcolor="#444", font_size=13,font_family="Lato, sans-serif"))
```



Observation:

Well, customers prefer to watch Movies over TV Show as 69.7% of the content is Movies.

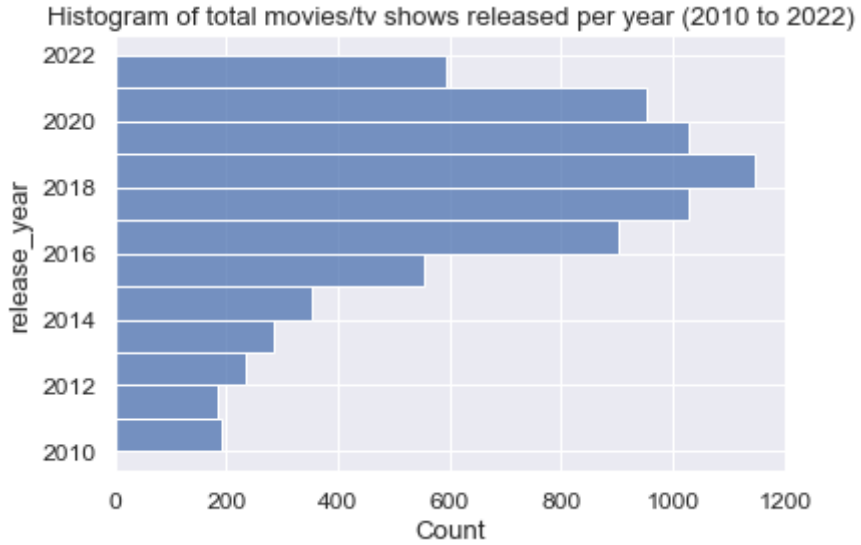
9.1.2 Percentage of data distribution in Release year, Genres, Ratings, Country and Duration columns

In [31]:

```
for column in ['release_year', 'rating', 'duration_in_minutes']:
    print(f"\n\nPercentage of Data distribution in \"{column}\" column\n")
    print((df[['show_id', column]].drop_duplicates()[column].value_counts()*100//len(df[['show_id', column]].dro
    if column == 'release_year':
        sns.histplot(data=df[['show_id', column]].drop_duplicates(), y=column, binrange=(2010, 2022), binwidth=1
        plt.show()
for column in ['genre', 'country']:
    print(f"\n\nPercentage of Data distribution in \"{column}\" column\n")
    print((df[['show_id', column]].drop_duplicates()[column].value_counts()*100//len(df[['show_id', column]].dro
    if column in ['country', 'genre']:
        colors = sns.color_palette('pastel')
        lab = df[['show_id', column]].drop_duplicates()[column].value_counts().reset_index()
        limit = 0
        if column == 'country':
            limit = 250
        else:
            limit = 700
        lab.loc[lab[column]<=limit, 'index'] = ''
        plt.pie(df[['show_id', column]].drop_duplicates()[column].value_counts(), labels=lab['index'], colors=co
        plt.title(f"Pie chart for content produced per {column}", loc='left')
        plt.show()
```

```
Percentage of Data distribution in "release_year" column

2018    13
2017    11
2019    11
2020    10
2016    10
2021     6
2015     6
2014     4
2013     3
2012     2
2010     2
2011     2
2009     1
```

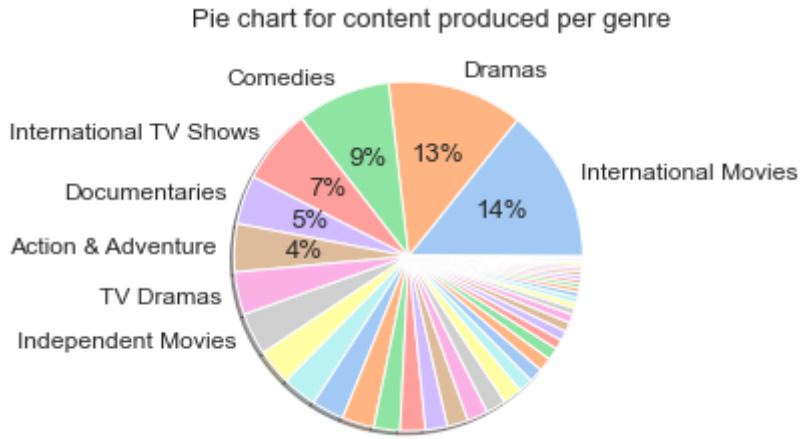
```
2008     1
2006     1
2007     1
2005     0
2004     0
2003     0
2002     0
Name: release_year, dtype: int64
```




```
Percentage of Data distribution in "rating" column

TV-MA       36
TV-14       24
TV-PG        9
R            9
PG-13        5
TV-Y7        3
TV-Y         3
PG           3
TV-G         2
NR           0
G            0
TV-Y7-FV     0
```

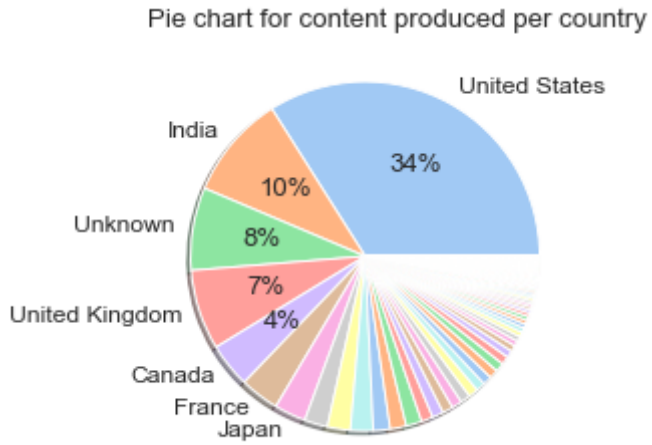
```
NC-17        0
UR           0
Name: rating, dtype: int64


Percentage of Data distribution in "duration_in_minutes" column

0      30
90      1
97      1
94      1
93      1
91      1
95      1
96      1
92      1
102     1
98      1
99      1
101     1
88      1
103     1
106     1
100     1
89      1
104     1
86      1
Name: duration_in_minutes, dtype: int64


Percentage of Data distribution in "genre" column

International Movies        14
Dramas                      12
Comedies                     8
International TV Shows       6
Documentaries                4
Action & Adventure           4
Children & Family Movies     3
Romantic Movies              3
Independent Movies           3
TV Dramas                    3
```

```
Thrillers                   2
TV Comedies                 2
Crime TV Shows              2
Kids' TV                    2
Docuseries                  2
Reality TV                  1
Sports Movies               1
British TV Shows            1
Sci-Fi & Fantasy            1
Stand-Up Comedy             1
Name: genre, dtype: int64
```




```
Percentage of Data distribution in "country" column

United States     33
India              9
Unknown            7
United Kingdom     7
Canada             4
France             3
Japan              2
Spain              2
South Korea        2
Germany            2
```

```
Australia          1
Egypt              1
Turkey             1
China              1
Mexico             1
Cayman Islands     0
Afghanistan        0
Samoa              0
Azerbaijan         0
East Germany       0
Name: country, dtype: int64
```



9.2 Analyzing rating values

The following code snippet groups redundant rating values together as well as fix the invalid rating values.

Observations:

- A major chunk **(42-46%)** of the content **(both movies and tv-shows)** is suitable for **mature adults** only.
  Also, a huge portion **(69-77%)** of the content **(both movies and tv-shows)** on netflix is not suitable for the audience **under 14 years** of age.

In [32]:

```
print("\nRatings distribution for movies in percentage\n")
print((df[df['type']=='Movie'][['show_id', 'rating']].drop_duplicates()['rating'].value_counts()*100//len(df[df[
sns.countplot(x = 'rating', data=df[df['type']=='Movie'][['show_id', 'rating']].drop_duplicates()).set(title="Co
plt.show()

print("\n\nRatings distribution for tv shows in percentage\n")
print((df[df['type']=='TV Show'][['show_id', 'rating']].drop_duplicates()['rating'].value_counts()*100//len(df[d
sns.countplot(x = 'rating', data=df[df['type']=='TV Show'][['show_id', 'rating']].drop_duplicates()).set(title="
plt.show()
```

```
Ratings distribution for movies in percentage

TV-MA       33
TV-14       23
R           13
TV-PG        8
PG-13        7
PG           4
TV-Y7        2
TV-Y         2
TV-G         2
NR           1
G            0
TV-Y7-FV     0
NC-17        0
UR           0
Name: rating, dtype: int64
```

9.3 Analyzing country values

Observations:

- A huge chunk (30-35%) of the content on Netflix (both movies and tv-shows) is produced in United States only.

In [33]:

```
print("\nDistribution of movies produced per country in percentage\n")
print((df[df['type']=='Movie'][['show_id', 'country']].drop_duplicates()['country'].value_counts()*100//len(df[d
colors = sns.color_palette('pastel')
lab = df[df['type']=='Movie'][['show_id', 'country']].drop_duplicates()['country'].value_counts().reset_index()
limit = 200
lab.loc[lab['country']<=limit, 'index'] = ''
plt.pie(df[df['type']=='Movie'][['show_id', 'country']].drop_duplicates()['country'].value_counts(), labels=lab[
plt.title(f"Movies produced per country", loc='left')
plt.show()

print("\n\nDistribution of tv shows produced per country in percentage\n")
print((df[df['type']=='TV Show'][['show_id', 'country']].drop_duplicates()['country'].value_counts()*100//len(df
colors = sns.color_palette('pastel')
lab = df[df['type']=='TV Show'][['show_id', 'country']].drop_duplicates()['country'].value_counts().reset_index(
limit = 200
lab.loc[lab['country']<=limit, 'index'] = ''
plt.pie(df[df['type']=='TV Show'][['show_id', 'country']].drop_duplicates()['country'].value_counts(), labels=la
plt.title(f"TV Shows produced per country", loc='left')
plt.show()
```

```
Distribution of movies produced per country in percentage

United States     35
India             12
United Kingdom     6
Unknown            5
Canada             4
France             3
Germany            2
Spain              2
Japan              1
China              1
Mexico             1
Egypt              1
Hong Kong          1
Nigeria            1
Australia          1
Indonesia          1
```

9.4 Analyzing genre values

Observations:

- International content, comedy and drama constitutes a major chunk (43-50%) of the content on Netflix.

In [34]:

```
print("\nDistribution of movies produced per genre in percentage\n")
print((df[df['type']=='Movie'][['show_id', 'genre']].drop_duplicates()['genre'].value_counts()*100//len(df[df['t
colors = sns.color_palette('pastel')
lab = df[df['type']=='Movie'][['show_id', 'genre']].drop_duplicates()['genre'].value_counts().reset_index()
limit = 650
lab.loc[lab['genre']<=limit, 'index'] = ''
plt.pie(df[df['type']=='Movie'][['show_id', 'genre']].drop_duplicates()['genre'].value_counts(), labels=lab['ind
plt.title(f"Movies produced per genre", loc='left')
plt.show()

print("\n\nDistribution of tv shows produced per genre in percentage\n")
print((df[df['type']=='TV Show'][['show_id', 'genre']].drop_duplicates()['genre'].value_counts()*100//len(df[df[
colors = sns.color_palette('pastel')
lab = df[df['type']=='TV Show'][['show_id', 'genre']].drop_duplicates()['genre'].value_counts().reset_index()
limit = 350
lab.loc[lab['genre']<=limit, 'index'] = ''
plt.pie(df[df['type']=='TV Show'][['show_id', 'genre']].drop_duplicates()['genre'].value_counts(), labels=lab['i
plt.title(f"TV Shows produced per genre", loc='left')
plt.show()
```

```
Distribution of movies produced per genre in percentage

International Movies        20
Dramas                      18
Comedies                    12
Documentaries                6
Action & Adventure           6
Independent Movies           5
Children & Family Movies     4
Romantic Movies              4
Thrillers                    4
Music & Musicals             2
Horror Movies                2
Stand-Up Comedy              2
Sci-Fi & Fantasy             1
Sports Movies                1
Classic Movies               0
LGBTQ Movies                 0
```

9.5 Analyzing director values

Observations:

1. Directors like Rajiv Chilaka, Jan Suter and Raul Campos are the top 3 directors in the world by number of movies directed.
2. Directors like Alastair Fothergill, and Ken Burns are the topmost directors in the world by number of tv shows directed.

In [35]:

```
df['director'].replace('nan', 'Unknown', inplace=True)

print("\nDistribution of movies produced by each director in total counts\n")
print((df[df['type']=='Movie'][['show_id', 'director']].drop_duplicates()['director'].value_counts()).head(20))

print("\n\nDistribution of tv shows produced by each director in total counts\n")
print((df[df['type']=='TV Show'][['show_id', 'director']].drop_duplicates()['director'].value_counts()).head(20)
```

```
Distribution of movies produced by each director in total counts

Unknown                187
Rajiv Chilaka           22
Jan Suter               21
Raúl Campos             19
Suhas Kadav             16
Jay Karas               15
Marcus Raboy            15
Cathy Garcia-Molina     13
Jay Chapman             12
Martin Scorsese         12
Youssef Chahine         12
Steven Spielberg        11
Don Michael Paul        10
Shannon Hartman          9
David Dhawan             9
Yılmaz Erdoğan           9
```

9.6 Analyzing cast values

Observations:

1. Takahiro Sakurai has acted in most number of tv shows (25) on Netflix.
2. Anupam Kher has acted in most number of movies (42) on Netflix.

In [36]:
```
print("\nDistribution of movies per actor in total counts\n")
print((df[df['type']=='Movie'][['show_id', 'cast']].drop_duplicates()['cast'].value_counts()).head(20))

print("\n\nDistribution of tv shows per actor in total counts\n")
print((df[df['type']=='TV Show'][['show_id', 'cast']].drop_duplicates()['cast'].value_counts()).head(20))
```

```
Distribution of movies per actor in total counts

Unknown               475
Anupam Kher            42
Shah Rukh Khan         35
Naseeruddin Shah       32
Akshay Kumar           30
Om Puri                30
Amitabh Bachchan       28
Paresh Rawal           28
Julie Tejwani          28
Boman Irani            27
Rupa Bhimani           27
Kareena Kapoor         25
Samuel L. Jackson      22
Rajesh Kava            21
Ajay Devgn             21
Kay Kay Menon          20
```

9.7 Data distribution for the year, day, month and weekday when the movie/tv show was added to Netflix

The following output shows disribution of data in integer percentages for multiple tables.

Observations:

1. Majority of the content being streamed on Netflix was added after 2015.
   We can see a sudden drop in the content being added to Netflix since 2019, which probably shows the effect of Covid-19 on the production and release of movies/tv-shows.

2. Majority of the content is added on 1st and the 15th day of the month on Netflix.
3. Majority of the content is added during the first 4 days of the week (Mon, Tue, Wed, Thu) on Netflix.

In [37]:

```
print("\nPercentage of movies and tv shows distribution in Year added, Month added, Day added, Weekday added and
for column in ['year_added', 'month_added', 'day_added', 'weekday_added', 'is_weekend_added']:
    print(f"\n\nPercentage of movie distribution in \"{column}\" column\n")
    print((df[df.type == 'Movie'][['show_id', column]].drop_duplicates()[column].value_counts()*100//len(df[df.t
    if column not in ['is_weekend_added']:
        sns.distplot(df[['show_id', column]].drop_duplicates()[column]).set(title=f"\n\nMovie distribution in \"
        plt.show()
    print(f"\n\nPercentage of tv show distribution in \"{column}\" column\n")
    print((df[df.type == 'TV Show'][['show_id', column]].drop_duplicates()[column].value_counts()*100//len(df[df
    if column not in ['is_weekend_added']:
        sns.histplot(data=df[['show_id', column]].drop_duplicates(), y=column).set(title=f"\n\nTV Show distribut
        plt.show()
```

```
Percentage of movies and tv shows distribution in Year added, Month added, Day added, Weekday added and Weekend a
dded columns


