NETFLIX CASE STUDY

Let's import the necessary libraries required.

In [1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
warnings.filterwarnings('ignore')
```

Let us import our dataset.

In [2]:
```
df = pd.read_csv('netflix.csv')
```

Getting Started

Let's view the first 5 rows of the dataset.

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

Out[3]:

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

Let's explore the details of each column:

Show_id: Unique ID for every Movie / Tv Show

Type: Identifier - A Movie or TV Show

Title: Title of the Movie / Tv Show

Director: Director of the Movie

Cast: Actors involved in the movie/show

Country: Country where the movie/show was produced

Date_added: Date it was added on Netflix

Release_year: Actual Release year of the movie/show

Rating: TV Rating of the movie/show

Duration: Total Duration - in minutes or number of seasons

Listed_in: Genre

Description: The summary description

How many entries are there in this data?

In [4]:
```
df.shape
```

Out[4]:
```
(8807, 12)
```

The dataset consists of 8807 rows i.e. 8807 unique Movies/TV Shows, and 12 columns/fields.

Let's further explore the dataset.

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

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

As we can see, some of the columns have **non-null** values less than the total number of rows i.e. 8807, which means some rows have missing values.

Let us see the count of missing values for each column.

In [6]:
```
df.isna().sum()
```

Out[6]:
```
show_id            0
type               0
title              0
director        2634
cast             825
country          831
date_added        10
release_year       0
rating             4
duration           3
listed_in          0
description        0
dtype: int64
```

We can see that the columns `director`, `cast`, `country`, `date_added`, `rating` and `duration` have missing values. How can we handle these?

- One option is to drop the rows with missing values. But each row in the dataset represents a unique Movie/TV Show, hence dropping the row would result in loss of potentially important data.
- Hence, an alternative is implemented, to replace the missing values with a placeholder.
- For the columns `director`, `cast` and `country`, the placeholder for missing values will be taken as **'Unknown'**.
- For the column `date_added`, for missing values, it will be assumed that the content was added to Netflix on 31st December of the year it was released.

Let us first implement these changes.

In [7]:
```
# director, cast, country
df['director'].fillna('Unknown', inplace=True)
df['cast'].fillna('Unknown', inplace=True)
df['country'].fillna('Unknown', inplace=True)

# date_added
date_added_missing_values = df[df['date_added'].isna()]['release_year'].apply(lambda x: 'December 31, '+str(x))
df['date_added'].fillna(date_added_missing_values, inplace=True)
```

In [8]:
```
df.isna().sum()
```

Out[8]:
```
show_id         0
type            0
title           0
director        0
cast            0
country         0
date_added      0
release_year    0
rating          4
duration        3
listed_in       0
description     0
dtype: int64
```

Now, columns `rating` and `duration` still have missing values. Let's have a look at these.

In [9]:
```
df[df['rating'].isna()]
```

Out[9]:

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in	description
5989	s5990	Movie	13TH: A Conversation with Oprah Winfrey & Ava ...	Unknown	Oprah Winfrey, Ava DuVernay	Unknown	January 26, 2017	2017	NaN	37 min	Movies	Oprah Winfrey sits down with director Ava DuVe...
6827	s6828	TV Show	Gargantia on the Verdurous Planet	Unknown	Kaito Ishikawa, Hisako Kanemoto, Ai Kayano, Ka...	Japan	December 1, 2016	2013	NaN	1 Season	Anime Series, International TV Shows	After falling through a wormhole, a space-dwel...
7312	s7313	TV Show	Little Lunch	Unknown	Flynn Curry, Olivia Deeble, Madison Lu, Oisín ...	Australia	February 1, 2018	2015	NaN	1 Season	Kids' TV, TV Comedies	Adopting a child's perspective, this show take...
7537	s7538	Movie	My Honor Was Loyalty	Alessandro Pepe	Leone Frisa, Paolo Vaccarino, Francesco Miglio...	Italy	March 1, 2017	2015	NaN	115 min	Dramas	Amid the chaos and horror of World War II, a c...

In [10]:
```
df[df['duration'].isna()]
```

Out[10]:

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in	description
5541	s5542	Movie	Louis C.K. 2017	Louis C.K.	Louis C.K.	United States	April 4, 2017	2017	74 min	NaN	Movies	Louis C.K. muses on religion, eternal love, gi...
5794	s5795	Movie	Louis C.K.: Hilarious	Louis C.K.	Louis C.K.	United States	September 16, 2016	2010	84 min	NaN	Movies	Emmy-winning comedy writer Louis C.K. brings h...
5813	s5814	Movie	Louis C.K.: Live at the Comedy Store	Louis C.K.	Louis C.K.	United States	August 15, 2016	2015	66 min	NaN	Movies	The comic puts his trademark hilarious/thought...

For the column `duration`, we can see that the column `rating` has been accidentally filled in with the values of the column `duration`.

Let us replace them back to the `duration`.

For the `rating` column, we will assume that the missing values mean that the content was not rated and hence fill the missing values with **'NR'**.

In [11]:
```
# duration
duration_missing_values = df[df['duration'].isna()]['rating']
df['duration'].fillna(duration_missing_values, inplace=True)

# replacing the misplaced values in 'rating' column with np.nan
df.loc[duration_missing_values.index,'rating'] = np.nan

# rating
df['rating'].fillna('NR', inplace=True)
```

In [12]:
```
df.isna().sum()
```

Out[12]:
```
show_id         0
type            0
title           0
director        0
cast            0
country         0
date_added      0
release_year    0
rating          0
duration        0
listed_in       0
description     0
dtype: int64
```

Now that all the missing values have been replaced, let us explore perform some further pre-processing.

In [13]:
```
df.info()
```

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

The `date_added` column is of the type 'object', which needs to be converted to **datetime**.

In [14]:
```
df['date_added'] = pd.to_datetime(df['date_added'], format='mixed')
```

In [15]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 8807 entries, 0 to 8806
Data columns (total 12 columns):
 #   Column        Non-Null Count  Dtype
---  ------        --------------  -----
 0   show_id       8807 non-null   object
 1   type          8807 non-null   object
 2   title         8807 non-null   object
 3   director      8807 non-null   object
 4   cast          8807 non-null   object
 5   country       8807 non-null   object
 6   date_added    8807 non-null   datetime64[ns]
 7   release_year  8807 non-null   int64
 8   rating        8807 non-null   object
 9   duration      8807 non-null   object
 10  listed_in     8807 non-null   object
 11  description   8807 non-null   object
dtypes: datetime64[ns](1), int64(1), object(10)
memory usage: 825.8+ KB
```

In the dataset, the columns `director`, `cast`, `country` and `listed_in` have comma-separated values. For simplicity of analysis, we will explode these values so that each row will have a unique value.

In [16]:
```
columns_to_explode = ['director', 'cast', 'country', 'listed_in']
for column in columns_to_explode:
    df[column] = df[column].str.split(', ')
    df = df.explode(column).reset_index(drop=True)
```

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

Out[17]:

	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	Unknown	United States	2021-09-25	2020	PG-13	90 min	Documentaries	As her father nears the end of his life, filmm...
1	s2	TV Show	Blood & Water	Unknown	Ama Qamata	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows	After crossing paths at a party, a Cape Town t...
2	s2	TV Show	Blood & Water	Unknown	Ama Qamata	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Dramas	After crossing paths at a party, a Cape Town t...
3	s2	TV Show	Blood & Water	Unknown	Ama Qamata	South Africa	2021-09-24	2021	TV-MA	2 Seasons	TV Mysteries	After crossing paths at a party, a Cape Town t...
4	s2	TV Show	Blood & Water	Unknown	Khosi Ngema	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows	After crossing paths at a party, a Cape Town t...

In [18]:
```
df.shape
```

Out[18]:
```
(201991, 12)
```

In [19]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 201991 entries, 0 to 201990
Data columns (total 12 columns):
 #   Column        Non-Null Count   Dtype
---  ------        --------------   -----
 0   show_id       201991 non-null  object
 1   type          201991 non-null  object
 2   title         201991 non-null  object
 3   director      201991 non-null  object
 4   cast          201991 non-null  object
 5   country       201991 non-null  object
 6   date_added    201991 non-null  datetime64[ns]
 7   release_year  201991 non-null  int64
 8   rating        201991 non-null  object
 9   duration      201991 non-null  object
 10  listed_in     201991 non-null  object
 11  description   201991 non-null  object
dtypes: datetime64[ns](1), int64(1), object(10)
memory usage: 18.5+ MB
```

In [20]:
```
df.nunique()
```

Out[20]:
```
show_id          8807
type                2
title            8807
director         4994
cast            36440
country           128
date_added       1719
release_year       74
rating             14
duration          220
listed_in          42
description      8775
dtype: int64
```

For simplicity later, movies and TV Shows are separated into two separate dataframes.

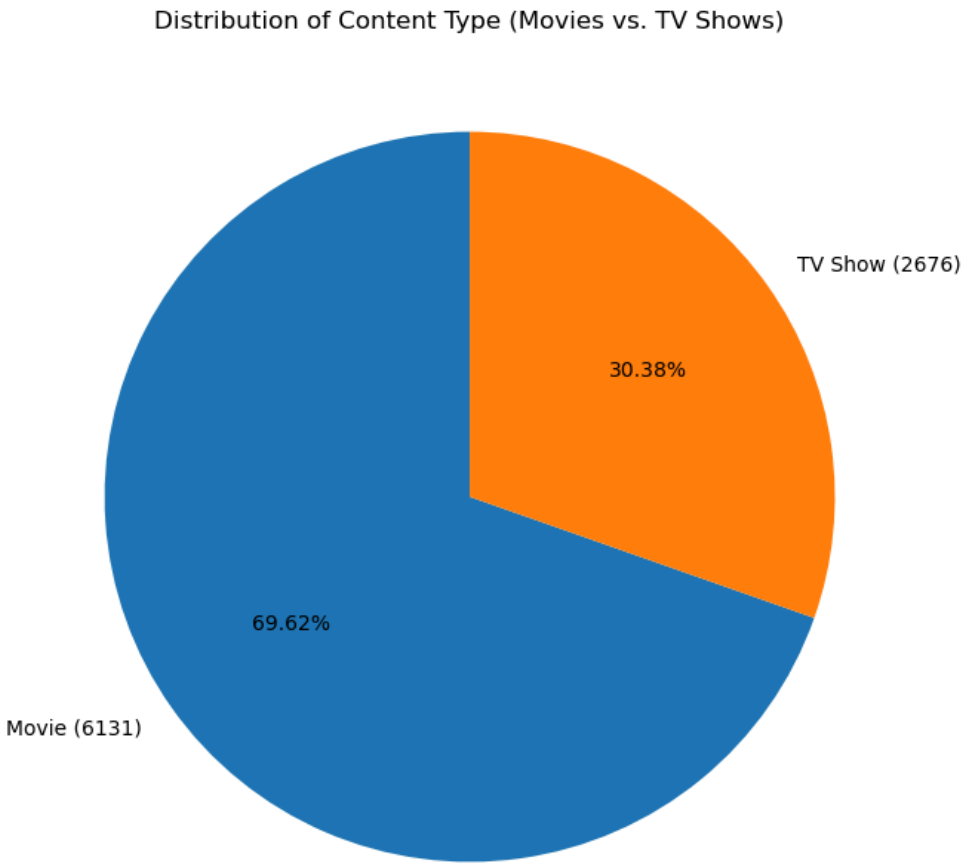
In [21]:
```
movies = df[df['type']=='Movie']
tv_shows = df[df['type']=='TV Show']
```

1. Content related trends

1.1 Distribution of Content type (Movies vs. TV Shows)

In [22]:
```
type_counts = df.groupby('type')['show_id'].nunique()

plt.figure(figsize=(8,8))
plt.pie(
    x=type_counts,
    labels=[f"{label} ({count})" for label, count in zip(type_counts.index, type_counts)],
```

