In [68]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import plotly.express as px
from plotly.subplots import make_subplots

import random

import warnings
warnings.filterwarnings("ignore")

sns.set_style("darkgrid")
```

In [69]:
```
df = pd.read_csv("data exploration.csv")
```

Problem Statement

Which type of shows/movies to produce: Understanding the preferences and trends of viewers to create content that attracts more subscribers and retains existing ones.

Initial Data Exploration

In [70]:
```
df.shape
```

Out[70]:
```
(8807, 12)
```

In [71]:
```
df.info()
```

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

In [72]:
```
df.head(10)
```

Out[72]:

	show_id	type	title	director	cast	country	date_added	release_year	rating	duratio
0	s1	Movie	Dick Johnson Is Dead	Kirsten Johnson	NaN	United States	September 25, 2021	2020	PG-13	90 mi
1	s2	TV Show	Blood & Water	NaN	Ama Qamata, Khosi Ngema, Gail Mabalane, Thaban...	South Africa	September 24, 2021	2021	TV-MA	Seasor
2	s3	TV Show	Ganglands	Julien Leclercq	Sami Bouajila, Tracy Gotoas, Samuel Jouy, Nabi...	NaN	September 24, 2021	2021	TV-MA	Seasc
3	s4	TV Show	Jailbirds New Orleans	NaN	NaN	NaN	September 24, 2021	2021	TV-MA	Seasc
4	s5	TV Show	Kota Factory	NaN	Mayur More, Jitendra Kumar, Ranjan Raj, Alam K...	India	September 24, 2021	2021	TV-MA	Seasor
5	s6	TV Show	Midnight Mass	Mike Flanagan	Kate Siegel, Zach Gilford, Hamish Linklater, H...	NaN	September 24, 2021	2021	TV-MA	Seasc
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 mi
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 mi
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	Seasor
9	s10	Movie	The Starling	Theodore Melfi	Melissa McCarthy, Chris O'Dowd, Kevin Kline, T...	United States	September 24, 2021	2021	PG-13	104 mi

1. We can convert `date_added` to datetime, then extract yearly, monthly, weekly columns

2. Convert Duration into numerical column.
3. Need to unnest the cast, director, country and listed_in columns.
4. We can drop Description and Title column as they are unique columns.

Let's check how much missing data is present:

In [73]:
```
pd.concat([df.isna().sum(),(df.isna().sum()/len(df))*100], axis = 1)
```

Out[73]:

	0	1
show_id	0	0.000000
type	0	0.000000
title	0	0.000000
director	2634	29.908028
cast	825	9.367549
country	831	9.435676
date_added	10	0.113546
release_year	0	0.000000
rating	4	0.045418
duration	3	0.034064
listed_in	0	0.000000
description	0	0.000000

We can see almost 30% of director data and approx 10% of both cast and country are missing, Except the above mentioned columns date_added, duration and rating has some missing values but they don't amount to much

Let's check if any row is duplicated?

In [74]:
```
df.duplicated().sum()
```

Out[74]:
```
0
```

Let's check some statistical data

In [75]:
```
df.describe()
```

Out[75]:

	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

- Min value of `release_year` is 1925, so some TV Shows or Movies are present that are almost 95 years old
- Only 25% of records that are present in this dataset were released before 2013. So,we have a lot of data that were released in the past decade

In [76]:
```
df.describe(include = 'object')
```

Out[76]:

	show_id	type	title	director	cast	country	date_added	rating	duration	listed_i
count	8807	8807	8807	6173	7982	7976	8797	8803	8804	880
unique	8807	2	8807	4528	7692	748	1767	17	220	51
top	s1	Movie	Dick Johnson Is Dead	Rajiv Chilaka	David Attenborough	United States	January 1, 2020	TV-MA	1 Season	Drama Internation Movie
freq	1	6131	1	19	19	2818	109	3207	1793	36

- Rajiv Chilaka is has directed most Movies or TV Shows
- Most of the TV Shows or Movies were available in United States
- David Attenborough has worked in most Movies or TV Shows
- Even this particular `"Paranormal activity at a lush...."` description has been repeated four times in Movies/TV Shows. It can suspected that other descrptions are also be repeated
- One thing to Note as we have not yet **unnested the data** these above basic insights might not hold true

In [77]:
```
df.loc[df.duplicated('description',keep = False)].sort_values('description')
```

Out[77]:

	show_id	type	title	director	cast	country	date_added	rel
78	s79	Movie	Tughlaq Durbar	Delhiprasad Deenadayalan	Vijay Sethupathi, Parthiban, Raashi Khanna	NaN	September 11, 2021	
79	s80	Movie	Tughlaq Durbar (Telugu)	Delhiprasad Deenadayalan	Vijay Sethupathi, Parthiban, Raashi Khanna	NaN	September 11, 2021	
7022	s7023	Movie	Hum Saath-Saath Hain	Sooraj R. Barjatya	Salman Khan, Karisma Kapoor, Saif Ali Khan, Ta...	India	January 1, 2018	
2969	s2970	Movie	Together For Eternity	Sooraj R. Barjatya	Salman Khan, Karisma Kapoor,	India	February 1, 2020	

Description column helped to find the repeated Movies/TV Shows or the Movies/TV Shows that were released in other languages

Unnesting the Columns

In [78]:
```
final_df = df.copy()
```

In [79]:
```
def remove_spaces(x):
    if x != x:
        return np.nan
    return x.strip()

def unnesting (new_df,col):

    dataframe =new_df.copy()
    dataframe[col] = dataframe[col].str.split(',')
    dataframe = dataframe.explode(col)
    dataframe[col] = dataframe[col].apply(remove_spaces)
    return dataframe
```

In [80]:
```
%%time
final_df = unnesting(df,'cast')
print('After splitting cast into muliple rows', final_df.shape)
final_df = unnesting(final_df,'country')
print('After splitting country into muliple rows', final_df.shape)
final_df = unnesting(final_df,'listed_in')
print('After splitting listed_in into muliple rows', final_df.shape)
final_df = unnesting(final_df,'director')
print('After splitting listed_in into muliple rows', final_df.shape)


final_df = final_df.reset_index(drop = True)
```

```
After splitting cast into muliple rows (64951, 12)
After splitting country into muliple rows (81741, 12)
After splitting listed_in into muliple rows (186399, 12)
After splitting listed_in into muliple rows (202065, 12)
CPU times: total: 906 ms
Wall time: 1.18 s
```

Handling Missing Data

In [81]:
```
pd.concat([final_df.isna().sum(),(final_df.isna().sum()/len(final_df))*100], axis = 1
```

Out[81]:

	0	1
show_id	0	0.000000
type	0	0.000000
title	0	0.000000
director	50643	25.062727
cast	2149	1.063519
country	11897	5.887709
date_added	158	0.078193
release_year	0	0.000000
rating	67	0.033158
duration	3	0.001485
listed_in	0	0.000000
description	0	0.000000

In [82]:
```
#Smart Imputations is done here
# mode of country grouped by director is imputed for missing values in country
# director_country = (final_df.groupby('director')['country'].\
#                     agg(lambda x: x.mode()[0] if len(x.mode()) > 1 else x.mode())).

# # final_df['country1'] = final_df.apply(lambda x: director_country.get(x['director'
# final_df['country'] = final_df['country'].fillna(final_df['director'].map(director_
```

In [83]:
```
final_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 202065 entries, 0 to 202064
Data columns (total 12 columns):
 #   Column        Non-Null Count   Dtype 
---  ------        --------------   ----- 
 0   show_id       202065 non-null  object
 1   type          202065 non-null  object
 2   title         202065 non-null  object
 3   director      151422 non-null  object
 4   cast          199916 non-null  object
 5   country       190168 non-null  object
 6   date_added    201907 non-null  object
 7   release_year  202065 non-null  int64 
 8   rating        201998 non-null  object
 9   duration      202062 non-null  object
 10  listed_in     202065 non-null  object
 11  description   202065 non-null  object
dtypes: int64(1), object(11)
memory usage: 18.5+ MB
```

In [84]:
```
final_df['country']=final_df['country'].fillna('Unknown Country')
final_df['cast']=final_df['cast'].fillna('Unknown Actor')
final_df['director'] = final_df['director'].fillna('Unknown Director')
final_df['listed_in']  = final_df['listed_in'].fillna('Unknown Genre')
final_df['rating'] = final_df['rating'].fillna('Unknown Rating')
final_df['duration'] = final_df['duration'].fillna(0)
```

Feature Engineering

Converted Date added to DateTime column and extracted dayname, day, month, year and week of the year

In [85]:
```
final_df['date_added'] = pd.to_datetime(final_df['date_added'].apply(lambda x: str(x)
final_df['dayname'] = final_df['date_added'].dt.day_name()
final_df['day'] = final_df['date_added'].dt.day
final_df['month'] = final_df['date_added'].dt.month_name()
final_df['year'] = final_df['date_added'].dt.year
final_df['week'] = final_df['date_added'].dt.isocalendar().week
final_df['year_diff'] = final_df['year'] - final_df['release_year']
final_df.drop(columns=['date_added'],inplace = True)
```

In [86]:
```
final_df.columns
```

Out[86]:
```
Index(['show_id', 'type', 'title', 'director', 'cast', 'country',
       'release_year', 'rating', 'duration', 'listed_in', 'description',
       'dayname', 'day', 'month', 'year', 'week', 'year_diff'],
      dtype='object')
```

In [87]:
```
def release_year_bins(x):
    if x <= 1960:
        return '<1960'
    elif x>1960 and x <= 1970:
        return '60s'
    elif x>1970 and x <= 1980:
        return '70s'
    elif x>1980 and x <= 1990:
        return '80s'
    else:
        return x

def days_bins(x):
    if x>=1 and x<=7:
        return '1st week'
    elif x>7 and x<=14:
        return '2nd week'
    elif x>14 and x<= 21:
        return '3rd week'
    else:
        return '4th week'
```

In [88]:
```
final_df['release_year_bins'] = final_df['release_year'].apply(release_year_bins)
final_df['days_bins'] = final_df['day'].apply(days_bins)
```

Converted Duration column from object to numerical column

In [89]:
```
#converting the duration from object type to float
final_df['duration'] = final_df['duration'].str.split(' ',expand = True)[0].astype('f
```

Statistical Summary in unnested data:

In [90]:
```
final_df.describe()
```

Out[90]:

	release_year	duration	day	year	week	year_diff
count	202065.000000	202062.000000	201907.000000	201907.000000	201907.0	201907.000000
mean	2013.448950	77.687873	12.183431	2018.965440	26.698312	5.514420
std	9.013616	51.482097	9.847135	1.551654	15.051306	9.067137
min	1925.000000	1.000000	1.000000	2008.000000	1.0	-3.000000
25%	2012.000000	4.000000	1.000000	2018.000000	14.0	0.000000
50%	2016.000000	95.000000	12.000000	2019.000000	27.0	2.000000
75%	2019.000000	112.000000	20.000000	2020.000000	39.0	7.000000
max	2021.000000	312.000000	31.000000	2021.000000	53.0	93.000000

In [91]:
```
final_df.describe(include = 'object')
```

Out[91]:

	show_id	type	title	director	cast	country	rating	listed_in	description	dayname
count	202065	202065	202065	202065	202065	202065	202065	202065	202065	201907
unique	8807	2	8807	4994	36440	124	18	42	8775	7
top	s7165	Movie	Kahlil Gibran's The Prophet	Unknown Director	Unknown Actor	United States	TV-MA	Dramas	A troubled young girl and her mother find sola...	Friday
freq	700	145917	700	50643	2149	59350	73915	29806	700	58028

Here we cannot derive much inferences as due to nesting many records are duplicated

Non-Graphical Analysis: Value counts and unique attributes

In [92]:
```
# this function is to bold python output
def bold_text(text):
    bold_start = '\033[1m'
    bold_end = '\033[0m'
    return bold_start + text + bold_end
```

In [93]:
```
cols_list = ['type','director','cast','country','release_year','rating','duration','l
```

Value counts and unique attributes in original data

In [94]:
```
for i in cols_list:
    print(bold_text(i.upper()+':'))
    print(f'Number of unique elements in {i} is:\n {df[i].nunique()}\n')
    print(f'Unique elements present in {i} column is:\n {df[i].unique()}\n')
    print(f'Value Counts of {i} columns is:\n{df[i].value_counts()}\n\n\n')
```

