Importing Libraries required

In [1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import missingno as msno
```

Reading the file and loading the data it into dataframe

In [2]:
```
df=pd.read_csv("C:/Users/akash/Desktop/Scaler/netflix.csv")
```

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

Out[3]:

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	list
0	s1	Movie	Dick Johnson Is Dead	Kirsten Johnson	NaN	United States	September 25, 2021	2020	PG-13	90 min	Documen
1	s2	TV Show	Blood & Water	NaN	Ama Qamata, Khosi Ngema, Gail Mabalane, Thaban...	South Africa	September 24, 2021	2021	TV-MA	2 Seasons	Interna TV Shov Dram Mys
2	s3	TV Show	Ganglands	Julien Leclercq	Sami Bouajila, Tracy Gotoas, Samuel Jouy, Nabi...	NaN	September 24, 2021	2021	TV-MA	1 Season	Crir S Interna TV Shov
3	s4	TV Show	Jailbirds New Orleans	NaN	NaN	NaN	September 24, 2021	2021	TV-MA	1 Season	Docus Real
4	s5	TV Show	Kota Factory	NaN	Mayur More, Jitendra Kumar, Ranjan Raj, Alam K...	India	September 24, 2021	2021	TV-MA	2 Seasons	Interna TV S Roman Shows,

Checking the missing values in each column also checking the data types of each column.

In [4]:
```
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
```

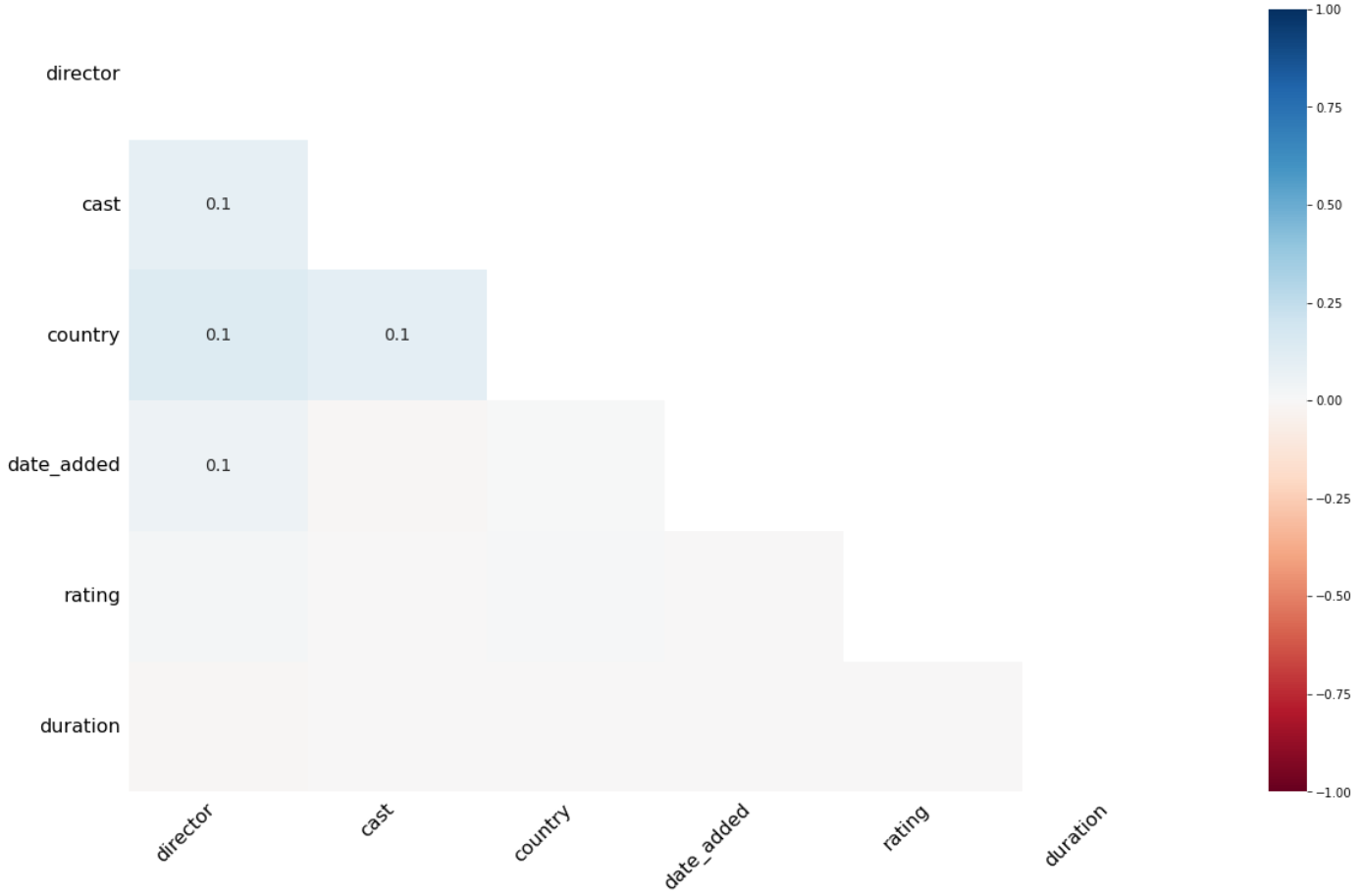
In [5]:
```
df.isna().sum()
```

Out[5]:
```
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
```

Below plot is to see we have any relanships between missing values and there is none

In [6]:
```
msno.heatmap(df,labels=True)
```

Out[6]:
```
<AxesSubplot:>
```



In [7]:
```
df['date_added']=pd.to_datetime(df['date_added'])
```

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

Out[8]:

show_id	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in	description

Observations from below dataset.