```
    autopct='%.2f%%',
    startangle=90
)
plt.title('Distribution of Content Type (Movies vs. TV Shows)')
plt.show()
```



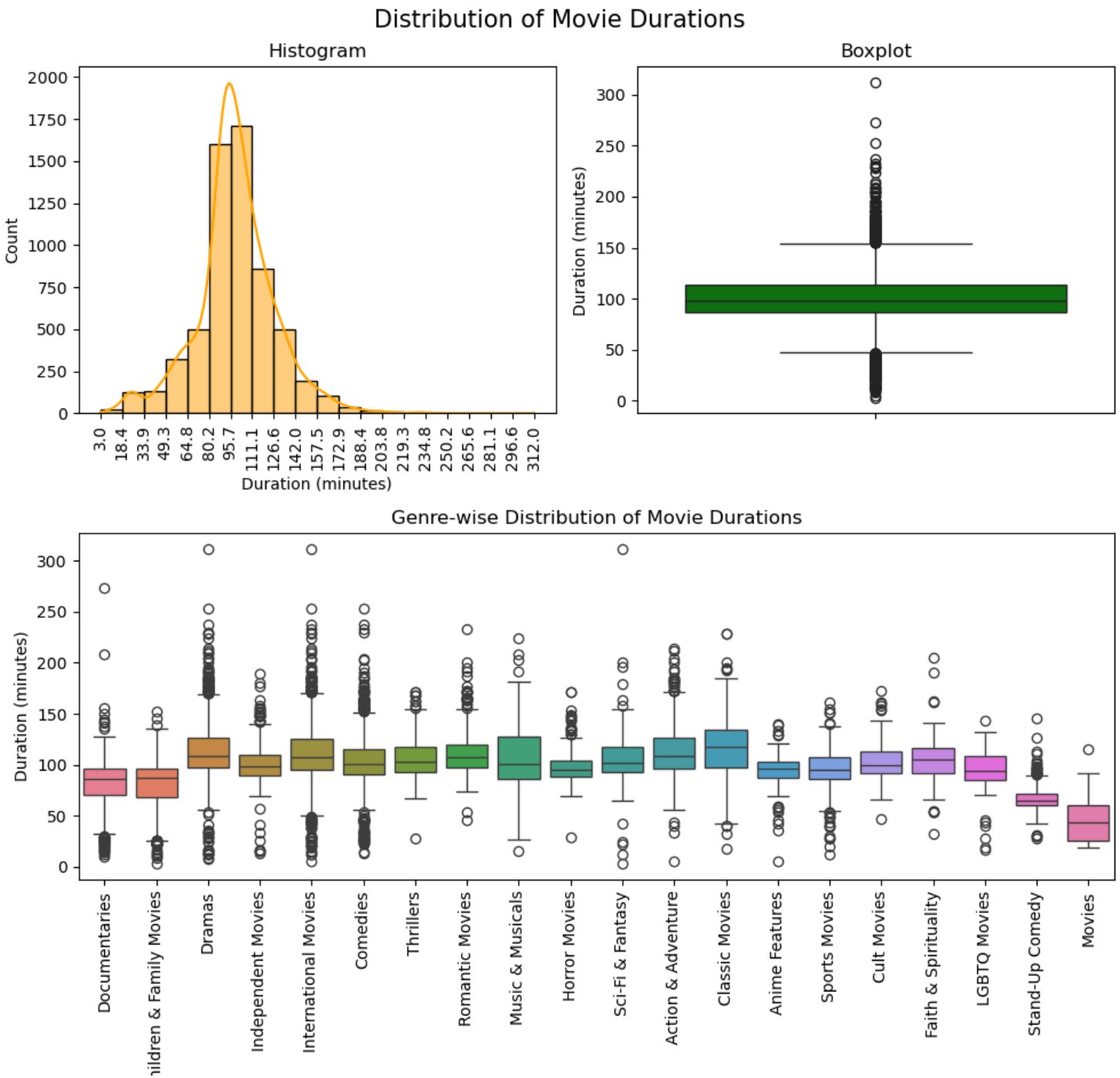
Insights:

With an almost 70% share, Netflix produces significant number of movies over TV shows, showing a stronger preference of audiences to one-time viewing experience over long-term storytelling.

1.2. What is the distribution of duration of Movies and TV Shows? How does it vary by different Genres?

In [23]:
```
movies['duration'] = movies['duration'].apply(lambda x: int(x.split()[0]) if type(x) != int else x)
movies_duration = movies.groupby('show_id')['duration'].unique().explode()
```

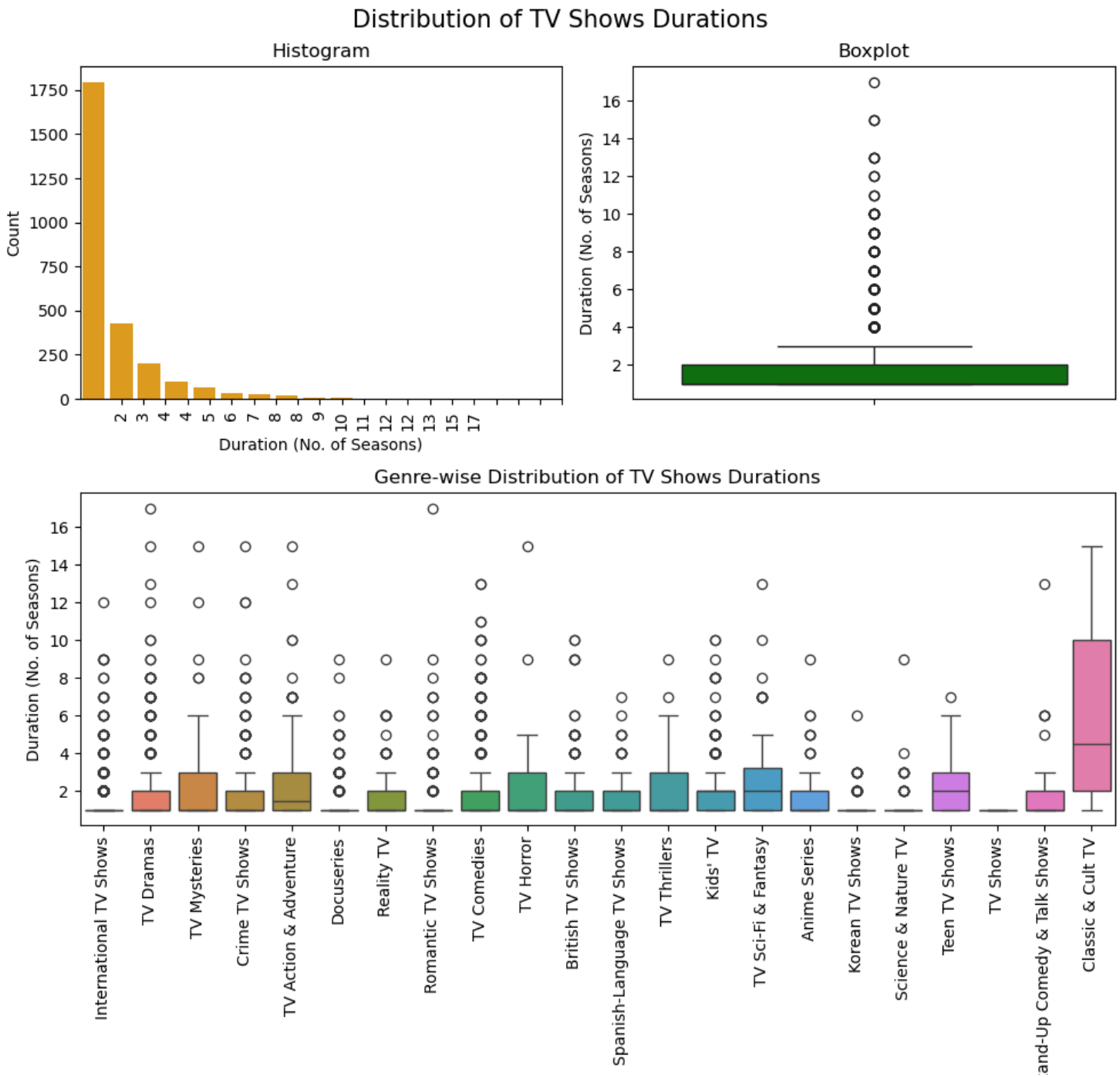
```
movies_duration_genres = movies[['show_id','duration','listed_in']].drop_duplicates().reset_index(drop=True)

plt.figure(figsize=(10,10)).suptitle('Distribution of Movie Durations', fontsize=15)

plt.subplot(2,2,1)
sns.histplot(data=movies_duration,
             bins=20,
             kde=True,
             color='orange')
plt.title('Histogram')
plt.xlabel('Duration (minutes)')
plt.xticks(np.linspace(movies['duration'].min(),movies['duration'].max(),21), rotation =90)
plt.ylabel('Count')

plt.subplot(2,2,2)
sns.boxplot(data=movies_duration, color='green')
plt.title('Boxplot')
plt.ylabel('Duration (minutes)')

plt.subplot(2,2,(3,4))
sns.boxplot(data=movies_duration_genres, x='listed_in', y='duration', hue='listed_in')
plt.title('Genre-wise Distribution of Movie Durations')
plt.xlabel('Genres')
plt.xticks(rotation=90)
plt.ylabel('Duration (minutes)')

plt.tight_layout()
plt.show()
```


Distribution of Movie Durations
Histogram
Count
Duration (minutes)
Boxplot
Duration (minutes)
Genre-wise Distribution of Movie Durations
Duration (minutes)
Documentaries
Children & Family Movies
Dramas
Independent Movies
International Movies
Comedies
Thrillers
Romantic Movies
Music & Musicals
Horror Movies
Sci-Fi & Fantasy
Action & Adventure
Classic Movies
Anime Features
Sports Movies
Cult Movies
Faith & Spirituality
LGBTQ Movies
Stand-Up Comedy
Movies

Insights:

1. Most of the movies have duration between 80 to 120 minutes i.e. approximately 1.5 to 2 hours.
2. Classic, old movies seem to have longer duration, followed by dramas. Whereas standalone movie-like content like Stand-Up Comedy have much shorter duration.

In [24]:
```
tv_shows['duration'] = tv_shows['duration'].apply(lambda x: int(x.split()[0]) if type(x) != int else x)
tv_duration = tv_shows.groupby('show_id')['duration'].unique().explode()
tv_duration_genres = tv_shows[['show_id','duration','listed_in']].drop_duplicates().reset_index(drop=True)

plt.figure(figsize=(10,10)).suptitle('Distribution of TV Shows Durations', fontsize=15)

plt.subplot(2,2,1)
sns.barplot(data=tv_duration.value_counts(),
            color='orange')
plt.title('Histogram')
plt.xlabel('Duration (No. of Seasons)')
plt.xticks(np.linspace(tv_shows['duration'].min(),tv_shows['duration'].max(),21), rotation =90)
plt.ylabel('Count')

plt.subplot(2,2,2)
sns.boxplot(data=tv_duration, color='green')
plt.title('Boxplot')
plt.ylabel('Duration (No. of Seasons)')

plt.subplot(2,2,(3,4))
sns.boxplot(data=tv_duration_genres, x='listed_in', y='duration', hue='listed_in')
plt.title('Genre-wise Distribution of TV Shows Durations')
plt.xlabel('Genres')
plt.xticks(rotation=90)
plt.ylabel('Duration (No. of Seasons)')