Percentage of movie distribution in "year_added" column

2019    23
2020    20
2018    20
2021    16
2017    13
2016     4
2015     0
2014     0
2011     0
2013     0
2012     0
2009     0
```

9.8 Statistical summary of the data.

The following output shows

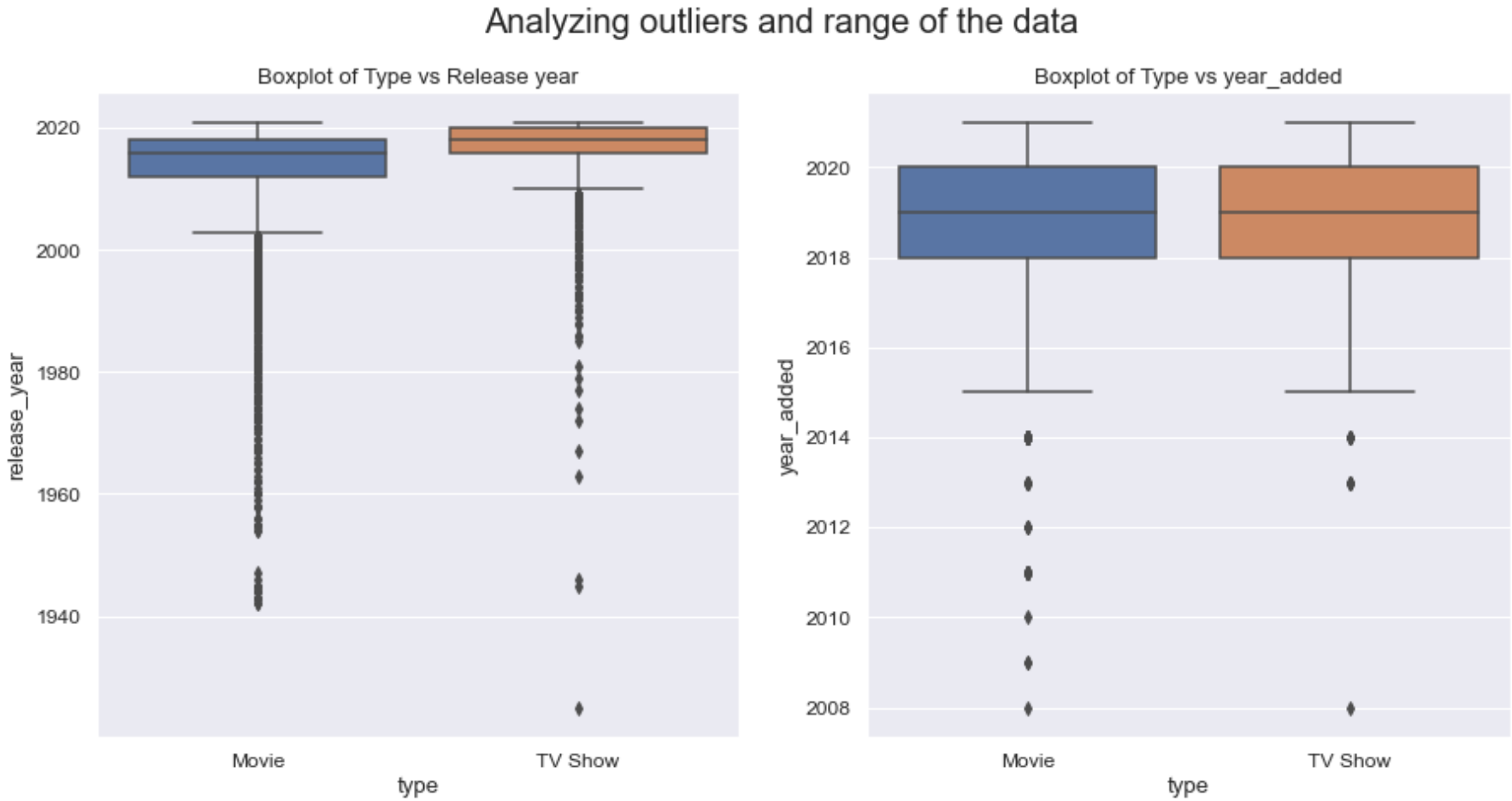
1. The stastical summary of the data.
2. Boxplots displaying range of the data and outliers.

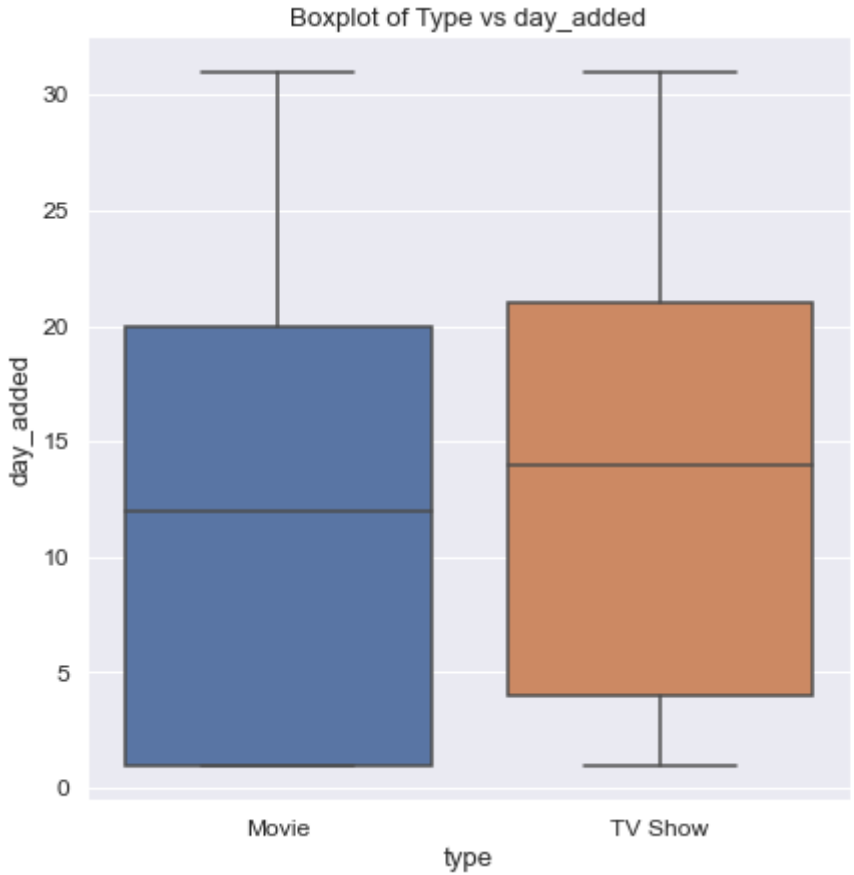
Observations:

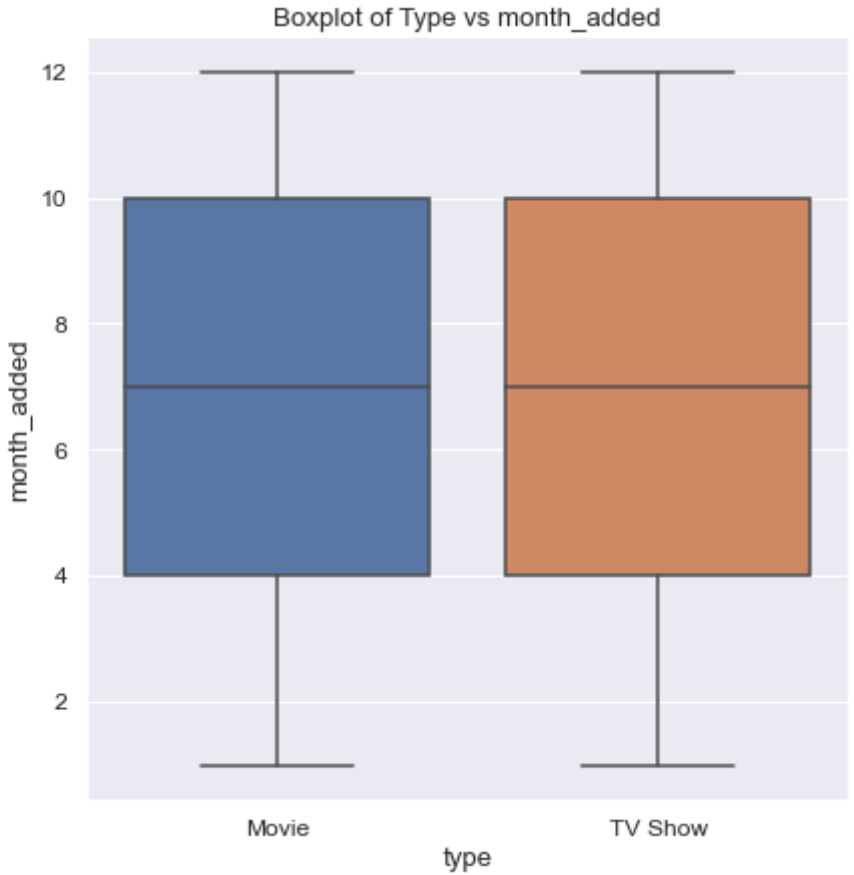
1. Movies are released from 1940s to 2021. Movies released before 2000s are outliers.
2. TV shows are released from 1920s to 2021. TV shows released before 2010's are outliers.
3. Movies are added to Netflix from 2008 to 2021. Movies added to Netflix before 2015 are outliers.
4. TV shows are added to Netflix from 2008 to 2021. TV shows added to Netflix before 2015 are outliers.
5. Movies and TV shows are added throughout the month on Netflix. Majority of movies and TV shows are added to Netflix in first half of the month.
6. Duration of the movies go upto 312 minutes on Netflix. Movies with duration less than 50 minutes or greater than 150 minutes are outliers.

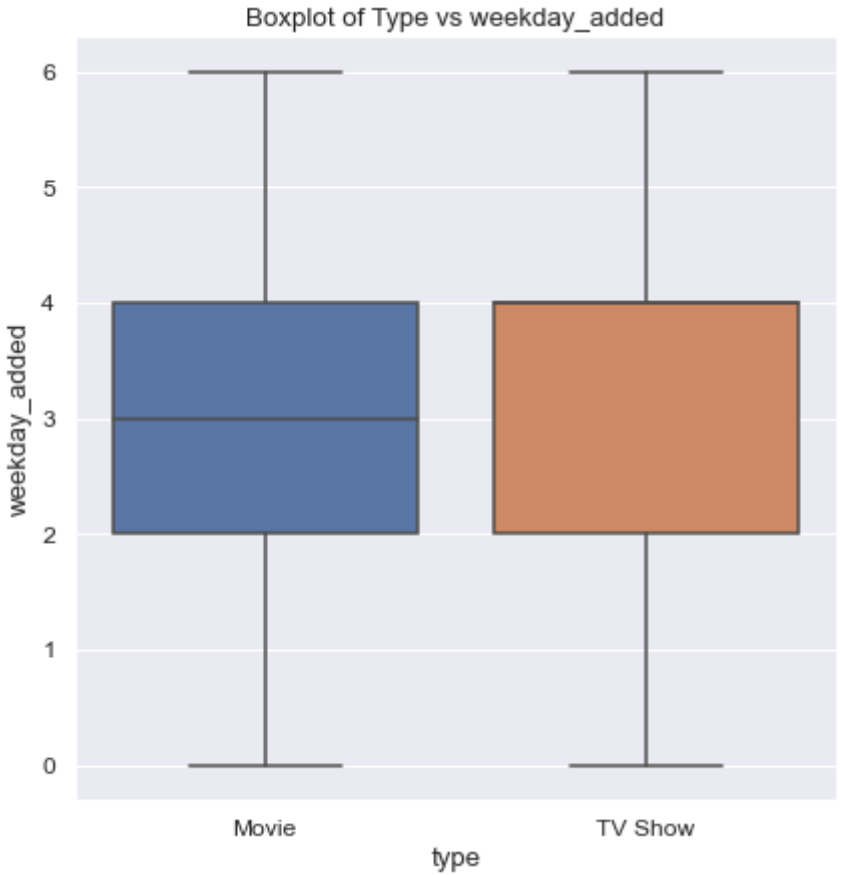
In [38]:

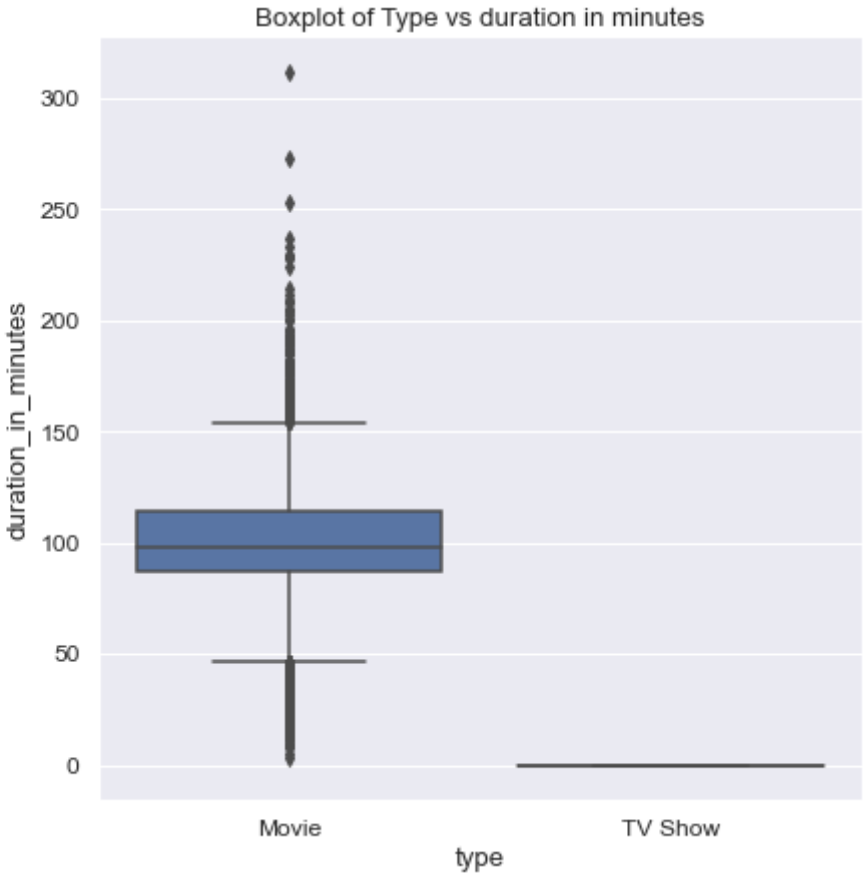
```
fig, axes = plt.subplots(1, 2, sharex=True, figsize=(15,7))
fig.suptitle('Analyzing outliers and range of the data', fontsize=20)
axes[0].set_title('Boxplot of Type vs Release year')
sns.boxplot(ax=axes[0], x="type", y="release_year", data=df[['show_id', 'type', 'release_year']].drop_duplicates
axes[1].set_title('Boxplot of Type vs year_added')
sns.boxplot(ax=axes[1], x="type", y="year_added", data=df[['show_id', 'type', 'year_added']].drop_duplicates())
plt.show()
fig, axes = plt.subplots(1, 2, sharex=True, figsize=(15,7))
axes[0].set_title('Boxplot of Type vs day_added')
sns.boxplot(ax=axes[0], x="type", y="day_added", data=df[['show_id', 'type', 'day_added']].drop_duplicates())
axes[1].set_title('Boxplot of Type vs month_added')
sns.boxplot(ax=axes[1], x="type", y="month_added", data=df[['show_id', 'type', 'month_added']].drop_duplicates()
plt.show()
fig, axes = plt.subplots(1, 2, sharex=True, figsize=(15,7))
axes[0].set_title('Boxplot of Type vs weekday_added')
sns.boxplot(ax=axes[0], x="type", y="weekday_added", data=df[['show_id', 'type', 'weekday_added']].drop_duplicat
axes[1].set_title('Boxplot of Type vs duration in minutes')
sns.boxplot(ax=axes[1], x='type', y="duration_in_minutes", data=df[['show_id', 'type', 'duration_in_minutes']].d
plt.show()
```


Analyzing outliers and range of the data
Boxplot of Type vs Release year
release_year
2020
2000
1980
1960
1940
Movie
TV Show
type
Boxplot of Type vs year_added
year_added
2020
2018
2016
2014
2012
2010
2008
Movie
TV Show
type


Boxplot of Type vs day_added
day_added
0
5
10
15
20
25
30
Movie
TV Show
type


Boxplot of Type vs month_added
month_added
2
4
6
8
10
12
Movie
TV Show
type


Boxplot of Type vs weekday_added
weekday_added
0
1
2
3
4
5
6
Movie
TV Show
type


Boxplot of Type vs duration in minutes
duration_in_minutes
0
50
100
150
200
250
300
Movie
TV Show
type

9.9 Most popular actors, directors and genres in top 5 countries of the world on Netflix.

Observations:

1. Anupam Kher and Samulel Jackson are most popular movie actors in India and the United States respectively.
2. Takahiro Sakurai and David Attenborough are most popular tv show actors in India and the United States respectively.
3. Jay Karas and David Dhawan are most popular movie directors in the United States and India respectively.
4. Alastair Fothergill and Stan Lathan are most popular tv show directors in the United Kingdom and the United States respectively.
5. International Movies and Dramas are most popular movie genres in India and the United States respectively.
6. TV Comedies and British TV Shows are most popular tv show genres in the United States and the United Kingdom respectively.
7. TV-MA and TV-14 are most popular movie ratings in the United States and India respectively.
8. TV-MA is the most popular tv show rating in both the United States and the United Kingdom.

In [39]:

```
movies = df[(df['type'] == 'Movie') & (df['cast']!='Unknown') & (df['country'].isin(['United States', 'India', '
tv_shows = df[(df['type'] == 'TV Show') & (df['cast']!='Unknown') & (df['country'].isin(['United States', 'Unite
for column in ['cast', 'director', 'genre', 'rating']:
    print(f"\n\nTop {column} in movies by countries\n")
    m = movies[movies[column] != 'Unknown']
    m = m.groupby(['country', column])['show_id'].nunique().reset_index()
    print(m[m.groupby(['country'])['show_id'].transform(max) == m['show_id']].sort_values(by='show_id', ascendin
    print(f"\n\nTop {column} in tv shows by countries\n")
    t = tv_shows[tv_shows[column] != 'Unknown']
    t = t.groupby(['country', column])['show_id'].nunique().reset_index()
    print(t[t.groupby(['country'])['show_id'].transform(max) == t['show_id']].sort_values(by='show_id', ascendin
```

```
Top cast in movies by countries

             country               cast
4529           India        Anupam Kher
20710   United States   Samuel L. Jackson
9172   United Kingdom        John Cleese
942            Canada  John Paul Tremblay
4118           France      Wille Lindberg


Top cast in tv shows by countries

            country               cast
1869          Japan    Takahiro Sakurai
3442  United Kingdom  David Attenborough
6393   United States       Grey Griffin
75            Canada      Ashleigh Ball
2192     South Korea       Cho Seong-ha


Top director in movies by countries

            country       director
2508   United States      Jay Karas
726            India    David Dhawan
134           Canada  Justin G. Dyck
```

```
551           France  Thierry Donard
1324  United Kingdom   Blair Simmons
```

Top director in tv shows by countries

```
            country             director
39   United Kingdom  Alastair Fothergill
102   United States          Stan Lathan
35      South Korea          Shin Won-ho
15            Japan        Kazuya Murata
0            Canada  Alastair Fothergill
```

Top genre in movies by countries

```
           country                 genre
47           India  International Movies
81   United States                Dramas
61  United Kingdom                Dramas
28          France  International Movies
2           Canada              Comedies
```

Top genre in tv shows by countries

```
           country                   genre
81   United States             TV Comedies
49  United Kingdom        British TV Shows
37     South Korea  International TV Shows
23           Japan  International TV Shows
6           Canada                Kids' TV
```

Top rating in movies by countries