```
TYPE:
Number of unique elements in type is:
 2

Unique elements present in type column is:
 ['Movie' 'TV Show']

Value Counts of type columns is:
type
Movie      6131
TV Show    2676
Name: count, dtype: int64



DIRECTOR:
Number of unique elements in director is:
 4528

Unique elements present in director column is:
```

Value counts and unique attributes in unnested data

In [95]:
```
cols_list = ['type','rating','director','cast','country','listed_in','release_year_bi
```

In [96]:
```
for i in cols_list:
    print(bold_text(i.upper()+':'))
    print(f'Number of unique elements in {i} is:\n {final_df[i].nunique()}\n')
    print(f'Unique elements present in {i} column is:\n {final_df[i].unique()}\n')
    print(f'Value Counts of {i} columns is:\n{final_df[i].value_counts()}\n\n\n')
```

```
TYPE:
Number of unique elements in type is:
 2

Unique elements present in type column is:
 ['Movie' 'TV Show']

Value Counts of type columns is:
type
Movie      145917
TV Show     56148
Name: count, dtype: int64



RATING:
Number of unique elements in rating is:
 18
```

Replacing values in Listed in

In [97]:
```
values = {
    'Dramas':'Drama','Comedies':'Comedy','TV Dramas':'Drama','TV Comedies':'Comedy',
    'Romantic Movies':'Romantic','Romantic TV Shows':'Romantic',
    'Crime TV Shows':'Crime','Horror Movies':'Horror',"Kids' TV":'Kids','Children & F
    'International Movies':'International','International TV Shows':'International',
    'Independent Movies':'Movies',
    'Music & Musicals':'Music','Anime Series':'Anime','TV Action & Adventure':'Action
    'Spanish-Language TV Shows':'Spanish','British TV Shows':'British','Sports Movies
    'TV Mysteries':'Mystery','Korean TV Shows':'Korean','Cult Movies':'Cult','TV Sci-
    'Anime Features':'Anime','TV Horror':'Horror','Docuseries':'Documentaries','TV Th
    'Reality TV':'Reality','Stand-Up Comedy':'Comedy','Stand-Up Comedy & Talk Shows':

}
final_df['listed_in'] = final_df['listed_in'].replace(values)
```

In [98]:
```
final_df['listed_in'].nunique()
```

Out[98]:
```
28
```

Dividing the dataset into two categories Movies and Shows

In [99]:
```
movies = final_df[final_df['type'] =='Movie']
shows = final_df[final_df['type'] == 'TV Show']
```

In [100]:
```
cols_list = ['type','rating','director','cast','country','listed_in','release_year_bi
```

In [101]:
```
for i in cols_list:
    print(bold_text(i.upper()+':'))
    print(f'Number of unique elements in {i} is:\n {movies[i].nunique()}\n')
    print(f'Unique elements present in {i} column is:\n {movies[i].unique()}\n')
    print(f'Value Counts of {i} columns is:\n{movies[i].value_counts()}\n\n\n')
```

```
TYPE:
Number of unique elements in type is:
 1

Unique elements present in type column is:
 ['Movie']

Value Counts of type columns is:
type
Movie    145917
Name: count, dtype: int64



RATING:
Number of unique elements in rating is:
 18

Unique elements present in rating column is:
```

In [102]:
```
for i in cols_list:
    print(bold_text(i.upper()+':'))
    print(f'Number of unique elements in {i} is:\n {shows[i].nunique()}\n')
    print(f'Unique elements present in {i} column is:\n {shows[i].unique()}\n')
    print(f'Value Counts of {i} columns is:\n{shows[i].value_counts()}\n\n\n')
```

```
TYPE:
Number of unique elements in type is:
 1

Unique elements present in type column is:
 ['TV Show']

Value Counts of type columns is:
type
TV Show    56148
Name: count, dtype: int64



RATING:
Number of unique elements in rating is:
 10

Unique elements present in rating column is:
```

In [103]:
```
print("Number of directors that directed both movies and shows are:",\
len(set(movies['director'].unique()).intersection(shows['director'].unique())) )
```

```
Number of directors that directed both movies and shows are: 84
```

In [104]:
```
print("Number of cast members that worked in both movies and shows are:",\
      len(set(movies['cast'].unique()).intersection(shows['cast'].unique())) )
```

```
Number of cast members that worked in both movies and shows are: 4376
```

Insights from Non Graphical Analysis:

Type:

There are Only Two types of Show -> Movies and TV Shows

b. Out of 8807 shows 6131 shows are Movies and 2676 shows are TV Shows

Rating:

a. There were a total of 17 ratings present for movies. Only 9 of which are ratings used in TV Shows

Director:

a. There were a total of 4528 directors in original dataset

b. There are a total of 4993 directors in the unnested dataset. Out of which 4777 directors worked in movies and only 299 directors worked in TV shows. Also, 84 directors directed both in Movies and TV Shows.

Cast:

a. There were a total of 7692 actors in original dataset

b. There are a total of 36439 casted actors/actress present in the unnested dataset. Out of which 25951 worked in movies and 14863 worked in TV Shows. Only 4376 worked both in Movies and TV Shows.

Country:

a. There were a total of 748 different values of clubbe country in original dataset

b. There are a total of 123 countries where these shows were available. Movies were accessible in 118 different countries and only 66 countries for TV Shows

Genre/Listed_in:

a. There are a total of 28 genres values of present in the dataset. Out of which 18 belong to Movies and 21 belong the TV shows

b. There are a total of 123 countries where these shows were available

c. Drama and International Genres have the highest number of movies and TV Shows.

Years:

a. These movies/TV Shows were released in 74 different years starting from 1925. First TV Shows that was realeased in the dataset was in year 1925 and Movie was in year 1942.

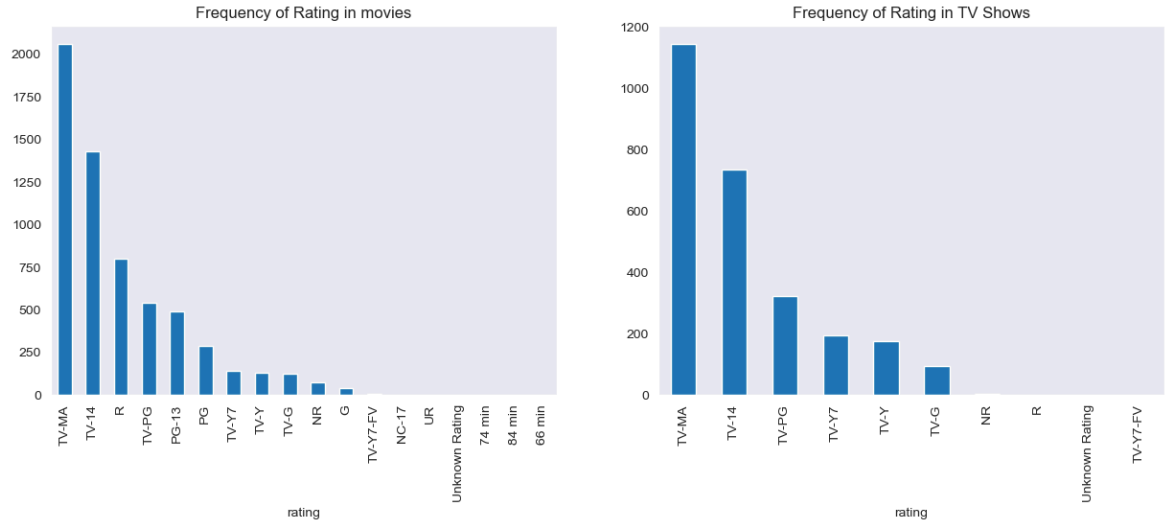
b. 75% of movies were released in the last decade and 75% of Shows were released in last 7 years.

c. Only from 2008 these tv shows/movies were added in the company. Most of the tv shows/movies were added in July following by December

Most of the tv shows/movies were released in Friday followed by Thursday

Visual Analysis - Univariate, Bivariate after pre-processing of the data

In [105]:
```
plt.figure(figsize =(15,5))

plt.subplot(1,2,1)
movies[['show_id','rating']].drop_duplicates(keep = 'first')['rating'].value_counts()
plt.title('Frequency of Rating in movies')
plt.grid()


plt.subplot(1,2,2)
shows[['show_id','rating']].drop_duplicates(keep = 'first')['rating'].value_counts().
plt.title('Frequency of Rating in TV Shows')
plt.grid()

plt.show()
```

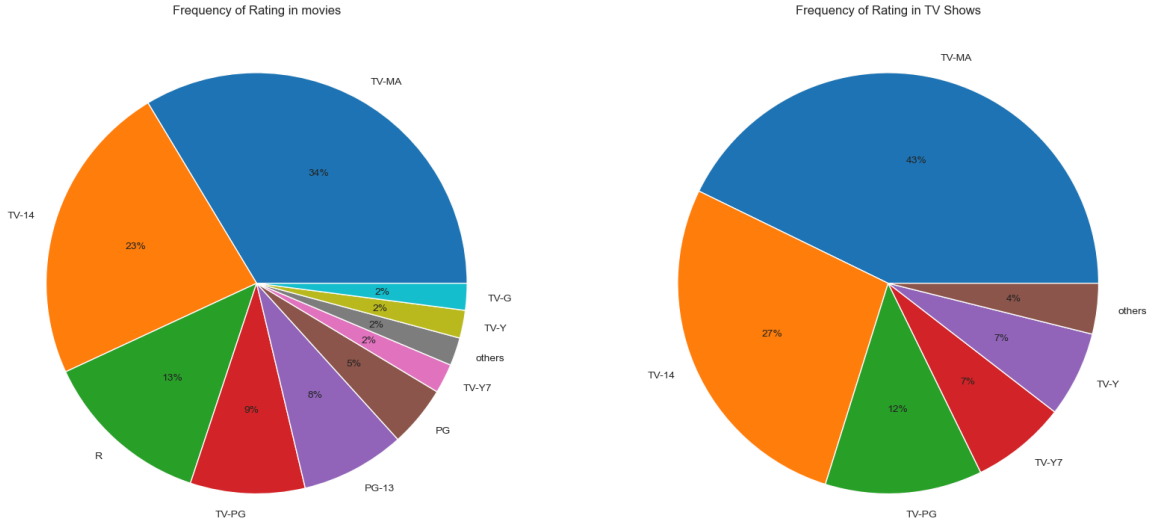


In [106]:
```
mrating_others = ['NR', 'G', 'TV-Y7-FV', 'NC-17', 'UR', 'Unknown Rating',
       '74 min', '84 min', '66 min']
srating_others = ['NR', 'R','TV-G',
       'Unknown Rating', 'TV-Y7-FV']