plt.tight_layout()
plt.show()
```

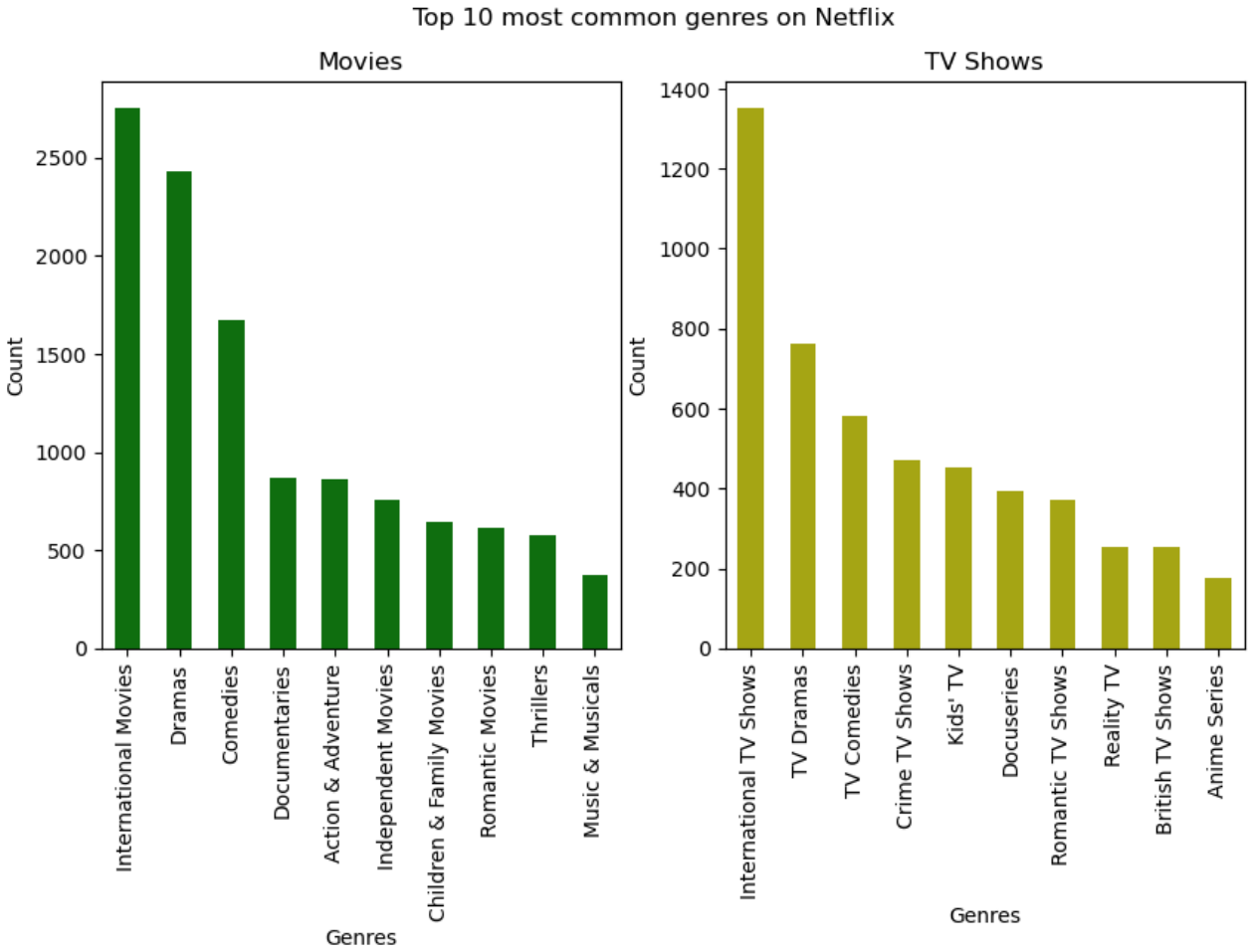

Distribution of TV Shows Durations
Histogram
Count
Duration (No. of Seasons)
Boxplot
Duration (No. of Seasons)
Genre-wise Distribution of TV Shows Durations
Duration (No. of Seasons)
International TV Shows
TV Dramas
TV Mysteries
Crime TV Shows
TV Action & Adventure
Docuseries
Reality TV
Romantic TV Shows
TV Comedies
TV Horror
British TV Shows
Spanish-Language TV Shows
TV Thrillers
Kids' TV
TV Sci-Fi & Fantasy
Anime Series
Korean TV Shows
Science & Nature TV
Teen TV Shows
TV Shows
and-Up Comedy & Talk Shows
Classic & Cult TV

Insights:

1. In case of TV Shows, Shows with a single season seem to be most popular, since people prefer to have a closure to the storyline by the end of a series, and they don't intend to wait another whole year in anticipation of the further plot.
2. Classic and cult TV content is the most popular amongst TV Shows.

1.3 Most Popular Genres on Netflix

In [25]:
```
top10_movie_genres = movies.groupby('listed_in')['show_id'].nunique().sort_values(ascending=False).head(10)
top10_tv_genres = tv_shows.groupby('listed_in')['show_id'].nunique().sort_values(ascending=False).head(10)

plt.figure(figsize=(10,5)).suptitle('Top 10 most common genres on Netflix')

plt.subplot(1,2,1)
sns.barplot(x=top10_movie_genres.index, y=top10_movie_genres, color='g', width=0.5)
plt.title('Movies')
plt.xlabel('Genres')
plt.xticks(rotation=90)
plt.ylabel('Count')

plt.subplot(1,2,2)
sns.barplot(x=top10_tv_genres.index, y=top10_tv_genres, color='y', width=0.5)
plt.title('TV Shows')
plt.xlabel('Genres')
plt.xticks(rotation=90)
plt.ylabel('Count')

plt.show()
```



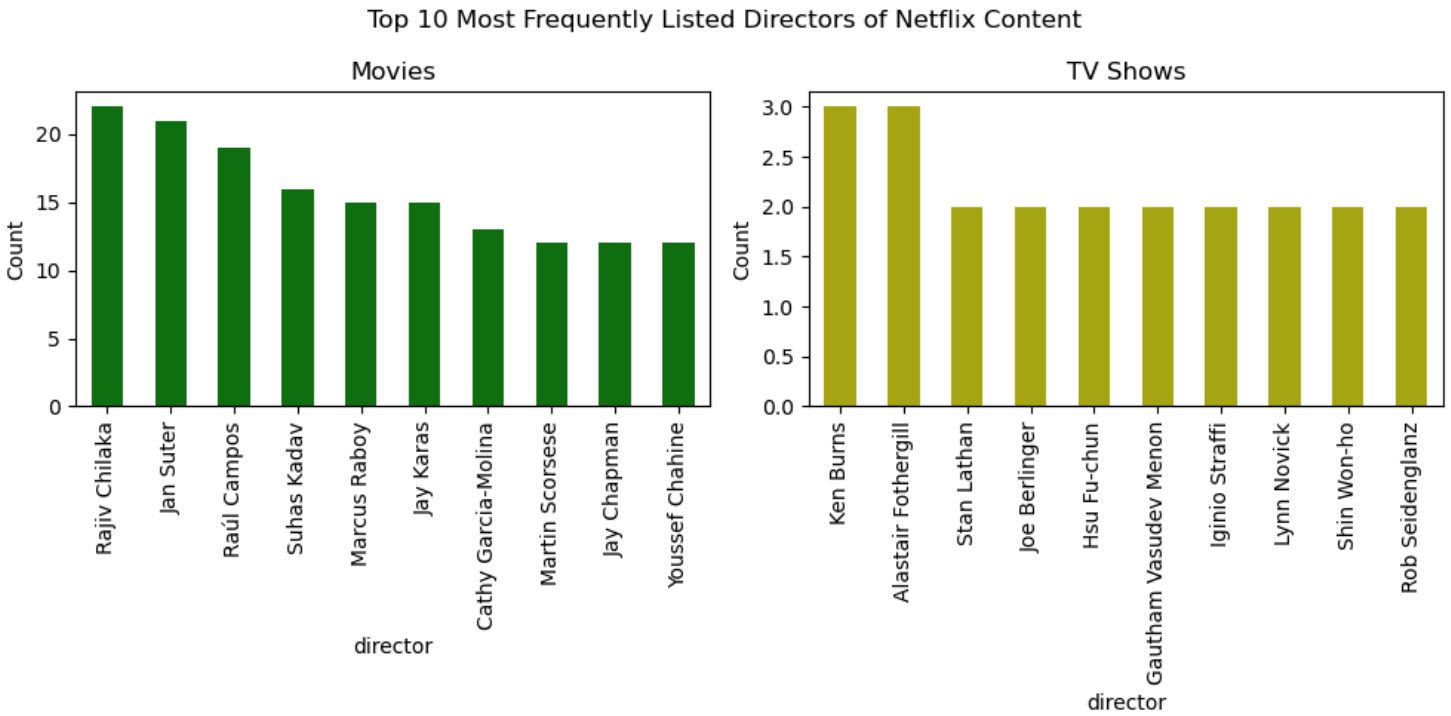
Insights:

1. Top-3 Most popular genres in Movies are Dramas, Comedies and Documentaries. Whereas for TV Shows, Dramas, Comedies and Crime Shows.
2. People seem to prefer standalone documentaries to docuseries.
3. High count of International Movies and TV shows denotes a demand for globally diverse content.

1.4 Who are the most frequently listed directors and actors?

In [26]:
```
top10_movie_directors = movies.groupby('director')['show_id'].nunique().sort_values(ascending=False)[1:11]
top10_tv_directors = tv_shows.groupby('director')['show_id'].nunique().sort_values(ascending=False)[1:11]

plt.figure(figsize=(10,5)).suptitle('Top 10 Most Frequently Listed Directors of Netflix Content')
```

```
plt.subplot(1,2,1)
sns.barplot(x=top10_movie_directors.index, y=top10_movie_directors, color='g', width=0.5)
plt.title('Movies')
plt.xticks(rotation=90)
plt.ylabel('Count')

plt.subplot(1,2,2)
sns.barplot(x=top10_tv_directors.index, y=top10_tv_directors, color='y', width=0.5)
plt.title('TV Shows')
plt.xticks(rotation=90)
plt.ylabel('Count')

plt.tight_layout()
plt.show()
```

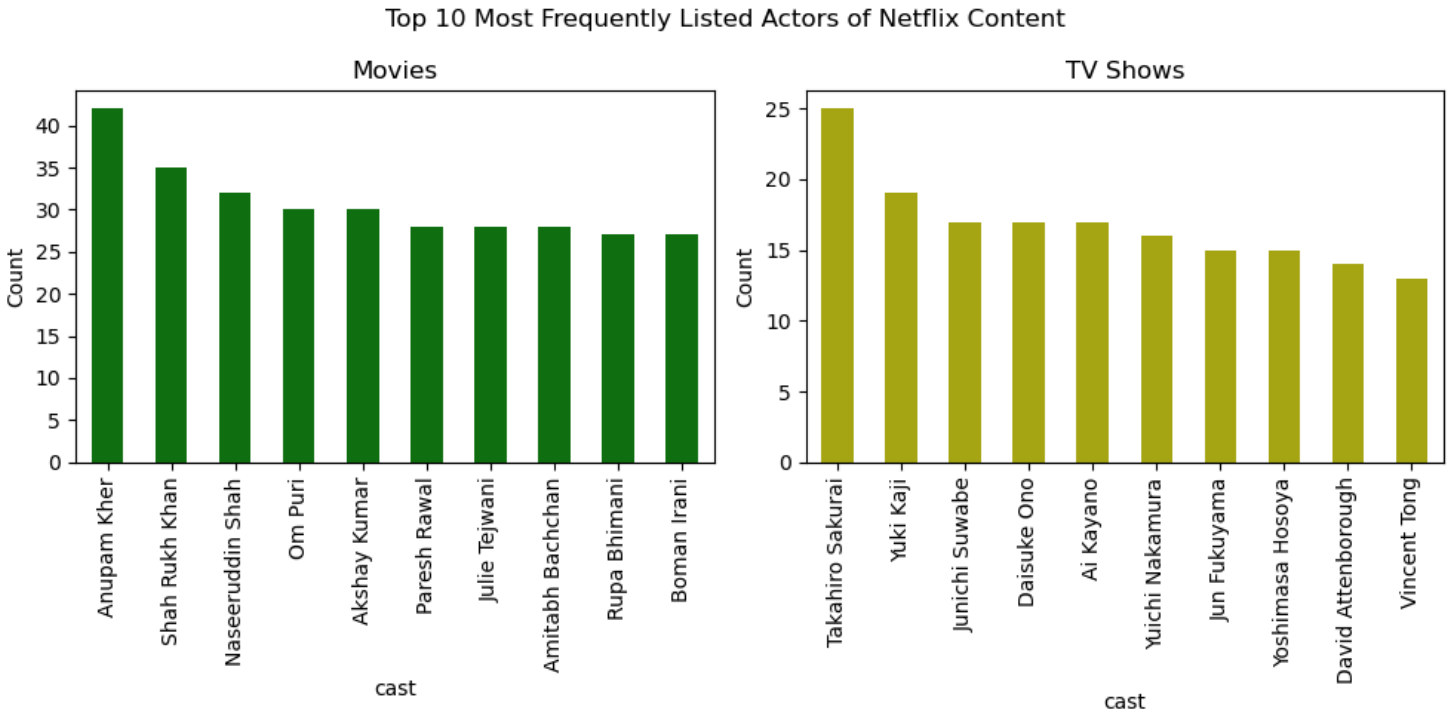


Insights:

Top-3 directors in Movies are Rajiv Chilaka, Jan Suter and Raul Campos, whereas for TV shows Ken Burns, Alastair Fothergill and Stan Lathan are the winners.

In [27]:
```
top10_movie_actors = movies.groupby('cast')['show_id'].nunique().sort_values(ascending=False)[1:11]
top10_tv_actors = tv_shows.groupby('cast')['show_id'].nunique().sort_values(ascending=False)[1:11]