```
           country rating
52   United States      R
29           India  TV-14
39  United Kingdom      R
20          France  TV-MA
5           Canada      R
```

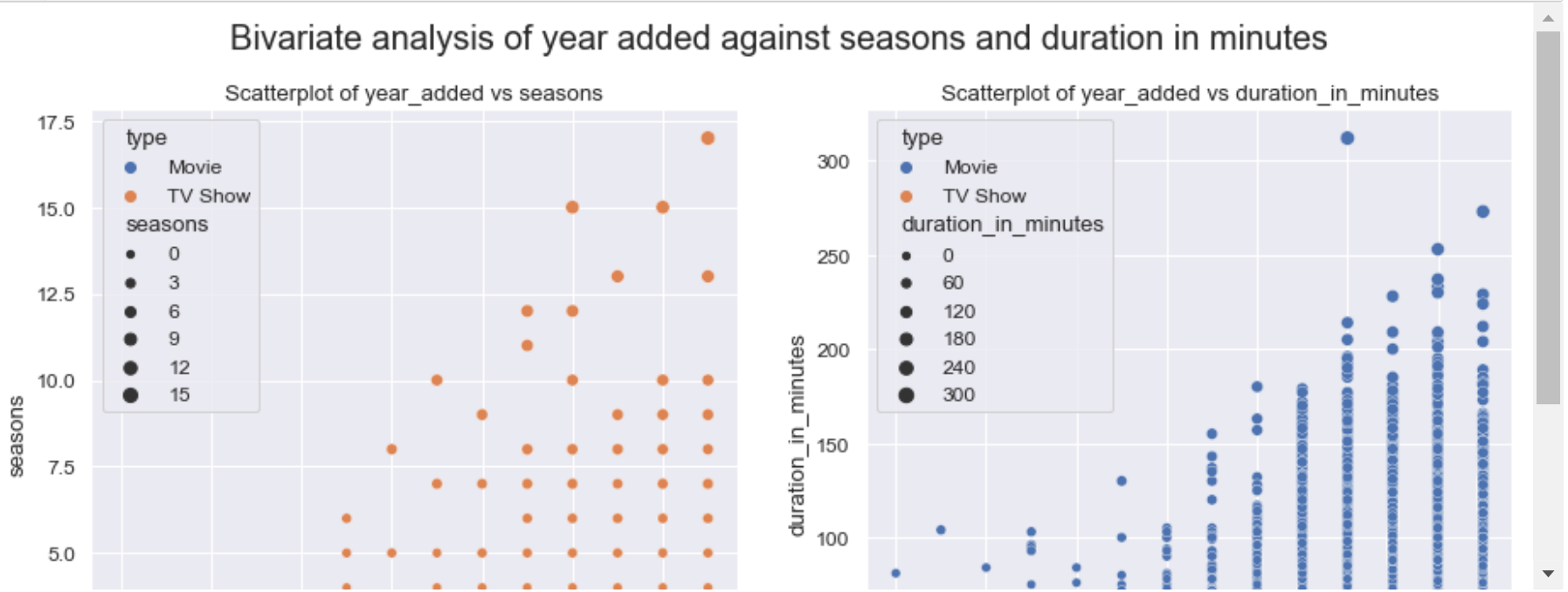
```
Top rating in tv shows by countries

           country rating
29   United States  TV-MA
22  United Kingdom  TV-MA
13     South Korea  TV-14
7            Japan  TV-14
2           Canada  TV-MA
```

9.10 Analysis of season counts movie duration change over the years on Netflix

Observations:

1. As years passed by, tv shows with more and more number of season counts were added to Netflix.
2. Over the years, movie duration on Netflix has changed significantly from average 80-120 minutes to now include short films and longer duration movies too.

In [40]:
```
fig, axes = plt.subplots(1, 2, sharex=True, figsize=(15,7))
fig.suptitle('Bivariate analysis of year added against seasons and duration in minutes', fontsize=20)
axes[0].set_title('Scatterplot of year_added vs seasons')
sns.scatterplot(ax=axes[0], data=df[['show_id', 'year_added', 'seasons', 'type']].drop_duplicates(), x="year_add
axes[1].set_title('Scatterplot of year_added vs duration_in_minutes')
sns.scatterplot(ax=axes[1], data=df[['show_id', 'year_added', 'duration_in_minutes', 'type']].drop_duplicates(),
plt.show()
```

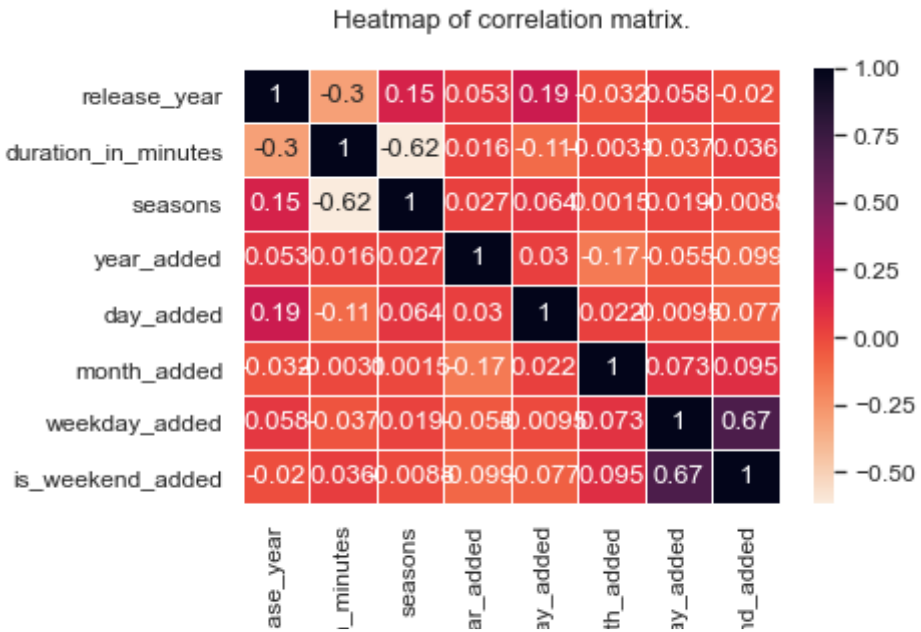


9.11 Correlation between different columns.

Observations:

- release_year column is positively correlated with seasons and day_added columns.
- weekday_added column is highly correlated with is_weekend_added column.

In [41]:
```
sns.heatmap(df.corr(), linewidths=.5, cmap=sns.cm.rocket_r, annot=True).set(title='\nHeatmap of correlation matr
plt.show()
```

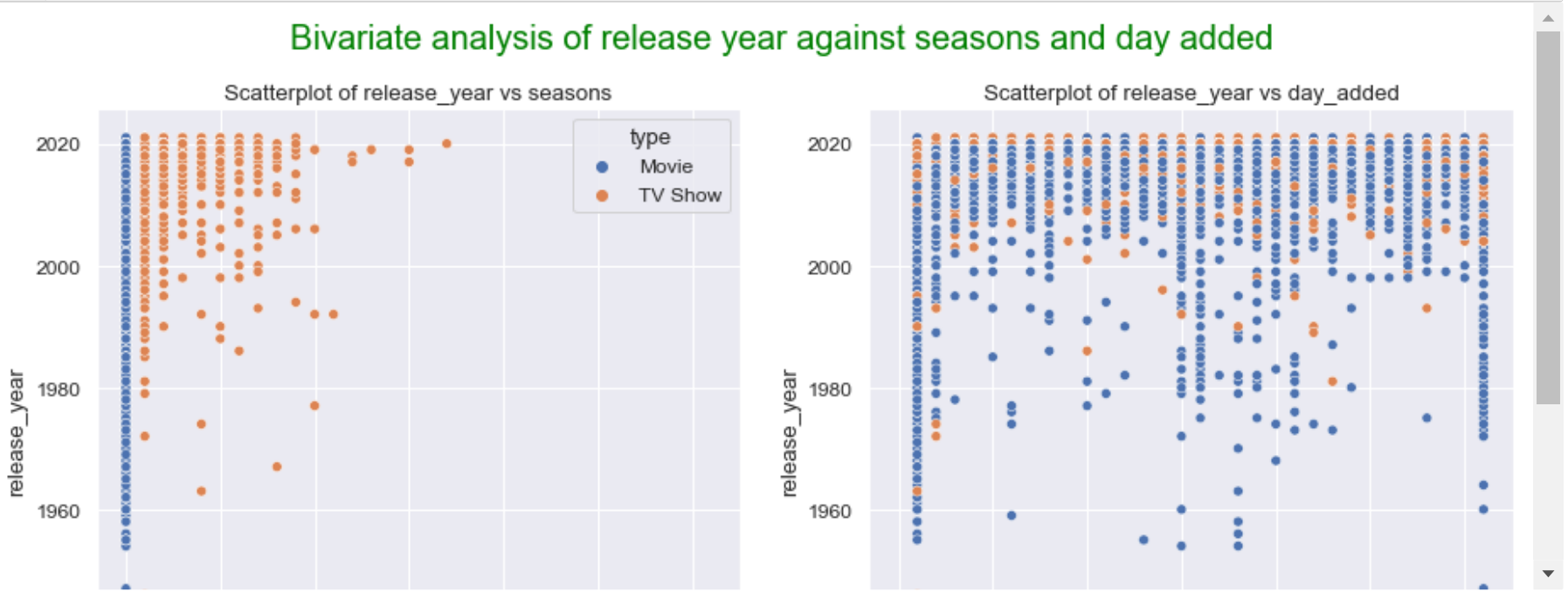


9.12 Analysis of season counts and day added change over the release years on Netflix

Observations:

1. As years passed by, tv shows with more and more number of season were released.
2. Old movies are added to Netflix on first day, last day or mid of the month compared to newly released movies which are added on all days of the month.

In [42]:
```
fig, axes = plt.subplots(1, 2, sharex=True, figsize=(15,7))
fig.suptitle('Bivariate analysis of release year against seasons and day added', fontsize=20,color='green')
axes[0].set_title('Scatterplot of release_year vs seasons')
sns.scatterplot(ax=axes[0], data=df[['show_id', 'release_year', 'seasons', 'type']].drop_duplicates(), x="season
axes[1].set_title('Scatterplot of release_year vs day_added')
sns.scatterplot(ax=axes[1], data=df[['show_id', 'release_year', 'day_added', 'type']].drop_duplicates(), x="day_
plt.show()
```



9.13 - Creating a seperate DataFrame which would only comprise of Movies

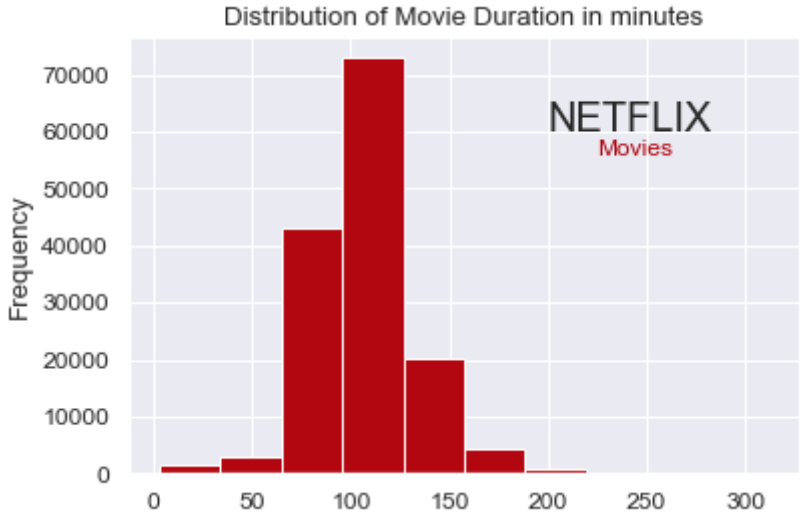
In [43]:
```
df_movie = df[df['type'] == 'Movie'].reset_index().drop(columns=['index'])
df_movie["date_added"] = pd.to_datetime(df_movie['date_added'])
df_movie.head()
```

Out[43]:

	show_id	director	cast	country	genre	type	title	date_added	release_year	rating	duration	ratings_ages	duration_i
0	s1	Kirsten Johnson	Unknown	United States	Documentaries	Movie	Dick Johnson Is Dead	2021-09-25	2020	PG-13	90 min	Teens	
1	s7	Robert Cullen	Vanessa Hudgens	Unknown	Children & Family Movies	Movie	My Little Pony: A New Generation	2021-09-24	2021	PG	91 min	Older Kids	
2	s7	Robert Cullen	Kimiko Glenn	Unknown	Children & Family Movies	Movie	My Little Pony: A New Generation	2021-09-24	2021	PG	91 min	Older Kids	
3	s7	Robert Cullen	James Marsden	Unknown	Children & Family Movies	Movie	My Little Pony: A New Generation	2021-09-24	2021	PG	91 min	Older Kids	
4	s7	Robert Cullen	Sofia Carson	Unknown	Children & Family Movies	Movie	My Little Pony: A New Generation	2021-09-24	2021	PG	91 min	Older Kids	

Chart 1 - Distribution of Movie duration in minutes

In [44]:
```
df_movie['duration_in_minutes'].plot(kind='hist',color='#b20710',title = "Distribution of Movie Duration in minu
plt.annotate("NETFLIX",xy=(200,60000),fontsize=20)
plt.annotate("Movies",xy=(225,56000),fontsize=12,color='#b20710')
plt.show()
```



Observation : The above distribution states taht the average movie duration is around 100 minutes whereas majority of the movies have duration between the range 70-130 minutes

Chart 2 - Number of movies released per year over the last 30 years

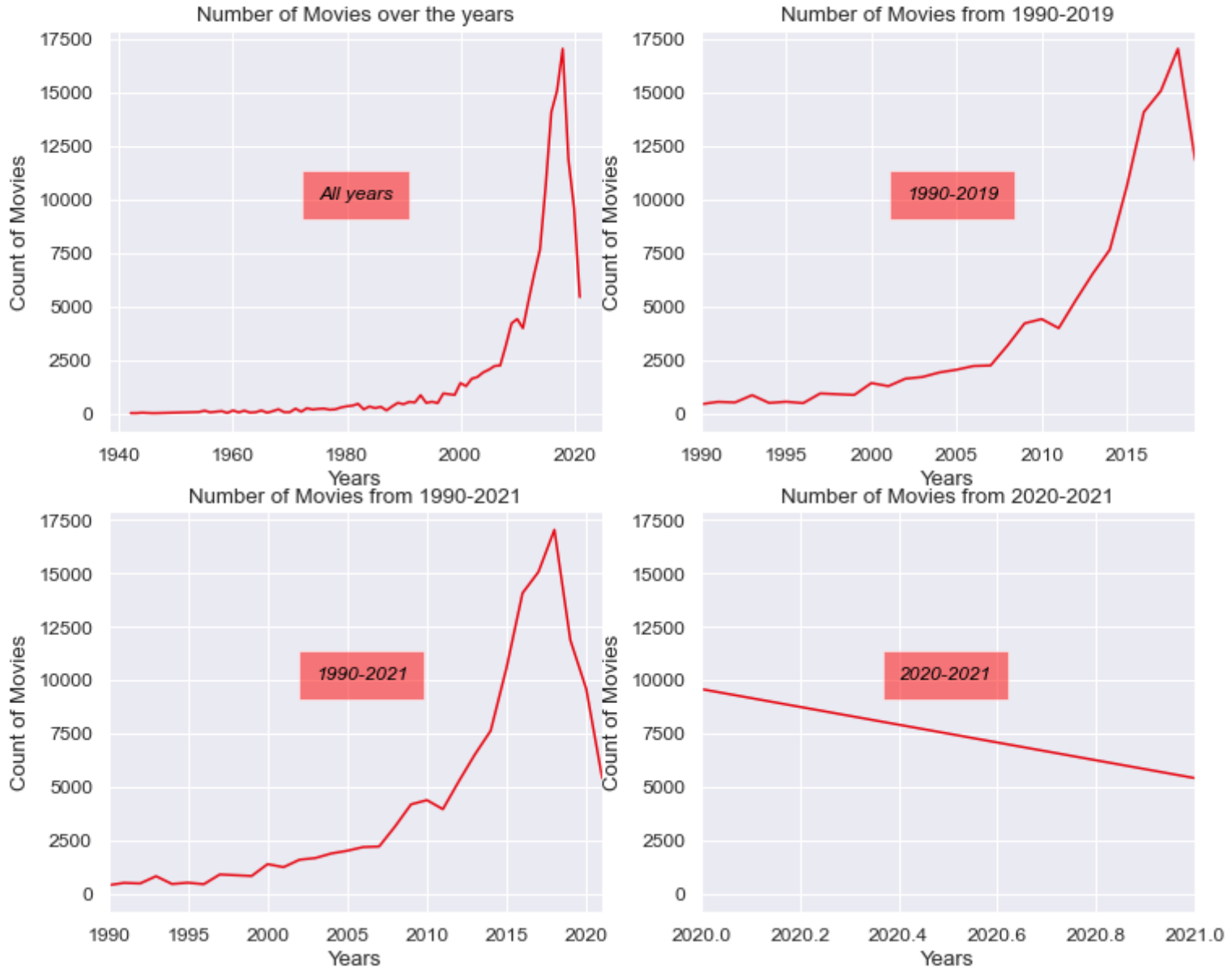
In [45]:
```
df_movie['release_year'] = df_movie['release_year'].apply(lambda x : int(x))
df_movie_year = df_movie.groupby('release_year').count()['show_id'].to_frame().reset_index()
```

In [46]:

```
fig_movies = plt.figure(figsize=(12,10))
ax_mov = fig_movies.add_subplot(221)
ax_mov.plot( df_movie_year['release_year'], df_movie_year['show_id'],color="#e50914")
ax_mov.set_xlabel("Years")
ax_mov.set_ylabel("Count of Movies")
ax_mov.set_title("Number of Movies over the years")
ax_mov.annotate("All years",xy = (1975,10000),fontsize=12,
                color='black',style= 'italic',
                bbox=
                {'facecolor': 'Red', 'alpha': 0.5, 'pad': 10})

ax_mov1 = fig_movies.add_subplot(222)
ax_mov1.plot( df_movie_year['release_year'], df_movie_year['show_id'],color="#e50914")
ax_mov1.set_xlabel("Years")
ax_mov1.set_ylabel("Count of Movies")
ax_mov1.set_title("Number of Movies from 1990-2019")
ax_mov1.set_xlim(1990,2019)
ax_mov1.annotate("1990-2019",xy = (2002,10000),fontsize=12,
                color='Black',style= 'italic',
                bbox=
                {'facecolor': 'Red', 'alpha': 0.5, 'pad': 10})

plt.title("\nNumber of Movies released per year over the last 30 years\n", fontsize=30, color="green",loc="right

ax_mov2 = fig_movies.add_subplot(223)
ax_mov2.plot( df_movie_year['release_year'], df_movie_year['show_id'],color="#e50914")
ax_mov2.set_xlabel("Years")
ax_mov2.set_ylabel("Count of Movies")
ax_mov2.set_title("Number of Movies from 1990-2021")
ax_mov2.set_xlim(1990,2021)
ax_mov2.annotate("1990-2021",xy = (2003,10000),fontsize=12,
                color='Black',style= 'italic',
                bbox=
                {'facecolor': 'Red', 'alpha': 0.5, 'pad': 10})

ax_mov3 = fig_movies.add_subplot(224)
ax_mov3.plot( df_movie_year['release_year'], df_movie_year['show_id'],color="#e50914")
ax_mov3.set_xlabel("Years")
ax_mov3.set_ylabel("Count of Movies")
ax_mov3.set_title("Number of Movies from 2020-2021")
ax_mov3.set_xlim(2020,2021)
```