- David Attenborough casted in more number of movies+TV series.
- Rajiv Chilaka directed most number of movies+TV series.
- 109 movies and TV Shows released on January 1 2020 on netflix is the most in one day.
- TV-MA most number of movies+TV series made in this rating.
- United States made more number of movies , as per this we can say that they have largest film industry and big audience.
- we have Tv series or movies released from 1925- 2021

In [9]:
```
df.describe(include=['object','int64'])
```

Out[9]:

	show_id	type	title	director	cast	country	release_year	rating	duration	listed_in	desc
count	8807	8807	8807	6173	7982	7976	8807.000000	8803	8804	8807	
unique	8807	2	8807	4528	7692	748	NaN	17	220	514	
top	s4369	Movie	The Land	Rajiv Chilaka	David Attenborough	United States	NaN	TV-MA	1 Season	Dramas, International Movies	Para activ abar

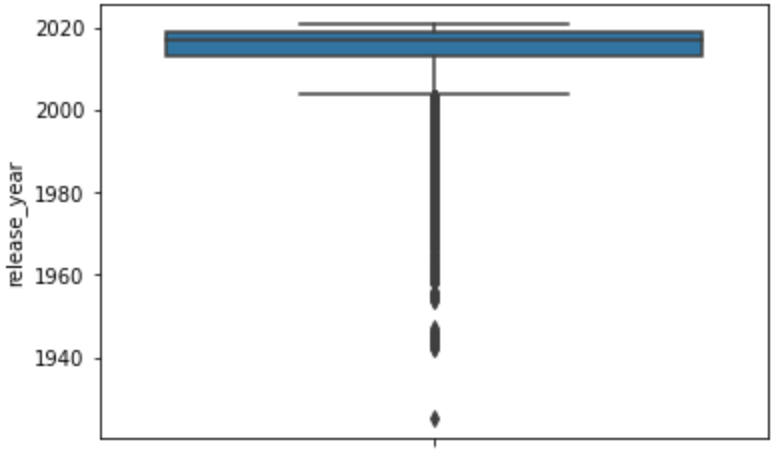
freq	1	6131	1	19	19	2818	NaN	3207	1793	362
mean	NaN	NaN	NaN	NaN	NaN	NaN	2014.180198	NaN	NaN	NaN
std	NaN	NaN	NaN	NaN	NaN	NaN	8.819312	NaN	NaN	NaN
min	NaN	NaN	NaN	NaN	NaN	NaN	1925.000000	NaN	NaN	NaN
25%	NaN	NaN	NaN	NaN	NaN	NaN	2013.000000	NaN	NaN	NaN
50%	NaN	NaN	NaN	NaN	NaN	NaN	2017.000000	NaN	NaN	NaN
75%	NaN	NaN	NaN	NaN	NaN	NaN	2019.000000	NaN	NaN	NaN
max	NaN	NaN	NaN	NaN	NaN	NaN	2021.000000	NaN	NaN	NaN

Outliers

- From above we can see that year seems to have outliers becuase minimum is 1925 and 25 percent is 2013 , lets check with a boxplot.
- As we see in Boxplot clearely data below year 2000 is a outlier that say from 1925 to 2000 , we have 75 outliers in this year column for the dataset.