movies['rating_new'] = movies.rating.apply(lambda x: 'others' if x in mrating_others
shows['rating_new'] = shows.rating.apply(lambda x: 'others' if x in srating_others el
```

In [107]:
```
shows[['show_id','rating_new']].drop_duplicates(keep = 'first')['rating_new'].value_c
```

Out[107]:
```
Index(['TV-MA', 'TV-14', 'TV-PG', 'TV-Y7', 'TV-Y', 'others'], dtype='object', name
='rating_new')
```

In [108]:
```
plt.figure(figsize =(20,10))

plt.subplot(1,2,1)
mpie = movies[['show_id','rating_new']].drop_duplicates(keep = 'first')['rating_new']
plt.pie(mpie, labels= mpie.index, autopct='%.0f%%')
plt.title('Frequency of Rating in movies')


plt.subplot(1,2,2)
tpie = shows[['show_id','rating_new']].drop_duplicates(keep = 'first')['rating_new'].
plt.pie(tpie, labels= tpie.index, autopct='%.0f%%')
plt.title('Frequency of Rating in TV Shows')

plt.show()
```



Inferences from Rating:

a. Netlix caters to a lot of Mature audience, 34% of movies and 48% of tv shows that are avaiable content is for mature

b. 23% and 27% movies and tv shows rated respectively as TV-14 i.e. children under age of 14 are not suitable to watch, target audience been mid and late teens

c. There are around 13% R Rated movies.

d.There are only 4% movies and 14% of TV Shows available for kids(TV-Y and TV-Y7)

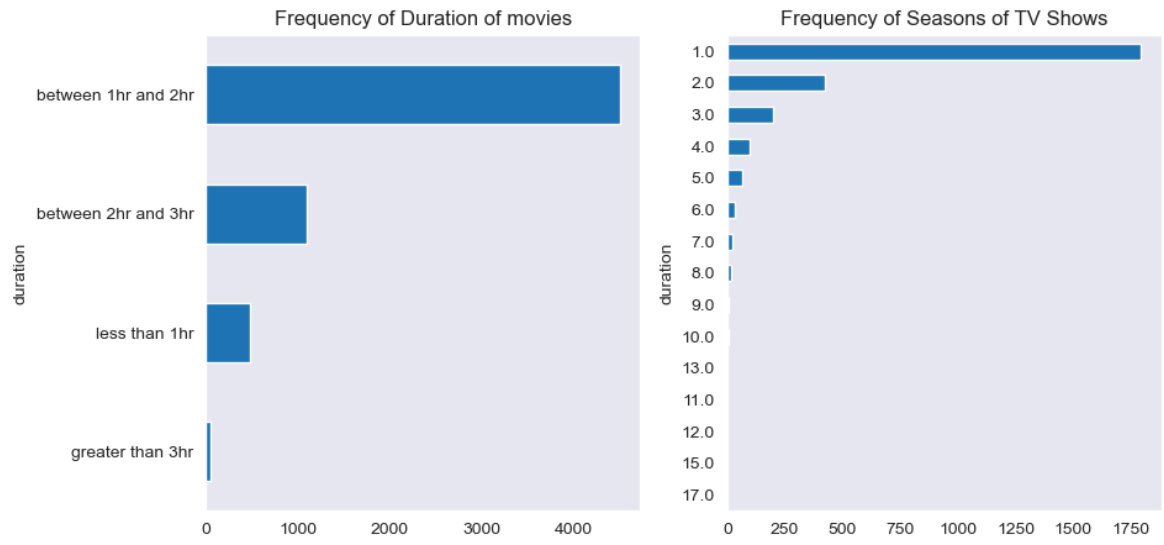
In [109]:
```
label = ['less than 1hr', 'between 1hr and 2hr','between 2hr and 3hr','greater than 3
movies_duration = movies.drop_duplicates(subset=['show_id','duration'], keep='first')
(pd.cut(movies.drop_duplicates(subset=['show_id','duration'], keep='first')['duration
                bins=[1,60,120,180,1000],
                labels = label
).value_counts()/len(movies_duration))*100
```

Out[109]:
```
duration
between 1hr and 2hr    73.381178
between 2hr and 3hr    17.860055
less than 1hr           7.943239
greater than 3hr        0.766596
Name: count, dtype: float64
```

In [110]:
```
shows_duration = shows[['show_id','duration']].drop_duplicates(keep = 'first')['durat
shows_duration.value_counts()#/len(shows_duration)*100
```

Out[110]:
```
duration
1.0     1793
2.0      425
3.0      199
4.0       95
5.0       65
6.0       33
7.0       23
8.0       17
9.0        9
10.0       7
13.0       3
15.0       2
12.0       2
11.0       2
17.0       1
Name: count, dtype: int64
```

In [111]:
```
#binning duration of movies
label = ['less than 1hr', 'between 1hr and 2hr','between 2hr and 3hr','greater than 3
movies_duration = movies.drop_duplicates(subset=['show_id','duration'], keep='first')
(pd.cut(movies.drop_duplicates(subset=['show_id','duration'], keep='first')['duration
                bins=[1,60,120,180,1000],
                labels = label
).value_counts()/len(movies_duration))*100

plt.figure(figsize =(10,5))
plt.subplot(1,2,1)
label = ['less than 1hr', 'between 1hr and 2hr','between 2hr and 3hr','greater than 3
plt.title('Frequency of Duration of movies')
pd.cut(movies.drop_duplicates(subset=['show_id','duration'], keep='first')['duration'
                bins=[1,60,120,180,1000],
                labels = label
).value_counts(ascending = True).plot(kind = 'barh')
plt.grid()

plt.subplot(1,2,2)
shows[['show_id','duration']].drop_duplicates(keep = 'first')['duration'].value_counts
plt.title('Frequency of Seasons of TV Shows')
plt.grid()

plt.show()
```



Inferences for Duration:

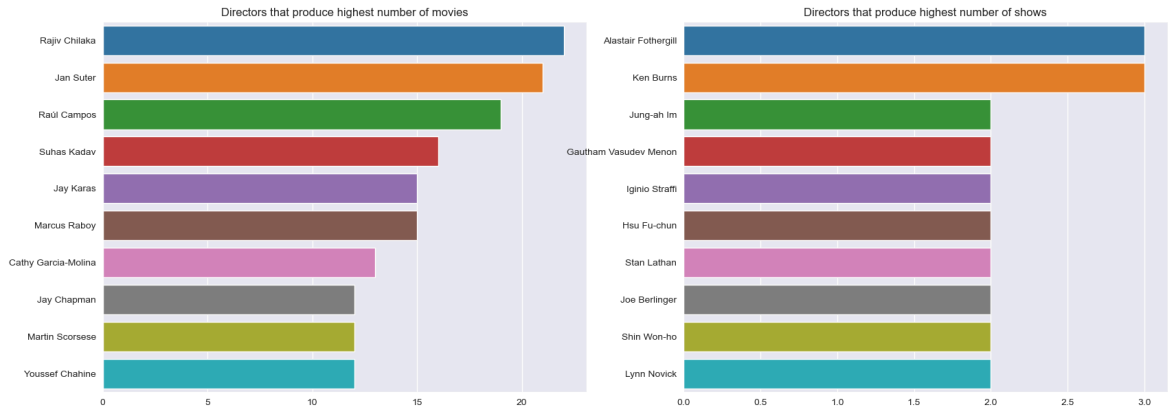
a. 4499(~73%) movies are between 1hr and 2hr. 1095 Movies are between 2hr and 3hr.

b. 487 movies are less than 1hr. Only 47 movies are greater than 3hr.

c. TV Shows are mostly of only one season around 65%. There's one such TV Show which has 17 seasons.

d. There are only 26 such TV shows which have more than 8 seasons

In [112]:
```
plt.figure(figsize = (20,7))

plt.subplot(1,2,1)
mask = movies['director'] == 'Unknown Director'
movies_director= movies.loc[~mask,['show_id','director']].drop_duplicates(keep = 'firs
sns.barplot(x = movies_director, y = movies_director.index )
plt.title('Directors that produce highest number of movies')
plt.ylabel('')
plt.xlabel('')



plt.subplot(1,2,2)
mask = shows['director'] == 'Unknown Director'
shows_director= shows.loc[~mask,['show_id','director']].drop_duplicates(keep = 'first
sns.barplot(x = shows_director, y = shows_director.index )
plt.title('Directors that produce highest number of shows')
plt.ylabel('')
plt.xlabel('')

plt.show()
```

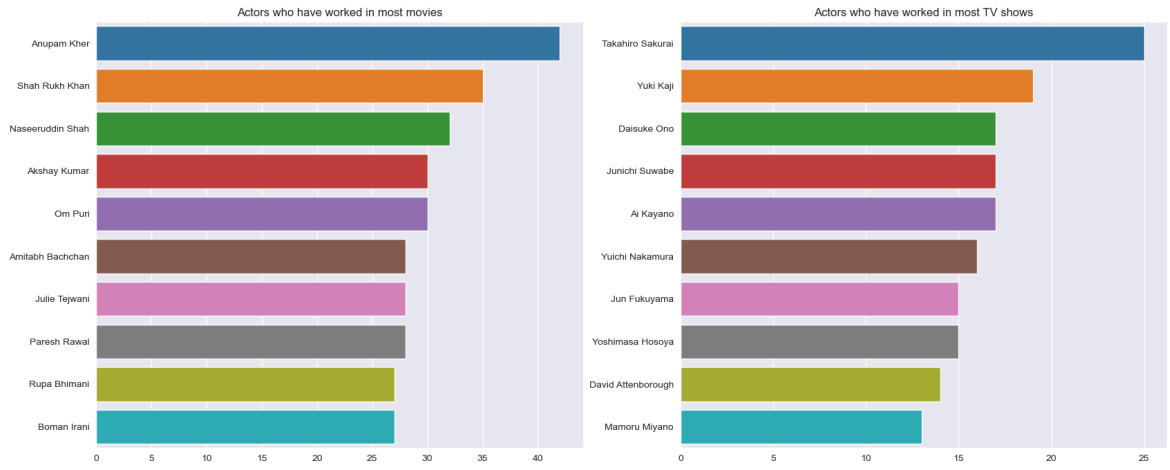


Inferences for Directors:

a. Rajiv Chilaka directed highest number of movies.

b. Alaistar Fothergill directed highest number of TV Shows.

In [113]:
```
plt.figure(figsize =(20,8))

plt.subplot(1,2,1)
mask = movies['cast'] == 'Unknown Actor'
casts = movies.loc[~mask,['show_id','cast']].drop_duplicates(keep = 'first')['cast'].
sns.barplot(x=casts,y = casts.index)
plt.title('Actors who have worked in most movies')
plt.ylabel('')
plt.xlabel('')

plt.subplot(1,2,2)
mask = shows['cast'] == 'Unknown Actor'
casts = shows.loc[~mask,['show_id','cast']].drop_duplicates(keep = 'first')['cast'].va
sns.barplot(x=casts,y = casts.index)
plt.title('Actors who have worked in most TV shows')
plt.ylabel('')
plt.xlabel('')