```
ax_mov3.annotate("2020-2021",xy = (2020.4,10000),fontsize=12,
                 color='Black',style= 'italic',
                 bbox=
                 {'facecolor': 'Red', 'alpha': 0.5, 'pad': 10})
plt.show()
```

Number of Movies released per year over the last 30 years



Observation :

- There is certainly a huge reduction in number of movies released in the recent years. This is attributed to the ongoing COVID pandemic which has affected all our lives.
- The surprising observation is that the number of movies released reduced even in the year 2019 which was pre-pandemic.

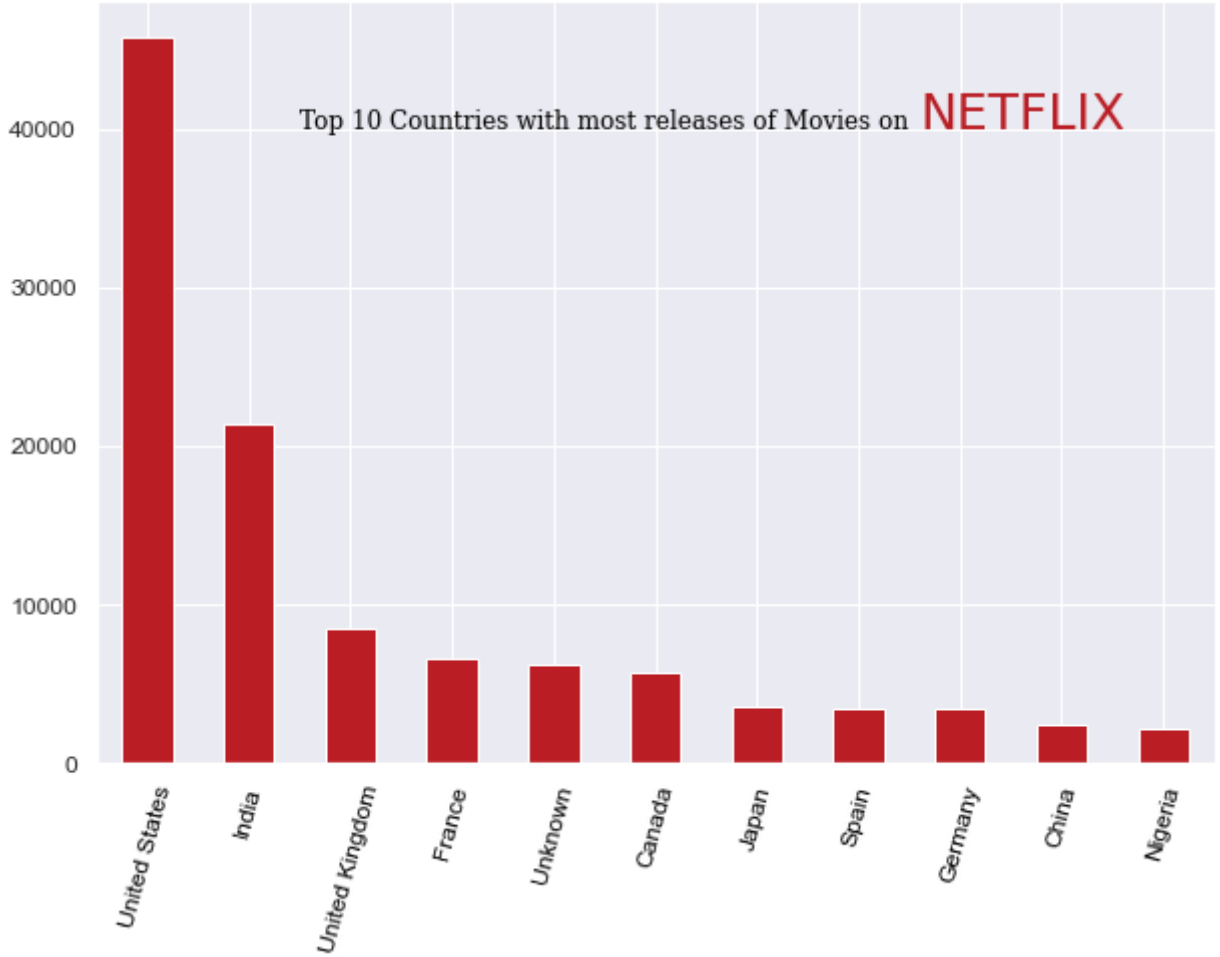
Chart 3 - The top 10 countries that have produced most content in Netflix

In [47]:
```
all_countries = []
for i in df_movie['country']:
    all_countries.append(i)

df_top10_countries = pd.Series(all_countries).value_counts()[:11]#.to_frame().drop(labels=['nan'])
df_top10_countries
```

Out[47]:
```
United States     45788
India             21411
United Kingdom     8560
France             6605
Unknown            6197
Canada             5738
Japan              3525
Spain              3469
Germany            3427
China              2377
Nigeria            2236
dtype: int64
```

In [48]:

```
df_top10_countries.plot(kind='bar',color = "#bb1d24",figsize=(10,7))
plt.annotate("Top 10 Countries with most releases of Movies on",xy=(1.5,40000),fontsize=12,
             color='black',fontfamily='serif')
plt.annotate("NETFLIX",xy=(7.6,40000),fontsize=25,
             color='#bb1d24',fontfamily='DejaVu Sans')
plt.xticks(rotation=75,color="black")
plt.show()
```



Observation :.

The number of content produced in USA is almost 3 times the sum of India which is the second largest content producer for Netflix.

Chart 4 - Top 10 countries and their genres

In [49]:

```
df_exp_genre = df.explode("country").explode('genre')
temp_country = list(set(list(df_exp_genre['country'].unique())) - set(list(df_top10_countries.index.values)))
temp_country_df = df_exp_genre.set_index('country').drop(labels=temp_country).reset_index()
countries_movietypes = pd.crosstab(temp_country_df['genre'],temp_country_df['country'])
display(countries_movietypes)
```

country genre	Canada	China	France	Germany	India	Japan	Nigeria	Spain	United Kingdom	United States	Unknown
Action & Adventure	432	573	378	340	1187	823	45	99	859	4508	413
Anime Features	0	28	0	0	0	814	0	0	0	103	100
Anime Series	11	8	0	0	0	1745	0	5	0	209	263
British TV Shows	49	24	16	36	19	5	0	37	1329	147	32
Children & Family Movies	919	189	367	186	225	238	0	109	566	4888	777
Classic & Cult TV	41	0	0	0	0	0	0	0	42	140	9
Classic Movies	0	0	62	0	98	29	0	10	167	753	20
Comedies	1017	345	567	407	2685	128	392	476	975	8385	786
Crime TV Shows	122	31	184	147	61	177	16	284	347	1047	347
Cult Movies	70	9	22	62	42	14	0	0	70	600	5
Documentaries	95	8	116	27	32	19	2	50	255	1205	211
Docuseries	31	1	7	9	15	8	0	15	158	404	107
Dramas	793	277	1707	763	5569	208	601	691	1939	8165	958
Faith & Spirituality	14	1	32	1	20	0	10	28	69	365	14
Horror Movies	363	17	93	66	307	52	18	74	217	2078	144
Independent Movies	392	12	716	290	1394	64	63	153	712	3893	108
International Movies	437	644	1739	704	7059	810	784	1131	1189	1203	1598
International TV Shows	177	292	430	326	428	1787	91	597	905	638	1622
Kids' TV	534	48	294	56	57	309	0	17	314	1786	471
Korean TV Shows	9	4	0	0	0	0	0	0	0	20	89

country genre	Canada	China	France	Germany	India	Japan	Nigeria	Spain	United Kingdom	United States	Unknown
LGBTQ Movies	39	0	8	1	33	10	0	38	54	438	36
Movies	54	0	11	2	0	19	0	4	4	136	118
Music & Musicals	98	16	53	86	847	39	10	34	190	1011	279
Reality TV	31	7	26	28	7	66	0	4	62	271	97
Romantic Movies	189	88	191	87	931	99	159	91	347	2242	231
Romantic TV Shows	17	140	10	12	68	209	17	120	104	346	501
Sci-Fi & Fantasy	289	124	102	125	111	114	0	102	321	2091	8
Science & Nature TV	4	0	1	3	0	0	0	1	40	69	12
Spanish-Language TV Shows	0	0	0	0	0	0	0	467	2	280	203
Sports Movies	113	2	45	24	121	1	0	59	53	727	65
Stand-Up Comedy	9	0	5	12	7	0	0	1	32	300	80
Stand-Up Comedy & Talk Shows	0	0	2	6	8	4	0	0	1	169	46
TV Action & Adventure	116	81	82	18	44	57	0	48	126	1055	144
TV Comedies	289	81	174	40	141	83	14	52	316	2088	588
TV Dramas	343	150	320	255	272	218	77	173	468	2561	868
TV Horror	90	0	52	0	28	66	0	0	17	415	34
TV Mysteries	113	10	15	13	11	46	0	0	16	557	112
TV Sci-Fi & Fantasy	83	29	11	7	27	0	0	0	55	627	61
TV Shows	0	0	0	0	207	22	0	0	0	15	43
TV Thrillers	91	0	23	0	3	79	0	0	56	308	27
Teen TV Shows	26	34	0	0	7	193	0	26	0	297	21
Thrillers	415	44	391	244	743	44	152	319	541	2697	246

Some of the inferences are as follows:

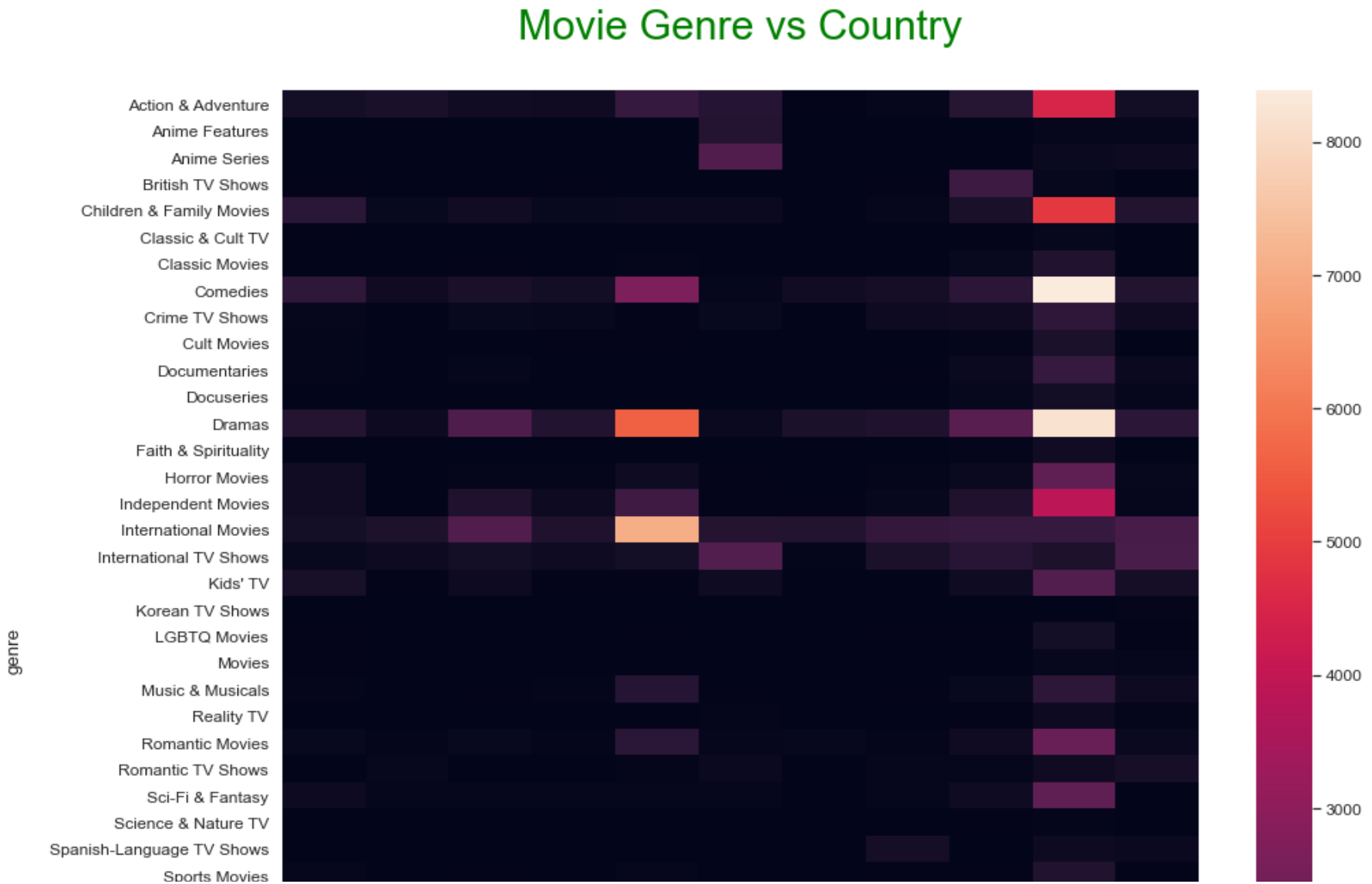
- United States has the most movies produced almost across all genres
- India has the most number of Dramas geners, as "International Movies" is not really a genre.
- Japan has the most number of anime centric shows

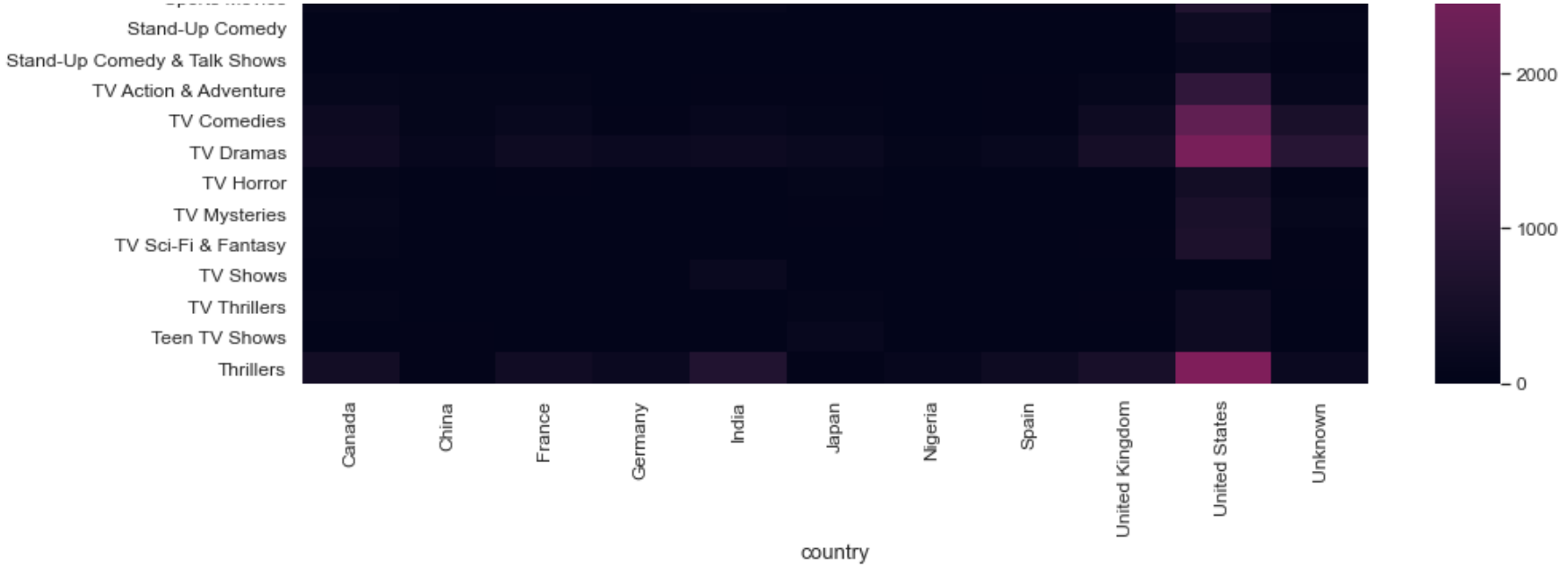
Recommendation to Netflix:

- Japanese people has a very strong affection to animes, hence Netflix should produce more animes in Japan

In [50]:

```
fig_1, ax_1 = plt.subplots(figsize=(15,15))
sns.heatmap(countries_movietypes)