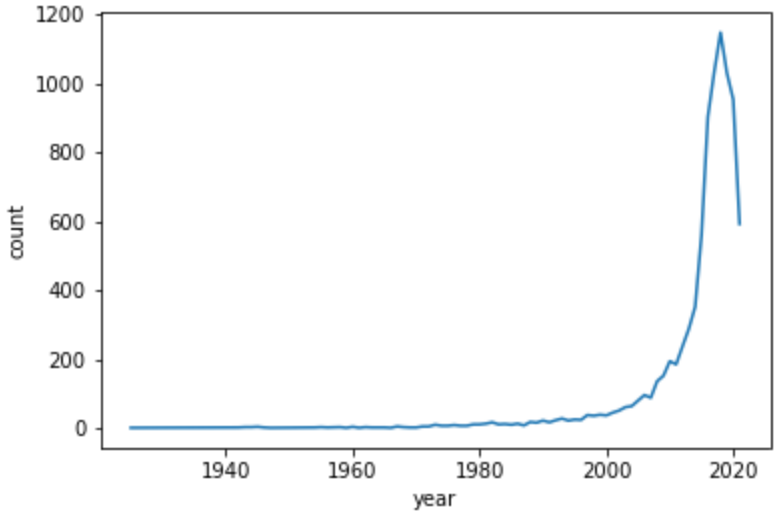
In [10]:
```
sns.boxplot(y='release_year',data=df)
```

Out[10]:
```
<AxesSubplot:ylabel='release_year'>
```



How has the number of movies released per year changed years?

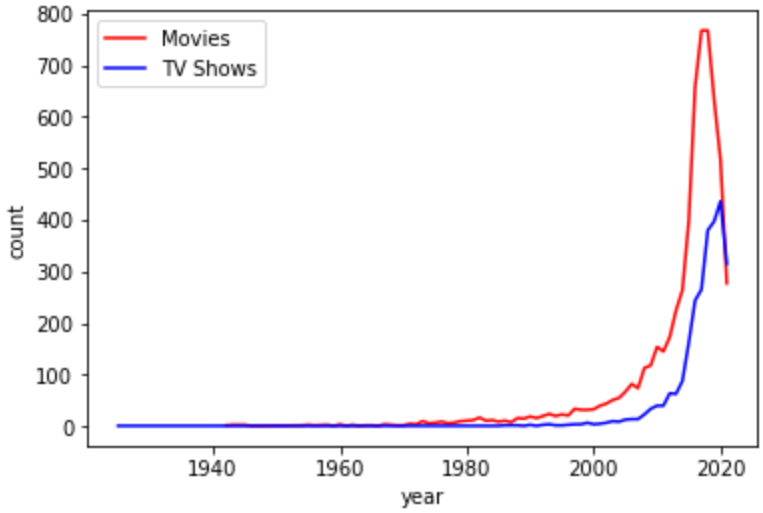
In [11]:
```
df.sort_values(by='release_year',inplace=True,ascending=False)
df_y=df['release_year'].value_counts(sort=True).reset_index()
df_y.rename(columns={'index':'year','release_year':'count'},inplace=True)
sns.lineplot(x='year',y='count',data=df_y)
plt.show()
```



- We can see that after 2019 there is a decrease in movie and TV shows release which is caused by corona
- As we see the graph that we can say that after year 2000 movie and TV shows releases started raising exponentially.

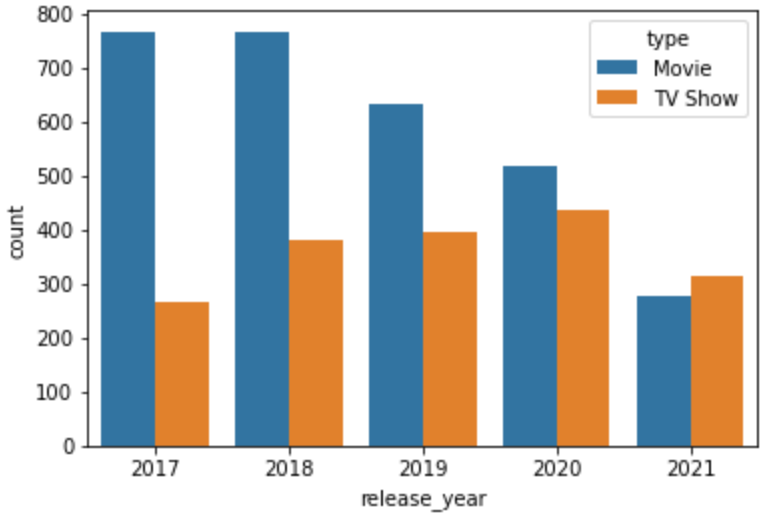
Lets compare Movies and TV shows how the number of releases changed over the course of the years.