plt.show()
```

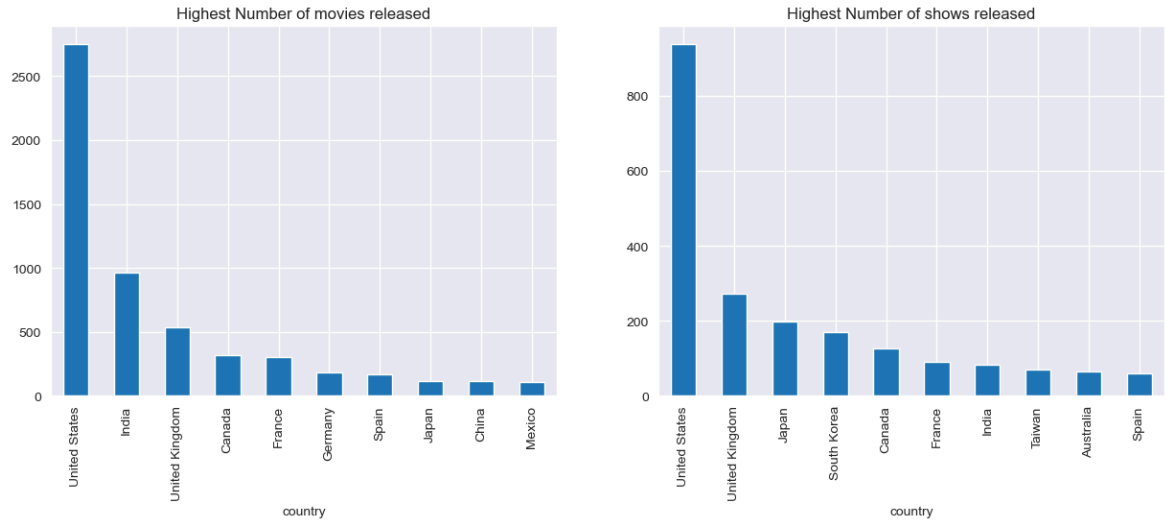


Inferences from Cast:

a. Anupam Kher has appeared in most of movies.

b. Takahiko Sakurai has apperead in most of TV Shows.

In [114]:
```
plt.figure(figsize=(15,5))

plt.subplot(1,2,1)
mask = movies['country'] == 'Unknown Country'
movies.loc[~mask,['show_id','country']].drop_duplicates(keep = 'first')['country'].va
plt.title('Highest Number of movies released')


plt.subplot(1,2,2)
mask = shows['country'] == 'Unknown Country'
shows.loc[~mask,['show_id','country']].drop_duplicates(keep = 'first')['country'].valu
plt.title('Highest Number of shows released')

plt.show()
```

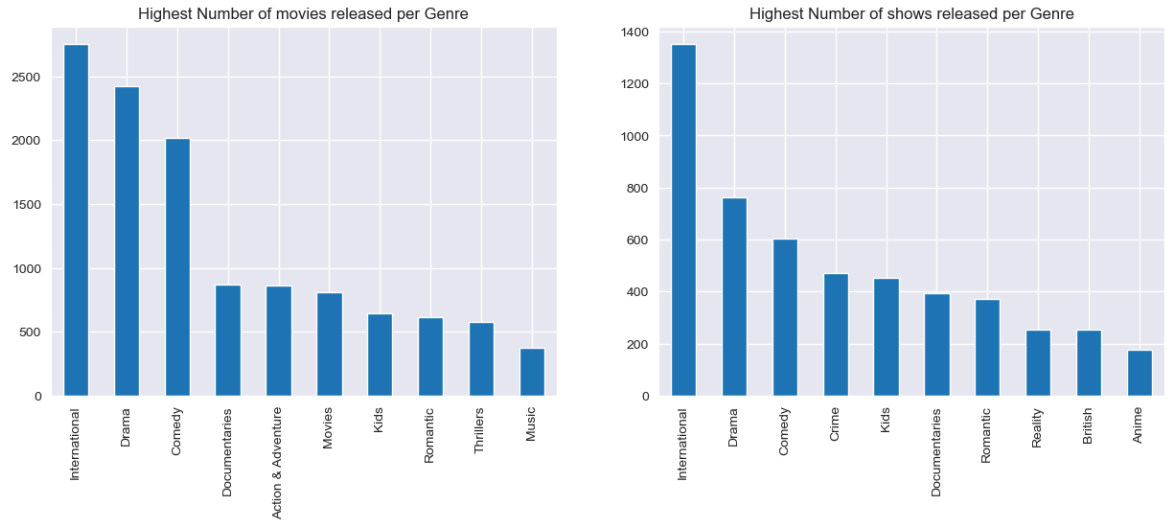


Inferences from Country:

a. Highest number of movies were released in United States Followed by India and Uk.

b. Highest number of TV Shows were released in United States followed by UK and Japan.

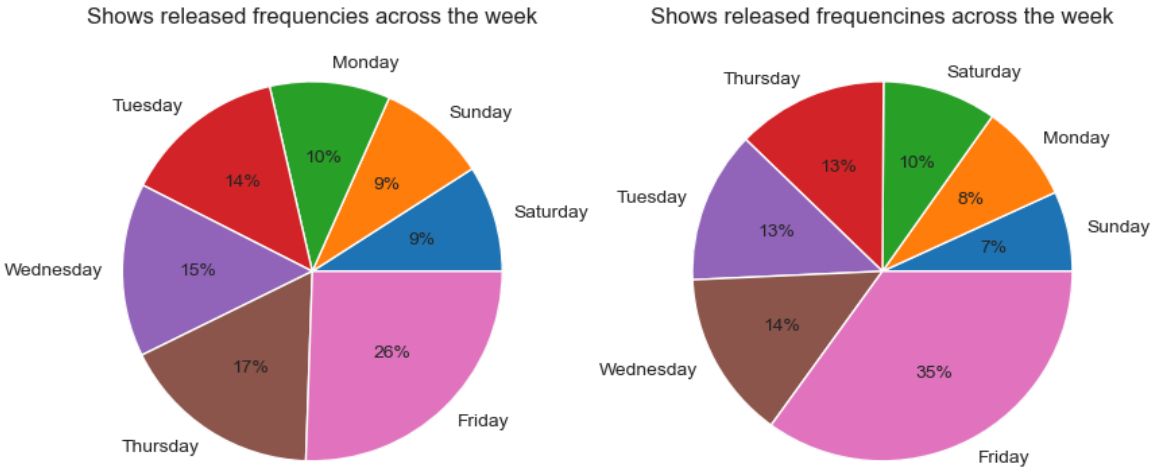
In [115]:
```
plt.figure(figsize =(15,5))
plt.subplot(1,2,1)
movies[['show_id','listed_in']].drop_duplicates(keep = 'first')['listed_in'].value_co
plt.title('Highest Number of movies released per Genre')
plt.ylabel('')
plt.xlabel('')


plt.subplot(1,2,2)
shows[['show_id','listed_in']].drop_duplicates(keep = 'first')['listed_in'].value_cou
plt.title('Highest Number of shows released per Genre')
plt.ylabel('')
plt.xlabel('')

plt.show()
```



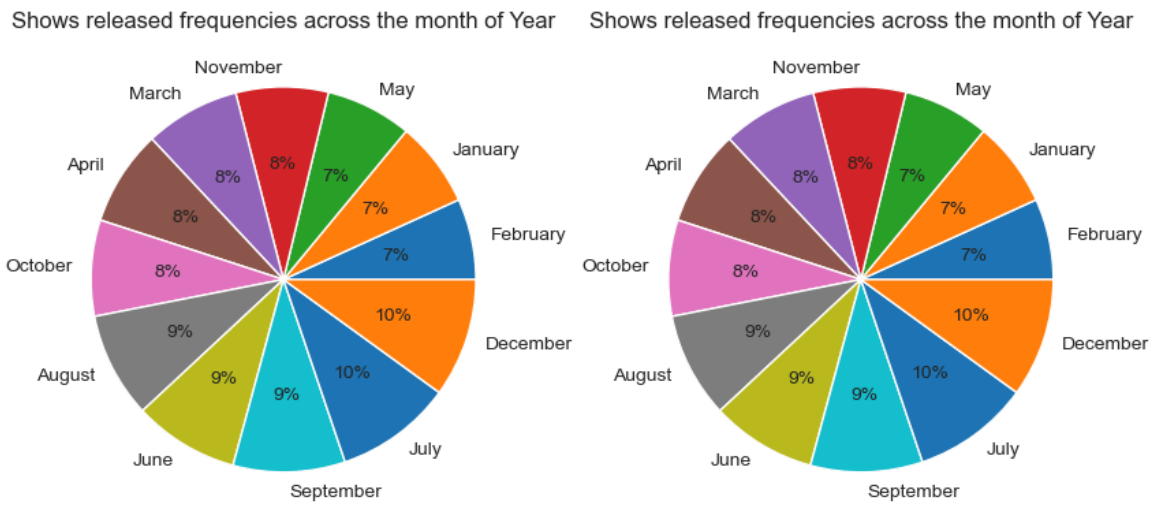
Observations from Genres:

a. Highest Number of Movies/TV Shows are from International Movies, Dramas and Comedy Shows.

In [116]:
```
plt.figure(figsize =(10,5))

plt.subplot(1,2,1)
day_name = movies[['show_id','dayname']].drop_duplicates(keep = 'first')['dayname'].va
plt.pie(day_name, labels= day_name.index, autopct='%.0f%%')
plt.title('Shows released frequencies across the week')

plt.subplot(1,2,2)
day_name = shows[['show_id','dayname']].drop_duplicates(keep = 'first')['dayname'].val
plt.pie(day_name, labels= day_name.index, autopct='%.0f%%')
plt.title('Shows released frequencines across the week')
plt.show()
```

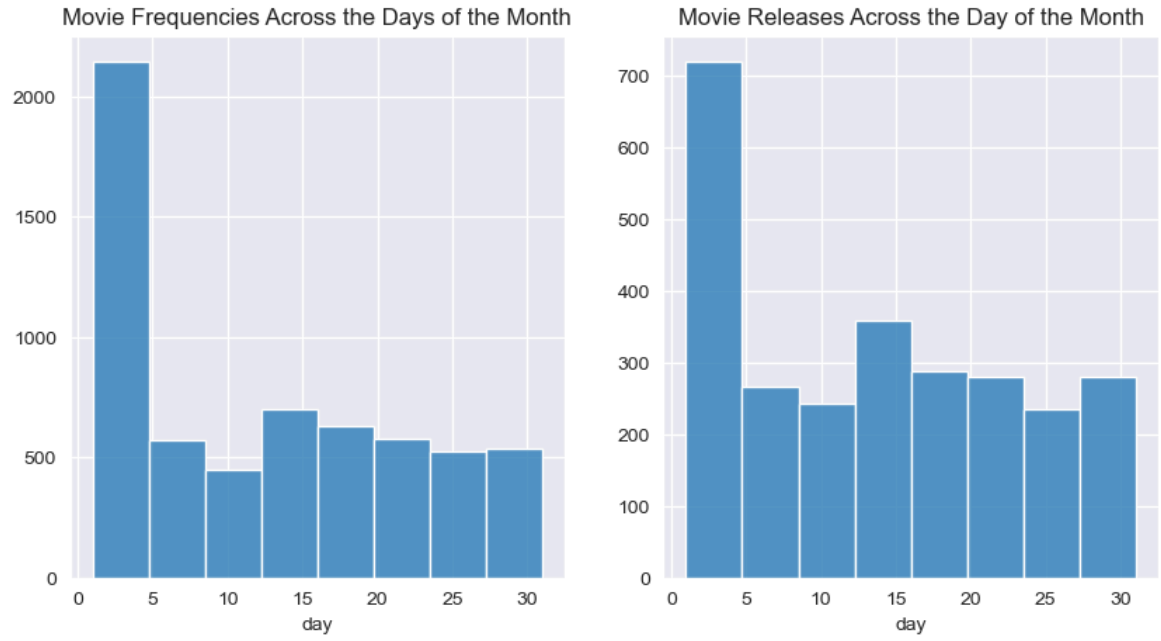


In [117]:
```
plt.figure(figsize =(10,5))