plt.title("\nMovie Genre vs Country\n", fontsize=30, color="green")
plt.show()
```





The heatmap above shows the relationship between the type of movies/shows across the top 10 countries.

Observations:

- United State's favourite kind of genre is "Comedies"
- India's favourite type of genre is "Drama" as well since "International Movies" is not really a genre.

Anime Series

In [51]:
```
print('\nTop \033[1mDirector\'s involved in Anime Series production in JAPAN\033[0m are:')
temp_country_df[(temp_country_df['country']== 'Japan') & (temp_country_df['genre']== 'Anime Series') ]['director
```

Top **Director's involved in Anime Series production in JAPAN** are:

Out[51]:
```
Yasuhiro Irie        21
Go Koga              15
Masaaki Yuasa        13
Tensai Okamura       13
Kazuya Murata        11
Tsutomu Mizushima     8
Hayato Date           8
Takuya Igarashi       7
Name: director, dtype: int64
```

Drama

In [52]:
```
print('\nTop \033[1mDirector\'s involved in Dramas production in INDIA\033[0m are:')
temp_country_df[(temp_country_df['country']== 'India') & (temp_country_df['genre']== 'Dramas') ]['director'].val
```

Top **Director's involved in Dramas production in INDIA** are:

Out[52]:
```
Sooraj R. Barjatya    60
Dibakar Banerjee      57
Zoya Akhtar           49
Karan Johar           48
Umesh Mehra           46
                      ..
Parthiban              1
Harry Baweja           1
Arjun Gourisaria       1
Vinod Kapri            1
Aatmaram Dharne        1
Name: director, Length: 521, dtype: int64
```

Observation :

- Yasuhiro Irie appears to be a popular choice for Anime Series
- Sooraj R. Barjatya has directed many Dramas in India

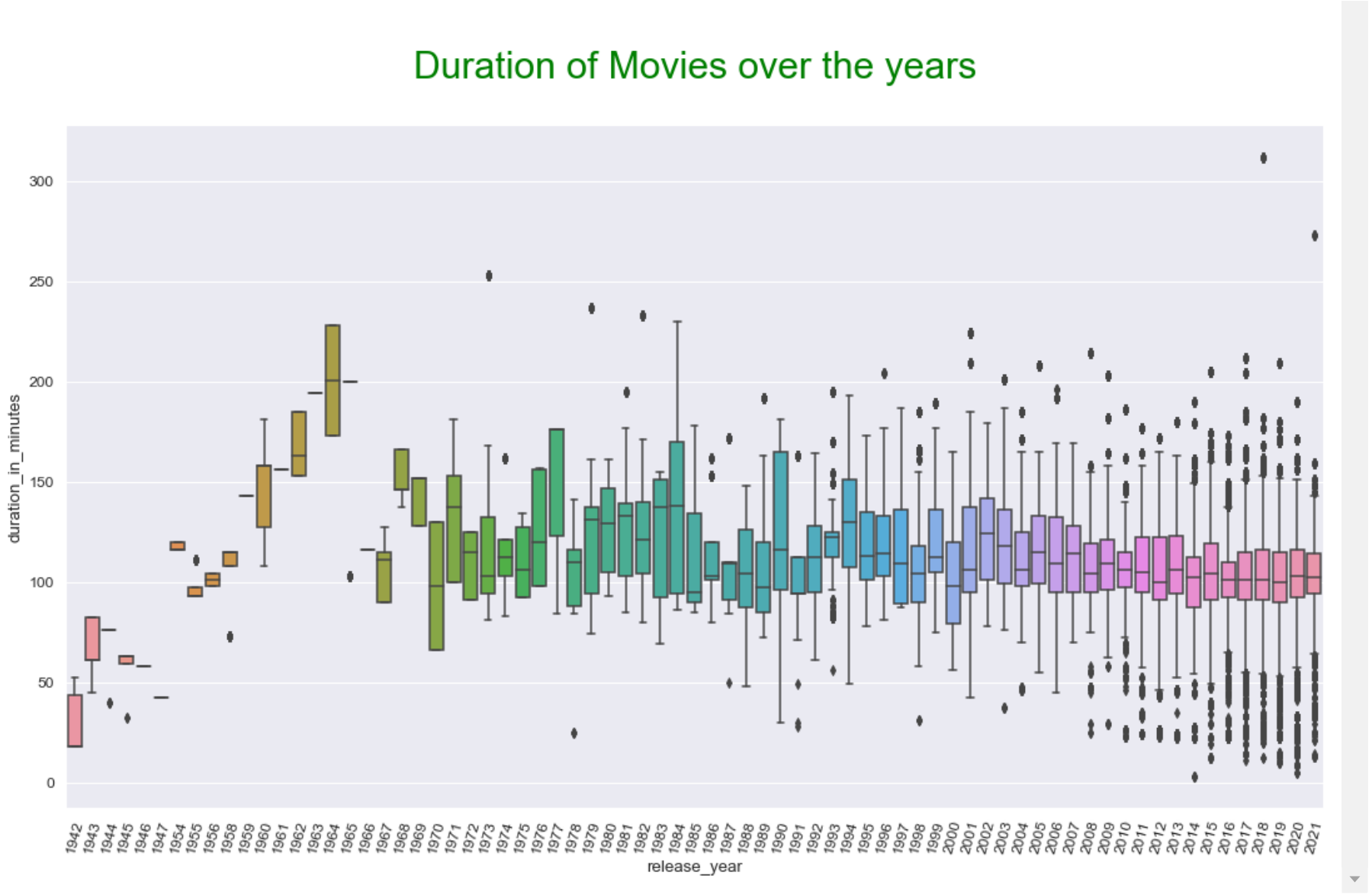
Recommendation to Netflix :

- Approach Yasuhiro Irie to create Anime Series genre TV show for Netflix Originals and Sooraj R. Barjatya to create more Netflix Originals Dramas

Chart 5 - Duration of Movies over the years

In [53]:

```
order_year = list(pd.Series(df_movie['release_year'].unique()).sort_values())

plt.figure(figsize=(18,10))
ax = sns.boxplot(df_movie['release_year'],df_movie['duration_in_minutes'],order=order_year)
ax.set_xticklabels(ax.get_xticklabels(),rotation = 75)
sns.despine()
plt.title("\nDuration of Movies over the years\n", fontsize=30, color="green")
plt.show()
```



The above boxplot helps us visualise the movie duration over the years.

Observation : Till 1990 the movies were of long duration whereas from the 1900 onwards the movies are on an average for 1.5hr to 2.5hr.

Values for: Shortest and Longest Movie on Netflix

In [54]:
```
movie_dur = df_movie.groupby("duration_in_minutes")['title'].unique().reset_index()
```

In [55]:
```
print('\nTop \033[1mShortest movie on Netflix \033[0m are:')
shortest_movie = min(movie_dur['duration_in_minutes'])
shortest_movie = movie_dur[movie_dur['duration_in_minutes'] == shortest_movie]
shortest_movie
```

Top **Shortest movie on Netflix** are:

Out[55]:

	duration_in_minutes	title
0	3	[Silent]

In [56]:
```
print('\nTop \033[1mLongest movie on Netflix \033[0m are:')
longest_movie = max(movie_dur['duration_in_minutes'])
longest_movie = movie_dur[movie_dur['duration_in_minutes'] == longest_movie]
longest_movie
```

Top **Longest movie on Netflix** are:

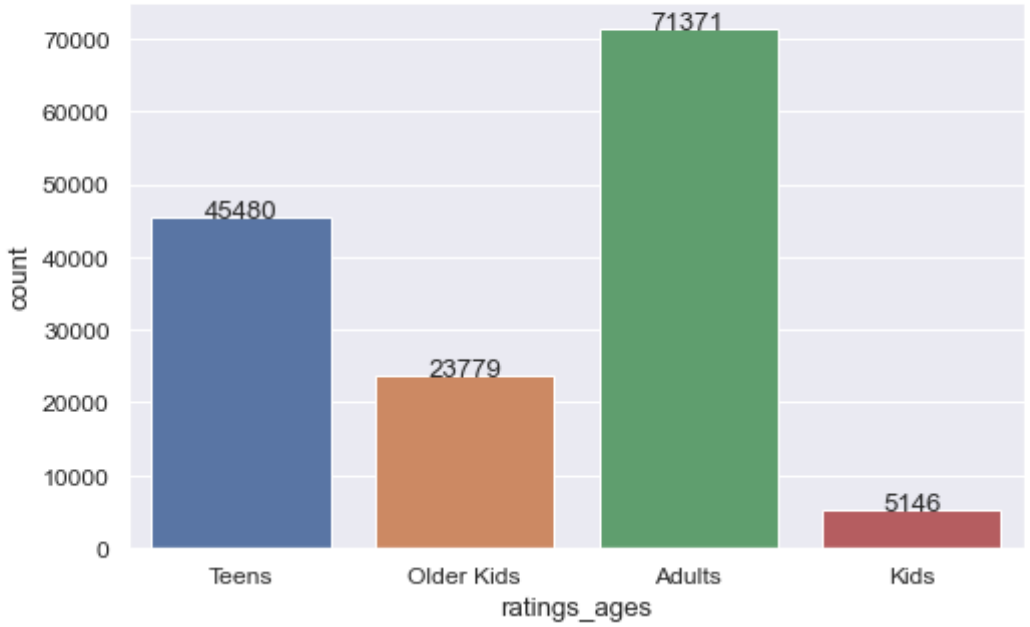
Out[56]:

	duration_in_minutes	title
204	312	[Black Mirror: Bandersnatch]

Chart 6 - Distribution on the bases of age groups, and the countplot graph

In [57]:

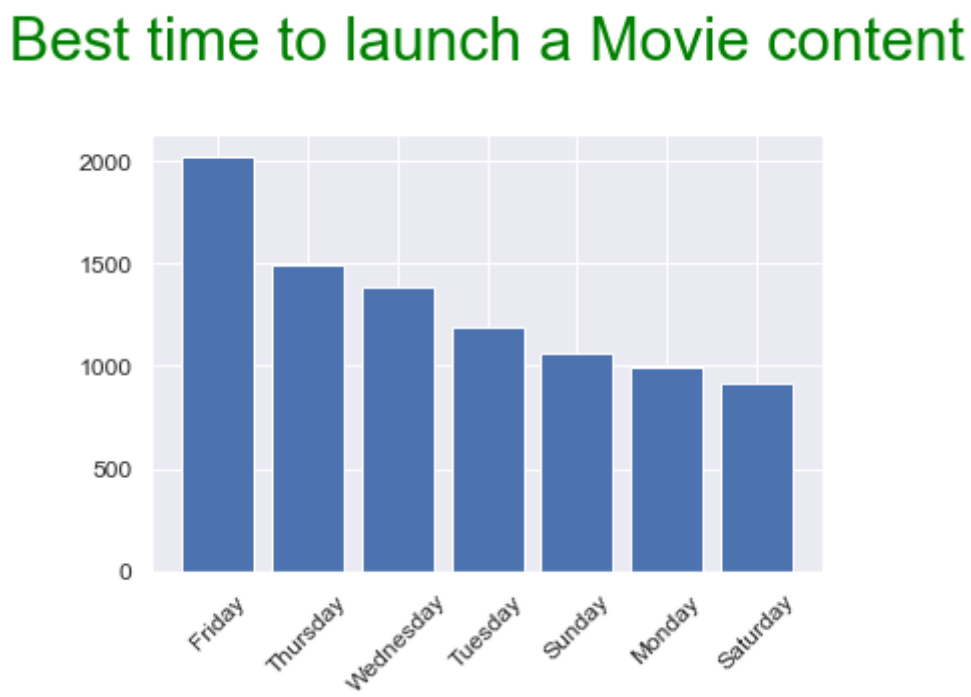
```
age_base_distribution = df_movie["ratings_ages"].value_counts()
age_base_distribution
age_base_distribution_in_percent = df_movie["ratings_ages"].value_counts(normalize=True)*100
age_base_distribution_in_percent

plt.figure(figsize=(8,5))
show_values_on_bars(sns.countplot(x = df_movie["ratings_ages"]))
plt.title("\nDistribution on the bases of age groups for Movies content\n", fontsize=30, color="green")
plt.show()
```



Observation : Netflix has more content for Adult age group

Chart 7 - Best time to launch a content

In [58]:
```
plt.bar(df.groupby(df_movie["date_added"].dt.day_name())["title"].nunique().sort_values(ascending=False).index,
df.groupby(df_movie["date_added"].dt.day_name())["title"].nunique().sort_values(ascending=False))
plt.xticks(rotation = 45)
plt.title("\nBest time to launch a Movie content\n", fontsize=30, color="green")
plt.show()
```



Observation:

- Friday is the best day to release content
- Thrusday can be other alternative to release a content

9.14 - Creating a seperate DataFrame which would only comprise of TV Shows

In [59]:
```
df_tvshow = df[df['type'] == 'TV Show'].reset_index().drop(columns=['index'])
df_tvshow['duration_time'] =  df_tvshow['duration'].apply(lambda x : int(x.split(" ")[0]))
```

In [60]:
```
df_tvshow['date_added'] = pd.to_datetime(df['date_added'])
```

Chart 1 - Distribution of TV Show duration in seasons

In [61]:
```
df_tvshow['duration_time'].plot(kind='hist',color='#b20710',title = "Distribution of TV Shows into number of Sea
plt.annotate("NETFLIX",xy=(10,40000),fontsize=20)
plt.annotate("TV Shows",xy=(11,38000),fontsize=12,color='#b20710')
plt.show()
```

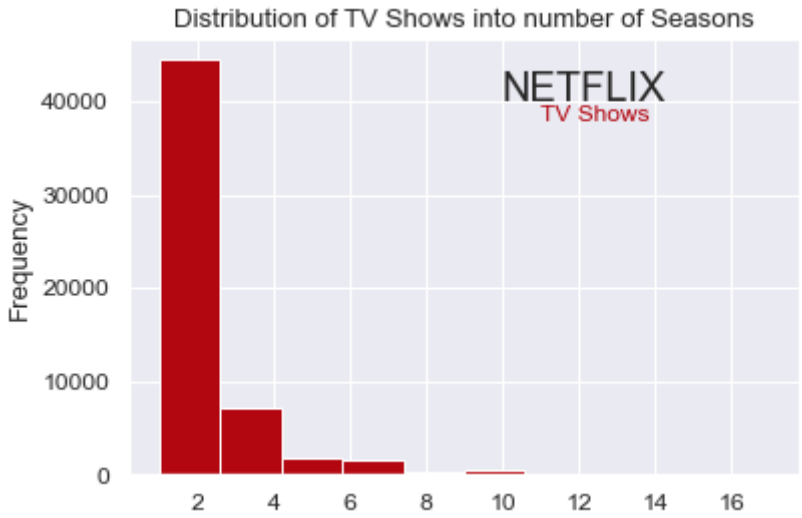


Chart 2 - Number of TV Shows released per year over the last 30 years

In [62]:

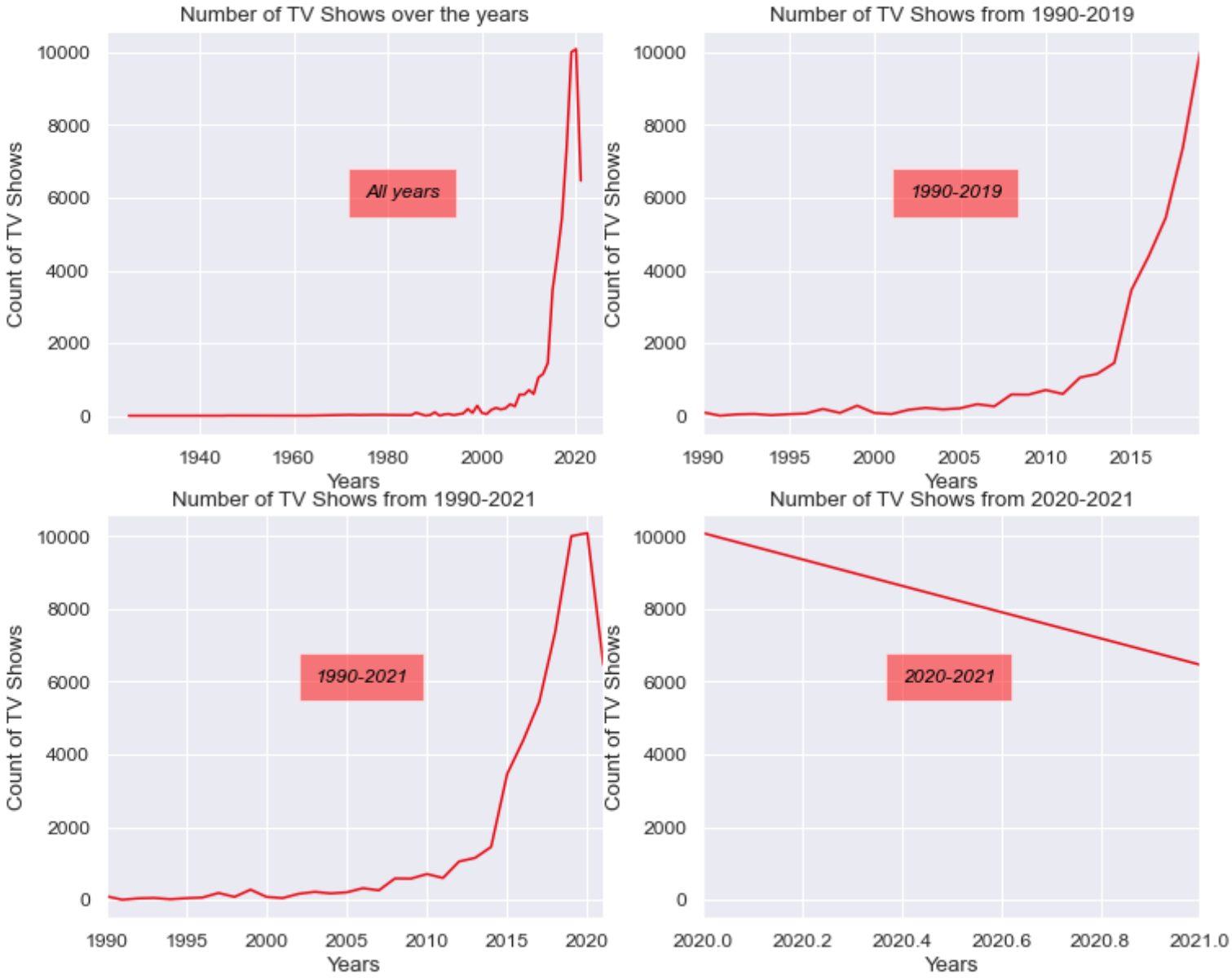
```
df_tvshow['release_year'] = df_tvshow['release_year'].apply(lambda x : int(x))
df_tvshw_year = df_tvshow.groupby('release_year').count()['show_id'].to_frame().reset_index()
```

In [63]:

```
fig_movies = plt.figure(figsize=(12,10))
ax_mov = fig_movies.add_subplot(221)
ax_mov.plot( df_tvshw_year['release_year'], df_tvshw_year['show_id'],color="#e50914")
ax_mov.set_xlabel("Years")
ax_mov.set_ylabel("Count of TV Shows")
ax_mov.set_title("Number of TV Shows over the years")
ax_mov.annotate("All years",xy = (1975,6000),fontsize=12,
                color='black',style= 'italic',
                bbox=
                {'facecolor': 'Red', 'alpha': 0.5, 'pad': 10})

ax_mov1 = fig_movies.add_subplot(222)
ax_mov1.plot( df_tvshw_year['release_year'], df_tvshw_year['show_id'],color="#e50914")
ax_mov1.set_xlabel("Years")
ax_mov1.set_ylabel("Count of TV Shows")
ax_mov1.set_title("Number of TV Shows from 1990-2019")
ax_mov1.set_xlim(1990,2019)
ax_mov1.annotate("1990-2019",xy = (2002,6000),fontsize=12,
                color='Black',style= 'italic',
                bbox=
                {'facecolor': 'Red', 'alpha': 0.5, 'pad': 10})

plt.title("\nNumber of TV Shows released per year over the last 30 years\n", fontsize=30, color="green",loc="rig

ax_mov2 = fig_movies.add_subplot(223)
ax_mov2.plot( df_tvshw_year['release_year'], df_tvshw_year['show_id'],color="#e50914")
ax_mov2.set_xlabel("Years")
ax_mov2.set_ylabel("Count of TV Shows")
ax_mov2.set_title("Number of TV Shows from 1990-2021")
ax_mov2.set_xlim(1990,2021)
ax_mov2.annotate("1990-2021",xy = (2003,6000),fontsize=12,
                color='Black',style= 'italic',
                bbox=
                {'facecolor': 'Red', 'alpha': 0.5, 'pad': 10})

ax_mov3 = fig_movies.add_subplot(224)
ax_mov3.plot( df_tvshw_year['release_year'], df_tvshw_year['show_id'],color="#e50914")
ax_mov3.set_xlabel("Years")
ax_mov3.set_ylabel("Count of TV Shows")
ax_mov3.set_title("Number of TV Shows from 2020-2021")
ax_mov3.set_xlim(2020,2021)
```