In [47]:
```
df_m=df[df['type']=='Movie']
df_tv=df[df['type']=='TV Show']
df_m=df_m['release_year'].value_counts(sort=True).reset_index()
df_tv=df_tv['release_year'].value_counts(sort=True).reset_index()
df_m.rename(columns={'index':'year','release_year':'count'},inplace=True)
df_tv.rename(columns={'index':'year','release_year':'count'},inplace=True)
sns.lineplot(x='year',y='count',data=df_m,color='r',label='Movies')
sns.lineplot(x='year',y='count',data=df_tv,color='b',label='TV Shows')
plt.show()
```



Does Netflix has more focus on TV Shows than movies in recent years? Lets see with last 5 years

In [13]:
```
df_temp=df[df['release_year']>=2017]
sns.countplot(x='release_year',hue='type',data=df_temp)
plt.show()
```



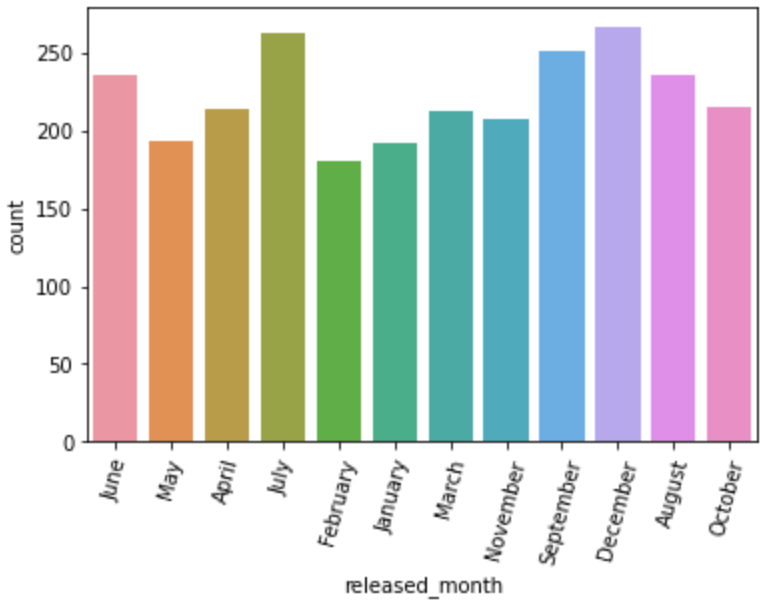
- As we see both grapths are in same shape in first plot but as wee as zoomed version in countplot we are clearly able to see that in last 5 years the number of movies decresed and number of TV Shows increased, which indeed says that in recent years Netflix is focusing more on TV Shows

What is the best time to launch a TV show?

Note: Analyzing with which month most no of TV shows released.

In [49]:
```
df_tv=df[df['type']=='TV Show']
df_tv['released_month']=df_tv['date_added'].dt.strftime('%B')
sns.countplot(x='released_month',data=df_tv)
plt.xticks(rotation=75)
plt.show()
```

```
C:\Users\akash\AppData\Local\Temp\ipykernel_38040\1122455223.py:2: SettingWithCopyWarnin
g:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_
guide/indexing.html#returning-a-view-versus-a-copy
  df_tv['released_month']=df_tv['date_added'].dt.strftime('%B')
```



- We are able to see a peak in middle of the year which is 6th,7th,8th Month and at 12th month.

Preciosuly December and July are the best time to release the TV shows.

As cast column is nested splitting it into different rows to make it easier to analyze.

In [15]:
```
df_cast=df['cast'].str.split(', ')
df_cast.index=df['title']
df_cast=df_cast.reset_index().explode('cast')
df_cast.head(7)
```

Out[15]:

	title	cast
0	Ali & Ratu Ratu Queens	Iqbaal Ramadhan
0	Ali & Ratu Ratu Queens	Nirina Zubir
0	Ali & Ratu Ratu Queens	Asri Welas
0	Ali & Ratu Ratu Queens	Tika Panggabean
0	Ali & Ratu Ratu Queens	Happy Salma
0	Ali & Ratu Ratu Queens	Aurora Ribero
0	Ali & Ratu Ratu Queens	Marissa Anita

observations:

- Social Distance had big cast

In [16]:
```
df_cast.describe()
```

Out[16]:

	title	cast
count	64951	64126
unique	8807	36439
top	Social Distance	Anupam Kher
freq	50	43

Using similar technique above used on cast column to split the other nested column includes listed_in,director,country

In [17]:
```
df_genre=df['listed_in'].str.split(', ')
df_genre.index=df['title']
df_genre=df_genre.reset_index()
df_genre=df_genre.explode('listed_in')
df_genre.head(7)
```

Out[17]:

	title	listed_in
0	Ali & Ratu Ratu Queens	Comedies
0	Ali & Ratu Ratu Queens	Dramas
0	Ali & Ratu Ratu Queens	International Movies
1	Black Holes | The Edge of All We Know	Documentaries
2	Sweet & Sour	Comedies

2	Sweet & Sour	International Movies
2	Sweet & Sour	Romantic Movies

observations:

- Dramas,Comedies,Documentaries are the top most involved genre in all movies and tv series.