plt.subplot(1,2,1)
month_name = shows[['show_id','month']].drop_duplicates(keep = 'first')['month'].valu
plt.pie(month_name, labels= month_name.index, autopct='%.0f%%')
plt.title('Shows released frequencies across the month of Year')

plt.subplot(1,2,2)
month_name = shows[['show_id','month']].drop_duplicates(keep = 'first')['month'].valu
plt.pie(month_name, labels= month_name.index, autopct='%.0f%%')
plt.title('Shows released frequencies across the month of Year')

plt.show()
```

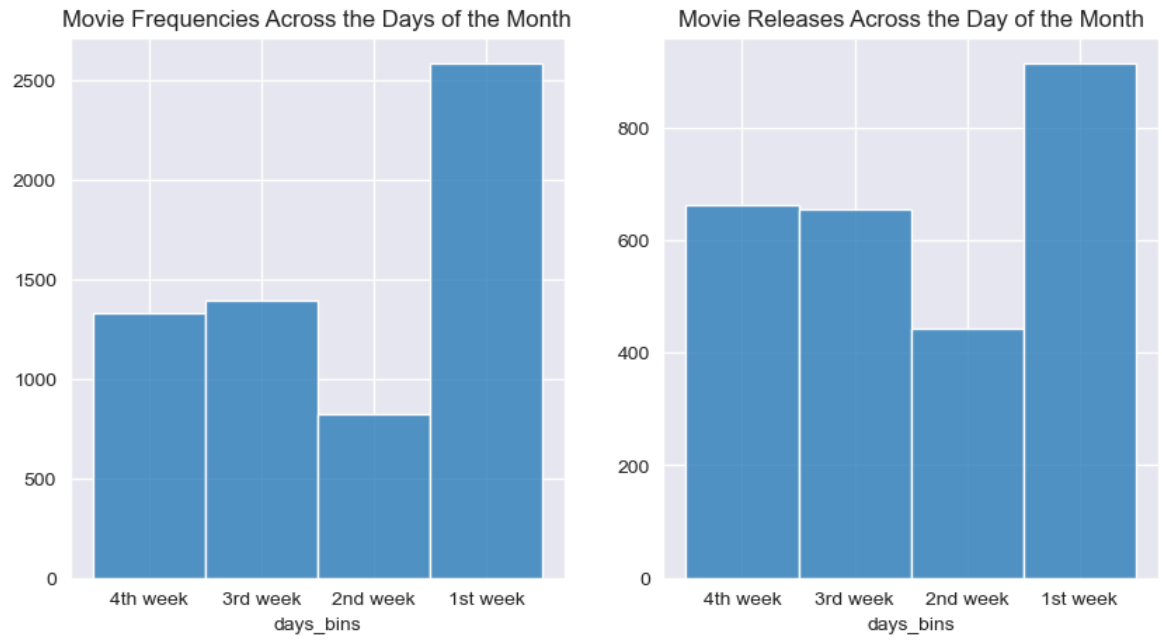


Observations:

In [118]:
```
plt.figure(figsize =(10,5))

plt.subplot(1,2,1)
days = movies[['show_id','day']].drop_duplicates(keep = 'first')['day']
sns.histplot(days,bins = 8)
plt.title('Movie Frequencies Across the Days of the Month')
plt.ylabel('')

plt.subplot(1,2,2)
days = shows[['show_id','day']].drop_duplicates(keep = 'first')['day']
sns.histplot(days,bins = 8)
plt.title('Movie Releases Across the Day of the Month')
plt.ylabel('')
plt.show()
```



In [119]:
```
plt.figure(figsize =(10,5))

plt.subplot(1,2,1)
days = movies[['show_id','days_bins']].drop_duplicates(keep = 'first')['days_bins']
sns.histplot(days,bins = 8)
plt.title('Movie Frequencies Across the Days of the Month')
plt.ylabel('')

plt.subplot(1,2,2)
days = shows[['show_id','days_bins']].drop_duplicates(keep = 'first')['days_bins']
sns.histplot(days,bins = 8)
plt.title('Movie Releases Across the Day of the Month')
plt.ylabel('')
plt.show()
```



Observations:

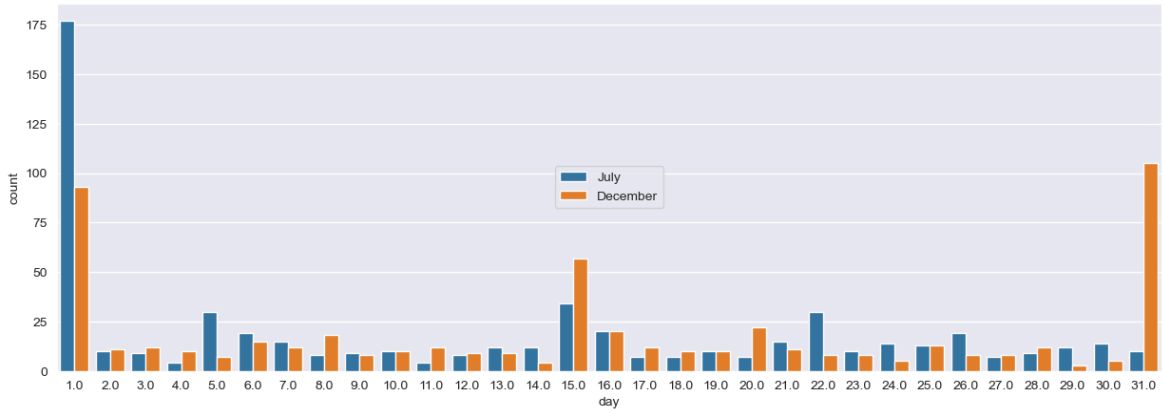
a. Most of the TV Shows/Movies are added in the first week

In [120]:
```
movies[['listed_in','director']].drop_duplicates(keep = 'first').groupby('listed_in')
```

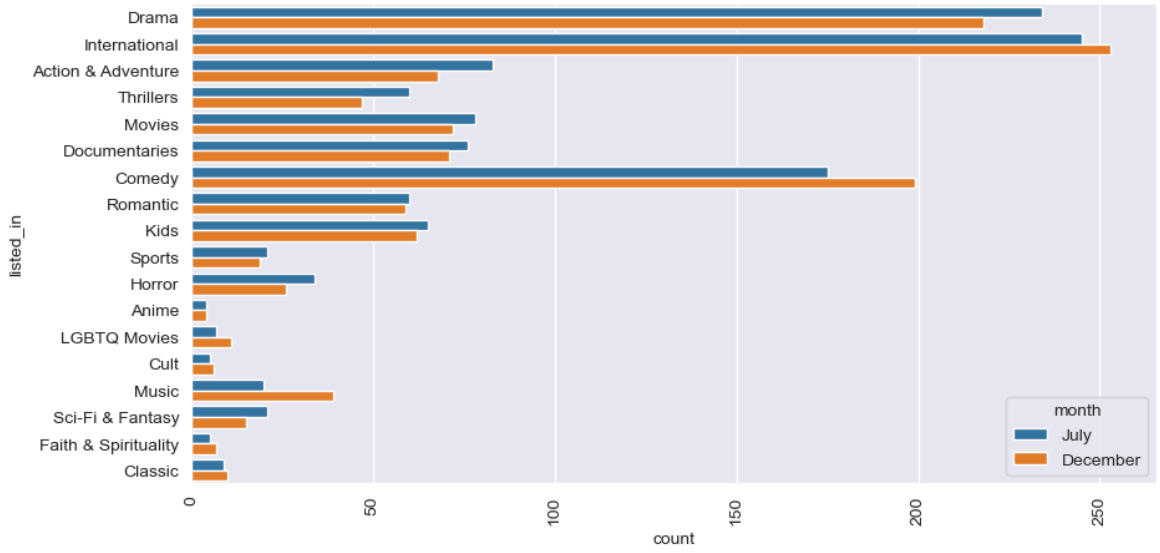
Out[120]:

listed_in	director
Action & Adventure	[A. Salaam, A.R. Murugadoss]
Anime	[Akihiko Yamashita, Akira Saitoh]
Classic	[Alfonso Arau, Anthony Veiller]
Comedy	[A. L. Vijay, Aanand Rai]
Cult	[Alejandro Doria, Alex Proyas]
Documentaries	[Aaron Hancox, Aaron Lieber]
Drama	[A. L. Vijay, A. Raajdheep]
Faith & Spirituality	[Alexandre Avancini, Archie Hekagery]
Horror	[Abhijit Kokate, Adam Egypt Mortimer]
International	[A. L. Vijay, A. Raajdheep]
Kids	[Aaron Lieber, Aaron Woodley]
LGBTQ Movies	[Adam Darke, Alexander Smith]
Movies	[Aadish Keluskar, Aaron Hann]
Music	[A. Salaam, Abbas Alibhai Burmawalla]
Romantic	[Abbas Alibhai Burmawalla, Abdulaziz Alshlahei]
Sci-Fi & Fantasy	[A. L. Vijay, Aaron Hann]
Sports	[Aaron Lieber, Abhishek Kapoor]
Thrillers	[Aaron Burns, Aaron Moorhead]

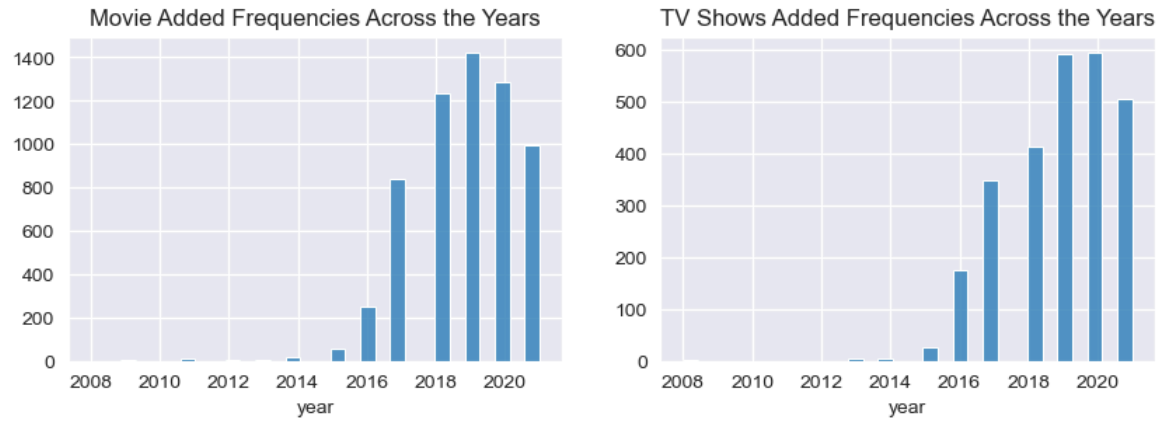
In [121]:
```
mon_list = np.array(['December','July'])
mon_movies = movies.loc[movies['month'].isin(mon_list),['show_id','day','month']].dro
plt.figure(figsize = (15,5))
sns.countplot(data = mon_movies,x = 'day',hue = 'month')
plt.legend(loc='center')
plt.show()
```



In [122]:
```
plt.figure(figsize =(10,5))