```
ax_mov3.annotate("2020-2021",xy = (2020.4,6000),fontsize=12,
                 color='Black',style= 'italic',
                 bbox=
                 {'facecolor': 'Red', 'alpha': 0.5, 'pad': 10})

plt.show()
```

Number of TV Shows released per year over the last 30 years



Observation

We can certainly see a huge reduction of movies released in the recent couple of years. This is attributed to the ongoing pandemic which has affected all our lives. The surprising observation is that the number of movies released reduced even in the year 2019 which was pre-pandemic.

Chart 3 - The top 10 countries that have produced most content in Netflix

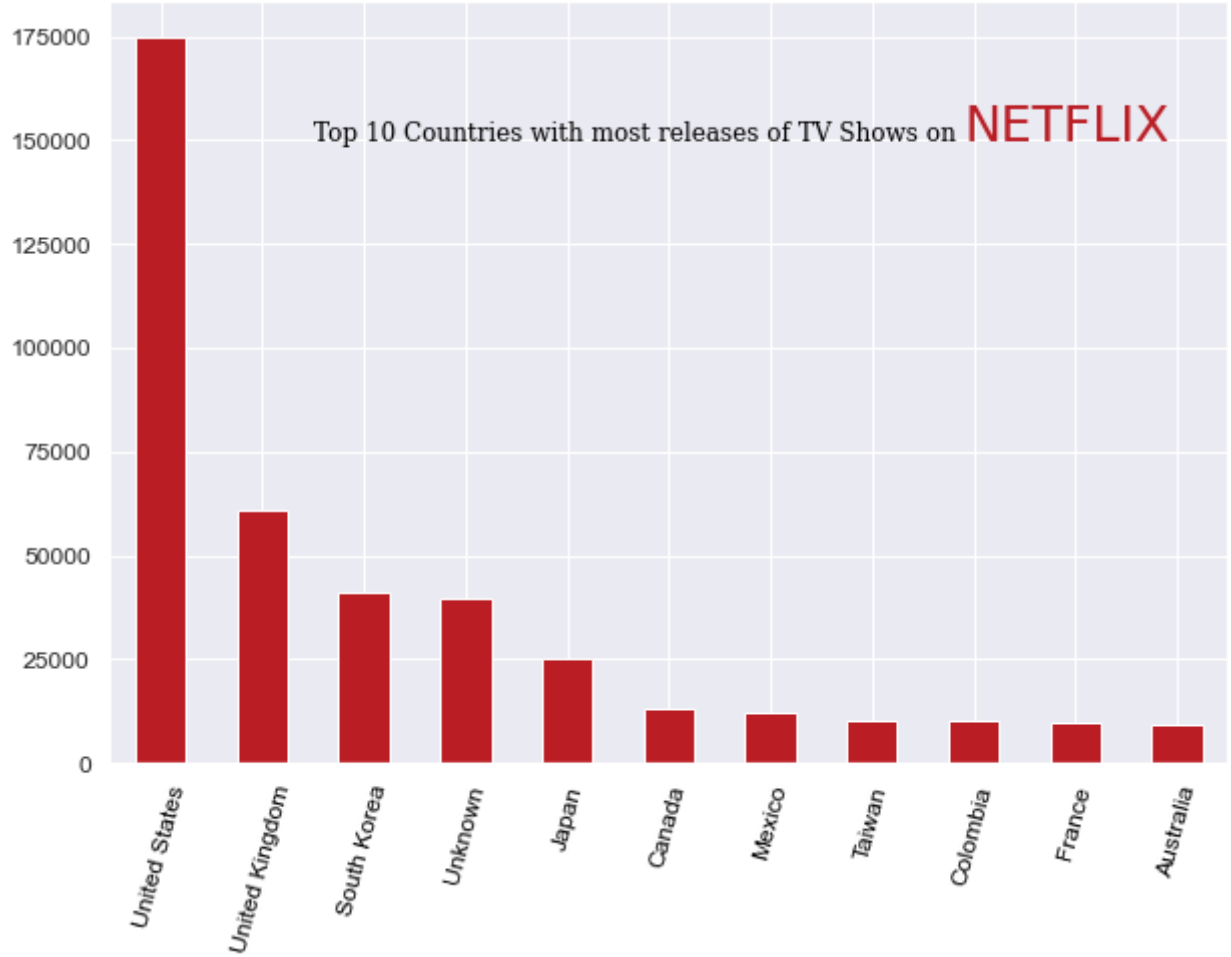
In [64]:
```
all_countries = []
for i in df_tvshow['country']:
    for j in range(len(i)):
        all_countries.append(i)
```

In [65]:
```
df_top10_countries_tvshw = pd.Series(all_countries).value_counts()[:11]
df_top10_countries_tvshw
```

Out[65]:
```
United States     174837
United Kingdom     61012
South Korea        41294
Unknown            39879
Japan              25370
Canada             13062
Mexico             12108
Taiwan             10314
Colombia           10272
France              9882
Australia           9369
dtype: int64
```

In [66]:

```
df_top10_countries_tvshw.plot(kind='bar',color = "#bb1d24",figsize=(10,7))
plt.annotate("Top 10 Countries with most releases of TV Shows on",xy=(1.5,150000),fontsize=12,
             color='black',fontfamily='serif')
plt.annotate("NETFLIX",xy=(7.9,150000),fontsize=25,
             color='#bb1d24',fontfamily='DejaVu Sans')
plt.xticks(rotation=75,color="black")
plt.show()
```

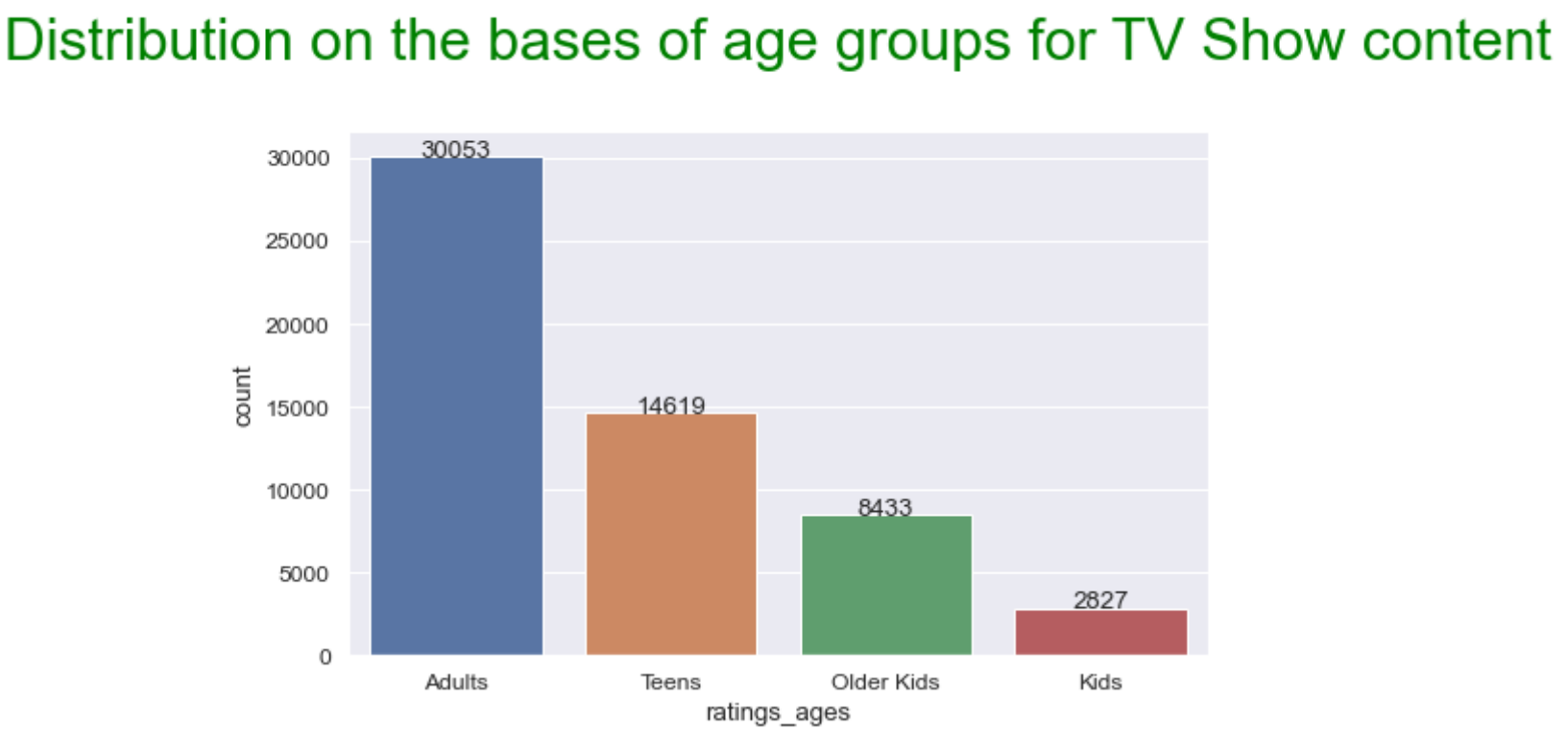


Observations:
These are the **top 10 countries which have the most number of movies/shows produced**

- The number of content produced in USA is almost 3 times the sum of India which is the second largest content producer for Netflix.

Chart 4 - Distribution on the bases of age groups, and the countplot graph

In [67]:
```
age_base_distribution = df_tvshow["ratings_ages"].value_counts()
age_base_distribution
age_base_distribution_in_percent = df_tvshow["ratings_ages"].value_counts(normalize=True)*100
age_base_distribution_in_percent

plt.figure(figsize=(8,5))

show_values_on_bars(sns.countplot(x = df_tvshow["ratings_ages"]))
plt.title("\nDistribution on the bases of age groups for TV Show content\n", fontsize=30, color="green")
plt.show()
```



Observations:

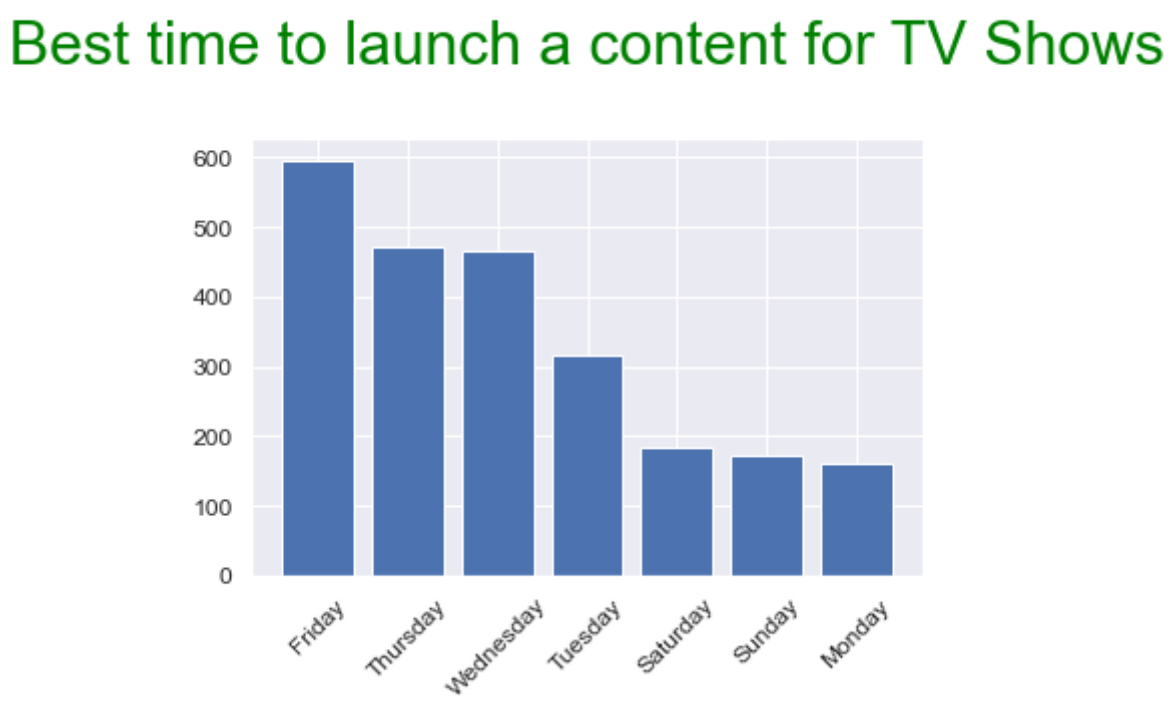
- The TV show content abundantly is available for Adults

Recommendations:

- Netflix should consider to add contents for Kids as well

Chart 5 - Best time to launch a content

In [68]:
```
plt.bar(df.groupby(df_tvshow["date_added"].dt.day_name())["title"].nunique().sort_values(ascending=False).index,
df.groupby(df_tvshow["date_added"].dt.day_name())["title"].nunique().sort_values(ascending=False))
plt.xticks(rotation = 45)
plt.title("\nBest time to launch a content for TV Shows\n", fontsize=30, color="green")
plt.show()
```



Observations:

- Best days to release a TV Show is Friday
- Other day that can be considered to release TV Show is Thursday

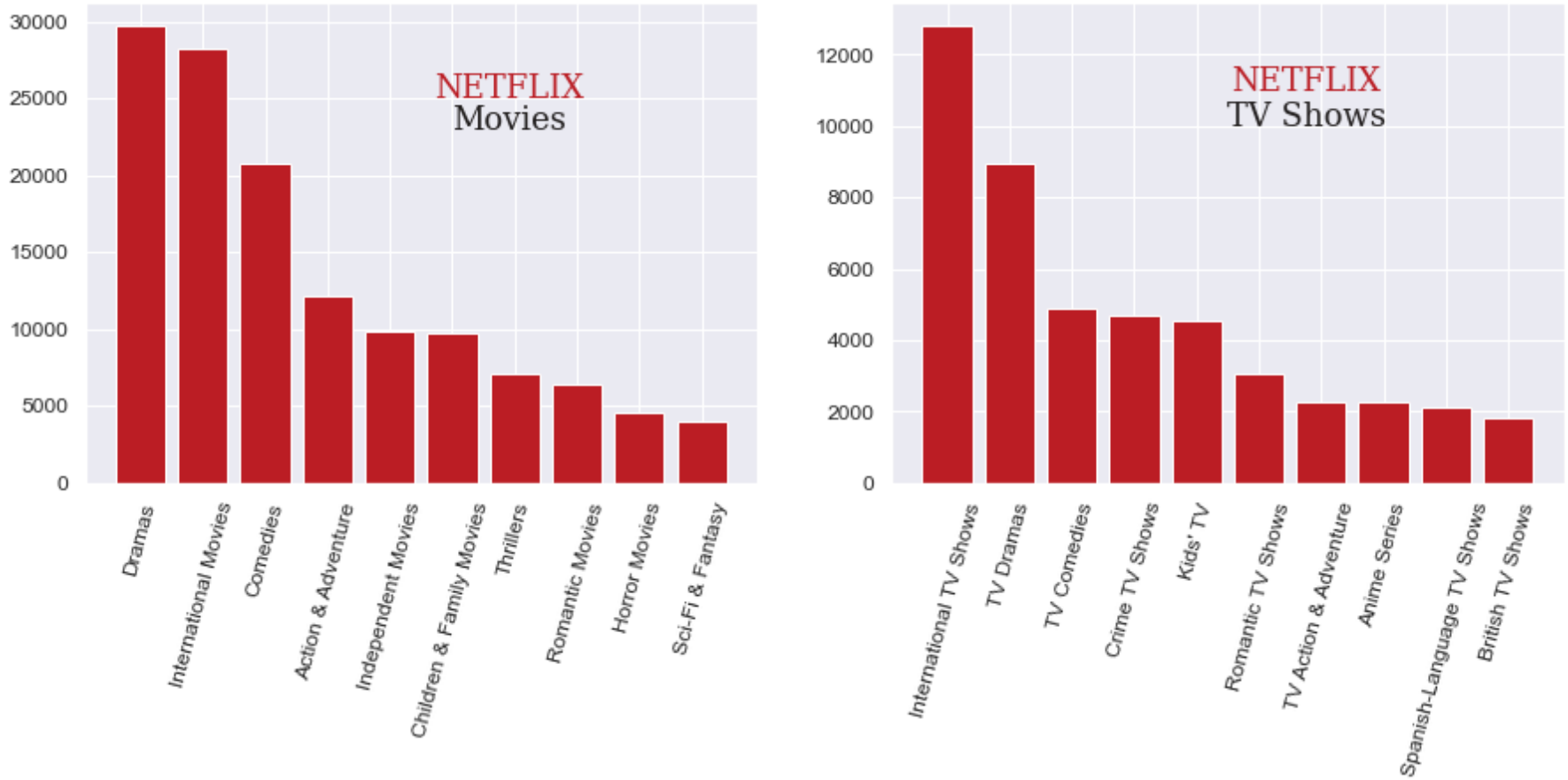
9.15 - Comparison TV show and Movies

In [69]:

```
df_movie_genre10 = df_movie.explode('genre')['genre'].value_counts()[:10].reset_index()
df_tvshow10_genre = df_tvshow.explode('genre')['genre'].value_counts()[:10].reset_index()
```

In [70]:

```
fig_new = plt.figure(figsize=(15,5))
ax_new = fig_new.add_subplot(121)
ax_new.bar(df_movie_genre10['index'],df_movie_genre10['genre'],color="#bb1d24")
ax_new1 = fig_new.add_subplot(122)
ax_new1.bar(df_tvshow10_genre['index'],df_tvshow10_genre['genre'],color="#bb1d24")
ax_new.set_xticklabels(list(df_movie_genre10['index']),rotation=75)
ax_new1.set_xticklabels(list(df_tvshow10_genre['index']),rotation=75)
ax_new.annotate("NETFLIX",xy=(4.7,25000),fontsize=18,color='#bb1d24',fontfamily='serif')
ax_new.annotate("Movies",xy=(5,23000),fontsize=18,color='#221f1f',fontfamily='serif')
ax_new1.annotate("NETFLIX",xy=(4.55,11000),fontsize=18,color='#bb1d24',fontfamily='serif')
ax_new1.annotate("TV Shows",xy=(4.5,10000),fontsize=18,color='#221f1f',fontfamily='serif')
plt.show()
```



In [71]:
```
1 df_exp_genre[df_exp_genre['genre'] == "Anime Series"]['rating'].value_counts()
```

Out[71]:
```
TV-MA    899
TV-14    853
TV-Y7    298
TV-PG    210
TV-Y      13
Name: rating, dtype: int64
```

Observation:

The first 3 categories are same in both Movies and Tv shows The one standout in the above plots are "Anime". Although Anime movie genre did not make the cut in "Movies" it certainly did in "TV shows".

Inference:

People enjoy watching Anime as a series over movies.

Although there is a pre set notion that Anime is usually for kids. We can see that the rating for "TV-MA" is almost around "TV-14" indicating that Anime is best enjoyed both by kids above 14 and mature adults.

Recommendation to Netflix:

Produce or onboard more Anime Series of rating TV-14/TV_MA on Netflix.

9.16 - The highest rating TV Shows or Movies.

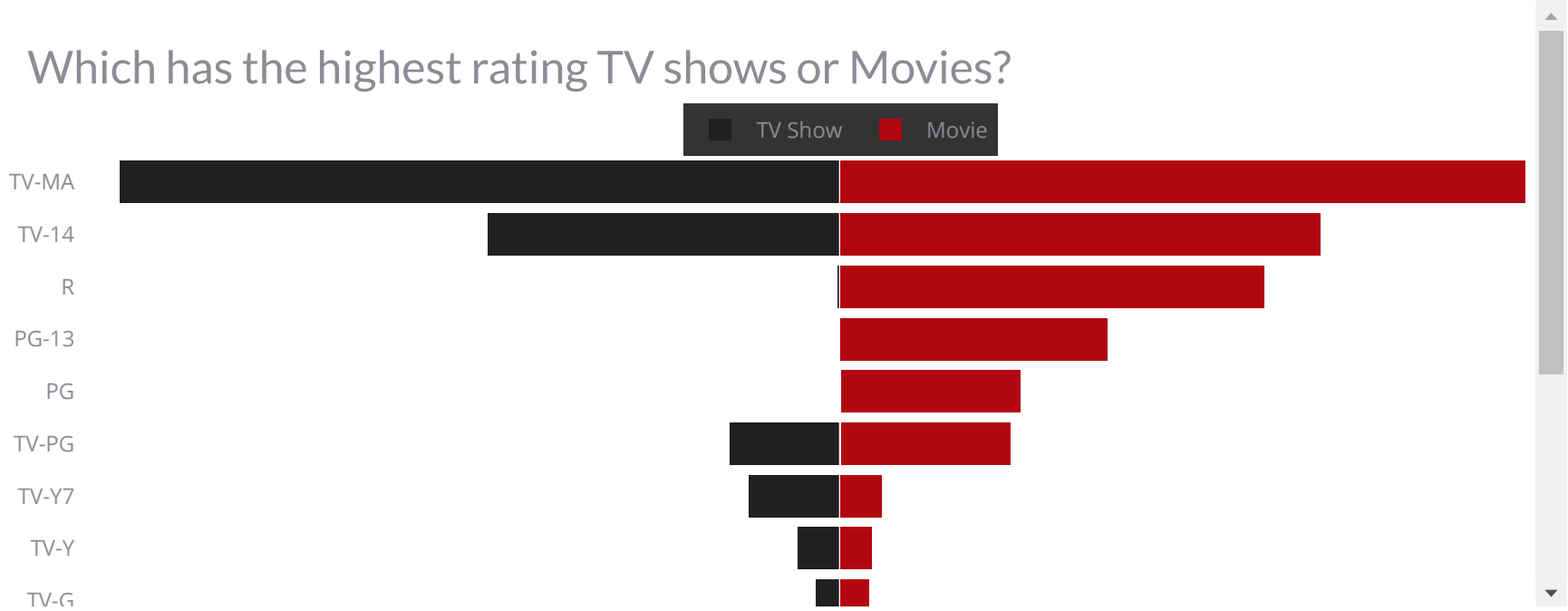
A bidirectional bar chart here to show the comparison between the TV shows and Movies vs Ratings. Creating two different bar charts one for TV Show and another for Movie doesn’t make sense but combining a user can easily understand the difference.

In [72]:

```
# making a copy of df
dff = df.copy()
# making 2 df one for tv show and another for movie with rating
df_tv_show = dff[dff['type']=='TV Show'][['rating', 'type']].rename(columns={'type':'tv_show'})
df_movie = dff[dff['type']=='Movie'][['rating', 'type']].rename(columns={'type':'movie'})
df_tv_show = pd.DataFrame(df_tv_show.rating.value_counts()).reset_index().rename(columns={'index':'tv_show'})
df_tv_show['rating_final'] = df_tv_show['rating']
# making rating column value negative
df_tv_show['rating'] *= -1
df_movie = pd.DataFrame(df_movie.rating.value_counts()).reset_index().rename(columns={'index':'movie'})
```

In [73]:

```
fig = make_subplots(rows=1, cols=2, specs=[[{}, {}]], shared_yaxes=True, horizontal_spacing=0)

# bar plot for tv shows
fig.append_trace(go.Bar(x=df_tv_show.rating, y=df_tv_show.tv_show, orientation='h', showlegend=True,
                        text=df_tv_show.rating_final, name='TV Show', marker_color='#221f1f'), 1, 1)

# bar plot for movies
fig.append_trace(go.Bar(x=df_movie.rating, y=df_movie.movie, orientation='h', showlegend=True, text=df_movie.rat
                        name='Movie', marker_color='#b20710'), 1, 2)
fig.update_xaxes(showgrid=False)
fig.update_yaxes(showgrid=False, categoryorder='total ascending', ticksuffix=' ', showline=False)
fig.update_traces(hovertemplate=None, marker=dict(line=dict(width=0)))
fig.update_layout(title='Which has the highest rating TV shows or Movies?',
                  margin=dict(t=80, b=0, l=70, r=40),
                  hovermode="y unified",
                  xaxis_title=' ', yaxis_title=" ",
                  plot_bgcolor='#333', paper_bgcolor='#333',
                  title_font=dict(size=25, color='#8a8d93', family="Lato, sans-serif"),
                  font=dict(color='#8a8d93'),
                  legend=dict(orientation="h", yanchor="bottom", y=1, xanchor="center", x=0.5),
                  hoverlabel=dict(bgcolor="black", font_size=13, font_family="Lato, sans-serif"))
```



Here for the bi-directional chart, we will make 2 different data frames one for Movies and another one for TV Shows having ratings in them.

We are making 2 subplots and they are sharing the y-axis.

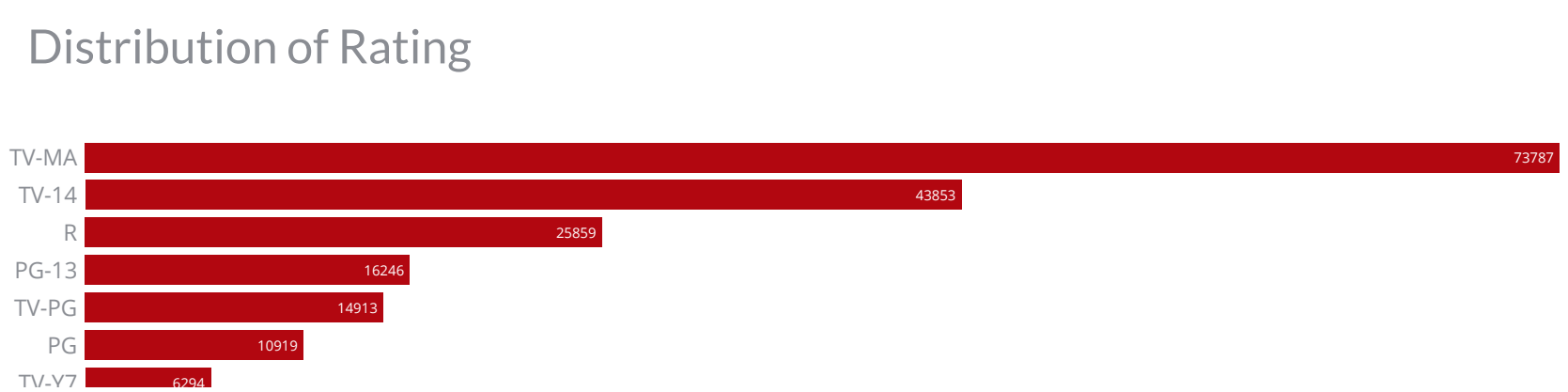
Observations:

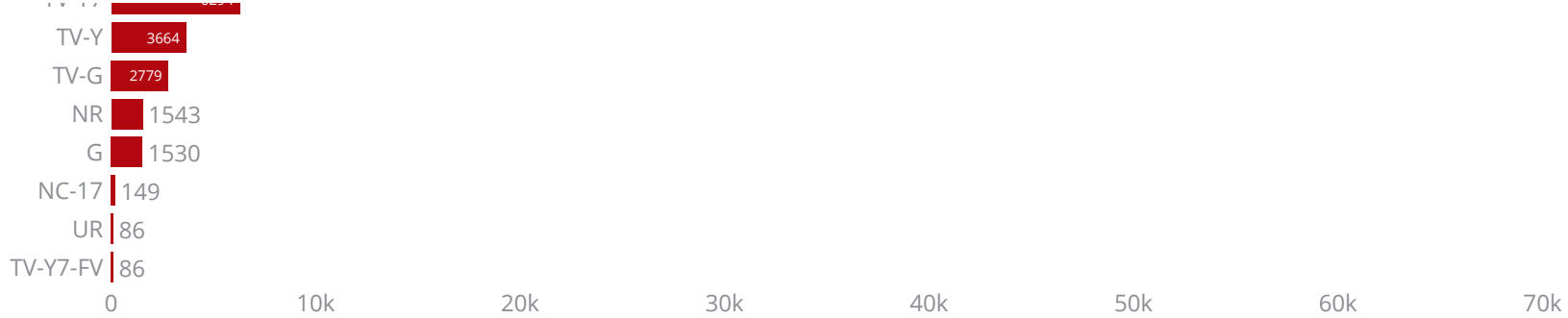
- 72.3% people prefer Movies over TV Shows on Netflix.Large number of people watch TV-MA rating Movies which are for mature audience.
- 27.7% people prefer TV Shows on Netflix. There is no inappropriate content for ages 17 and under in TV Shows.

Chart 1 - Distribution of Rating and finding what audience prefer to watch
To know which type of content is most watched by the audience so that Netflix can decide what type of content to be released next. It helps Netflix to understand the most and least favourite content watched by an audience.

In [74]:

```
df_rating = pd.DataFrame(df['rating'].value_counts()).reset_index().rename(columns={'index':'rating','rating':'c

fig_bar = px.bar(df_rating, y='rating', x='count', title='Distribution of Rating',

color_discrete_sequence=['#b20710'], text='count')

fig_bar.update_xaxes(showgrid=False)

fig_bar.update_yaxes(showgrid=False, categoryorder='total ascending', ticksuffix=' ', showline=False)

fig_bar.update_traces(hovertemplate=None, marker=dict(line=dict(width=0)))

fig_bar.update_layout(margin=dict(t=80, b=0, l=70, r=40),

hovermode="y unified",

xaxis_title=' ', yaxis_title=" ", height=400,

plot_bgcolor='#333', paper_bgcolor='#333',

title_font=dict(size=25, color='#8a8d93', family="Lato, sans-serif"),

font=dict(color='#8a8d93'),

legend=dict(orientation="h", yanchor="bottom", y=1, xanchor="center", x=0.5),

hoverlabel=dict(bgcolor="black", font_size=13, font_family="Lato, sans-serif"))
```





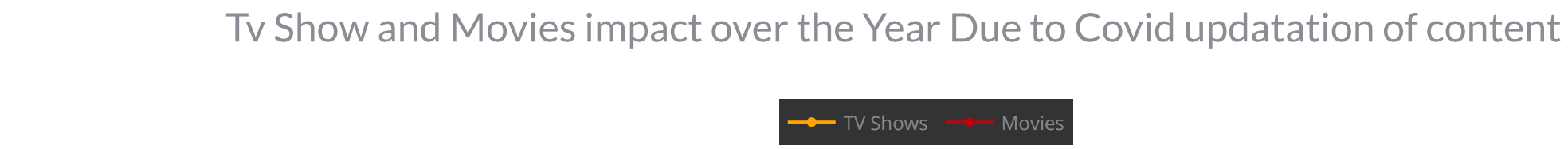
Observations:

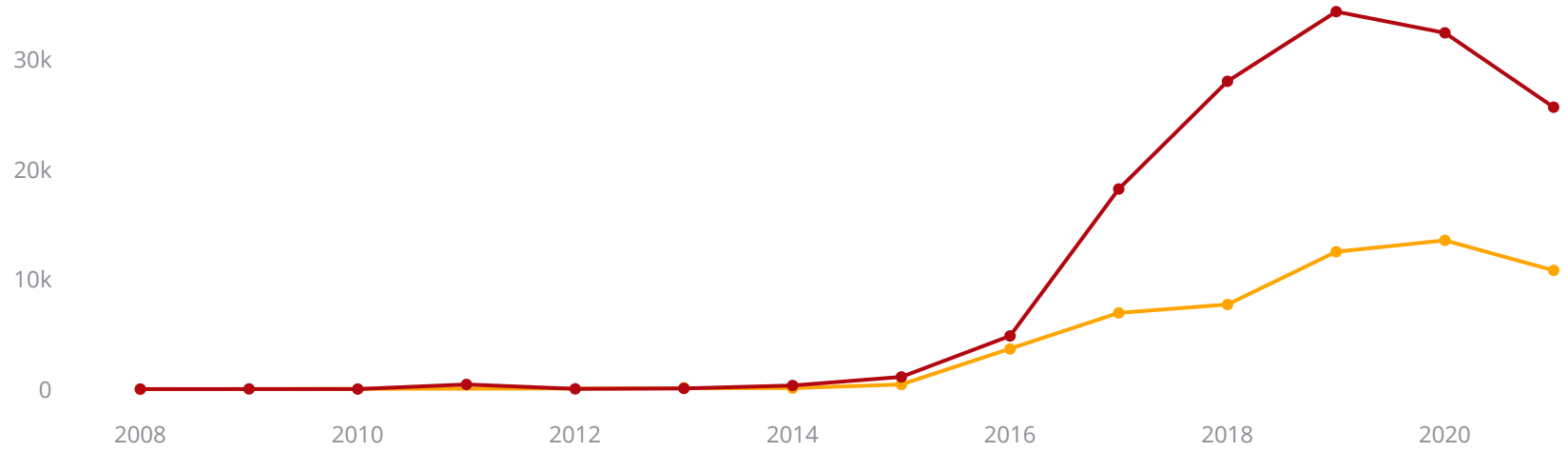
- Maximum rated content by Audience is TV-MA and TV-14

Chart 2 - the impact of Netflix TV Shows or Movies over the years by comparing both.

In [75]:

```
d1 = df[df["type"] == "TV Show"]
d2 = df[df["type"] == "Movie"]
col = "year_added"
vc1 = d1[col].value_counts().reset_index().rename(columns = {col : "count", "index" : col})
vc1['percent'] = vc1['count'].apply(lambda x : 100*x/sum(vc1['count']))
vc1 = vc1.sort_values(col)
vc2 = d2[col].value_counts().reset_index().rename(columns = {col : "count", "index" : col})
vc2['percent'] = vc2['count'].apply(lambda x : 100*x/sum(vc2['count']))
vc2 = vc2.sort_values(col)
trace1 = go.Scatter(x=vc1[col], y=vc1["count"], name="TV Shows", marker=dict(color="orange"), )
trace2 = go.Scatter(x=vc2[col], y=vc2["count"], name="Movies", marker=dict(color="#b20710"))
data = [trace1, trace2]
fig_line = go.Figure(data)
fig_line.update_traces(hovertemplate=None)
fig_line.update_xaxes(showgrid=False)
fig_line.update_yaxes(showgrid=False)
large_title_format = 'Tv Show and Movies impact over the Year'
small_title_format = "Due to Covid updatation of content is slowed."
fig_line.update_layout(title=large_title_format + " " + small_title_format,
    height=400, margin=dict(t=130, b=0, l=70, r=40),
    hovermode="x unified", xaxis_title=' ',
    yaxis_title=" ", plot_bgcolor='#333', paper_bgcolor='#333',
    title_font=dict(size=25, color='#8a8d93',
    family="Lato, sans-serif"),
    font=dict(color='#8a8d93'),
    legend=dict(orientation="h",
    yanchor="bottom",
    y=1,
    xanchor="center",
    x=0.5))

fig_line.show()
```





After the year 2019 covid came that badly affects Netflix for producing content. Movies have exponential growth from the start but due to covid, it is going downwards.

- Highest number of Tv Shows were released in 2019 followed by 2017.
- Highest number of Movies were relased in 2019 followed by 2020

Chart 3 - If a producer wants to release a show which month is the best month to release it.

The reason for plotting the chart

The best month to release content so the producer can gain much revenue. Most of the holidays came in December month so to releases a Movie or TV show in December is the best way to earn a lot of profit as the whole family will be spending time with each other and watching shows.

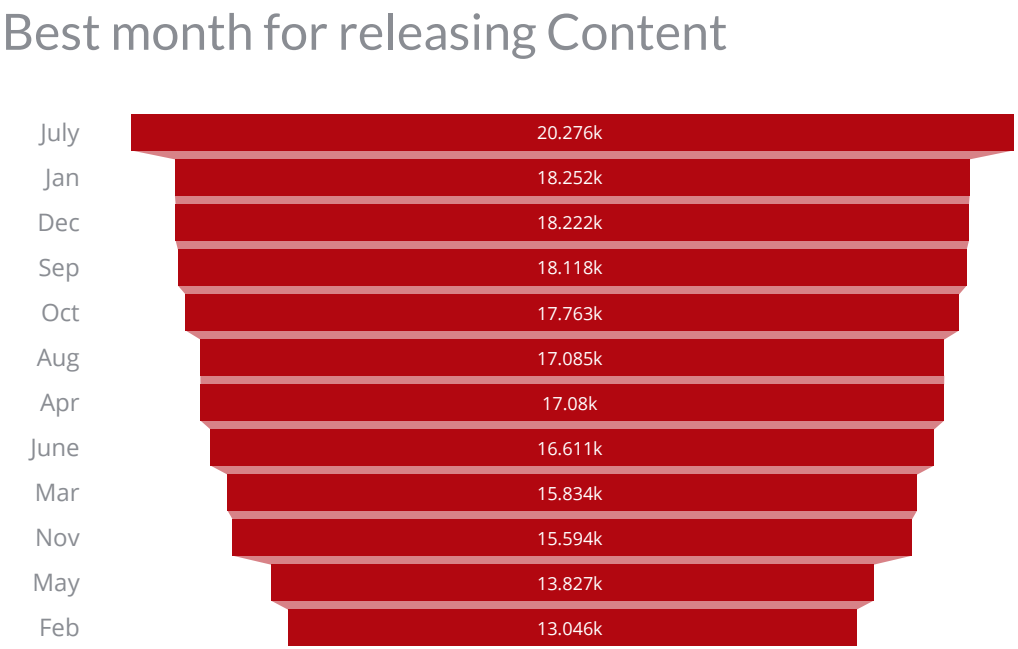
In [76]:

```
df_month = pd.DataFrame(df.month_added.value_counts()).reset_index().rename(columns={'index':'month','month_adde
# converting month number to month name
df_month['month_added'] = df_month['month'].replace({1:'Jan', 2:'Feb', 3:'Mar', 4:'Apr', 5:'May', 6:'June', 7:'J
df_month[:2]
```

Out[76]:

	month	count	month_added
0	7	20276	July
1	1	18252	Jan

In [77]:
```
fig_month = px.funnel(df_month, x='count', y='month_added', title='Best month for releasing Content',
                      height=350, width=600, color_discrete_sequence=['#b20710'])
fig_month.update_xaxes(showgrid=False, ticksuffix=' ', showline=True)
fig_month.update_traces(hovertemplate=None, marker=dict(line=dict(width=0)))
fig_month.update_layout(margin=dict(t=60, b=20, l=70, r=40),
                        xaxis_title=' ', yaxis_title=" ",
                        plot_bgcolor='#333', paper_bgcolor='#333',
                        title_font=dict(size=25, color='#8a8d93', family="Lato, sans-serif"),
                        font=dict(color='#8a8d93'),
                        hoverlabel=dict(bgcolor="black", font_size=13, font_family="Lato, sans-serif"))
```



Ending and starting of the year January and July is the best month to release content. The best 4 months to release content are July, January, October, and November.

9.17 - Netflix India

In [78]:
```
df_india = df[df['country'] == 'India'].reset_index().drop(columns=['index'])
df_india.head()
```

Out[78]:

	show_id	director	cast	country	genre	type	title	date_added	release_year	rating	duration	ratings_ages	duration_in_minut
0	s5	Unknown	Mayur More	India	International TV Shows	TV Show	Kota Factory	September 24, 2021	2021	TV-MA	2 Seasons	Adults	
1	s5	Unknown	Mayur More	India	Romantic TV Shows	TV Show	Kota Factory	September 24, 2021	2021	TV-MA	2 Seasons	Adults	
2	s5	Unknown	Mayur More	India	TV Comedies	TV Show	Kota Factory	September 24, 2021	2021	TV-MA	2 Seasons	Adults	
3	s5	Unknown	Jitendra Kumar	India	International TV Shows	TV Show	Kota Factory	September 24, 2021	2021	TV-MA	2 Seasons	Adults	
4	s5	Unknown	Jitendra Kumar	India	Romantic TV Shows	TV Show	Kota Factory	September 24, 2021	2021	TV-MA	2 Seasons	Adults	

9.17.1 Top directors in India

In [79]:
```
top_10_directors_India = df_india.groupby(['country','director'])['title'].count().reset_index()
top_10_directors_India[top_10_directors_India['country'] == 'India'].sort_values('title', ascending=False).head(
```

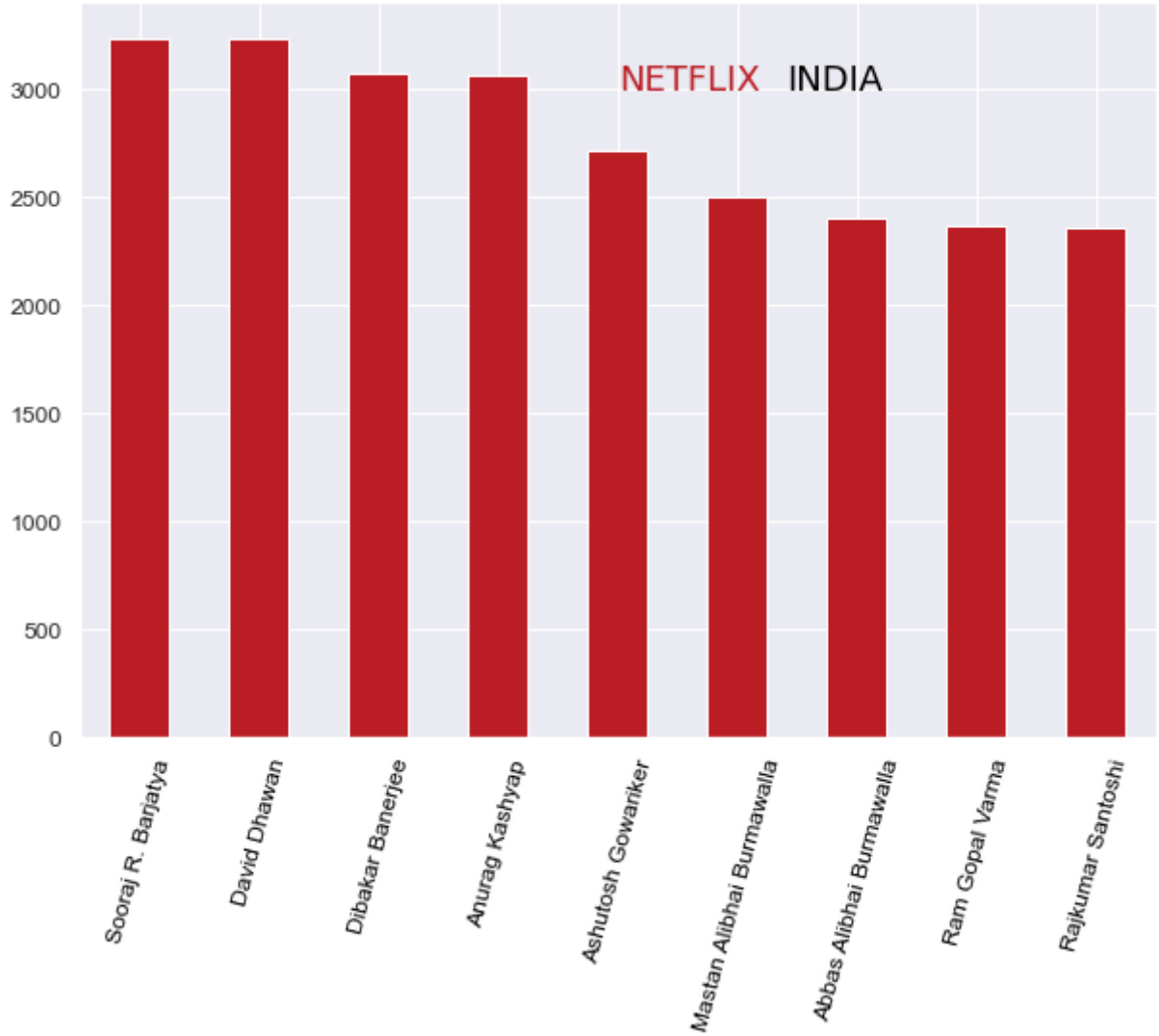
Out[79]:

	country	director	title
684	India	Unknown	995
151	India	David Dhawan	270
80	India	Anurag Kashyap	219
168	India	Dibakar Banerjee	192
617	India	Sooraj R. Barjatya	180
735	India	Zoya Akhtar	168
682	India	Umesh Mehra	162
478	India	Ram Gopal Varma	158
427	India	Priyadarshan	156
255	India	Karan Johar	155

In [80]:
```
india_director = []
for i in df_india['director']:
    for j in range(len(i)):
        india_director.append(i)
```

In [81]:

```
pd.Series(india_director).value_counts()[1:10].plot(kind='bar',color = "#bb1d24",figsize=(10,7))
plt.annotate("NETFLIX",xy=(4,3000),fontsize=18,
             color='#bb1d24',fontfamily='DejaVu Sans')
plt.annotate("INDIA",xy=(5.4035,3000),fontsize=18,
             color='black',fontfamily='DejaVu Sans')
plt.xticks(rotation=75,color="black")
plt.show()
```



Observation:

- Sooraj R Barjatya has maximum number of records in the dataset
- David Dhawan and Anurag Kashyap have maximum number of records under titles

9.17.2 Top actors in India

In [82]:
```
top_10_actors_India = df_india.groupby(['country','cast'])['title'].count().reset_index()
top_10_actors_India[top_10_actors_India['country'] == 'India'].sort_values('title', ascending=False).head(10)
```

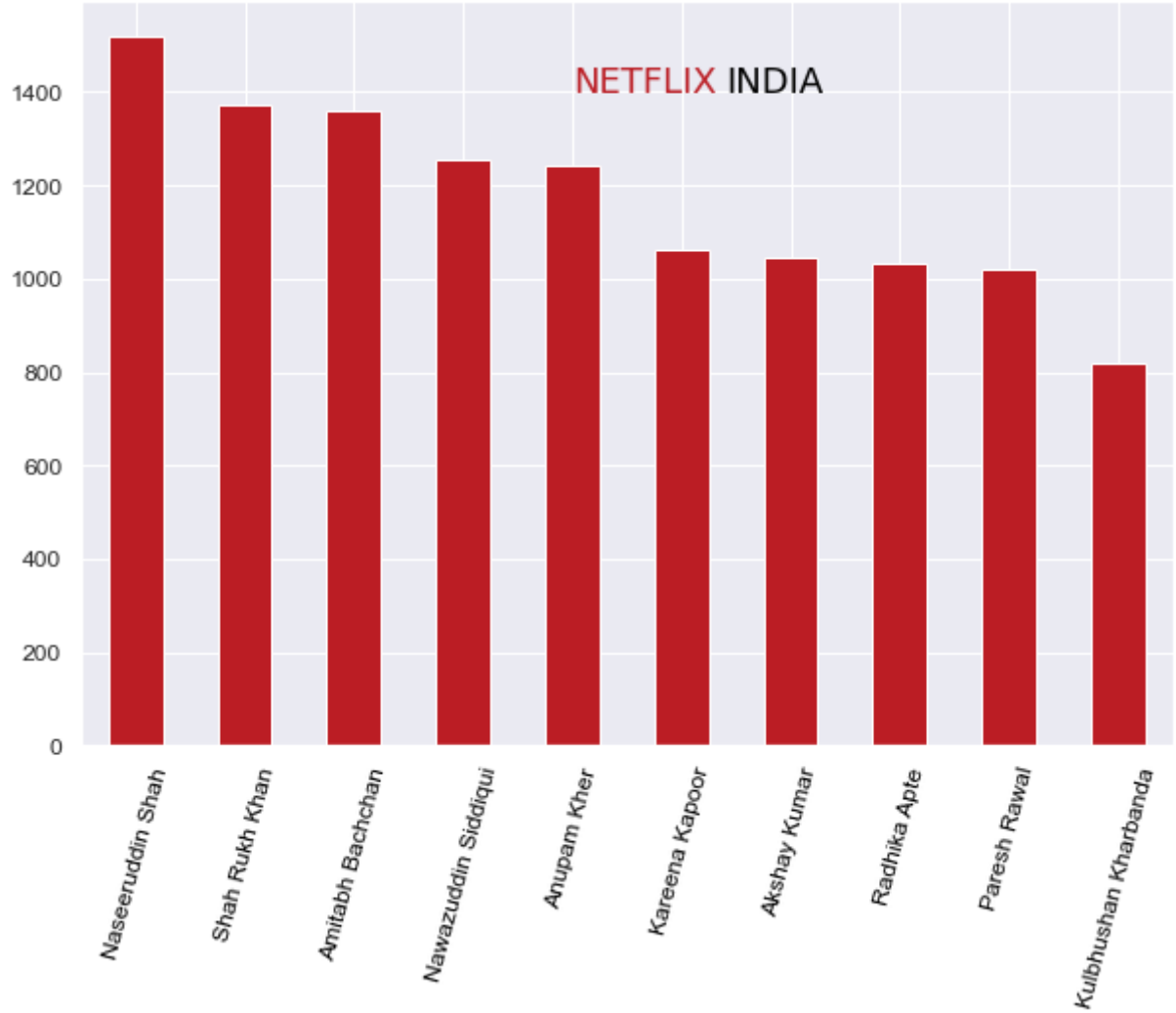
Out[82]:

	country	cast	title
383	India	Anupam Kher	113
3023	India	Shah Rukh Khan	98
3610	India	Unknown	97
2029	India	Naseeruddin Shah	95
151	India	Akshay Kumar	87
2447	India	Radhika Apte	86
2229	India	Paresh Rawal	85
223	India	Amitabh Bachchan	85
2179	India	Om Puri	79
1474	India	Kareena Kapoor	76

In [83]:
```
india_cast = []
for i in df_india['cast']:
    for j in range(len(i)):
        india_cast.append(i)
```

In [84]:

```
pd.Series(india_cast).value_counts()[:10].plot(kind='bar',color = "#bb1d24",figsize=(10,7))
plt.annotate("NETFLIX",xy=(4,1400),fontsize=18,
             color='#bb1d24',fontfamily='DejaVu Sans')
plt.annotate("INDIA",xy=(5.4035,1400),fontsize=18,
             color='black',fontfamily='DejaVu Sans')
plt.xticks(rotation=75,color="black")
plt.show()
```



9.17.2.1 Taking the last 10 years of data for actor

Observation: The top casts in India Netflix are as shown above.

Inference: They are ubdoubtedly marquee actors who draws a large attention from the fans.

Recommendation: Netflix should produce an original content movie roping in multiple people from this list. With the huge fan following that these people have, it would surely translate to more subscribers joining Netflix to see their beloved actors newest releases.

Taking the last 10 years data of Indian Movies data

In [85]:
```
df_india_recent_mov = df_india[(df_india['release_year'] > 2011) & (df_india['type'] == 'Movie')].reset_index().
```

In [86]:
```
india_cast_recent_mov = []
for i in df_india_recent_mov['cast']:
    for j in range(len(i)):
        india_cast_recent_mov.append(i)
```

Plotting the top 10 actors in recent Years

In [87]:

```
pd.Series(india_cast_recent_mov).value_counts()[1:].to_frame()[:10].rename(columns = {0:"count"}).plot(kind='bar
                                                                                                        ylabel ='
                                                                                                        xlabel =
                                                                                                        title = "
                                                                                                        color = '
                                                                                                        rot = 75)
plt.annotate("Trending actors in the recent times",xy=(3.4,700),fontsize=12,
             color='#bb1d24',fontfamily='serif')

plt.show()
```


Observation : Radhika Apte, Rajat Kapoor & Swara Bhaskar are some of the actors who are all time favourites from 2011

Observation : The graph shows us the trend of actors over the last 10 years.

- Radhika Apte is an actor who has been consistently trending since the last 10 years.
- Rajat Kapoor is one such actor who has been in the limelight since the last couple of years.

9.17.3 Genre trends in India

In [88]:
```
india_genre_recent_mov = []
for i in df_india_recent_mov['genre']:
    for j in range(len(i)):
        india_genre_recent_mov.append(i)
```

In [89]:
```
pd.Series(india_genre_recent_mov).value_counts()[1:].to_frame().plot(kind='bar',figsize = (10,7),
                                                    ylabel ='Number of Movies',
                                                    xlabel = "Genre",
                                                    title = "Genre trend in the recent years",
                                                    color = '#bb1d24',
                                                    rot = 75)
plt.show()
```

International Movies does not denote the genre of the movie rather it signifies that the movie has been made outside of USA, so ignoring/dropped the column

Observation:

- Dramas, Independent Movies and Comedies are India's most famous genres.

9.17.4 Rating vs Release Year

In [90]:
```
pd.crosstab(df_india['release_year'],df_india['rating']).plot(figsize=(18,10),title="Trend of Movie Ratings acro
plt.show()
```

Inference: India's choice for movies has always been "TV-14" (unsuitable for children under 14 years of age) rated since around the 1980s. This

choice does not come as a surprise since India being a Familialistic nation would naturally want to watch movies as a Family which includes everyone from children to grandparents without any explicit content. However, it is surprising to see a slight change in the Movie/TV show trends since the pandemic started. Of course, there has been a significant overall reduction in the number of movies rolled out since the pandemic, but the decline in "TV-14" rated shows is more strong compared to the "TV-MA" rated shows. This has supposedly got to be associated with the behavioral change that has been inflicted upon us since lockdowns started. People have probably started to watch movies individually rather not as a Family or group which has led to a lesser decline in movies meant for mature adults.

Recommendation: Netflix should add more movies that are "TV-MA" and "TV-14" rated.

Recommendation Based on Insights gathered:

1. Netflix should focus on adding content to the platform which is released in the recent past, instead of adding old content. **Source insights:** 9.1(observation 1), 9.8 (observations 1 and 2)
2. Netflix should add movies to its platform which are produced preferably in the United States, India, United Kingdom, Canada, and France. **Source insights:** 9.1(observation 6), 9.3
3. Netflix should add tv shows to its platform which are produced preferably in the United States, United Kingdom, and Japan. South Korea and Canada. **Source insights:** 9.1(observation 6), 9.3
4. Netflix should add tv shows to its platform which are produced preferably for mature audiences only. And they should add movies to their platform which are produced preferably for audiences aged 14 or more. **Source insights:** 9.2, 9.9(observations 7 and 8)
5. Netflix should focus on adding content to their platform which preferably falls under the categories of, International movies/tv shows, Drama, and Comedy. **Source insights:** 9.4, 9.9(observations 5 and 6)
6. Netflix should collaborate with the following actor-director duos to produce content for Netflix. Anupam Kher, David Dhawan Samuel Jackson, Jay Karas Takahiro Sakurai, Kazuya Murata David Attenborough, Stan Lathan **Source insights:** 9.5(observation 1 and 2), 9.6(observation 1 and 2), 9.9(observations 1,2,3 and 4)
7. Netflix should preferably add new movies or tv shows on the 1st or 15th day of the month. **Source insights:** 9.7(observation 2), 9.8(observation 5), 9.10(observation 2)
8. Along with the average length of feature films, Netflix should also add short films to its platform. **Source insights:** 9.12(observation: 2)
9. Movies and TV shows are generally available for adult group age, Netflix should collaborate with producers from Japan as they have expertise in Anime and produce content for younger age groups too Source insights: 9.13(Chart 4. Anime Series), 9.13(Chart 6), 9.14(Chart 4)
10. India's choice for movies has always been "TV-14" (unsuitable for children under 14 years of age) rated since around the 1980s. This choice does not come as a surprise since India being a Familialistic nation would naturally want to watch movies as a Family which includes everyone from children to grandparents without any explicit content. However, it is surprising to see a slight change in the Movie/TV show trends since the pandemic started. Of course, there has been a significant overall reduction in the number of movies rolled out since the pandemic, but the

decline in "TV-14" rated shows is more strong compared to the "TV-MA" rated shows. This has supposedly got to be associated with the behavioral change that has been inflicted upon us since lockdowns started. People have probably started to watch movies individually rather not as a Family or group which has led to a lesser decline in movies meant for mature adults.

Recommendation: Netflix should add more movies that are "TV-MA" and "TV-14" rated.

Source insights: 9.17 (9.17.3 and 9.17.4)

In [ ]:

```
1
```