Note: International Movies and International TV Shows are not genre , they are mostly like type of the movie

In [18]:
```
df_genre['listed_in'].value_counts()[0:5]
```

Out[18]:
```
International Movies      2752
Dramas                    2427
Comedies                  1674
International TV Shows    1351
Documentaries              869
Name: listed_in, dtype: int64
```

In [19]:
```
df_dir=df['director'].str.split(', ')
df_dir.index=df['title']
df_dir=df_dir.reset_index()
df_dir=df_dir.explode('director')
df_dir.head(7)
```

Out[19]:

	title	director
0	Ali & Ratu Ratu Queens	Lucky Kuswandi
1	Black Holes | The Edge of All We Know	Peter Galison
2	Sweet & Sour	Lee Kae-byeok
3	Sweet Tooth	NaN
4	Trippin' with the Kandasamys	Jayan Moodley
5	Xtreme	Daniel Benmayor
6	Alan Saldaña: Locked Up	Alex Díaz

Observations:

- Walt Disney Animation Studios Short Films Collection had directed by most number of directors 13.

In [20]:
```
df_dir.describe()
```

Out[20]:

	title	director
count	9612	6978
unique	8807	4993
top	Walt Disney Animation Studios Short Films Coll...	Rajiv Chilaka
freq	13	22

In [21]:
```
df_dir['title'].value_counts()[0:1]
```

Out[21]:
```
Walt Disney Animation Studios Short Films Collection    13
Name: title, dtype: int64
```

In [22]:
```
df_coun=df['country'].str.split(', ')
```

```
df_coun.index=df['title']
df_coun=df_coun.reset_index()
df_coun=df_coun.explode('country')
df_coun.head(7)
```

Out[22]:

	title	country
0	Ali & Ratu Ratu Queens	NaN
1	Black Holes | The Edge of All We Know	NaN
2	Sweet & Sour	South Korea
3	Sweet Tooth	United States
4	Trippin' with the Kandasamys	South Africa
5	Xtreme	Spain
6	Alan Saldaña: Locked Up	Mexico

Observation:

- United States have produced more number of movies and TV series which implies that they have big film industry

In [23]:
```
df_coun.describe()
```

Out[23]:

	title	country
count	10845	10014
unique	8807	127
top	Barbecue	United States
freq	12	3689

Lets merge the data

- Note: Why not merging all columns at once ?
- will create duplicates and counts will be inconsistent of the categorical columns.

Country vs Genre

In [24]:
```
df_new=pd.merge(df,df_coun,on='title',how='left')
df_new=pd.merge(df_new,df_genre,on='title',how='left')
df_new.head(2)
```

Out[24]:

	show_id	type	title	director	cast	country_x	date_added	release_year	rating	duration	listed_
0	s694	Movie	Ali & Ratu Ratu Queens	Lucky Kuswandi	Iqbaal Ramadhan, Nirina Zubir, Asri Welas, Tik...	NaN	2021-06-17	2021	TV-14	101 min	Come Dra Internat Mo
1	s694	Movie	Ali & Ratu Ratu Queens	Lucky Kuswandi	Iqbaal Ramadhan, Nirina Zubir, Asri Welas, Tik...	NaN	2021-06-17	2021	TV-14	101 min	Come Dra Internat Mo

In [25]:
```
temp=df_new.groupby(['country_y','listed_in_y']).size().reset_index()
temp.sort_values(by=[0],ascending=False).head(6)
```

Out[25]:

	country_y	listed_in_y	0
526	India	International Movies	864
1351	United States	Dramas	835
1346	United States	Comedies	680
522	India	Dramas	662
1349	United States	Documentaries	511
1339	United States	Action & Adventure	404

We can get the country and genre which is linked and also have more nu,ber of movies and TV Shows

- In US and Inida which are top countried in making films and TV shows are more insterested in Dramas.