mon_list = np.array(['December','July'])
mon_movies = movies.loc[movies['month'].isin(mon_list),['show_id','listed_in','month'
sns.countplot(data = mon_movies,y = 'listed_in',hue = 'month')
plt.xticks(rotation  = 90)
plt.show()
```



In [123]:
```
plt.figure(figsize =(10,3))

plt.subplot(1,2,1)
days = movies[['show_id','year']].drop_duplicates(keep = 'first')['year']
sns.histplot(days,bins = 30)
plt.title('Movie Added Frequencies Across the Years')
plt.ylabel('')

plt.subplot(1,2,2)
days = shows[['show_id','year']].drop_duplicates(keep = 'first')['year']
sns.histplot(days,bins = 30)
plt.title('TV Shows Added Frequencies Across the Years')
plt.ylabel('')
plt.show()
```



Inferences from Date Added :

a. Most of the TV Shows/Movies are added in December or July

b. Most of the TV Shows/Movies are added in the first week

c. Most of the movies are added in Month of December or July in the first week or last week

d. Most of the movies are added in Month of December or July have genres

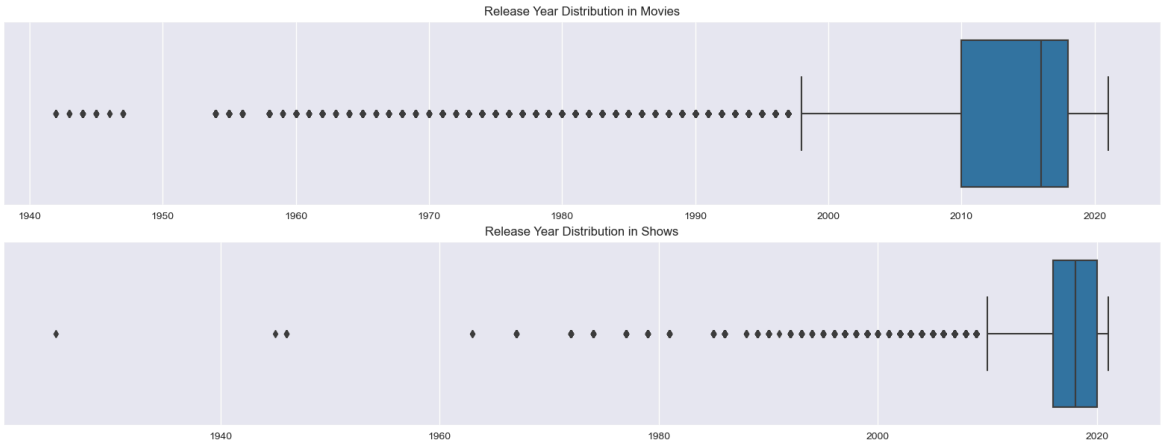
Dramas International Movies and Comedies

e. Most of the TV Shows are added in Month of December or July in the first week or last week

f. Most of the TV Shows are added in Month of December or July have genres Dramas International Movies and Comedies

g. Range of Year Added in 13 years

In [124]:
```
plt.figure(figsize = (20,7))
plt.subplot(2,1,1)
sns.boxplot(data = movies,x= 'release_year')
plt.title('Release Year Distribution in Movies')
plt.xlabel('')

plt.subplot(2,1,2)
sns.boxplot(data = shows,x = 'release_year')
plt.title('Release Year Distribution in Shows')
plt.xlabel('')

plt.show()
```



In [125]:
```
df[df['type'] == 'Movie'].describe()
```

Out[125]:

	release_year
count	6131.000000
mean	2013.121514
std	9.678169
min	1942.000000
25%	2012.000000
50%	2016.000000
75%	2018.000000
max	2021.000000

In [126]:
```
df[df['type'] == 'TV Show'].describe()
```

Out[126]:

	release_year
count	2676.000000
mean	2016.605755
std	5.740138
min	1925.000000
25%	2016.000000
50%	2018.000000
75%	2020.000000
max	2021.000000

Inferences from Release Year:

a. Very few movies were released before 2000 that are present in this dataset

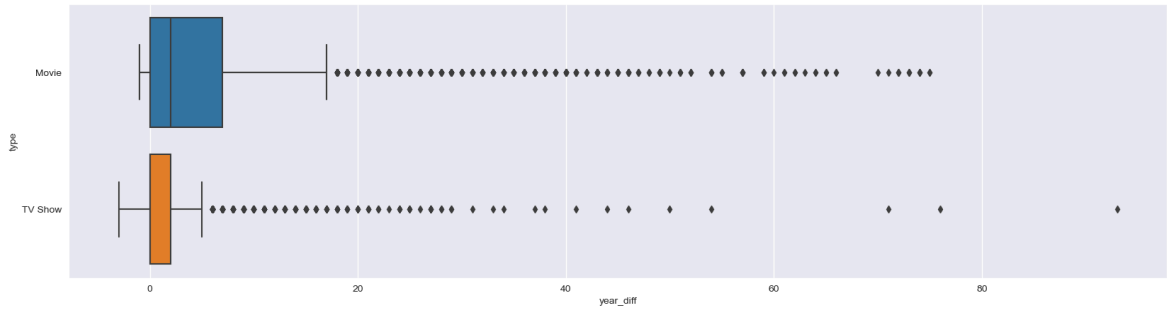
b. Very few TV Shows were released before 2010 that are present in this dataset

c. Most of the movies were released between 2012 to 2018 that are present in this dataset

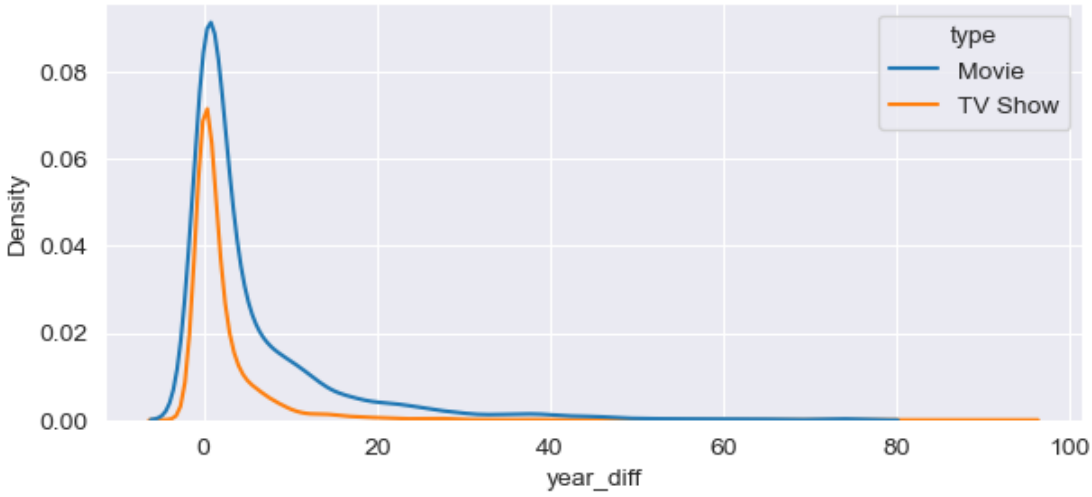
d. Very few TV Shows were released between 2016 to 2020 that are present in this dataset

e. Range of Release Year for Movies is equal to 79 years, for TV Shows it is equal to 96 years

In [127]:
```
plt.figure(figsize = (20,5))
box = final_df[['show_id','type','year_diff']].drop_duplicates()
sns.boxplot(data = box,x='year_diff',y  = 'type')
plt.show()
```



In [128]:
```
plt.figure(figsize = (7,3))
box = final_df[['show_id','type','year_diff']].drop_duplicates()
sns.kdeplot(data = box,x='year_diff',hue= 'type')
plt.show()
```



In [129]:
```
box[box['type'] == 'Movie'].max()
```

Out[129]:
```
show_id       s999
type         Movie
year_diff     75.0
dtype: object
```

In [130]:
```
box[box['type'] == 'TV Show'].max()
```

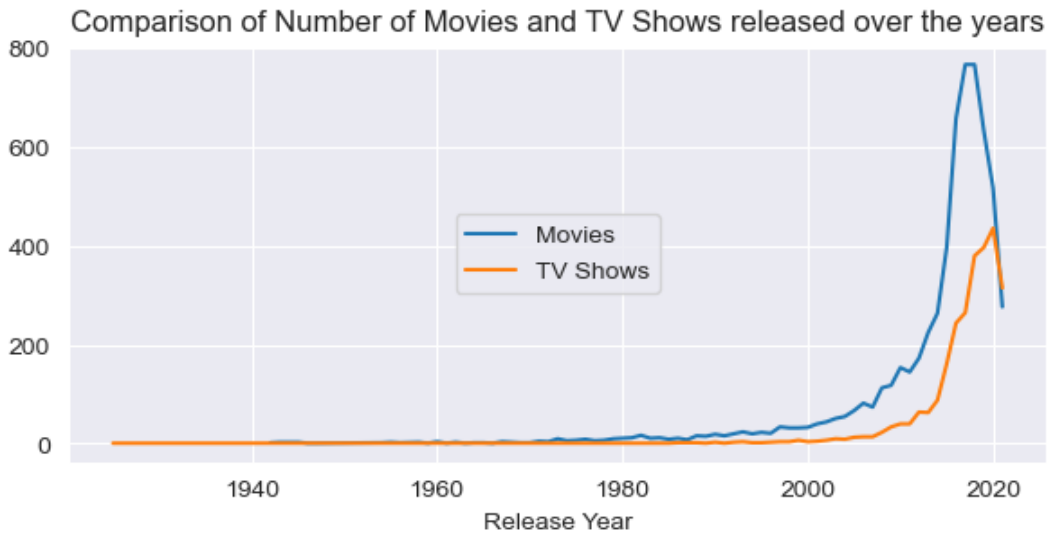
Out[130]:
```
show_id         s998
type         TV Show
year_diff       93.0
dtype: object
```

Inferences from difference between year added and year released:

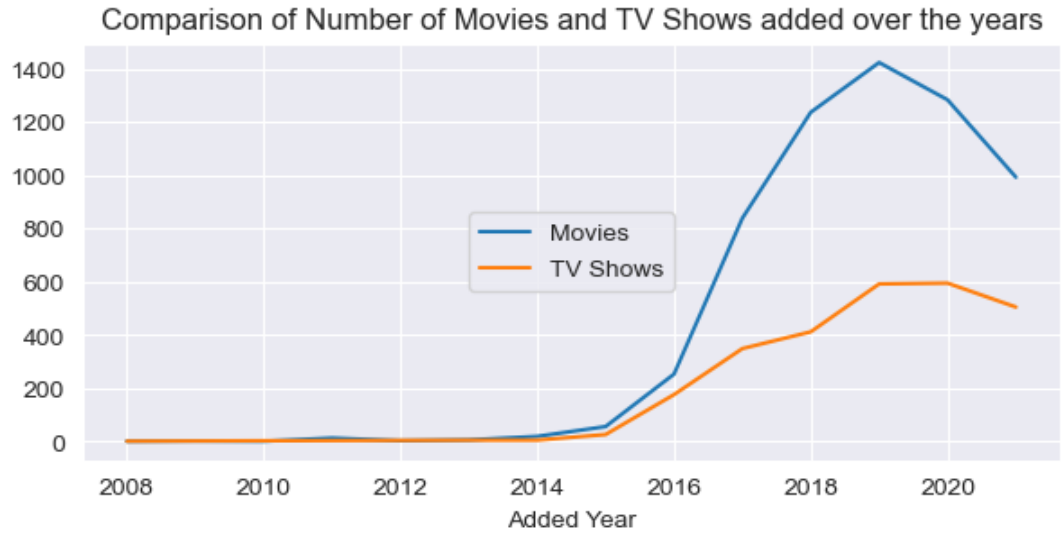
a. Most of the movies/tv shows were added in the same year as it was released

b. Highest year difference between when it was released and when it was added is 75 and 93 for movies and TV Shows respectively

In [131]:
```
plt.figure(figsize = (7,3))