plt.figure(figsize=(10,5)).suptitle('Top 10 Most Frequently Listed Actors of Netflix Content')

plt.subplot(1,2,1)
```

```
sns.barplot(x=top10_movie_actors.index, y=top10_movie_actors, color='g', width=0.5)
plt.title('Movies')
plt.xticks(rotation=90)
plt.ylabel('Count')

plt.subplot(1,2,2)
sns.barplot(x=top10_tv_actors.index, y=top10_tv_actors, color='y', width=0.5)
plt.title('TV Shows')
plt.xticks(rotation=90)
plt.ylabel('Count')

plt.tight_layout()
plt.show()
```



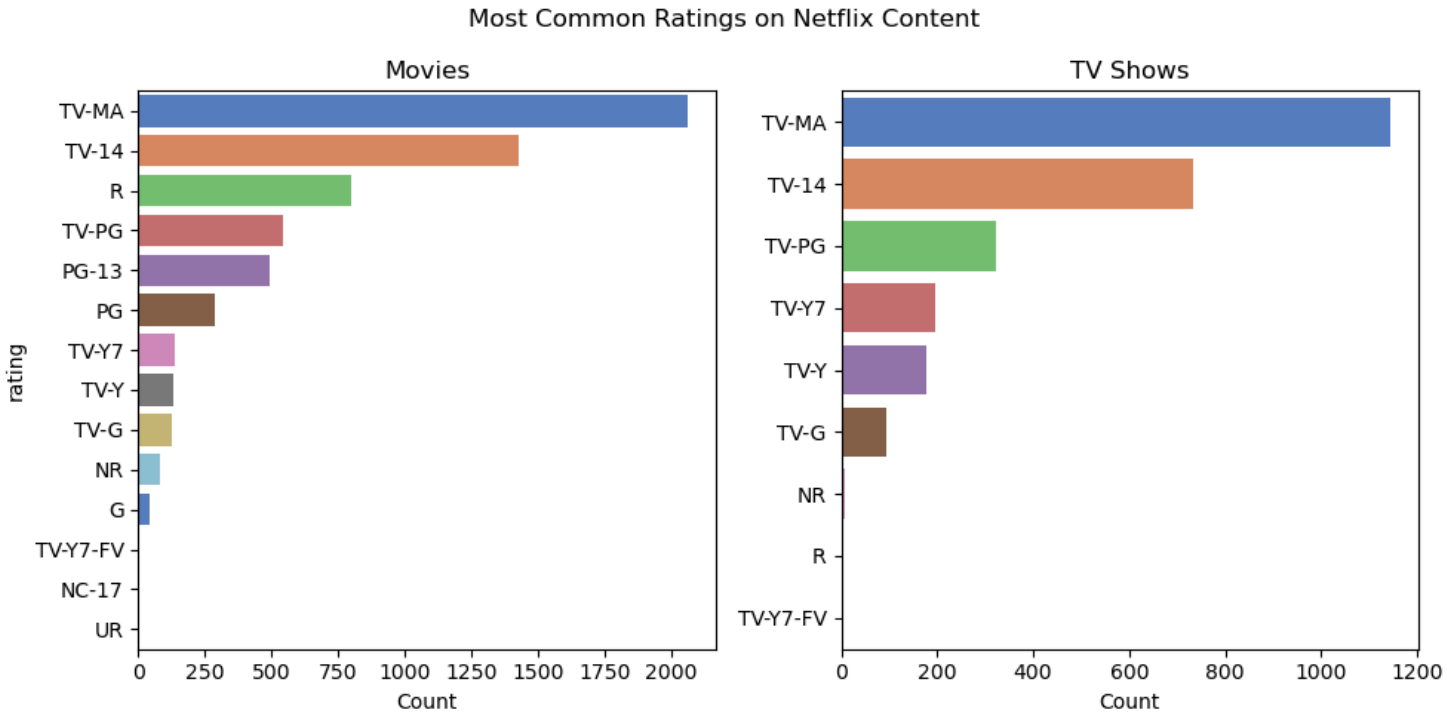
Insights:

1. Top-3 actors with most movies on Netflix are Anupam Kher, Shah Rukh Khan and Naseruddin Shah. For TV Shows, the top-3 actors are Takahiro Sakurai, Yuki Kaji and Junichi Suwabe.
2. An interesting insight is that all top-10 actors with most movies on Netflix are of the Indian origin.

1.5 What are the most common ratings on Netflix?

In [28]:
```
movie_ratings = df[df['type'] == 'Movie'].groupby('rating')['show_id'].nunique().sort_values(ascending=False)
tv_ratings = df[df['type'] == 'TV Show'].groupby('rating')['show_id'].nunique().sort_values(ascending=False)
```

```
plt.figure(figsize=(10,5)).suptitle('Most Common Ratings on Netflix Content')

plt.subplot(1,2,1)
sns.barplot(y=movie_ratings.index, x=movie_ratings, palette='muted')
plt.title('Movies')
plt.xlabel('Count')

plt.subplot(1,2,2)
sns.barplot(y=tv_ratings.index, x=tv_ratings, palette='muted')
plt.title('TV Shows')
plt.xlabel('Count')
plt.ylabel('')

plt.tight_layout()
plt.show()
```



Insights:

1. The top-3 most common ratings of Netflix content are TV-MA, TV-14 and TV-PG, although R-rated movie content is also infamously ample.
2. Surprisingly, General (G) content is very less in numbers.

2. Geographic Trends

2.1 Which countries produce the most content?

In [29]:
```
countries = df[df['country'] != 'Unknown'].groupby('country')['show_id'].nunique().sort_values(ascending=False).reset_index(name='count')
top10_countries = countries.head(10)['country'].values
countries['country'] = countries['country'].apply(lambda x : x if x in top10_countries else 'Other')
```

In [30]:
```
top10_countries
```

Out[30]:
```
array(['United States', 'India', 'United Kingdom', 'Canada', 'France',
       'Japan', 'Spain', 'South Korea', 'Germany', 'Mexico'], dtype=object)
```

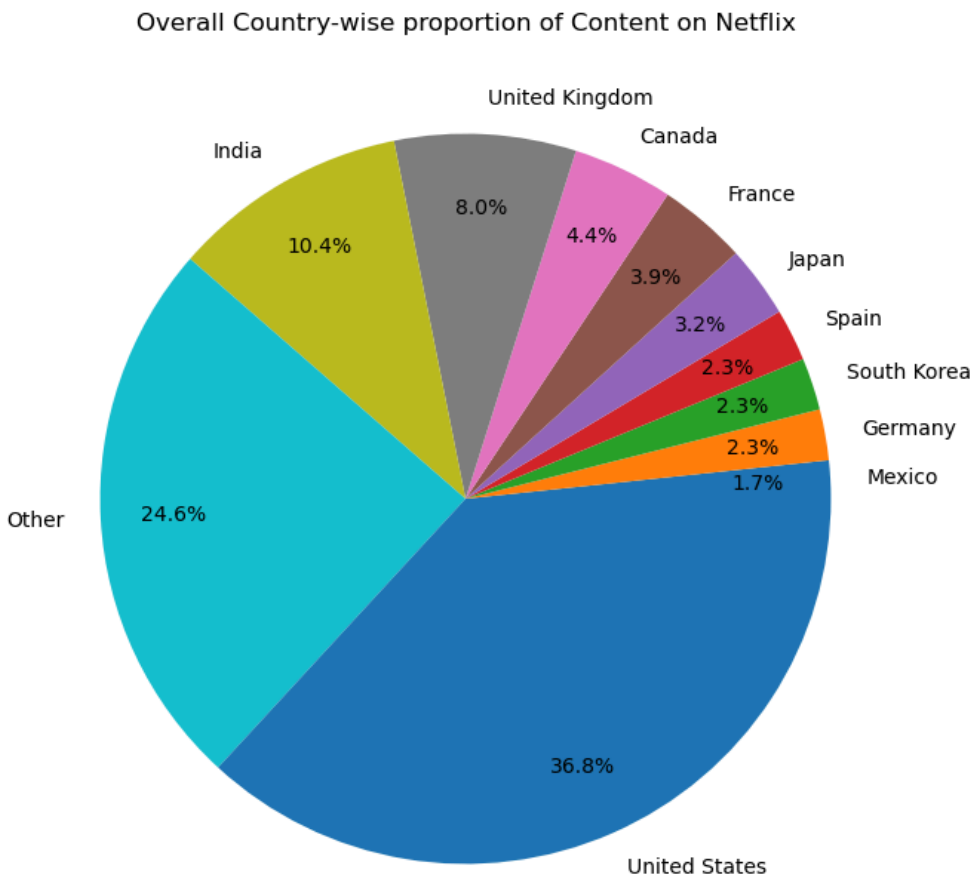
In [31]:
```
countries
```

Out[31]:

	country	count
0	United States	3689
1	India	1046
2	United Kingdom	804
3	Canada	445
4	France	393
...	...	...
122	Other	1
123	Other	1
124	Other	1
125	Other	1
126	Other	1

127 rows × 2 columns

In [32]:
```
countries_counts = countries.groupby('country')['count'].sum().sort_values()
plt.figure(figsize=(8,8))
plt.pie(countries_counts,
        labels = countries_counts.index,
        autopct='%.1f%%',
        pctdistance=0.8)
plt.title('Overall Country-wise proportion of Content on Netflix')
plt.show()
```

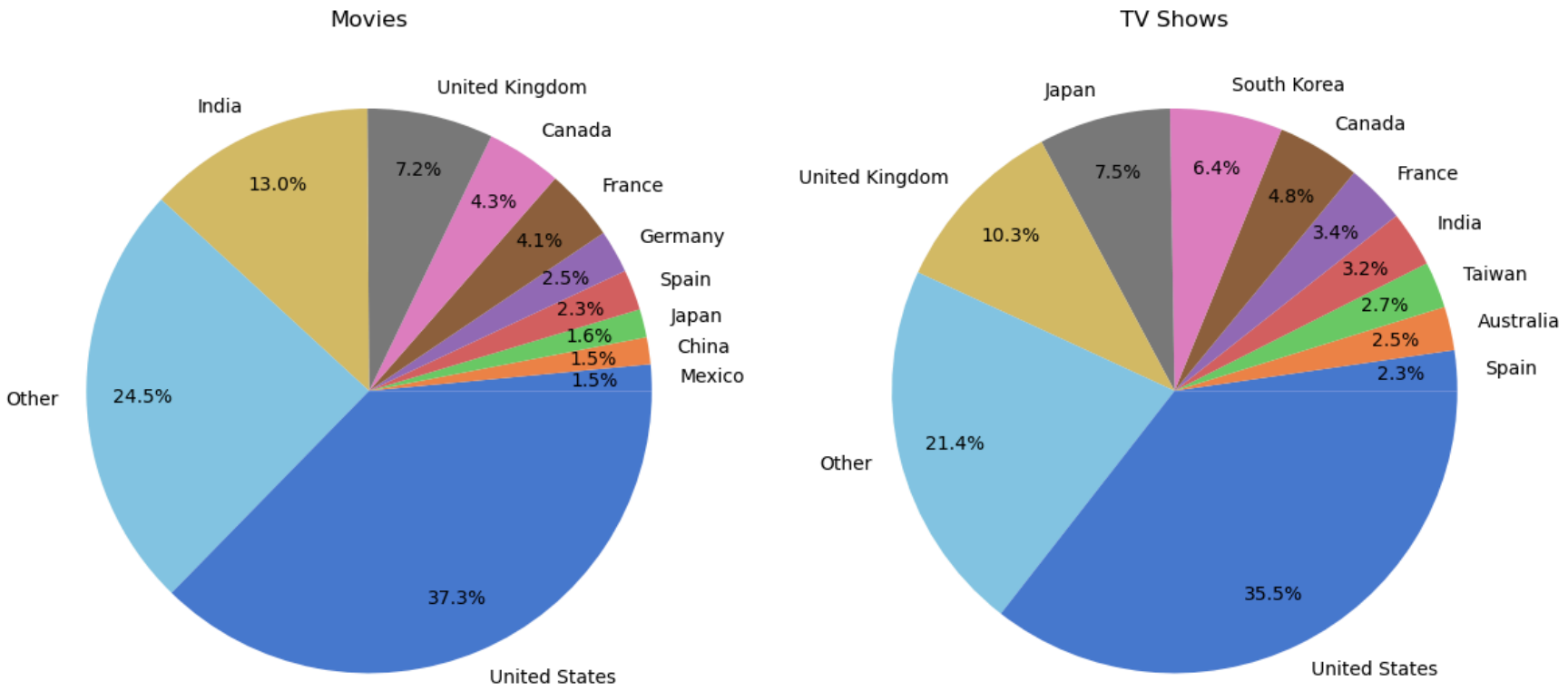


Insights:

1. Top-3 countries with the most content are United States (US), India and United Kingdom (UK).
2. Although at #2, India still lags far behind in production, with only 10% share, compared to a whopping 37% share of US-based content.

In [33]:
```
countries_movies = movies[movies['country'] != 'Unknown'].groupby('country')['show_id'].nunique().sort_values(ascending=False).reset_index(name='count')
countries_tv = tv_shows[tv_shows['country'] != 'Unknown'].groupby('country')['show_id'].nunique().sort_values(ascending=False).reset_index(name='count')