Cast vs Genre

In [26]:
```
df_new=pd.merge(df,df_cast,on='title',how='left')
df_new=pd.merge(df_new,df_genre,on='title',how='left')
df_new.head(2)
```

Out[26]:

	show_id	type	title	director	cast_x	country	date_added	release_year	rating	duration	listed_in
0	s694	Movie	Ali & Ratu Ratu Queens	Lucky Kuswandi	Iqbaal Ramadhan, Nirina Zubir, Asri Welas, Tik...	NaN	2021-06-17	2021	TV-14	101 min	Comedi Dram Internatior Movi
1	s694	Movie	Ali & Ratu Ratu Queens	Lucky Kuswandi	Iqbaal Ramadhan, Nirina Zubir, Asri Welas, Tik...	NaN	2021-06-17	2021	TV-14	101 min	Comedi Dram Internatior Movi

In [27]:
```
temp=df_new.groupby(['cast_y','listed_in_y']).size().reset_index()
temp.sort_values(by=[0],ascending=False).head(6)
```

Out[27]:

	cast_y	listed_in_y	0
8830	Anupam Kher	International Movies	38
94654	Shah Rukh Khan	International Movies	32
75002	Naseeruddin Shah	Dramas	28
8828	Anupam Kher	Dramas	28
94653	Shah Rukh Khan	Dramas	28
2668	Akshay Kumar	International Movies	27

Anupam Kher,Naseeruddin Shah and Shah Rukh Khan are the actors who done most movies or TV shows in one genre.From this we can also get each actors favorite genre.

Director vs Genre

In [28]:
```
df_new=pd.merge(df,df_dir,on='title',how='left')
df_new=pd.merge(df_new,df_genre,on='title',how='left')
df_new.head(2)
```

Out[28]:

	show_id	type	title	director_x	cast	country	date_added	release_year	rating	duration	listed_i
0	s694	Movie	Ali & Ratu Ratu Queens	Lucky Kuswandi	Iqbaal Ramadhan, Nirina Zubir, Asri Welas, Tik...	NaN	2021-06-17	2021	TV-14	101 min	Comec Dran Internatic Mo
1	s694	Movie	Ali & Ratu Ratu Queens	Lucky Kuswandi	Iqbaal Ramadhan, Nirina Zubir, Asri Welas, Tik...	NaN	2021-06-17	2021	TV-14	101 min	Comec Dran Internatic Mo

In [29]:
```
temp=df_new.groupby(['director_y','listed_in_y']).size().reset_index()
temp.sort_values(by=[0],ascending=False).head(6)
```

Out[29]:

	director_y	listed_in_y	0
8969	Rajiv Chilaka	Children & Family Movies	22
4553	Jan Suter	Stand-Up Comedy	21
9107	Raúl Campos	Stand-Up Comedy	19
10736	Suhas Kadav	Children & Family Movies	16
6817	Marcus Raboy	Stand-Up Comedy	15
4675	Jay Karas	Stand-Up Comedy	14

Rajiv Chilaka have directed most number of movies in one genre.

Director vs Cast

In [30]:
```
df_new=pd.merge(df,df_dir,on='title',how='left')
df_new=pd.merge(df_new,df_cast,on='title',how='left')
df_new.head(2)
```

Out[30]:

	show_id	type	title	director_x	cast_x	country	date_added	release_year	rating	duration	listed
0	s694	Movie	Ali & Ratu Ratu Queens	Lucky Kuswandi	Iqbaal Ramadhan, Nirina Zubir, Asri Welas, Tik...	NaN	2021-06-17	2021	TV-14	101 min	Comec Dran Internatic Mo
1	s694	Movie	Ali & Ratu Ratu Queens	Lucky Kuswandi	Iqbaal Ramadhan, Nirina Zubir, Asri Welas, Tik...	NaN	2021-06-17	2021	TV-14	101 min	Comec Dran Internatic Mo

In [31]:
```
temp=df_new.groupby(['director_y','cast_y']).size().reset_index()
temp.sort_values(by=[0],ascending=False).head(6)
```

	director_y	cast_y	0

Out[31]:

35337	Rajiv Chilaka	Rajesh Kava	19
35331	Rajiv Chilaka	Julie Tejwani	19
35338	Rajiv Chilaka	Rupa Bhimani	18
35330	Rajiv Chilaka	Jigna Bhardwaj	18
35345	Rajiv Chilaka	Vatsal Dubey	16
35334	Rajiv Chilaka	Mousam	13

As per above we can say that Rajiv Chilaka's favourite cast members are Rajesh Kava and Julie Tejwani

With following analysis ,Netflix can produce successfull TV show.

```
 - Best Director,Top 5 cast members,Top 3 genre to create a story, Best month
to release a TV Show,Best country to release on.
 - Best Month to release TV Show is we already analyzed with count plot and got
December and July.
```

Why select TV show ?

- Increase in number of release in recent years which shows it is improving field.
- Number of release is less compare to movies which shows it still have more to explore in that TV show field.

In [32]:
```
df_new=df.loc[df['type']=='TV Show']
```

Best director -- purely by number of TV shows he/she did , as i believe if director is not good will not get to do many TV Shows.