movies_released_per_year = df.loc[df['type']=='Movie','release_year'].value_counts().s
sns.lineplot(x = movies_released_per_year.index,y = movies_released_per_year,label =

shows_released_per_year = df.loc[df['type']=='TV Show','release_year'].value_counts()
sns.lineplot(x =shows_released_per_year.index,y = shows_released_per_year,label = 'TV

plt.xlabel('Release Year')
plt.ylabel('')
plt.title('Comparison of Number of Movies and TV Shows released over the years')
plt.legend(loc = 'center')

plt.show()
```



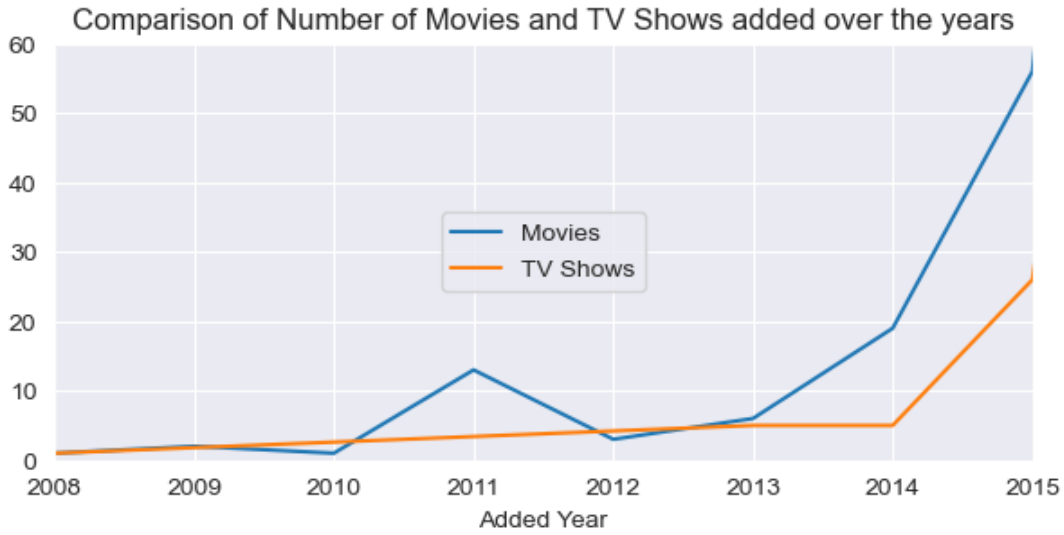
In [132]:
```
plt.figure(figsize = (7,3))

movies_added_per_year = movies.groupby('year')['show_id'].nunique()
sns.lineplot(x = movies_added_per_year.index,y = movies_added_per_year,label = 'Movie

shows_added_per_year = shows.groupby('year')['show_id'].nunique()
sns.lineplot(x =shows_added_per_year.index,y = shows_added_per_year,label = 'TV Shows

plt.xlabel('Added Year')
plt.ylabel('')
plt.title('Comparison of Number of Movies and TV Shows added over the years')
plt.legend(loc = 'center')

plt.show()
```



Number of Shows Released Across the Years :

a. In the recent years we can there has been a drop in release as well as drop in addition of Movies and Tv Shows. This maybe due to lack of data. As we donot have data we cannot conclude the above statement as true

In [133]:
```
plt.figure(figsize = (7,3))

movies_added_per_year = movies.groupby('year')['show_id'].nunique()
sns.lineplot(x = movies_added_per_year.index,y = movies_added_per_year,label = 'Movie

shows_added_per_year = shows.groupby('year')['show_id'].nunique()
sns.lineplot(x =shows_added_per_year.index,y = shows_added_per_year,label = 'TV Shows

plt.xlabel('Added Year')
plt.ylabel('')
plt.title('Comparison of Number of Movies and TV Shows added over the years')
plt.legend(loc = 'center')
plt.xlim(2008,2015)
plt.ylim(0,60)

plt.show()
```



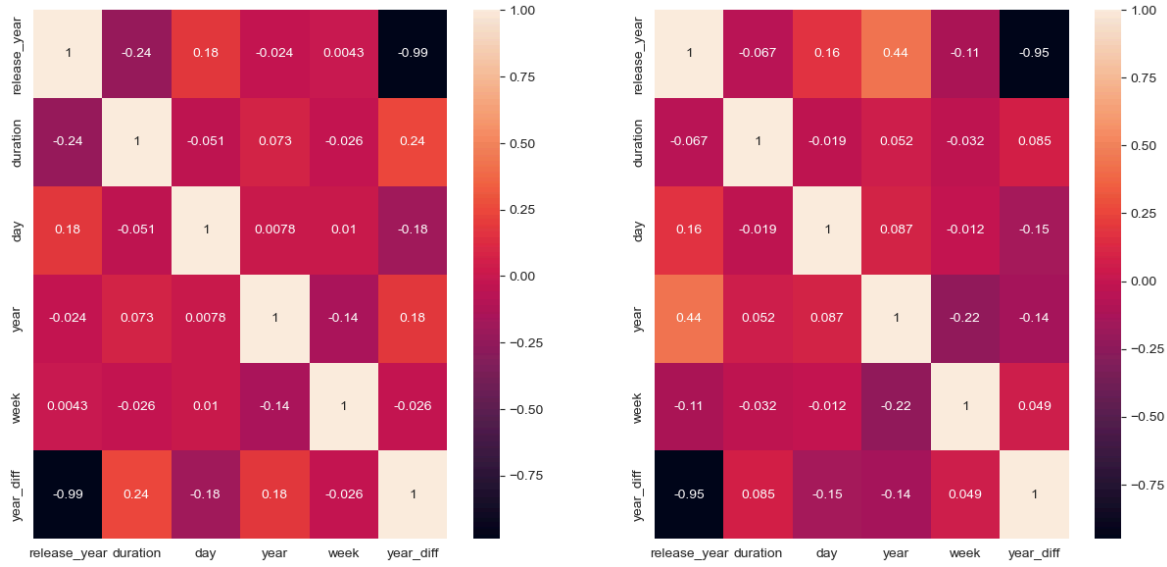
Number of Shows Added across the years:

a. There has been spike in addtion of Movies and spike in addtion of TV Shows from 2013 and 2014 respectively.

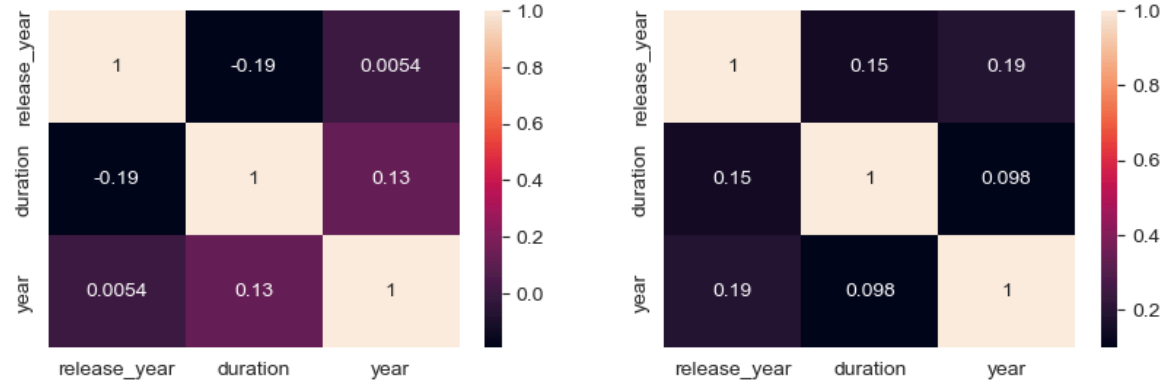
In [136]:
```
# # sns.pairplot(data = movies)
# plt.show()
```

In [137]:
```
# sns.pairplot(data = shows)
# plt.show()
```

In [138]:
```
plt.figure(figsize=(15,7))
plt.subplot(1,2,1)
sns.heatmap(movies[['release_year','duration','day','year','week','year_diff']].corr(

plt.subplot(1,2,2)
sns.heatmap(shows[['release_year','duration','day','year','week','year_diff']].corr()
plt.show()
```



In [139]:
```
plt.figure(figsize=(10,3))

plt.subplot(1,2,1)
corr_mov_data = movies[['release_year','duration','year']].drop_duplicates()
sns.heatmap(corr_mov_data.corr(),annot = True)

plt.subplot(1,2,2)
corr_shows_data = shows[['release_year','duration','year']].drop_duplicates()
sns.heatmap(corr_shows_data.corr(),annot = True)
plt.show()
```

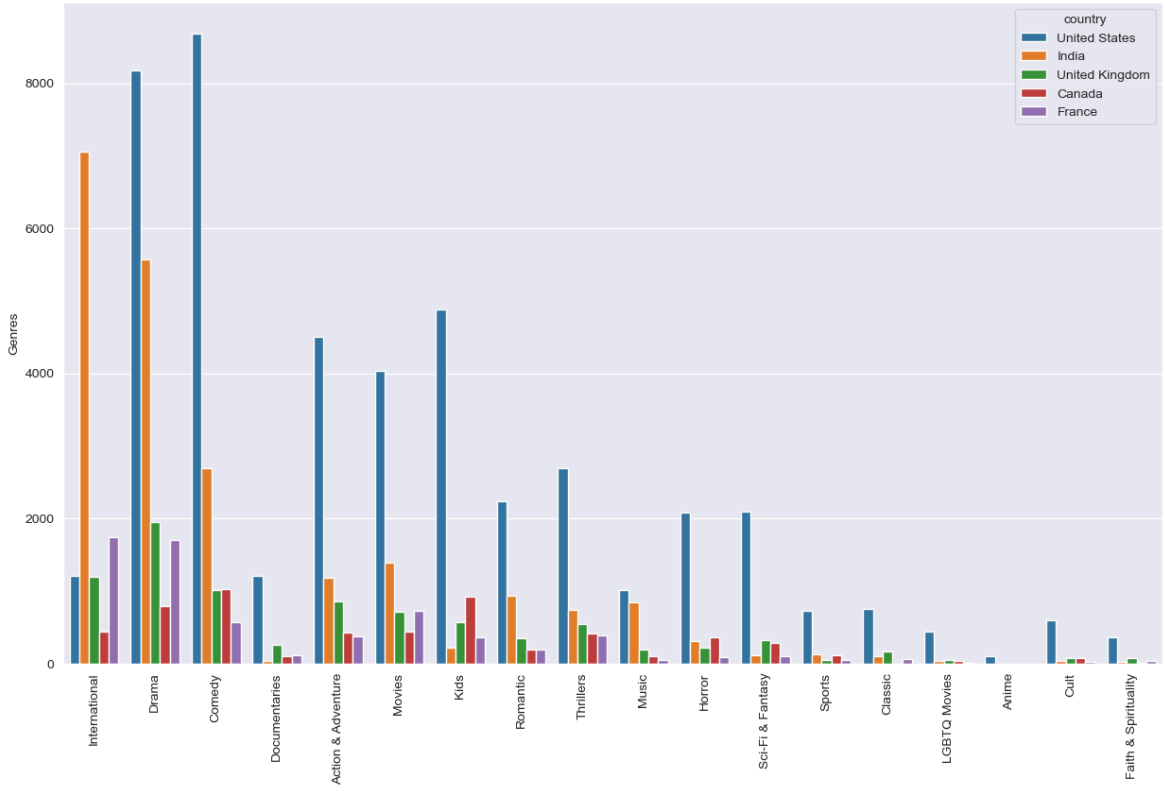


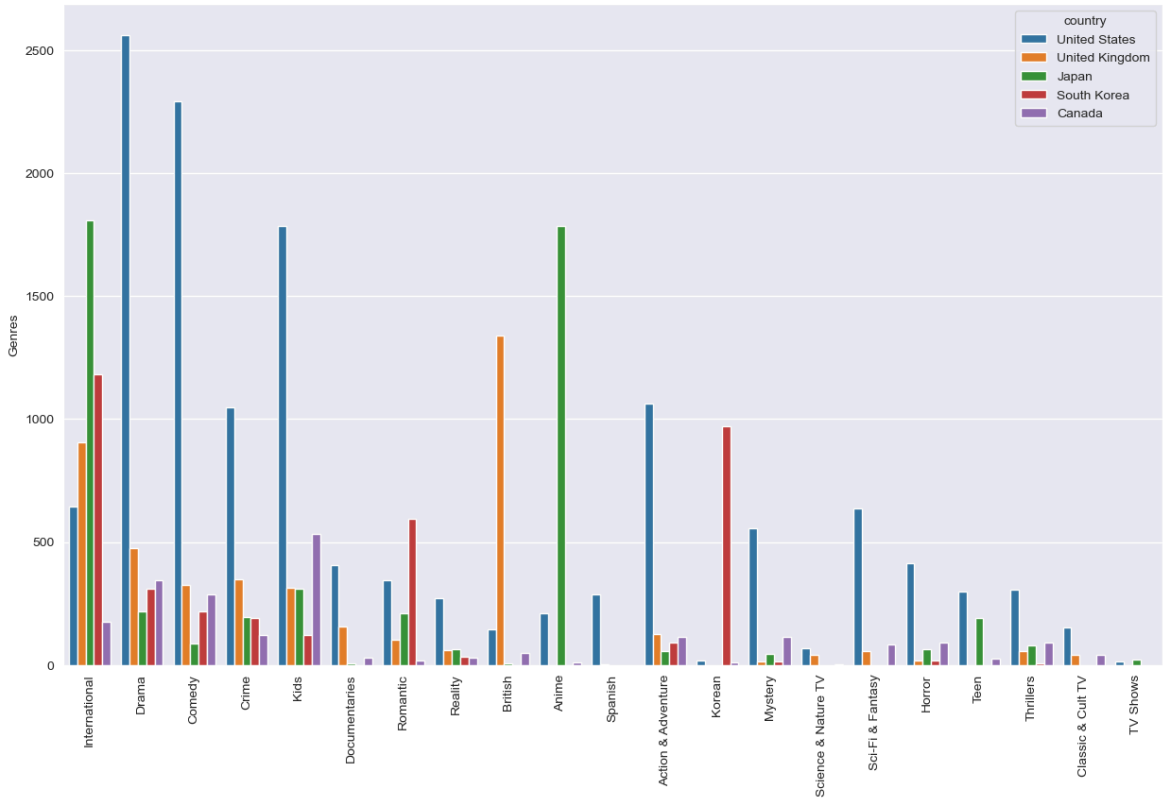
Observations:

a. Except for release_year and year_diff, any clear correlation between any other columns cannot been seen.

In [140]:

```
mask = movies['country'] == 'Unknown Country'
mov_country_list = movies.loc[~mask,['show_id','country']].drop_duplicates(keep = 'fi

mask = shows['country'] == 'Unknown Country'
show_country_list = shows.loc[~mask,['show_id','country']].drop_duplicates(keep = 'fi


mov_cg = movies[movies['country'].isin(mov_country_list)]
show_cg = shows[shows['country'].isin(show_country_list)]

mov_order = movies[['show_id','listed_in']].drop_duplicates(keep = 'first')['listed_i
show_order = shows[['show_id','listed_in']].drop_duplicates(keep = 'first')['listed_i

plt.figure(figsize = (15,20))

plt.subplot(2,1,1)
sns.countplot(data = mov_cg,x = 'listed_in',hue = 'country',order = mov_order,hue_orde
plt.ylabel('Genres')
plt.xlabel('')
plt.xticks(rotation = 90)

plt.subplot(2,1,2)
sns.countplot(data = show_cg,x = 'listed_in',hue = 'country',order = show_order,hue_o
plt.ylabel('Genres')
plt.xlabel('')
plt.xticks(rotation = 90)
plt.show()
```





Inferneces from Top 5 Countries and Genres:

a. Most TV shows in United States are of Dramas, Comedy and Kids Genre.

b. Most TV Shows in United Kingdom are of British TV shows, International Shows and Dramas.

c. Most TV shows in Japan are of International Shows and Anime Series.

d. Most TV Shows in South Korea are of International Shows, Korean and Romantic TV Shows.

e. Most Movies in United States are of Dramas and Comedy.

f. Most Movies in United Kingdom are of International Movies, Dramas and Comedy Genre.

g. Most Movies in India are of International Movies, Dramas and Comedy Genre.
h. Most Movies in France are of International Movies and Dramas.

Buisness Insights

Type:

a. There are Only Two types of Show -> Movies and TV Shows
b. Out of 8807 shows 6131 shows are Movies and 2676 shows are TV Shows

Rating:

a. There were a total of 17 ratings present for movies. Only 9 of which are ratings used in TV Shows
b. Netlix caters to a lot of Mature audience, 34% of movies and 48% of tv shows that are avaiable content is for mature
c. 23% and 27% movies and tv shows rated respectively as TV-14 i.e. children under age of 14 are not suitable to watch, target audience been mid and late teens
d. There are around 13% R Rated movies.
e.There are only 4% movies and 14% of TV Shows available for kids(TV-Y and TV-Y7)

Duration:

a. 4499(~73%) movies are between 1hr and 2hr. 1095 Movies are between 2hr and 3hr.
b. 487 movies are less than 1hr. Only 47 movies are greater than 3hr.
c. TV Shows are mostly of only one season around 65%. There's one such TV Show which has 17 seasons.
d. There are only 26 such TV shows which have more than 8 seasons

Director:

a. There were a total of 4528 directors in original dataset
b. There are a total of 4993 directors in the unnested dataset. Out of which 4777 directors worked in movies and only 299 directors worked in TV shows. Only 84 directors worked both in Movies and TV Shows
c. Rajiv Chilaka directed highest number of movies.
d. Alaistar Fothergill directed highest number of TV Shows.

Cast:

a. There were a total of 7692 actors in original dataset
b. There are a total of 36439 casted actors/actress present in the unnested dataset. Out of which 25951 worked in movies and 14863 worked in TV Shows. Only 4376 worked both in Movies and TV Shows
c. Anupam Kher has appeared in most of movies.
d. Takahiko Sakurai has apperead in most of TV Shows.

Country:

a. There were a total of 748 different values of clubbed country in original dataset
b. There are a total of 123 countries where these shows were available. Movies were accessible in 118 different countries and 66 countries for TV Shows
c. Highest number of movies were released in United States Followed by India and UK.
d. Highest number of TV Shows were released in United States followed by UK and Japan.

Genre/Listed_in:

a. There are a total of 28 genres values of present in the dataset. Out of which 18 belong to Movies and 21 belong the TV shows

b. There are a total of 123 countries where these shows were available

c. Drama and International Genres have the highest number of movies and TV Shows.

Years:

a. These movies/TV Shows were released in 74 different years starting from 1925. First TV Shows that was realeased in the dataset was in year 1925 and Movie was in year 1942.

b. 75% of movies were released in the last decade and 75% of Shows were released in last 7 years.

c. Only from 2008 these tv shows/movies were added. Most of the tv shows/movies were added in July following by December

d. Most of the tv shows/movies were released in Friday followed by Thursday

e. Most of the TV Shows/Movies are added in December or July

f. Most of the TV Shows/Movies are added in the first week

g. Most of the movies are added in Month of December or July in the first week or last week

h. Most of the movies are added in Month of December or July have genres Dramas International Movies and Comedies

i. Most of the TV Shows are added in Month of December or July in the first week or last week

j. Most of the TV Shows are added in Month of December or July have genres Dramas International Movies and Comedies

k. Range of Year Added in 13 years

l. Very few movies were released before 2000 that are present in this dataset

m. Very few TV Shows were released before 2010 that are present in this dataset

n. Most of the movies were released between 2012 to 2018 that are present in this dataset

o. Very few TV Shows were released between 2016 to 2020 that are present in this dataset

p. Range of Release Year for Movies is equal to 79 years, for TV Shows it is equal to 96 years

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b. Most TV Shows in United Kingdom are of British TV shows, International Shows and Dramas.

c. Most TV shows in Japan are of International Shows and Anime Series.

d. Most TV Shows in South Korea are of International Shows, Korean TV shows and Romantic TV Shows.

e. Most Movies in United States are of Dramas, Comedy and Children & Family Genre.

f. Most Movies in United Kingdom are of International Movies, Dramas and Comedy Genre.

g. Most Movies in India are of International Movies, Dramas and Comedy Genre.

h. Most Movies in France are of International Movies and Dramas.

Inferences from Top 5 Countries and Genres:

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h. Most Movies in France are of International Movies and Dramas.

Other Inferences:

a. Most of the movies/tv shows were added in the same year as it was released

b. Highest year difference between when it was released and when it was added is 75 and 93 for movies and TV Shows respectively

c. In the recent years we can there has been a drop in release as well as drop in addition of Movies and Tv Shows.

d. There has been spike in addtion of Movies and spike in addtion of TV Shows from 2013 and

Recommendations

1. Most of the shows are catered to mature audiences. Diversifying content genres is also important to attract a broader range of viewers. A mix of genres, including drama, comedy, action, romance, and documentary, to cater to varied tastes.
2. Given the popularity of TV-14 rated content, more shows and movies should be tailored for the late teens demographic.
3. Can Experiment with other genres like Sci-Fi, Fantasy, Thriller, and Documentaries.
4. Due to kids less attention span, shows of length 15-20 mins should be available more. Side by Side it is also very important to implement a robust parental control and ensure that the content is suitable for this age group
5. Focus on producing movies that fall within the popular 1-hour to 2-hour duration range.
6. A strategic approach is to develop TV shows spanning 3-5 seasons, with each season having a compelling cliffhanger. This will captivate viewers interest and anticipation, making them to eagerly await for the next season.
7. Additionally we can create brief glimpses of behind the screens or share entertaining bloopers, providing a relatable and authentic connection to our audience.
8. Some of the most old movies that are not present can be added, that were released before 2010, which will help to cater the elderly audience, creating a feeling of nostalgia. It will work especially well in a country like Japan due its higher older demographic.
9. The trend of adding most TV shows and movies in Friday and Thursday in the first and last week of Decemeber and July can be leveraged. The release of highly anticipated original content can be done during these months to attract maximum viewership.