top10_countries_movies = countries_movies.head(10)['country'].values
top10_countries_tv = countries_tv.head(10)['country'].values

countries_movies['country'] = countries_movies['country'].apply(lambda x: x if x in top10_countries_movies else 'Other')
countries_tv['country'] = countries_tv['country'].apply(lambda x: x if x in top10_countries_tv else 'Other')
```

```
countries_movies_counts = countries_movies.groupby('country')['count'].sum().sort_values()
countries_tv_counts = countries_tv.groupby('country')['count'].sum().sort_values()

plt.figure(figsize=(12,8)).suptitle('Country-wise Distribution of Movies and TV Shows on Netflix', fontsize=15)

plt.subplot(1,2,1)
plt.pie(x = countries_movies_counts,
        labels = countries_movies_counts.index,
        autopct='%.1f%%',
        pctdistance=0.8,
        colors=sns.color_palette(palette='muted', n_colors=11))
plt.title('Movies', fontsize=12)

plt.subplot(1,2,2)
plt.pie(x = countries_tv_counts,
        labels = countries_tv_counts.index,
        autopct='%.1f%%',
        pctdistance=0.8,
        colors=sns.color_palette(palette='muted', n_colors=11))
plt.title('TV Shows', fontsize=12)

plt.tight_layout()
plt.show()
```



Insights:

The bifurgation between Movies and TV Shows, shows an interesting insight. Japan is at #3 in producing TV Shows, followed by South Korea, which could be because of increasing global popularity of Japnese Anime series and Korean Dramas.

2.2 What genres are most popular in top 10 countries?

In [34]:
```
top10_country_genres = df[df['country'].isin(top10_countries)]
top10_country_genres = top10_country_genres.groupby(['country','listed_in'])['show_id'].nunique().reset_index(name='count')
top10_country_genres_pivot = top10_country_genres.pivot_table(index='country',columns='listed_in',values='count').T
```

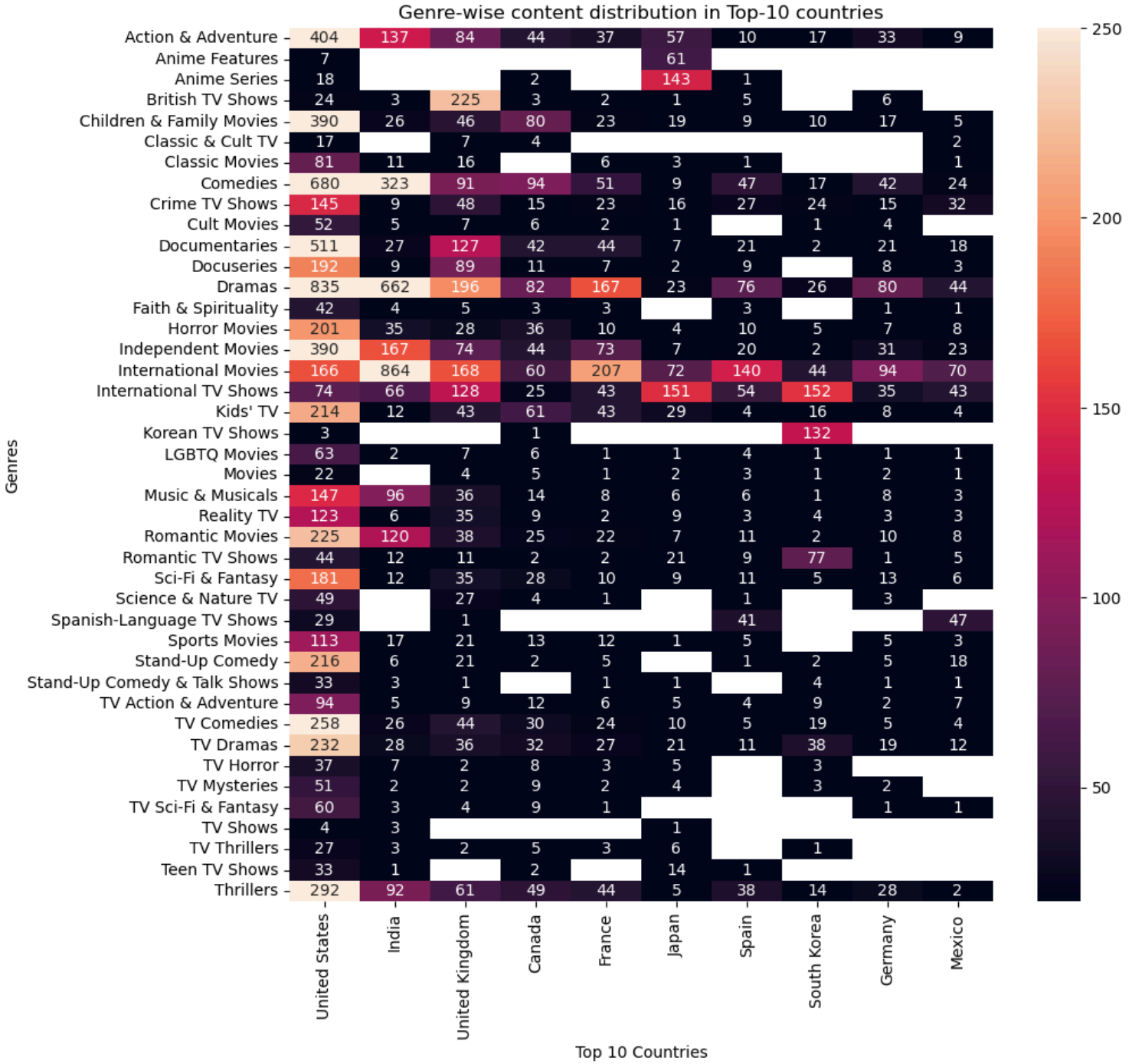
```
top10_country_genres_pivot = top10_country_genres_pivot[list(top10_countries)]
top10_country_genres_pivot
```

Out[34]:

country listed_in	United States	India	United Kingdom	Canada	France	Japan	Spain	South Korea	Germany	Mexico
Action & Adventure	404.0	137.0	84.0	44.0	37.0	57.0	10.0	17.0	33.0	9.0
Anime Features	7.0	NaN	NaN	NaN	NaN	61.0	NaN	NaN	NaN	NaN
Anime Series	18.0	NaN	NaN	2.0	NaN	143.0	1.0	NaN	NaN	NaN
British TV Shows	24.0	3.0	225.0	3.0	2.0	1.0	5.0	NaN	6.0	NaN
Children & Family Movies	390.0	26.0	46.0	80.0	23.0	19.0	9.0	10.0	17.0	5.0
Classic & Cult TV	17.0	NaN	7.0	4.0	NaN	NaN	NaN	NaN	NaN	2.0
Classic Movies	81.0	11.0	16.0	NaN	6.0	3.0	1.0	NaN	NaN	1.0
Comedies	680.0	323.0	91.0	94.0	51.0	9.0	47.0	17.0	42.0	24.0
Crime TV Shows	145.0	9.0	48.0	15.0	23.0	16.0	27.0	24.0	15.0	32.0
Cult Movies	52.0	5.0	7.0	6.0	2.0	1.0	NaN	1.0	4.0	NaN
Documentaries	511.0	27.0	127.0	42.0	44.0	7.0	21.0	2.0	21.0	18.0
Docuseries	192.0	9.0	89.0	11.0	7.0	2.0	9.0	NaN	8.0	3.0
Dramas	835.0	662.0	196.0	82.0	167.0	23.0	76.0	26.0	80.0	44.0
Faith & Spirituality	42.0	4.0	5.0	3.0	3.0	NaN	3.0	NaN	1.0	1.0
Horror Movies	201.0	35.0	28.0	36.0	10.0	4.0	10.0	5.0	7.0	8.0
Independent Movies	390.0	167.0	74.0	44.0	73.0	7.0	20.0	2.0	31.0	23.0
International Movies	166.0	864.0	168.0	60.0	207.0	72.0	140.0	44.0	94.0	70.0
International TV Shows	74.0	66.0	128.0	25.0	43.0	151.0	54.0	152.0	35.0	43.0
Kids' TV	214.0	12.0	43.0	61.0	43.0	29.0	4.0	16.0	8.0	4.0
Korean TV Shows	3.0	NaN	NaN	1.0	NaN	NaN	NaN	132.0	NaN	NaN
LGBTQ Movies	63.0	2.0	7.0	6.0	1.0	1.0	4.0	1.0	1.0	1.0
Movies	22.0	NaN	4.0	5.0	1.0	2.0	3.0	1.0	2.0	1.0
Music & Musicals	147.0	96.0	36.0	14.0	8.0	6.0	6.0	1.0	8.0	3.0
Reality TV	123.0	6.0	35.0	9.0	2.0	9.0	3.0	4.0	3.0	3.0
Romantic Movies	225.0	120.0	38.0	25.0	22.0	7.0	11.0	2.0	10.0	8.0
Romantic TV Shows	44.0	12.0	11.0	2.0	2.0	21.0	9.0	77.0	1.0	5.0
Sci-Fi & Fantasy	181.0	12.0	35.0	28.0	10.0	9.0	11.0	5.0	13.0	6.0
Science & Nature TV	49.0	NaN	27.0	4.0	1.0	NaN	1.0	NaN	3.0	NaN
Spanish-Language TV Shows	29.0	NaN	1.0	NaN	NaN	NaN	41.0	NaN	NaN	47.0

country listed_in	United States	India	United Kingdom	Canada	France	Japan	Spain	South Korea	Germany	Mexico
Sports Movies	113.0	17.0	21.0	13.0	12.0	1.0	5.0	NaN	5.0	3.0
Stand-Up Comedy	216.0	6.0	21.0	2.0	5.0	NaN	1.0	2.0	5.0	18.0
Stand-Up Comedy & Talk Shows	33.0	3.0	1.0	NaN	1.0	1.0	NaN	4.0	1.0	1.0
TV Action & Adventure	94.0	5.0	9.0	12.0	6.0	5.0	4.0	9.0	2.0	7.0
TV Comedies	258.0	26.0	44.0	30.0	24.0	10.0	5.0	19.0	5.0	4.0
TV Dramas	232.0	28.0	36.0	32.0	27.0	21.0	11.0	38.0	19.0	12.0
TV Horror	37.0	7.0	2.0	8.0	3.0	5.0	NaN	3.0	NaN	NaN
TV Mysteries	51.0	2.0	2.0	9.0	2.0	4.0	NaN	3.0	2.0	NaN
TV Sci-Fi & Fantasy	60.0	3.0	4.0	9.0	1.0	NaN	NaN	NaN	1.0	1.0
TV Shows	4.0	3.0	NaN	NaN	NaN	1.0	NaN	NaN	NaN	NaN
TV Thrillers	27.0	3.0	2.0	5.0	3.0	6.0	NaN	1.0	NaN	NaN
Teen TV Shows	33.0	1.0	NaN	2.0	NaN	14.0	1.0	NaN	NaN	NaN
Thrillers	292.0	92.0	61.0	49.0	44.0	5.0	38.0	14.0	28.0	2.0

In [35]:
```
plt.figure(figsize=(10,10))
sns.heatmap(data=top10_country_genres_pivot,
            annot=True,
            fmt=".0f",
            vmin = 20,
            vmax = 250)
plt.title('Genre-wise content distribution in Top-10 countries')
plt.xlabel('Top 10 Countries')
plt.ylabel('Genres')
plt.show()
```


Genre-wise content distribution in Top-10 countries
Genres
Top 10 Countries
United States
India
United Kingdom
Canada
France
Japan
Spain
South Korea
Germany
Mexico
Action & Adventure 404 137 84 44 37 57 10 17 33 9
Anime Features 7 61
Anime Series 18 2 143 1
British TV Shows 24 3 225 3 2 1 5 6
Children & Family Movies 390 26 46 80 23 19 9 10 17 5
Classic & Cult TV 17 7 4 2
Classic Movies 81 11 16 6 3 1 1
Comedies 680 323 91 94 51 9 47 17 42 24
Crime TV Shows 145 9 48 15 23 16 27 24 15 32
Cult Movies 52 5 7 6 2 1 1 4
Documentaries 511 27 127 42 44 7 21 2 21 18
Docuseries 192 9 89 11 7 2 9 8 3
Dramas 835 662 196 82 167 23 76 26 80 44
Faith & Spirituality 42 4 5 3 3 3 1 1
Horror Movies 201 35 28 36 10 4 10 5 7 8
Independent Movies 390 167 74 44 73 7 20 2 31 23
International Movies 166 864 168 60 207 72 140 44 94 70
International TV Shows 74 66 128 25 43 151 54 152 35 43
Kids' TV 214 12 43 61 43 29 4 16 8 4
Korean TV Shows 3 1 132
LGBTQ Movies 63 2 7 6 1 1 4 1 1 1
Movies 22 4 5 1 2 3 1 2 1
Music & Musicals 147 96 36 14 8 6 6 1 8 3
Reality TV 123 6 35 9 2 9 3 4 3 3
Romantic Movies 225 120 38 25 22 7 11 2 10 8
Romantic TV Shows 44 12 11 2 2 21 9 77 1 5
Sci-Fi & Fantasy 181 12 35 28 10 9 11 5 13 6
Science & Nature TV 49 27 4 1 1 3
Spanish-Language TV Shows 29 1 41 47
Sports Movies 113 17 21 13 12 1 5 5 3
Stand-Up Comedy 216 6 21 2 5 1 2 5 18
Stand-Up Comedy & Talk Shows 33 3 1 1 1 4 1 1
TV Action & Adventure 94 5 9 12 6 5 4 9 2 7
TV Comedies 258 26 44 30 24 10 5 19 5 4
TV Dramas 232 28 36 32 27 21 11 38 19 12
TV Horror 37 7 2 8 3 5 3
TV Mysteries 51 2 2 9 2 4 3 2
TV Sci-Fi & Fantasy 60 3 4 9 1 1 1
TV Shows 4 3 1
TV Thrillers 27 3 2 5 3 6 1
Teen TV Shows 33 1 2 14 1
Thrillers 292 92 61 49 44 5 38 14 28 2
250
200
150
100
50

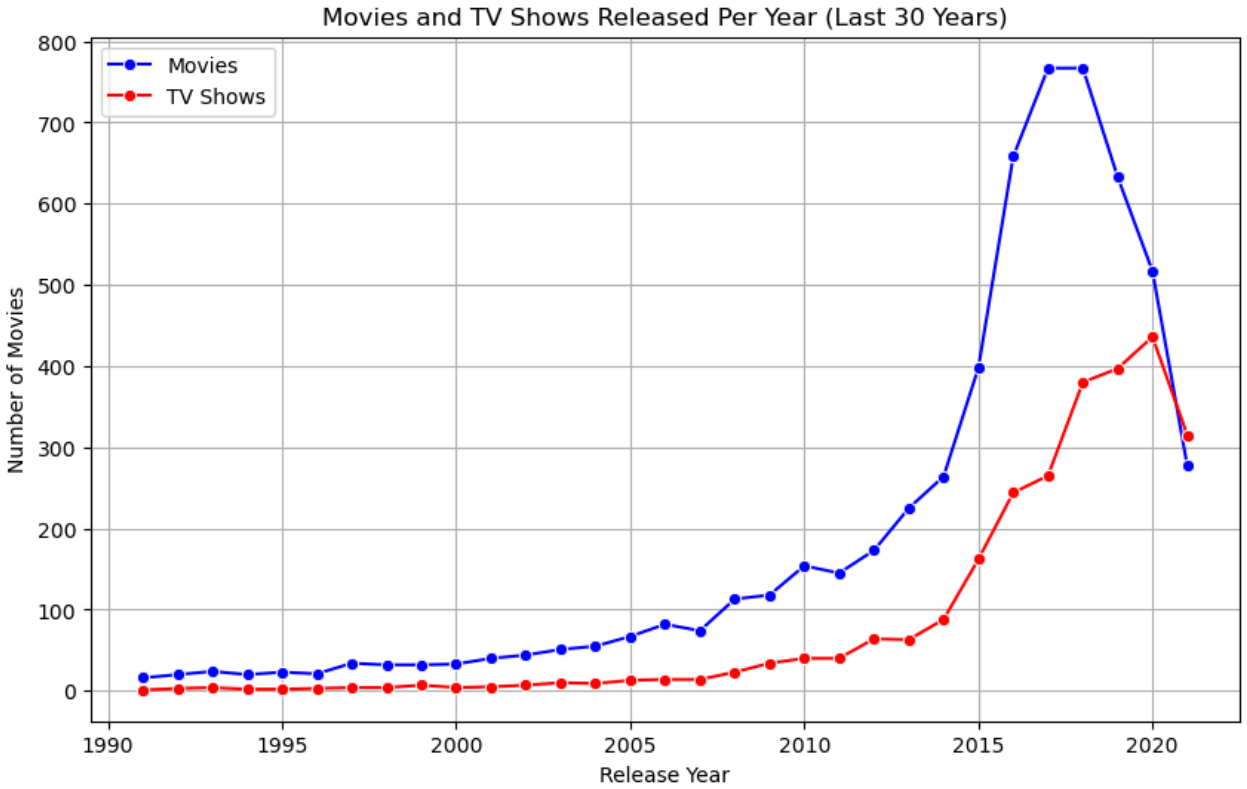
Insights:

1. Some popular genres across all countries are Dramas, Comedies and Action films.
2. United States seems to be diversifing its content into almost all the genres, with major focus on Documentaries, Comedies, Dramas, etc.
3. Popular genres in India are Dramas and International Movies.

Temporal Trends

3.1 How has the number of releases per year evolved over time?

In [45]:
```
last_30_years_movies = df[(df['type'] == 'Movie') & (df['release_year'] >= df['release_year'].max() - 30)]
last_30_years_tv_shows = df[(df['type'] == 'TV Show') & (df['release_year'] >= df['release_year'].max() - 30)]