In [33]:
```
df_new.isna().sum()
```

Out[33]:
```
show_id            0
type               0
title              0
director        2446
cast             350
country          391
date_added        10
release_year       0
rating             2
duration           0
listed_in          0
description        0
dtype: int64
```

In [34]:
```
df_new.shape
```

Out[34]:
```
(2676, 12)
```

In [35]:
```
2446/2676
```

Out[35]:
```
0.9140508221225710
```

In 2676 rows 2446 is missing for director , that is more than 90 percent .From this we can conclude that finding best director for the TV Show with this dataset is out of scope.

Best Country -- purely by number of TV shows made in the particular country.

In [36]:
```
df_c=pd.merge(df_new,df_coun,on='title',how='left')
df_c['country_y'].value_counts().reset_index()
```

Out[36]:

	index	country_y
0	United States	938
1	United Kingdom	272
2	Japan	199
3	South Korea	170
4	Canada	126
...	...	...
61	Austria	1
62	Uruguay	1
63	Syria	1
64	Hungary	1
65		1

66 rows × 2 columns

In [37]:
```
df_c[df_c.duplicated()]
```

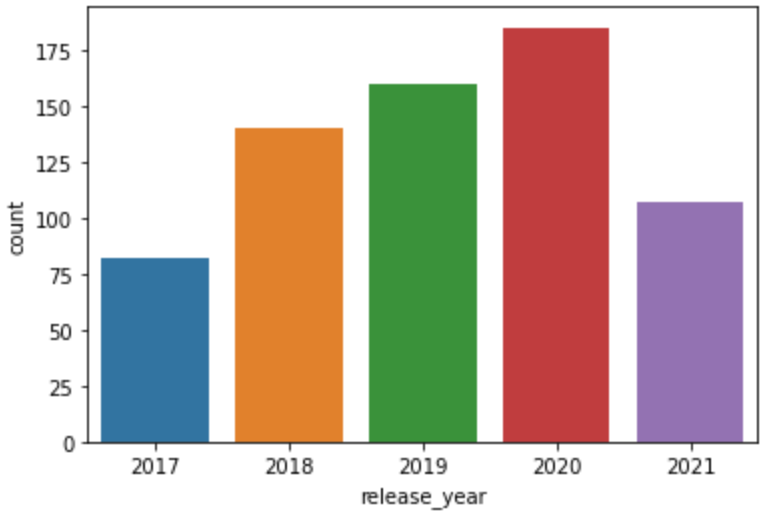
Out[37]:

show_id	type	title	director	cast	country_x	date_added	release_year	rating	duration	listed_in	descriptio

By far US have more number of TV Shows lets check its progress to see how in recent years no of release is in US

In [38]:
```
temp=df_c.loc[(df_c['country_y']=='United States') & (df_c['release_year']>=2017)]
sns.countplot(x='release_year',data=temp)
```

Out[38]:
```
<AxesSubplot:xlabel='release_year', ylabel='count'>
```



As we see the graph which implies the increase in counts of the country variable in the dataset which also represent that number of TV shows are increasing year by year it came down at 2021 due to corona , we can

neglect that as we are moving past corona in coming months,From this we can conclude best country to make TV Show is United States.

Top 3 Genre

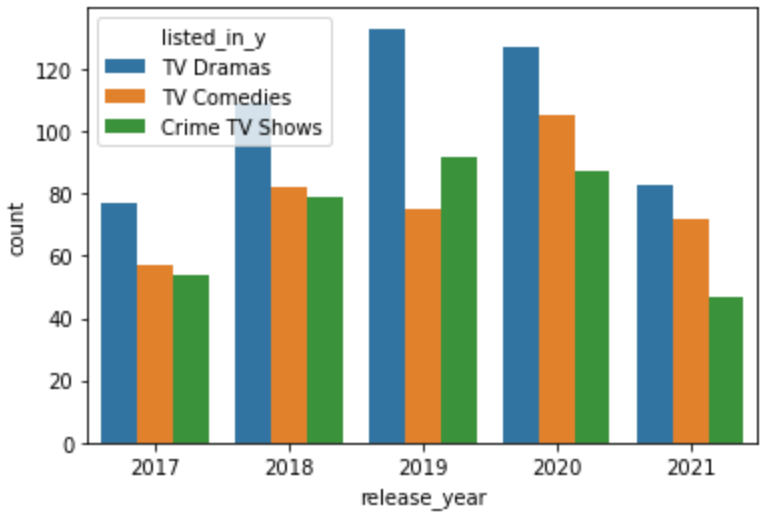
In [39]:
```
df_g=pd.merge(df_new,df_genre,on='title',how='left')
df_g['listed_in_y'].value_counts().reset_index().head(5)
```

Out[39]:

	index	listed_in_y
0	International TV Shows	1351
1	TV Dramas	763
2	TV Comedies	581
3	Crime TV Shows	470
4	Kids' TV	451

From above we can say that TV Dramas,TV Comedies and Crime TV Shows are the top 3 genre.

In [40]:
```
l=['TV Dramas','TV Comedies','Crime TV Shows']
temp=df_g.loc[(df_g['release_year']>=2017) & (df_g['listed_in_y'].isin(l))]
sns.countplot(x='release_year',hue='listed_in_y',data=temp)
plt.show()
```



Top 5 Cast Members-- As we planned on releasing movie in US lets get cast members who already established in US.

In [41]:
```
df_ca=pd.merge(df_new,df_cast,on='title',how='left')
df_ca=df_ca.loc[df_ca['country'] == 'United States' ]
df_ca['cast_y'].value_counts().reset_index().head(7)
```

Out[41]:

	index	cast_y
0	Grey Griffin	7
1	Mike Colter	7
2	Steven Yeun	6
3	Kari Wahlgren	6
4	Kevin Michael Richardson	6

5	Keith David	5
6	Sean Astin	5

These are the top 5 cast members in TV Shows

- Grey Griffin,Mike Colter,Kevin Michael Richardson,Kari Wahlgren,Steven Yeun

As year progressed how number of minutes in a movies have changed.

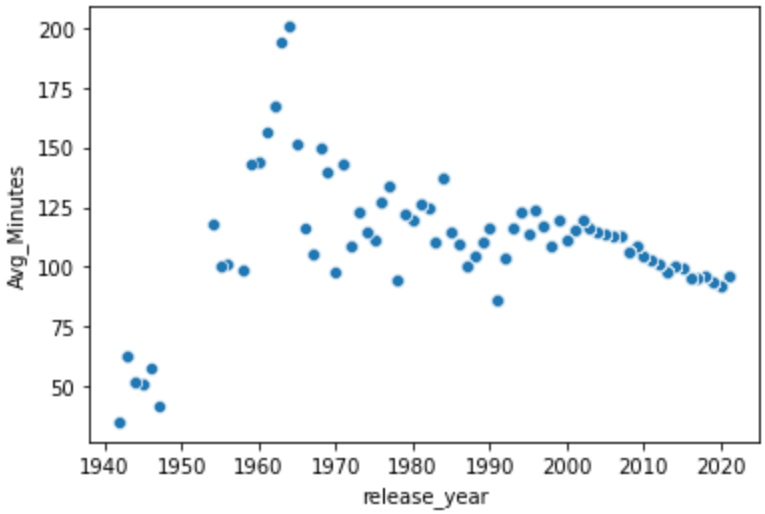
In [42]:
```
df_new=df.loc[df['type']=='Movie']
temp=df_new['duration'].str.extractall('(\d+)')
temp=temp.reset_index().drop(['match'],axis=1).set_index('level_0')
df_new['minutes']=temp[0].astype('int')
df_new['Avg_Minutes']=df_new.groupby(['release_year'])['minutes'].transform(np.mean)
df_new.head(3)
```

```
C:\Users\akash\AppData\Local\Temp\ipykernel_38040\2215455627.py:4: SettingWithCopyWarnin
g:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_
guide/indexing.html#returning-a-view-versus-a-copy
  df_new['minutes']=temp[0].astype('int')
C:\Users\akash\AppData\Local\Temp\ipykernel_38040\2215455627.py:5: SettingWithCopyWarnin
g:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_
guide/indexing.html#returning-a-view-versus-a-copy
  df_new['Avg_Minutes']=df_new.groupby(['release_year'])['minutes'].transform(np.mean)
```

Out[42]:

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	li
693	s694	Movie	Ali & Ratu Ratu Queens	Lucky Kuswandi	Iqbaal Ramadhan, Nirina Zubir, Asri Welas, Tik...	NaN	2021-06-17	2021	TV-14	101 min	Co D Interr
781	s782	Movie	Black Holes | The Edge of All We Know	Peter Galison	NaN	NaN	2021-06-02	2021	TV-14	99 min	Docume
762	s763	Movie	Sweet & Sour	Lee Kae-byeok	Jang Ki-yong, Chae Soo-bin, Jung Soo-jung	South Korea	2021-06-04	2021	TV-14	103 min	Co Interr Rc

In [43]:
```
sns.scatterplot(data=df_new,x='release_year',y='Avg_Minutes')
plt.show()
```



Before 2000 whatever we had those are outliers , as we saw above in boxplot so lets focus after . As per the plot Avg movie time per year is almost in range of 85 , 125 for last 21 years, Which says we have standard timings.

In [44]:
```
sns.scatterplot(data=df_new,x='release_year',y='Avg_Minutes')
plt.xlim(2000,)
plt.show()
```