movies_per_year = last_30_years_movies.groupby('release_year')['show_id'].nunique()
tv_shows_per_year = last_30_years_tv_shows.groupby('release_year')['show_id'].nunique()

plt.figure(figsize=(10, 6))
sns.lineplot(x=movies_per_year.index, y=movies_per_year.values, marker='o', color='b', label='Movies')
sns.lineplot(x=tv_shows_per_year.index, y=tv_shows_per_year.values, marker='o', color='r', label='TV Shows')
plt.title('Movies and TV Shows Released Per Year (Last 30 Years)')
plt.xlabel('Release Year')
plt.ylabel('Number of Movies')
plt.grid(True)
plt.show()
```



Insights:

Again, Netflix's prference is to producing more Movies over TV Shows. The sudden decrease in the number of Movies and TV Shows released after 2019 shows the drastic effect of COVID-19 Pandemic.

3.2 Which countries are adding more and more content on Netflix with time?

In [37]:
```
countries_date_added = df[['show_id','type','country','date_added']]
countries_date_added['year_added'] = countries_date_added['date_added'].dt.year
countries_date_added = countries_date_added[countries_date_added['country'].isin(top10_countries)]
countries_date_added = countries_date_added.groupby(['country','year_added'])['show_id'].nunique().reset_index(name='count')
countries_date_added
```

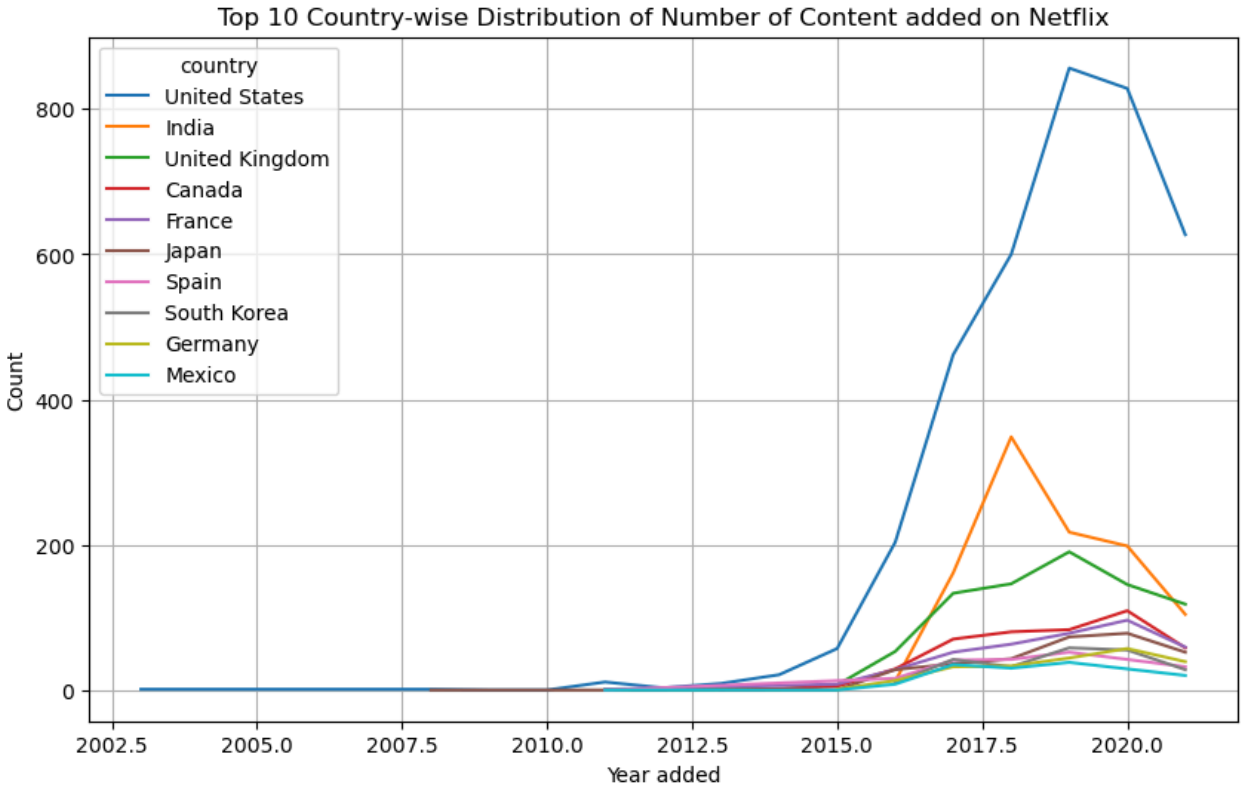
Out[37]:

	country	year_added	count
0	Canada	2013	1
1	Canada	2014	3
2	Canada	2015	6
3	Canada	2016	30
4	Canada	2017	71
...	...	...	...
80	United States	2017	462
81	United States	2018	600
82	United States	2019	856
83	United States	2020	828
84	United States	2021	627

85 rows × 3 columns

In [38]:

```
plt.figure(figsize=(10,6))
sns.lineplot(data=countries_date_added, x='year_added', y='count', hue='country', hue_order=top10_countries)
plt.title('Top 10 Country-wise Distribution of Number of Content added on Netflix')
plt.xlabel('Year added')
plt.ylabel('Count')
plt.grid(True)
plt.show()
```



Insights:

United States leads the production of content on Netflix. However, India has seen a sudden rise in production of content after 2015.

3.3 How has the duration of movies changed with time? Is there any influence of countries?

In [39]:
```
countries_duration = movies[['country','release_year','duration']].drop_duplicates().reset_index(drop=True)
countries_duration = countries_duration[countries_duration['country'].isin(top10_countries_movies[:5])]
countries_duration
```

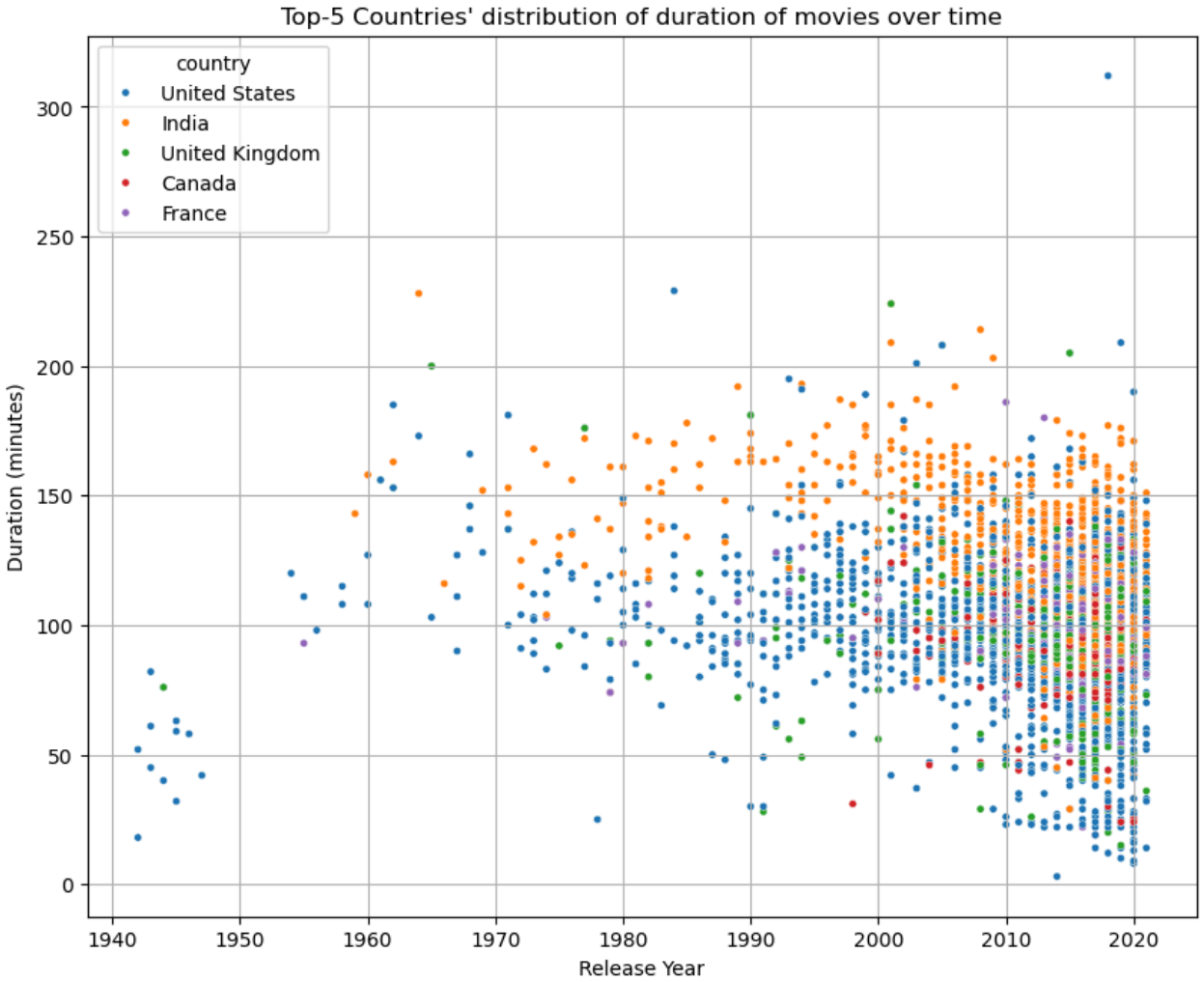
Out[39]:

	country	release_year	duration
0	United States	2020	90
2	United States	1993	125
5	United Kingdom	1993	125
8	United States	2021	104
15	India	1998	166
...	...	...	...
5624	United States	2011	94
5626	United States	2005	88
5628	France	2016	98
5631	United States	2006	88
5632	India	2015	111

2945 rows × 3 columns

In [40]:

```
plt.figure(figsize=(10,8))
sns.scatterplot(data=countries_duration,
                x='release_year',
                y='duration',
                hue='country',
                hue_order=top10_countries[:5],
                s=15)
plt.title("Top-5 Countries' distribution of duration of movies over time")
plt.xlabel('Release Year')
plt.ylabel('Duration (minutes)')
plt.grid(True)
plt.show()
```



Insights:

1. The duration of movies has been shrunk over the years, with users prefering a median duration of 100 minutes (almost 1.5 hours).
2. Indian movie durations are relatively higher by almost 50 minutes than US movie durations.

3.4 Are there any seasonal trends in addition of content to Netflix?

In [41]:
```
date_added_genres = df[['show_id','date_added','listed_in']]
date_added_genres['month_added'] = date_added_genres['date_added'].dt.month_name()
date_added_genres = date_added_genres.drop_duplicates().reset_index(drop=True)
```

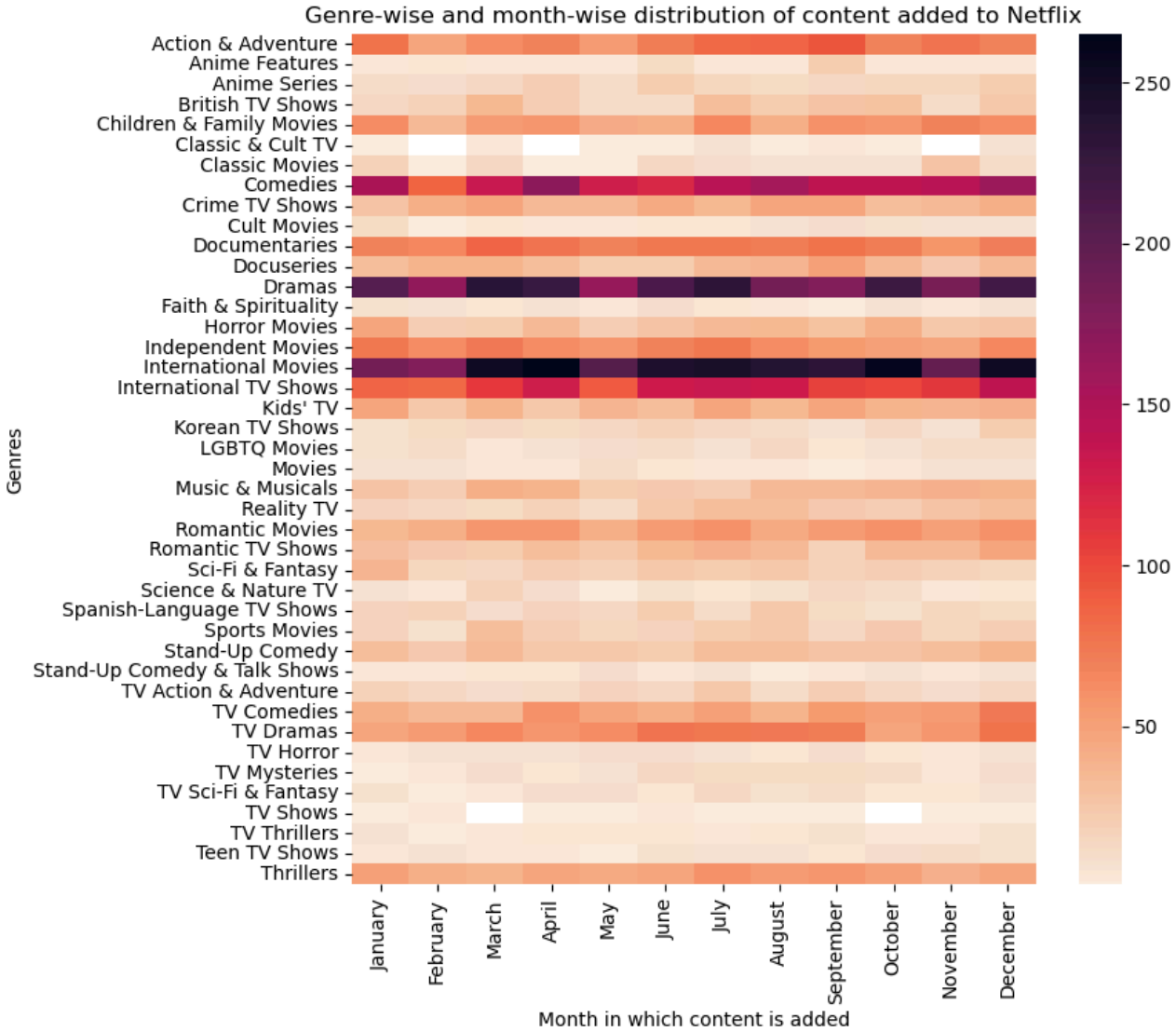
```
date_added_genres = date_added_genres.groupby(['month_added','listed_in'])['show_id'].nunique().reset_index(name='count')
date_added_genres = date_added_genres.pivot_table(index='listed_in',columns='month_added',values='count')
date_added_genres = date_added_genres[['January','February','March','April','May','June','July','August','September','October','November','December']]
date_added_genres
```

Out[41]:

month_added listed_in	January	February	March	April	May	June	July	August	September	October	November	December
Action & Adventure	79.0	46.0	61.0	70.0	54.0	72.0	83.0	86.0	93.0	69.0	78.0	68.0
Anime Features	4.0	5.0	3.0	4.0	4.0	12.0	4.0	3.0	21.0	4.0	3.0	4.0
Anime Series	11.0	9.0	13.0	20.0	10.0	22.0	15.0	12.0	13.0	15.0	15.0	21.0
British TV Shows	13.0	18.0	36.0	20.0	10.0	11.0	32.0	22.0	27.0	28.0	11.0	25.0
Children & Family Movies	63.0	33.0	53.0	56.0	43.0	42.0	65.0	41.0	59.0	57.0	67.0	62.0
Classic & Cult TV	2.0	NaN	3.0	NaN	1.0	2.0	6.0	2.0	3.0	2.0	NaN	7.0
Classic Movies	18.0	2.0	14.0	2.0	1.0	13.0	9.0	7.0	6.0	7.0	27.0	10.0
Comedies	152.0	87.0	134.0	170.0	129.0	121.0	145.0	156.0	139.0	139.0	142.0	160.0
Crime TV Shows	27.0	42.0	47.0	35.0	34.0	45.0	36.0	48.0	48.0	31.0	35.0	42.0
Cult Movies	12.0	1.0	5.0	4.0	3.0	5.0	5.0	7.0	9.0	8.0	6.0	6.0
Documentaries	68.0	64.0	86.0	78.0	68.0	76.0	76.0	72.0	79.0	73.0	58.0	71.0
Docuseries	31.0	39.0	39.0	30.0	21.0	21.0	35.0	38.0	50.0	35.0	23.0	33.0
Dramas	204.0	166.0	235.0	224.0	164.0	212.0	234.0	186.0	178.0	223.0	183.0	218.0
Faith & Spirituality	8.0	7.0	5.0	7.0	3.0	9.0	5.0	3.0	2.0	6.0	3.0	7.0
Horror Movies	48.0	20.0	21.0	33.0	19.0	26.0	34.0	36.0	28.0	42.0	24.0	26.0
Independent Movies	76.0	62.0	74.0	61.0	57.0	70.0	75.0	62.0	55.0	51.0	47.0	66.0
International Movies	187.0	176.0	254.0	265.0	205.0	241.0	245.0	238.0	234.0	259.0	195.0	253.0
International TV Shows	86.0	83.0	109.0	128.0	91.0	130.0	135.0	131.0	104.0	103.0	110.0	141.0
Kids' TV	46.0	25.0	39.0	25.0	37.0	31.0	48.0	36.0	47.0	39.0	38.0	40.0
Korean TV Shows	8.0	12.0	14.0	12.0	14.0	17.0	13.0	11.0	7.0	14.0	7.0	22.0
LGBTQ Movies	8.0	10.0	3.0	6.0	9.0	11.0	7.0	14.0	5.0	7.0	11.0	11.0
Movies	7.0	6.0	3.0	3.0	10.0	5.0	3.0	3.0	1.0	4.0	6.0	6.0
Music & Musicals	26.0	19.0	41.0	39.0	22.0	23.0	20.0	35.0	34.0	37.0	40.0	39.0
Reality TV	16.0	14.0	12.0	17.0	10.0	25.0	32.0	30.0	23.0	19.0	26.0	31.0
Romantic Movies	36.0	42.0	57.0	57.0	41.0	54.0	60.0	45.0	54.0	60.0	51.0	59.0
Romantic TV Shows	29.0	23.0	21.0	32.0	24.0	36.0	40.0	33.0	17.0	35.0	33.0	47.0
Sci-Fi & Fantasy	38.0	15.0	14.0	20.0	17.0	24.0	21.0	25.0	17.0	19.0	18.0	15.0
Science & Nature TV	7.0	4.0	17.0	9.0	2.0	8.0	5.0	8.0	13.0	10.0	4.0	5.0
Spanish-Language TV Shows	16.0	17.0	9.0	16.0	13.0	21.0	11.0	24.0	12.0	8.0	15.0	12.0

month_added listed_in	January	February	March	April	May	June	July	August	September	October	November	December
Sports Movies	16.0	8.0	30.0	19.0	15.0	16.0	21.0	24.0	13.0	23.0	15.0	19.0
Stand-Up Comedy	32.0	23.0	33.0	24.0	25.0	22.0	30.0	31.0	26.0	26.0	32.0	39.0
Stand-Up Comedy & Talk Shows	3.0	3.0	5.0	5.0	9.0	3.0	6.0	2.0	3.0	6.0	4.0	7.0
TV Action & Adventure	17.0	13.0	9.0	11.0	16.0	14.0	24.0	10.0	19.0	13.0	9.0	13.0
TV Comedies	42.0	35.0	33.0	60.0	47.0	41.0	51.0	39.0	55.0	50.0	54.0	74.0
TV Dramas	48.0	53.0	64.0	56.0	61.0	78.0	75.0	74.0	73.0	46.0	56.0	79.0
TV Horror	4.0	6.0	6.0	6.0	9.0	9.0	6.0	5.0	9.0	5.0	3.0	7.0
TV Mysteries	2.0	4.0	9.0	5.0	6.0	14.0	12.0	12.0	12.0	10.0	3.0	9.0
TV Sci-Fi & Fantasy	8.0	1.0	3.0	9.0	9.0	5.0	14.0	8.0	10.0	5.0	5.0	7.0
TV Shows	1.0	3.0	NaN	1.0	1.0	3.0	1.0	1.0	1.0	NaN	2.0	2.0
TV Thrillers	6.0	2.0	3.0	5.0	5.0	5.0	3.0	5.0	8.0	4.0	3.0	8.0
Teen TV Shows	3.0	6.0	3.0	4.0	1.0	8.0	6.0	6.0	5.0	9.0	10.0	8.0
Thrillers	51.0	42.0	39.0	47.0	45.0	47.0	60.0	53.0	56.0	50.0	40.0	47.0

In [42]:
```
plt.figure(figsize=(8,8))
sns.heatmap(data=date_added_genres, cmap='rocket_r')
plt.title('Genre-wise and month-wise distribution of content added to Netflix')
plt.xlabel('Month in which content is added')
plt.ylabel('Genres')
plt.show()
```



Insights:

Based on this heatmap, Netflix seems to be consistent in producing almost same number of content in each month. Dramas, Comedies, International Movies and TV Shows seem to have an all-time high demand.

3.5 Exploration of delay in content addition to Netflix after its release

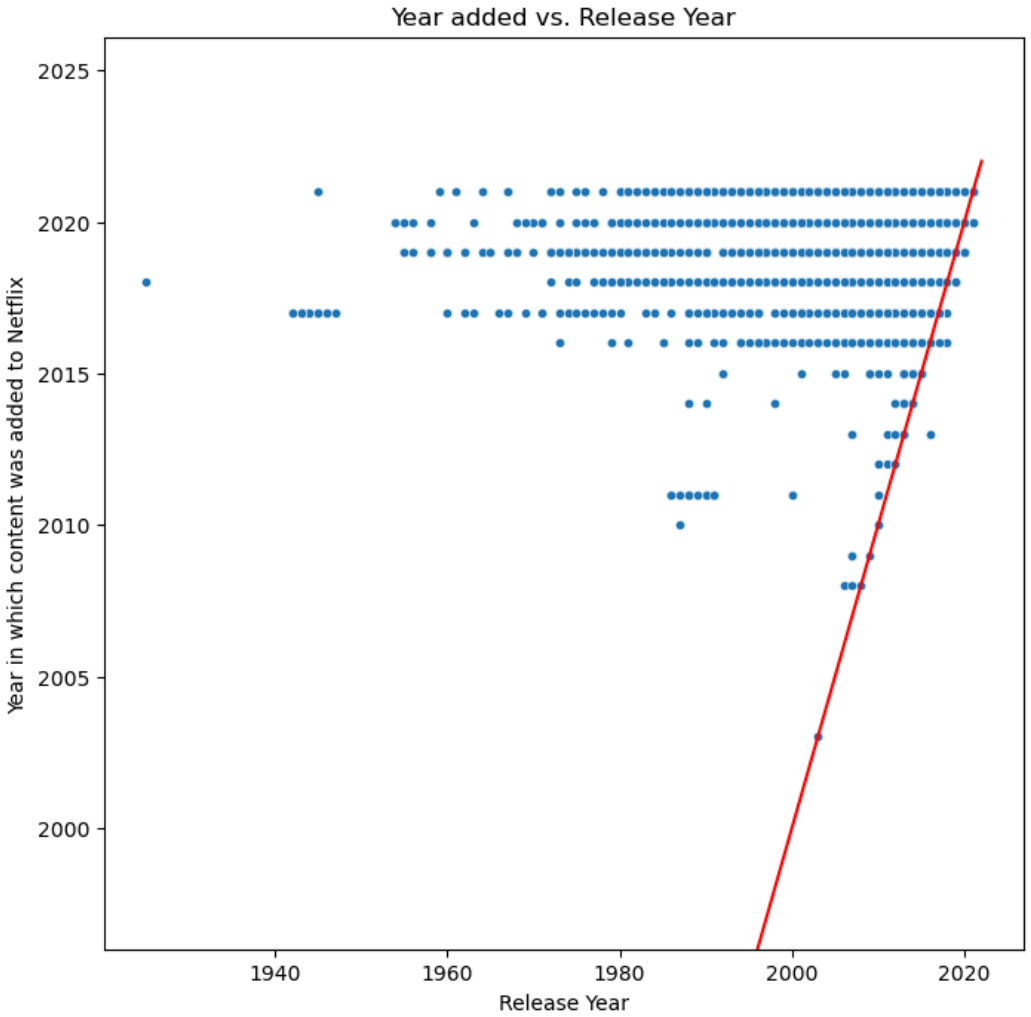
In [43]:
```
date_added_release_year = df[['show_id','type','release_year','date_added']].drop_duplicates().reset_index(drop=True)
date_added_release_year['year_added'] = date_added_release_year['date_added'].dt.year
date_added_release_year.drop('date_added',axis=1,inplace=True)
date_added_release_year
```

Out[43]:

	show_id	type	release_year	year_added
0	s1	Movie	2020	2021
1	s2	TV Show	2021	2021
2	s3	TV Show	2021	2021
3	s4	TV Show	2021	2021
4	s5	TV Show	2021	2021
...	...	...	...	...
8802	s8803	Movie	2007	2019
8803	s8804	TV Show	2018	2019
8804	s8805	Movie	2009	2019
8805	s8806	Movie	2006	2020
8806	s8807	Movie	2015	2019

8807 rows × 4 columns

In [46]:
```
plt.figure(figsize=(8,8))
sns.scatterplot(data=date_added_release_year,
                x='release_year',
                y='year_added',
                s=20)
plt.plot([1940,2022],[1940,2022], color='r')
plt.ylim(bottom=1996)
plt.title('Year added vs. Release Year')
plt.xlabel('Release Year')
plt.ylabel('Year in which content was added to Netflix')
plt.show()
```



Insights:

Over the red line, the release year is the same as year in which content was added to Netflix. But most of the content on Netflix has been added post 2015, irrespective of the release year, even though Netflix was founded in 1997. Netflix seems to be delaying the addition of content to its platform.

Business Recommendations

1. As there is much lesser proportion of TV Shows globally, Netflix should invest in hiring good writers to create high-quality TV Shows which can drive binge-watching and thus, user retention.

2. A focus on tailoring durations of movies according to genre is recommended. Users seem to prefer short and light movies in the comedy genre, whereas dramas and action films need longer durations to keep the viewer hitched to the story. Studying user completion data can also help to adjust durations of future movies.
3. Netflix should keep producing one-season TV Shows, with a focus on robust, binge-worthy stories. Another ways to have multi-season TV Shows are Anthologies or Mini-Series. Shows such as Black Mirror or Modern Love, are produced such that each episode is a standalone short-film, so the users can randomly watch any episode at any time.
4. Netflix is currently mostly producing content suitable for Mature Audiences, or content which requires parental guidance. Instead, They should focus more on producing 'General', family-friendly content, which can be consumed by a relatively much larger population.
5. Netflix should consider producing regional content, simultaneously inculcating the regional storytelling arts and culture, as is done with Japanese Anime and South Korean Dramas.
6. China, the second most populated country, has a huge potential of business. Despite that, China is not present in top 10 countries. Netflix should consider producing China-specific content and also collaborate with Chinese Government and writers to tap a new class of customers.
7. Netflix can capitalize over global holidays such as Christmas or Diwali (during October to December), by scheduling major releases.
8. Based on the decreasing duration of movies over the years, Netflix should focus on producing more short-films of 90-100 minutes durations. Here, a large focus will need to be given to an engaging and no-nonsense storyline, for a shorter-yet-stronger content.
9. A large delay in accquiring and adding a content on its platform after its release is not beneficial. This discourages users who are looking for high-demand content, and can cause user attrition to different competitor platforms. One solution to this is that Netflix can increase its investment to 'Netflix Originals', to ensure timely releases and exclusivity.

In [ ]: