1.Defining Problem Statement and Analysing basic metrics

Problem Statement:

The aim is to understand the current state of netflix library , extract the insights and trends and provide recommendations on what type of shows/movies to produc and grow business in different countries

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

Importing Data

```
data = pd.read_csv('/kaggle/input/netflix/netflix.csv')
data

     show_id     type                       title         director  \
0         s1    Movie    Dick Johnson Is Dead  Kirsten Johnson
1         s2  TV Show           Blood & Water              NaN
2         s3  TV Show               Ganglands  Julien Leclercq
3         s4  TV Show   Jailbirds New Orleans              NaN
4         s5  TV Show            Kota Factory              NaN
...      ...      ...                     ...              ...
8802   s8803    Movie                  Zodiac    David Fincher
8803   s8804  TV Show             Zombie Dumb              NaN
8804   s8805    Movie              Zombieland  Ruben Fleischer
8805   s8806    Movie                    Zoom     Peter Hewitt
8806   s8807    Movie                  Zubaan      Mozez Singh

                                                   cast        country
\
0                                                   NaN  United States

1     Ama Qamata, Khosi Ngema, Gail Mabalane, Thaban...   South Africa

2     Sami Bouajila, Tracy Gotoas, Samuel Jouy, Nabi...            NaN

3                                                   NaN            NaN

4     Mayur More, Jitendra Kumar, Ranjan Raj, Alam K...          India

...                                                 ...            ...

8802  Mark Ruffalo, Jake Gyllenhaal, Robert Downey J...  United States

8803                                                NaN            NaN
```

```
8804  Jesse Eisenberg, Woody Harrelson, Emma Stone, ...  United States

8805  Tim Allen, Courteney Cox, Chevy Chase, Kate Ma...  United States

8806  Vicky Kaushal, Sarah-Jane Dias, Raaghav Chanan...          India


              date_added  release_year rating   duration  \
0     September 25, 2021          2020  PG-13     90 min  
1     September 24, 2021          2021  TV-MA  2 Seasons  
2     September 24, 2021          2021  TV-MA   1 Season  
3     September 24, 2021          2021  TV-MA   1 Season  
4     September 24, 2021          2021  TV-MA  2 Seasons  
...                  ...           ...    ...        ...  
8802   November 20, 2019          2007      R    158 min  
8803        July 1, 2019          2018  TV-Y7  2 Seasons  
8804    November 1, 2019          2009      R     88 min  
8805    January 11, 2020          2006     PG     88 min  
8806       March 2, 2019          2015  TV-14    111 min  

                                              listed_in  \
0                                         Documentaries   
1       International TV Shows, TV Dramas, TV Mysteries   
2     Crime TV Shows, International TV Shows, TV Act...   
3                                Docuseries, Reality TV   
4     International TV Shows, Romantic TV Shows, TV ...   
...                                                 ...   
8802                     Cult Movies, Dramas, Thrillers   
8803             Kids' TV, Korean TV Shows, TV Comedies   
8804                            Comedies, Horror Movies   
8805                 Children & Family Movies, Comedies   
8806     Dramas, International Movies, Music & Musicals   

                                            description  
0     As her father nears the end of his life, filmm...  
1     After crossing paths at a party, a Cape Town t...  
2     To protect his family from a powerful drug lor...  
3     Feuds, flirtations and toilet talk go down amo...  
4     In a city of coaching centers known to train I...  
...                                                 ...  
8802  A political cartoonist, a crime reporter and a...  
8803  While living alone in a spooky town, a young g...  
8804  Looking to survive in a world taken over by zo...  
8805  Dragged from civilian life, a former superhero...  
8806  A scrappy but poor boy worms his way into a ty...  

[8807 rows x 12 columns]

data.head()
```

```
  show_id     type                  title         director  \
0      s1    Movie   Dick Johnson Is Dead  Kirsten Johnson   
1      s2  TV Show          Blood & Water              NaN   
2      s3  TV Show              Ganglands  Julien Leclercq   
3      s4  TV Show  Jailbirds New Orleans              NaN   
4      s5  TV Show           Kota Factory              NaN   

                                                cast        country  \
0                                                NaN  United States   
1  Ama Qamata, Khosi Ngema, Gail Mabalane, Thaban...   South Africa   
2  Sami Bouajila, Tracy Gotoas, Samuel Jouy, Nabi...            NaN   
3                                                NaN            NaN   
4  Mayur More, Jitendra Kumar, Ranjan Raj, Alam K...          India   

           date_added  release_year rating   duration  \
0  September 25, 2021          2020  PG-13     90 min   
1  September 24, 2021          2021  TV-MA  2 Seasons   
2  September 24, 2021          2021  TV-MA   1 Season   
3  September 24, 2021          2021  TV-MA   1 Season   
4  September 24, 2021          2021  TV-MA  2 Seasons   

                                           listed_in  \
0                                      Documentaries   
1    International TV Shows, TV Dramas, TV Mysteries   
2  Crime TV Shows, International TV Shows, TV Act...   
3                             Docuseries, Reality TV   
4  International TV Shows, Romantic TV Shows, TV ...   

                                         description  
0  As her father nears the end of his life, filmm...  
1  After crossing paths at a party, a Cape Town t...  
2  To protect his family from a powerful drug lor...  
3  Feuds, flirtations and toilet talk go down amo...  
4  In a city of coaching centers known to train I...  
```

2. Observations on the shape of data, data types of all the attributes, conversion of categorical attributes to 'category' (If required), missing value detection, statistical summary

```
data.columns
```

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

```
data.ndim
```

```
2
```

```
data.shape # rows and columns in data frame
```

```
(8807, 12)
```

```
data.dtypes # data types of all attributes
```

```
show_id         object
type            object
title           object
director        object
cast            object
country         object
date_added      object
release_year     int64
rating          object
duration        object
listed_in       object
description     object
dtype: object
```

```
data.info() # provides summary information about data frame
```

```
<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
```

```
data.nunique()
```

```
show_id         8807
type               2
title           8807
```

```
director        4528
cast            7692
country          748
date_added      1767
release_year      74
rating            17
duration         220
listed_in        514
description     8775
dtype: int64
```

From above data we can say that only column type is Categorical column

```
data['type'].value_counts()
```

```
type
Movie      6131
TV Show    2676
Name: count, dtype: int64
```

```
data.isnull().sum() # returns the sum of null values in each column
```

```
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
```

```
missing_value_table = pd.DataFrame({
    'Null Count': data.isnull().sum(),
    'Non-Null Count': data.notnull().sum()
})

missing_value_table
```

```
              Null Count  Non-Null Count
show_id                0            8807
type                   0            8807
title                  0            8807
director            2634            6173
cast                 825            7982
country              831            7976
```

```
date_added            10               8797
release_year           0               8807
rating                 4               8803
duration               3               8804
listed_in              0               8807
description            0               8807
```

```
data.describe() #returns statistical summary of only numeric columns
```

```
       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
```

```
data.describe(include='object').T # this gives statistical summary of
all columns
```

```
            count unique
top  \
show_id      8807   8807
s1
type         8807      2
Movie
title        8807   8807                               Dick Johnson Is
Dead
director     6173   4528                                      Rajiv
Chilaka
cast         7982   7692                                 David
Attenborough
country      7976    748                                      United
States
date_added   8797   1767                                    January 1,
2020
rating       8803     17
TV-MA
duration     8804    220                                           1
Season
listed_in    8807    514                       Dramas, International
Movies
description  8807   8775  Paranormal activity at a lush, abandoned
prope...

             freq
show_id         1
type         6131
```

```
title             1
director         19
cast             19
country        2818
date_added      109
rating         3207
duration       1793
listed_in       362
description       4
```

Non-Graphical Analysis: Value counts and unique attributes

```
data.nunique() # Gives count of unique values in each colum
```

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

By results from above analysis type and rating are only columns that have unique attributes rest are continuous

```
# To get unique values from specific column
data['rating'].unique()
```

```
array(['PG-13', 'TV-MA', 'PG', 'TV-14', 'TV-PG', 'TV-Y', 'TV-Y7', 'R',
       'TV-G', 'G', 'NC-17', '74 min', '84 min', '66 min', 'NR', nan,
       'TV-Y7-FV', 'UR'], dtype=object)
```

```
# To get unique value count from especific column
data['rating'].value_counts()
```

```
rating
TV-MA       3207
TV-14       2160
TV-PG        863
R            799
PG-13        490
TV-Y7        334
```

```
TV-Y         307
PG           287
TV-G         220
NR            80
G             41
TV-Y7-FV       6
NC-17          3
UR             3
74 min         1
84 min         1
66 min         1
Name: count, dtype: int64
```

```
data['type'].unique()
```

```
array(['Movie', 'TV Show'], dtype=object)
```

```
data['type'].value_counts(normalize=True)*100 # we can get percentage as well
```

```
type
Movie      69.615079
TV Show    30.384921
Name: proportion, dtype: float64
```

```
data
```

```
     show_id     type                  title         director  \
0         s1    Movie   Dick Johnson Is Dead  Kirsten Johnson
1         s2  TV Show          Blood & Water              NaN
2         s3  TV Show              Ganglands  Julien Leclercq
3         s4  TV Show  Jailbirds New Orleans              NaN
4         s5  TV Show           Kota Factory              NaN
...      ...      ...                    ...              ...
8802   s8803    Movie                 Zodiac    David Fincher
8803   s8804  TV Show            Zombie Dumb              NaN
8804   s8805    Movie             Zombieland  Ruben Fleischer
8805   s8806    Movie                   Zoom     Peter Hewitt
8806   s8807    Movie                 Zubaan      Mozez Singh

                                                   cast        country
\
0                                                   NaN  United States

1     Ama Qamata, Khosi Ngema, Gail Mabalane, Thaban...   South Africa

2     Sami Bouajila, Tracy Gotoas, Samuel Jouy, Nabi...            NaN

3                                                   NaN            NaN

4     Mayur More, Jitendra Kumar, Ranjan Raj, Alam K...          India
```

```
...                                                  ...            ...
8802  Mark Ruffalo, Jake Gyllenhaal, Robert Downey J...  United States
8803                                                 NaN            NaN
8804  Jesse Eisenberg, Woody Harrelson, Emma Stone, ...  United States
8805  Tim Allen, Courteney Cox, Chevy Chase, Kate Ma...  United States
8806  Vicky Kaushal, Sarah-Jane Dias, Raaghav Chanan...          India

              date_added  release_year rating   duration  \
0     September 25, 2021          2020  PG-13     90 min
1     September 24, 2021          2021  TV-MA  2 Seasons
2     September 24, 2021          2021  TV-MA   1 Season
3     September 24, 2021          2021  TV-MA   1 Season
4     September 24, 2021          2021  TV-MA  2 Seasons
...                  ...           ...    ...        ...
8802   November 20, 2019          2007      R    158 min
8803        July 1, 2019          2018  TV-Y7  2 Seasons
8804    November 1, 2019          2009      R     88 min
8805    January 11, 2020          2006     PG     88 min
8806       March 2, 2019          2015  TV-14    111 min

                                              listed_in  \
0                                         Documentaries
1       International TV Shows, TV Dramas, TV Mysteries
2     Crime TV Shows, International TV Shows, TV Act...
3                                Docuseries, Reality TV
4     International TV Shows, Romantic TV Shows, TV ...
...                                                 ...
8802                     Cult Movies, Dramas, Thrillers
8803             Kids' TV, Korean TV Shows, TV Comedies
8804                            Comedies, Horror Movies
8805                 Children & Family Movies, Comedies
8806     Dramas, International Movies, Music & Musicals

                                            description
0     As her father nears the end of his life, filmm...
1     After crossing paths at a party, a Cape Town t...
2     To protect his family from a powerful drug lor...
3     Feuds, flirtations and toilet talk go down amo...
4     In a city of coaching centers known to train I...
...                                                 ...
8802  A political cartoonist, a crime reporter and a...
8803  While living alone in a spooky town, a young g...
8804  Looking to survive in a world taken over by zo...
```

```
8805  Dragged from civilian life, a former superhero...
8806  A scrappy but poor boy worms his way into a ty...

[8807 rows x 12 columns]
```

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

Pre-processing

```
data.isnull().sum()
```

```
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
```

Filling with other values for null attributes

```
data.director.fillna("No Director", inplace=True)
data.cast.fillna("No Cast", inplace=True)
data.country.fillna("Country Unavailable", inplace=True)
```

For date column i used ffill which fills missed data with previous rows data

```
data['date_added'].fillna(method='ffill', inplace=True)
```

For index column null values are relaced by mode of column

```
x = data['rating'].value_counts().index[0]
data.rating.fillna(x,inplace=True)

data.isnull().sum()
```

```
show_id         0
type            0
title           0
director        0
cast            0
```

```
country         0
date_added      0
release_year    0
rating          0
duration        3
listed_in       0
description     0
dtype: int64
```

Un-nesting columns those have cells with multiple comma separated values by creating multiple rows

From data we can see that country,director,cast,listed_in rows have multiple values seperated by commas

```
data.head()

  show_id     type                  title         director  \
0      s1    Movie   Dick Johnson Is Dead  Kirsten Johnson
1      s2  TV Show          Blood & Water      No Director
2      s3  TV Show              Ganglands  Julien Leclercq
3      s4  TV Show  Jailbirds New Orleans      No Director
4      s5  TV Show           Kota Factory      No Director

                                                cast
country  \
0                                            No Cast        United
States
1  Ama Qamata, Khosi Ngema, Gail Mabalane, Thaban...         South
Africa
2  Sami Bouajila, Tracy Gotoas, Samuel Jouy, Nabi...  Country
Unavailable
3                                            No Cast  Country
Unavailable
4  Mayur More, Jitendra Kumar, Ranjan Raj, Alam K...
India

           date_added  release_year rating   duration  \
0  September 25, 2021          2020  PG-13     90 min
1  September 24, 2021          2021  TV-MA  2 Seasons
2  September 24, 2021          2021  TV-MA   1 Season
3  September 24, 2021          2021  TV-MA   1 Season
4  September 24, 2021          2021  TV-MA  2 Seasons

                                           listed_in  \
0                                      Documentaries
1    International TV Shows, TV Dramas, TV Mysteries
2  Crime TV Shows, International TV Shows, TV Act...
3                             Docuseries, Reality TV
4  International TV Shows, Romantic TV Shows, TV ...
```

```
                                         description
0  As her father nears the end of his life, filmm...
1  After crossing paths at a party, a Cape Town t...
2  To protect his family from a powerful drug lor...
3  Feuds, flirtations and toilet talk go down amo...
4  In a city of coaching centers known to train I...
```

```
df=data
```

```
constraint=df['cast'].apply(lambda x: str(x).split(', ')).tolist()
df_new=pd.DataFrame(constraint,index=df['title'])
df_new=df_new.stack()
df_new=pd.DataFrame(df_new)
df_new.reset_index(inplace=True)
df_new=df_new[['title',0]]
df_new.columns=['title','cast']
df_new
```

```
                      title                    cast
0      Dick Johnson Is Dead                 No Cast
1             Blood & Water              Ama Qamata
2             Blood & Water             Khosi Ngema
3             Blood & Water           Gail Mabalane
4             Blood & Water          Thabang Molaba
...                     ...                     ...
64946                Zubaan        Manish Chaudhary
64947                Zubaan            Meghna Malik
64948                Zubaan           Malkeet Rauni
64949                Zubaan          Anita Shabdish
64950                Zubaan  Chittaranjan Tripathy

[64951 rows x 2 columns]
```

```
constraint=df['country'].apply(lambda x: str(x).split(', ')).tolist()
df_new_coun=pd.DataFrame(constraint,index=df['title'])
df_new_coun=df_new_coun.stack()
df_new_coun=pd.DataFrame(df_new_coun)
df_new_coun.reset_index(inplace=True)
df_new_coun=df_new_coun[['title',0]]
df_new_coun.columns=['title','country']
df_new_coun
```

```
                       title              country
0       Dick Johnson Is Dead        United States
1              Blood & Water         South Africa
2                  Ganglands  Country Unavailable
3      Jailbirds New Orleans  Country Unavailable
4               Kota Factory                India
...                      ...                  ...
10840                 Zodiac        United States
```

```
10841            Zombie Dumb  Country Unavailable
10842             Zombieland        United States
10843                   Zoom        United States
10844                 Zubaan                India

[10845 rows x 2 columns]
```

```
constraint=df['listed_in'].apply(lambda x: str(x).split(', 
')).tolist()
df_new_gen=pd.DataFrame(constraint,index=df['title'])
df_new_gen=df_new_gen.stack()
df_new_gen=pd.DataFrame(df_new_gen)
df_new_gen.reset_index(inplace=True)
df_new_gen=df_new_gen[['title',0]]
df_new_gen.columns=['title','genre']
df_new_gen
```

```
                      title                     genre
0      Dick Johnson Is Dead             Documentaries
1             Blood & Water    International TV Shows
2             Blood & Water                 TV Dramas
3             Blood & Water              TV Mysteries
4                 Ganglands            Crime TV Shows
...                     ...                       ...
19318                  Zoom  Children & Family Movies
19319                  Zoom                  Comedies
19320                Zubaan                    Dramas
19321                Zubaan      International Movies
19322                Zubaan          Music & Musicals

[19323 rows x 2 columns]
```

```
constraint=df['director'].apply(lambda x: str(x).split(', ')).tolist()
df_new_dir=pd.DataFrame(constraint,index=df['title'])
df_new_dir=df_new_dir.stack()
df_new_dir=pd.DataFrame(df_new_dir)
df_new_dir.reset_index(inplace=True)
df_new_dir=df_new_dir[['title',0]]
df_new_dir.columns=['title','director']
df_new_dir
```

```
                      title         director
0      Dick Johnson Is Dead  Kirsten Johnson
1             Blood & Water      No Director
2                 Ganglands  Julien Leclercq
3     Jailbirds New Orleans      No Director
4              Kota Factory      No Director
...                     ...              ...
9607                 Zodiac    David Fincher
9608            Zombie Dumb      No Director
```

```
9609             Zombieland  Ruben Fleischer
9610                   Zoom     Peter Hewitt
9611                 Zubaan      Mozez Singh

[9612 rows x 2 columns]
```

Now Merging all using title as commom colum one by one

```
df_cast_coun = pd.merge(df_new,df_new_coun,on='title')

df_cast_coun_gen= pd.merge(df_cast_coun,df_new_gen,on='title')

df_cast_coun_gen_dir = 
pd.merge(df_cast_coun_gen,df_new_dir,on='title')
```

Merged with original data to get final preprocessed data

```
df_pre_process = pd.merge(df,df_cast_coun_gen_dir,on='title')
df_pre_process.head()

  show_id     type                 title       director_x  \
0      s1    Movie  Dick Johnson Is Dead  Kirsten Johnson   
1      s2  TV Show         Blood & Water      No Director   
2      s2  TV Show         Blood & Water      No Director   
3      s2  TV Show         Blood & Water      No Director   
4      s2  TV Show         Blood & Water      No Director   

                                              cast_x      country_x  \
0                                            No Cast  United States   
1  Ama Qamata, Khosi Ngema, Gail Mabalane, Thaban...   South Africa   
2  Ama Qamata, Khosi Ngema, Gail Mabalane, Thaban...   South Africa   
3  Ama Qamata, Khosi Ngema, Gail Mabalane, Thaban...   South Africa   
4  Ama Qamata, Khosi Ngema, Gail Mabalane, Thaban...   South Africa   

           date_added  release_year rating   duration  \
0  September 25, 2021          2020  PG-13     90 min   
1  September 24, 2021          2021  TV-MA  2 Seasons   
2  September 24, 2021          2021  TV-MA  2 Seasons   
3  September 24, 2021          2021  TV-MA  2 Seasons   
4  September 24, 2021          2021  TV-MA  2 Seasons   

                                         listed_in  \
0                                    Documentaries   
1  International TV Shows, TV Dramas, TV Mysteries   
2  International TV Shows, TV Dramas, TV Mysteries   
3  International TV Shows, TV Dramas, TV Mysteries   
4  International TV Shows, TV Dramas, TV Mysteries   

                                         description       cast_y  \
0  As her father nears the end of his life, filmm...      No Cast
1  After crossing paths at a party, a Cape Town t...   Ama Qamata
2  After crossing paths at a party, a Cape Town t...   Ama Qamata
3  After crossing paths at a party, a Cape Town t...   Ama Qamata
4  After crossing paths at a party, a Cape Town t...  Khosi Ngema

       country_y                   genre       director_y
0  United States           Documentaries  Kirsten Johnson
1   South Africa  International TV Shows      No Director
2   South Africa               TV Dramas      No Director
3   South Africa             TV Mysteries      No Director
4   South Africa  International TV Shows      No Director
```

remove dulicate columns and rename the new generaeted rows

```
df_pre_process.drop(['director_x','cast_x','country_x','listed_in'],in
place=True,axis=1)

df_pre_process.rename({'cast_y':'cast','country_y':'country','director
_y':'director'},axis=1,inplace=True)

df_pre_process
```

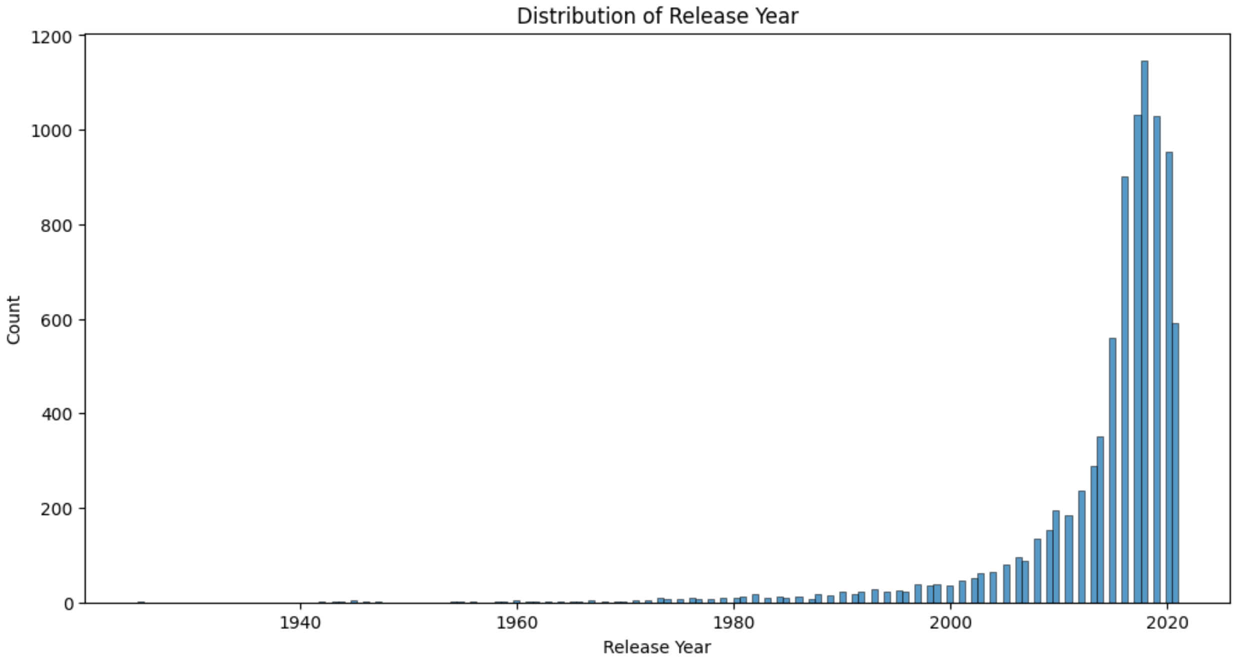
```
       show_id     type                 title          date_added  \
0           s1    Movie  Dick Johnson Is Dead  September 25, 2021
1           s2  TV Show         Blood & Water  September 24, 2021
2           s2  TV Show         Blood & Water  September 24, 2021
3           s2  TV Show         Blood & Water  September 24, 2021
4           s2  TV Show         Blood & Water  September 24, 2021
...        ...      ...                   ...                 ...
201986   s8807    Movie                Zubaan       March 2, 2019
201987   s8807    Movie                Zubaan       March 2, 2019
201988   s8807    Movie                Zubaan       March 2, 2019
201989   s8807    Movie                Zubaan       March 2, 2019
201990   s8807    Movie                Zubaan       March 2, 2019

        release_year rating   duration  \
0               2020  PG-13     90 min
1               2021  TV-MA  2 Seasons
2               2021  TV-MA  2 Seasons
3               2021  TV-MA  2 Seasons
4               2021  TV-MA  2 Seasons
...              ...    ...        ...
201986          2015  TV-14    111 min
201987          2015  TV-14    111 min
201988          2015  TV-14    111 min
201989          2015  TV-14    111 min
201990          2015  TV-14    111 min

                                              description  \
0       As her father nears the end of his life, filmm...
1       After crossing paths at a party, a Cape Town t...
2       After crossing paths at a party, a Cape Town t...
3       After crossing paths at a party, a Cape Town t...
4       After crossing paths at a party, a Cape Town t...
...                                                   ...
201986  A scrappy but poor boy worms his way into a ty...
201987  A scrappy but poor boy worms his way into a ty...
201988  A scrappy but poor boy worms his way into a ty...
201989  A scrappy but poor boy worms his way into a ty...
201990  A scrappy but poor boy worms his way into a ty...

                         cast        country
genre  \
0                     No Cast  United States           Documentaries

1                  Ama Qamata   South Africa  International TV Shows

2                  Ama Qamata   South Africa               TV Dramas

3                  Ama Qamata   South Africa            TV Mysteries

4                 Khosi Ngema   South Africa  International TV Shows

...                       ...            ...                     ...

201986         Anita Shabdish          India    International Movies

201987         Anita Shabdish          India        Music & Musicals

201988  Chittaranjan Tripathy          India                  Dramas

201989  Chittaranjan Tripathy          India    International Movies

201990  Chittaranjan Tripathy          India        Music & Musicals


               director
0       Kirsten Johnson
1           No Director
2           No Director
3           No Director
4           No Director
...                 ...
201986      Mozez Singh
201987      Mozez Singh
201988      Mozez Singh
201989      Mozez Singh
201990      Mozez Singh

[201991 rows x 12 columns]
```

```
df_pre_process.isnull().sum()
```

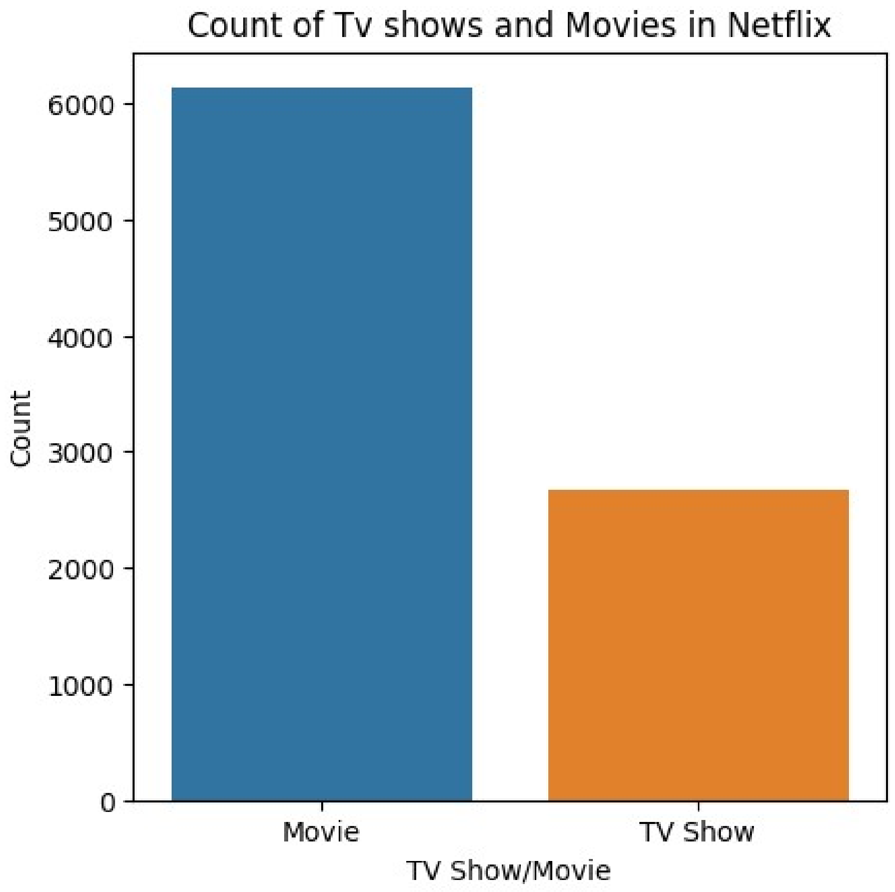
```
show_id         0
type            0
title           0
date_added      0
release_year    0
rating          0
duration        3
description     0
cast            0
country         0
genre           0
director        0
dtype: int64
```

For continuous variable(s): Distplot, countplot, histogram for univariate analysis

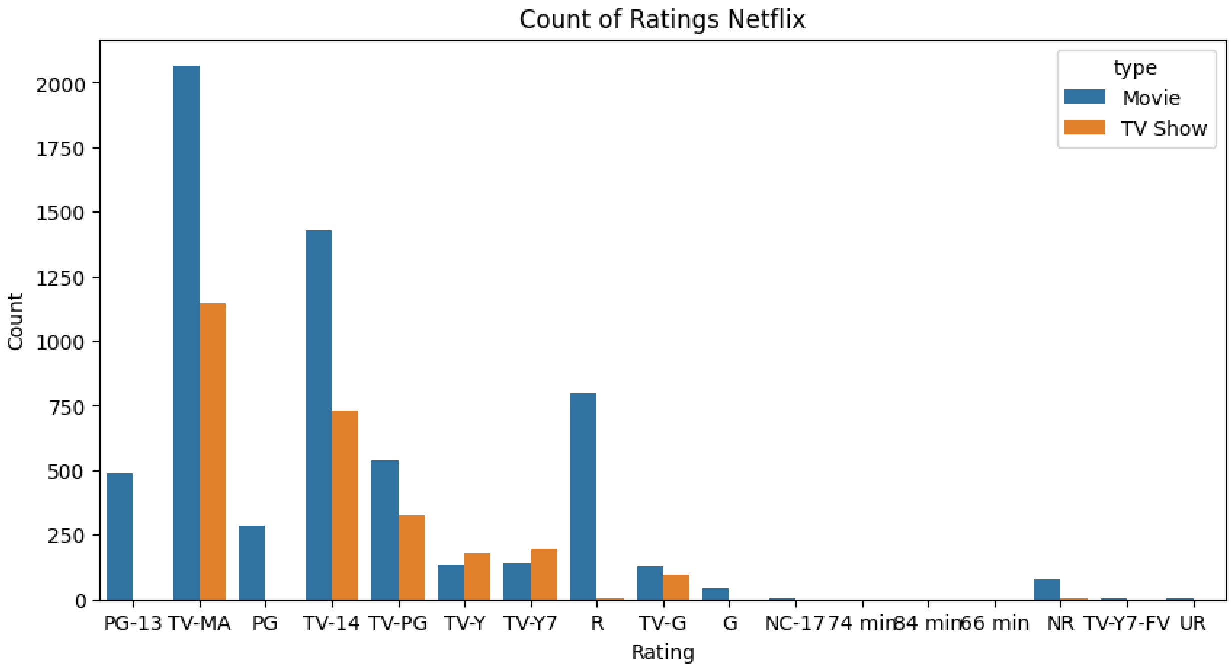
```
plt.figure(figsize=(12, 6))
sns.histplot(df['release_year'])
plt.title('Distribution of Release Year')
plt.xlabel('Release Year')
plt.ylabel('Count')
plt.show()
```



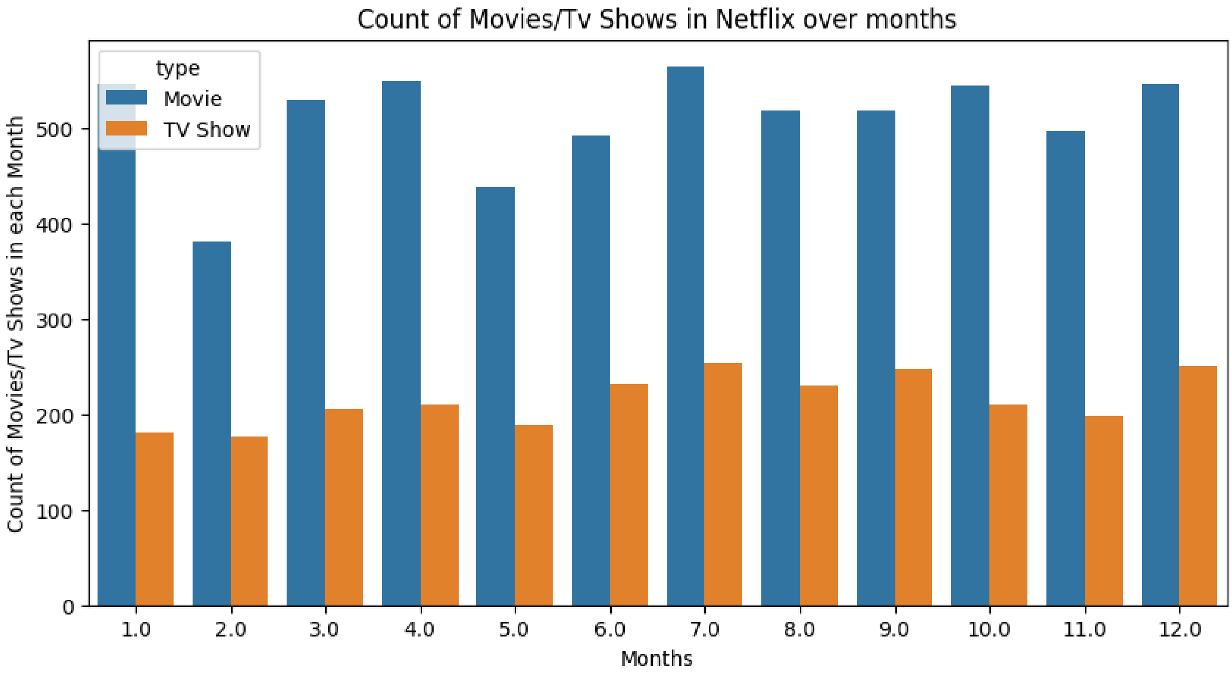
```
plt.figure(figsize=(5,5))
sns.countplot(x='type',data=df)
plt.xlabel("TV Show/Movie")
plt.ylabel("Count")
plt.title('Count of Tv shows and Movies in Netflix')
plt.show()
```



```
plt.figure(figsize=(10,5))
sns.countplot(x='rating',hue='type',data=df)
plt.xlabel("Rating")
plt.ylabel("Count")
plt.title('Count of Ratings Netflix')
plt.show()
```



```
x = pd.to_datetime(df['date_added'], format='%B %d, %Y',
errors='coerce')
plt.figure(figsize=(10,5))
sns.countplot(x=x.dt.month,hue='type',data=df)
plt.xlabel("Months")
plt.ylabel("Count of Movies/Tv Shows in each Month")
plt.title('Count of Movies/Tv Shows in Netflix over months')
plt.show()
```



```
df_pre_process.isnull().sum()
```

```
show_id         0
type            0
title           0
date_added      0
release_year    0
rating          0
duration        3
description     0
cast            0
country         0
genre           0
director        0
dtype: int64
```

Fill duration column null values with max occouring values of that type

```
df_pre_process[df_pre_process['duration'].isnull()==True]
```

```
       show_id   type                                title  \
126537   s5542  Movie                      Louis C.K. 2017
131603   s5795  Movie                 Louis C.K.: Hilarious
131737   s5814  Movie  Louis C.K.: Live at the Comedy Store

                date_added  release_year  rating duration  \
126537       April 4, 2017          2017  74 min      NaN
131603  September 16, 2016          2010  84 min      NaN
131737     August 15, 2016          2015  66 min      NaN

                                              description       cast
\
126537  Louis C.K. muses on religion, eternal love, gi...  Louis C.K.

131603  Emmy-winning comedy writer Louis C.K. brings h...  Louis C.K.

131737  The comic puts his trademark hilarious/thought...  Louis C.K.


              country   genre    director
126537  United States  Movies  Louis C.K.
131603  United States  Movies  Louis C.K.
131737  United States  Movies  Louis C.K.
```

```
x1 = df_pre_process.groupby('type')
['duration'].value_counts().get('Movie').index[0]
x1
```

```
'94 min'
```

```
df_pre_process['duration'].fillna(x1,inplace=True)
df_pre_process.isnull().sum()
```

```
show_id         0
type            0
title           0
date_added      0
release_year    0
rating          0
duration        0
description     0
cast            0
country         0
genre           0
director        0
dtype: int64
```

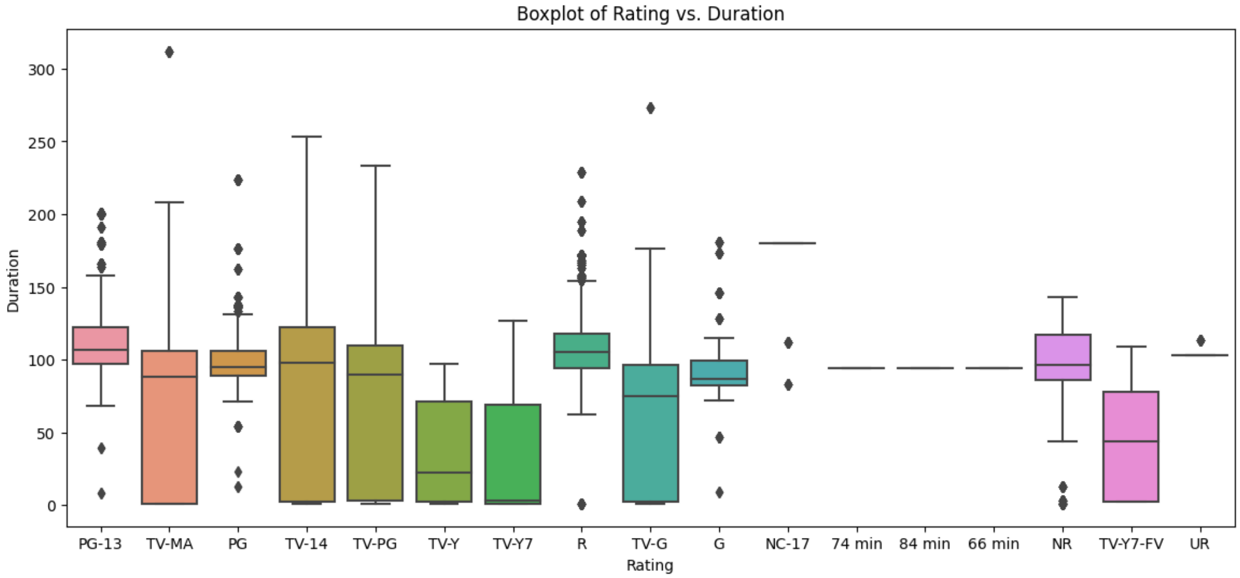
Now convert duration column to numerical to plot boxlot against duration/various data

```
x = df_pre_process['duration'].str.split(' ', expand=True)

# Convert the DataFrame to a list
list_of_lists = x.values.tolist()

# Create a new DataFrame using the list and set the index
df_ti = pd.DataFrame(list_of_lists, index=df_pre_process['title'])
#df_ti = df_ti.stack()
df_ti = pd.DataFrame(df_ti)
df_ti.columns=['time','unit']
df_ti
```

```
                     time     unit
title
Dick Johnson Is Dead   90      min
Blood & Water           2  Seasons
Blood & Water           2  Seasons
Blood & Water           2  Seasons
Blood & Water           2  Seasons
...                   ...      ...
Zubaan                111      min
Zubaan                111      min
Zubaan                111      min
Zubaan                111      min
Zubaan                111      min

[201991 rows x 2 columns]
```

```
v = df_ti['time'].astype('int')
time = v.values
```

```
plt.figure(figsize=(14, 6))
sns.boxplot(x='rating', y=time, data=df_pre_process)
plt.title('Boxplot of Rating vs. Duration')
plt.xlabel('Rating')
plt.ylabel('Duration')
plt.show()
```



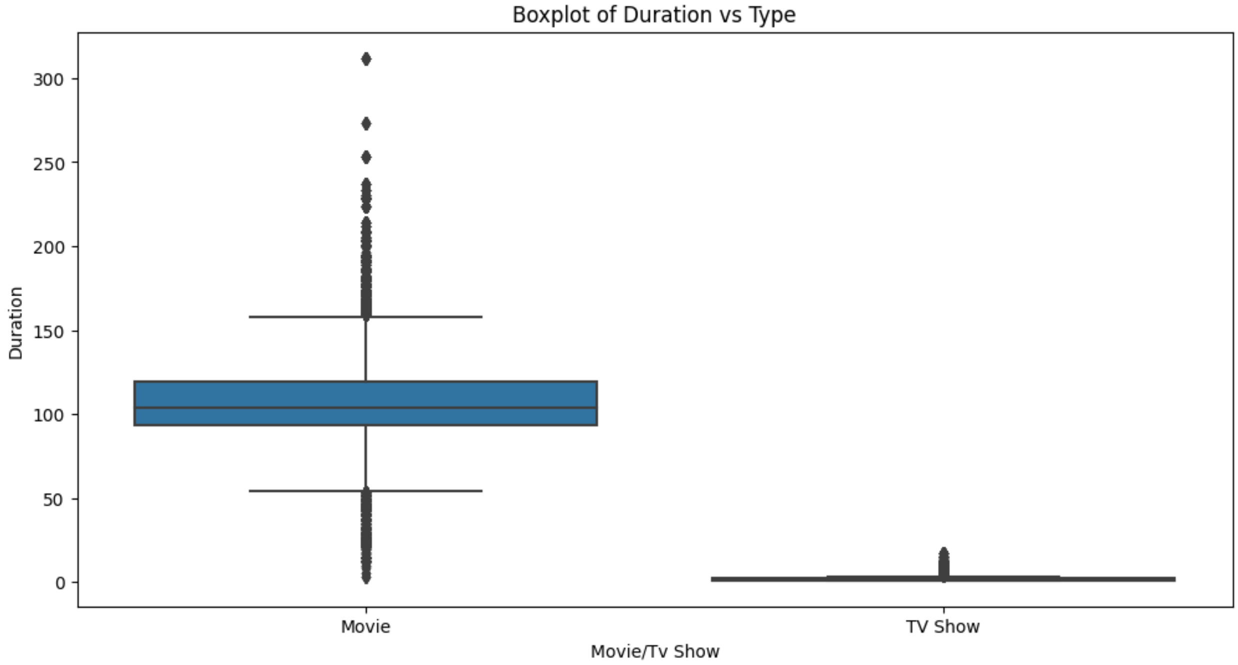
5. Missing Value & Outlier check

Missing Values are handles in pre-processing stage itself now all values are filled

```
df_pre_process.isnull().sum()
```

```
show_id         0
type            0
title           0
date_added      0
release_year    0
rating          0
duration        0
description     0
cast            0
country         0
genre           0
director        0
dtype: int64
```

```
plt.figure(figsize=(12, 6))
sns.boxplot(x='type',y=time,data=df_pre_process)
plt.title('Boxplot of Duration vs Type')
plt.xlabel('Movie/Tv Show')
plt.ylabel('Duration')
plt.show()
```



From above boxplot it is clear that Movies are calculated in Minutes thats why movie values are high and generally TV Show time is calculated in Seasons thats why for TV SHow we have low valees. But thre are outliers in both like some movies are short and some TV Shows may have more seasons

6. Insights based on Non-Graphical and Visual Analysis

6.1 Comments on the range of attributes

```
df_pre_process.describe(include='all').T
```

```
                  count  unique  \
show_id          201991    8807
type             201991       2
title            201991    8807
date_added       201991    1767
release_year   201991.0     NaN
rating           201991      17
duration         201991     220
description      201991    8775
cast             201991   36440
country          201991     128
genre            201991      42
director         201991    4994

                                                                top
```

```
freq  \
show_id                                                   s7165
700
type                                                      Movie
145843
title                               Kahlil Gibran's The Prophet
700
date_added                                      January 1, 2020
3730
release_year                                                NaN
NaN
rating                                                    TV-MA
73934
duration                                               1 Season
35035
description   A troubled young girl and her mother find sola...
700
cast                                                    No Cast
2146
country                                           United States
59349
genre                                                    Dramas
29775
director                                            No Director
50643

                     mean       std     min     25%     50%     75%
max
show_id               NaN       NaN     NaN     NaN     NaN     NaN
NaN
type                  NaN       NaN     NaN     NaN     NaN     NaN
NaN
title                 NaN       NaN     NaN     NaN     NaN     NaN
NaN
date_added            NaN       NaN     NaN     NaN     NaN     NaN
NaN
release_year  2013.452891  9.003933  1925.0  2012.0  2016.0  2019.0
2021.0
rating                NaN       NaN     NaN     NaN     NaN     NaN
NaN
duration              NaN       NaN     NaN     NaN     NaN     NaN
NaN
description           NaN       NaN     NaN     NaN     NaN     NaN
NaN
cast                  NaN       NaN     NaN     NaN     NaN     NaN
NaN
country               NaN       NaN     NaN     NaN     NaN     NaN
NaN
genre                 NaN       NaN     NaN     NaN     NaN     NaN
```

```
NaN
director              NaN       NaN     NaN     NaN     NaN     NaN
NaN

df_pre_process.shape

(201991, 12)
```

Comments on the range of attributes

- After the stage of Pre-Processing the data we have consisits of above shape. As we did unnesting rows got heavely increased
- Among the given data we can find type and rating as categorical and rest are continuous or object types
- Becaues of missing data we couldnt be able to completely fill some rows with accuarte data

Comments on the distribution of the variables and relationship between them

```
df_pre_process

       show_id     type                 title          date_added  \
0           s1    Movie  Dick Johnson Is Dead  September 25, 2021
1           s2  TV Show         Blood & Water  September 24, 2021
2           s2  TV Show         Blood & Water  September 24, 2021
3           s2  TV Show         Blood & Water  September 24, 2021
4           s2  TV Show         Blood & Water  September 24, 2021
...        ...      ...                   ...                 ...
201986   s8807    Movie                Zubaan       March 2, 2019
201987   s8807    Movie                Zubaan       March 2, 2019
201988   s8807    Movie                Zubaan       March 2, 2019
201989   s8807    Movie                Zubaan       March 2, 2019
201990   s8807    Movie                Zubaan       March 2, 2019

        release_year rating   duration  \
0               2020  PG-13     90 min
1               2021  TV-MA  2 Seasons
2               2021  TV-MA  2 Seasons
3               2021  TV-MA  2 Seasons
4               2021  TV-MA  2 Seasons
...              ...    ...        ...
201986          2015  TV-14    111 min
201987          2015  TV-14    111 min
201988          2015  TV-14    111 min
201989          2015  TV-14    111 min
201990          2015  TV-14    111 min

                                              description  \
0       As her father nears the end of his life, filmm...
1       After crossing paths at a party, a Cape Town t...
2       After crossing paths at a party, a Cape Town t...
3       After crossing paths at a party, a Cape Town t...
4       After crossing paths at a party, a Cape Town t...
...                                                   ...
201986  A scrappy but poor boy worms his way into a ty...
201987  A scrappy but poor boy worms his way into a ty...
201988  A scrappy but poor boy worms his way into a ty...
201989  A scrappy but poor boy worms his way into a ty...
201990  A scrappy but poor boy worms his way into a ty...

                         cast        country
genre  \
0                     No Cast  United States           Documentaries

1                  Ama Qamata   South Africa  International TV Shows

2                  Ama Qamata   South Africa               TV Dramas

3                  Ama Qamata   South Africa            TV Mysteries

4                 Khosi Ngema   South Africa  International TV Shows

...                       ...            ...                     ...

201986         Anita Shabdish          India    International Movies

201987         Anita Shabdish          India        Music & Musicals

201988  Chittaranjan Tripathy          India                  Dramas

201989  Chittaranjan Tripathy          India    International Movies

201990  Chittaranjan Tripathy          India        Music & Musicals


               director
0       Kirsten Johnson
1           No Director
2           No Director
3           No Director
4           No Director
...                 ...
201986      Mozez Singh
201987      Mozez Singh
201988      Mozez Singh
201989      Mozez Singh
201990      Mozez Singh

[201991 rows x 12 columns]
```

- Here most of variables of independent except we can see more movies in netflix are added from mid 2000's there the hist plot is Right Skewed

- The spead of variables also unique to each column at any point of month the movies added to netflix are more compared to TV Shows. It is understandable as movie is uploaded once where as for TV Shoes Seasons and Episodes exits

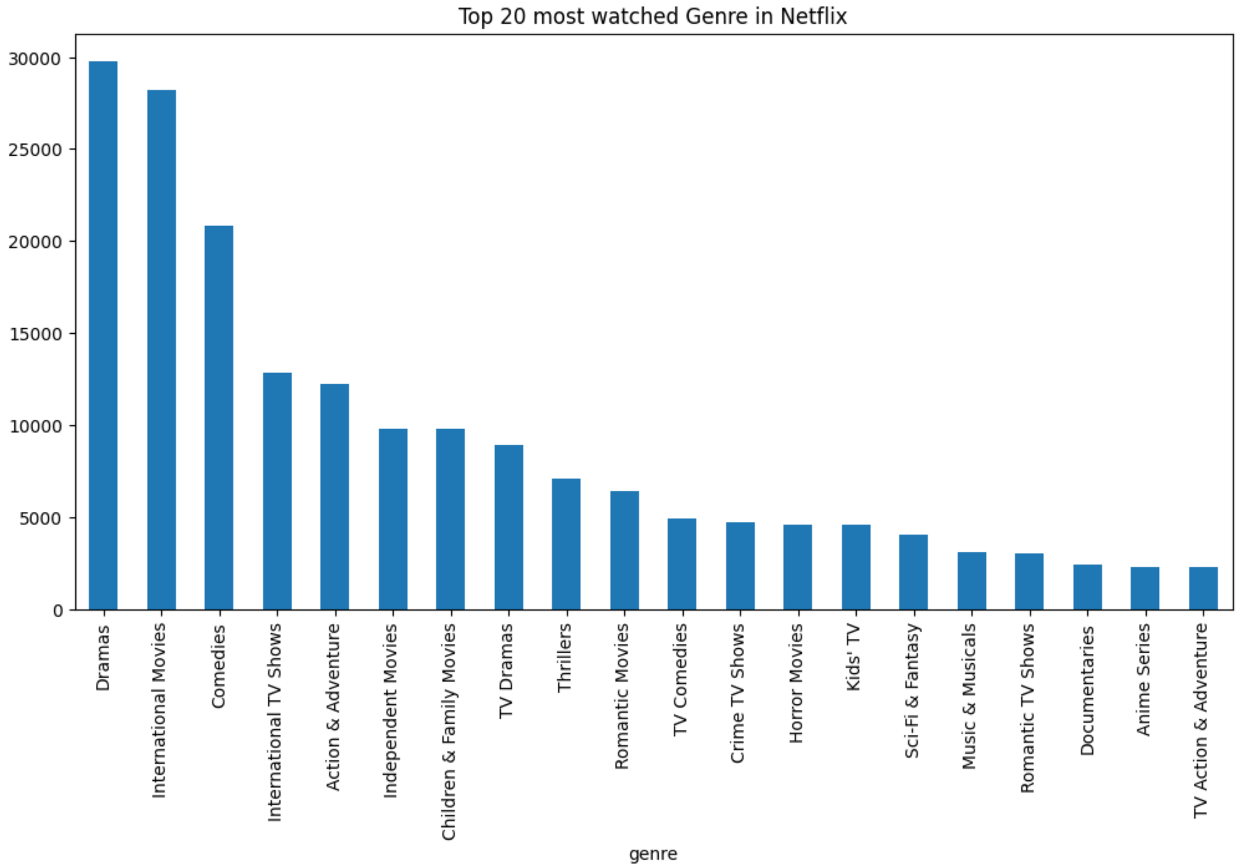
Comments for each univariate and bivariate plot

- Histogram plot states that count of movies/tv shows started increasing in movies from mid 2000's as internet was booming then its the correct inference we can make

- Count plot of categorical variables type shows the same as above that Movies are more in number compared to TV Show

- Count on Ratings of diff type of ratings provided to Moves/TV Shows

```
plt.figure(figsize=(12, 6))
df_pre_process['genre'].value_counts()[:20].plot(kind='bar')
plt.title('Top 20 most watched Genre in Netflix')

Text(0.5, 1.0, 'Top 20 most watched Genre in Netflix')
```



From above graph we can say that more viewers like to watch Dramas and International Movies from Netflix

Business Insights

```
df_pre_process[['country','type']].value_counts()[:10]
```

```
country               type   
United States         Movie      45816
India                 Movie      21411
United States         TV Show    13533
United Kingdom        Movie       8560
France                Movie       6607
Country Unavailable   Movie       6199
Canada                Movie       5738
Country Unavailable   TV Show     5698
Japan                 TV Show     5154
United Kingdom        TV Show     4385
Name: count, dtype: int64
```

From above data we can say that mostly Movies are preferred in top 10 countries and in U.K it seems TV Shows have high priority compared to Movies

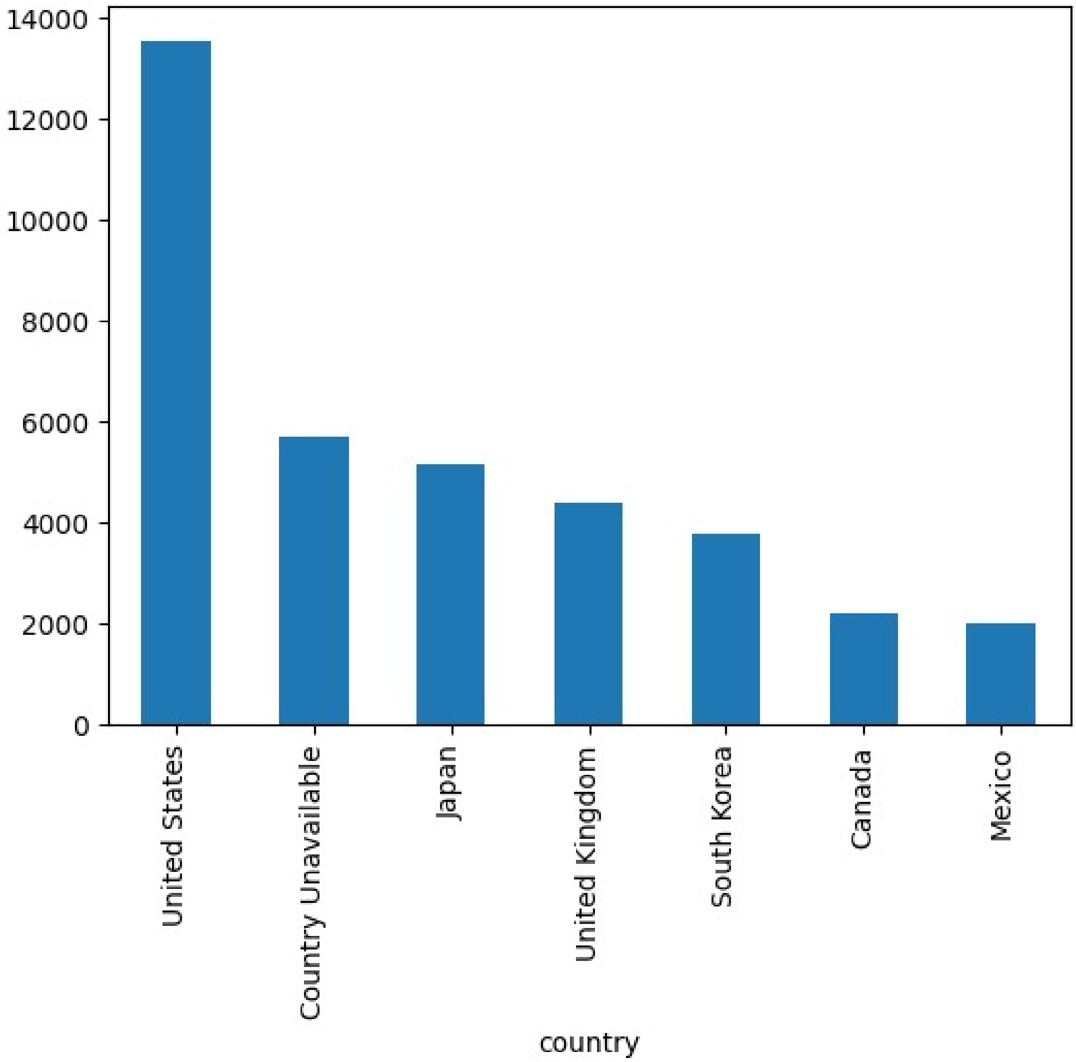
```
df_pre_process[['director','type']].value_counts()[:10]
```

```
director              type   
No Director           TV Show    49358
                      Movie       1285
Martin Scorsese       Movie        419
Youssef Chahine       Movie        409
Cathy Garcia-Molina   Movie        356
Steven Spielberg      Movie        355
Lars von Trier        Movie        336
Raja Gosnell          Movie        308
Tom Hooper            Movie        306
McG                   Movie        293
Name: count, dtype: int64
```

Above data tells us that more directors in top 10 want to do movies rather than TV Shows

```
df_pre_process[['type','country']].value_counts()[:20].get('TV Show')
df_pre_process[['type','country']].value_counts()[:20].get('TV 
Show').plot(kind='bar')
```

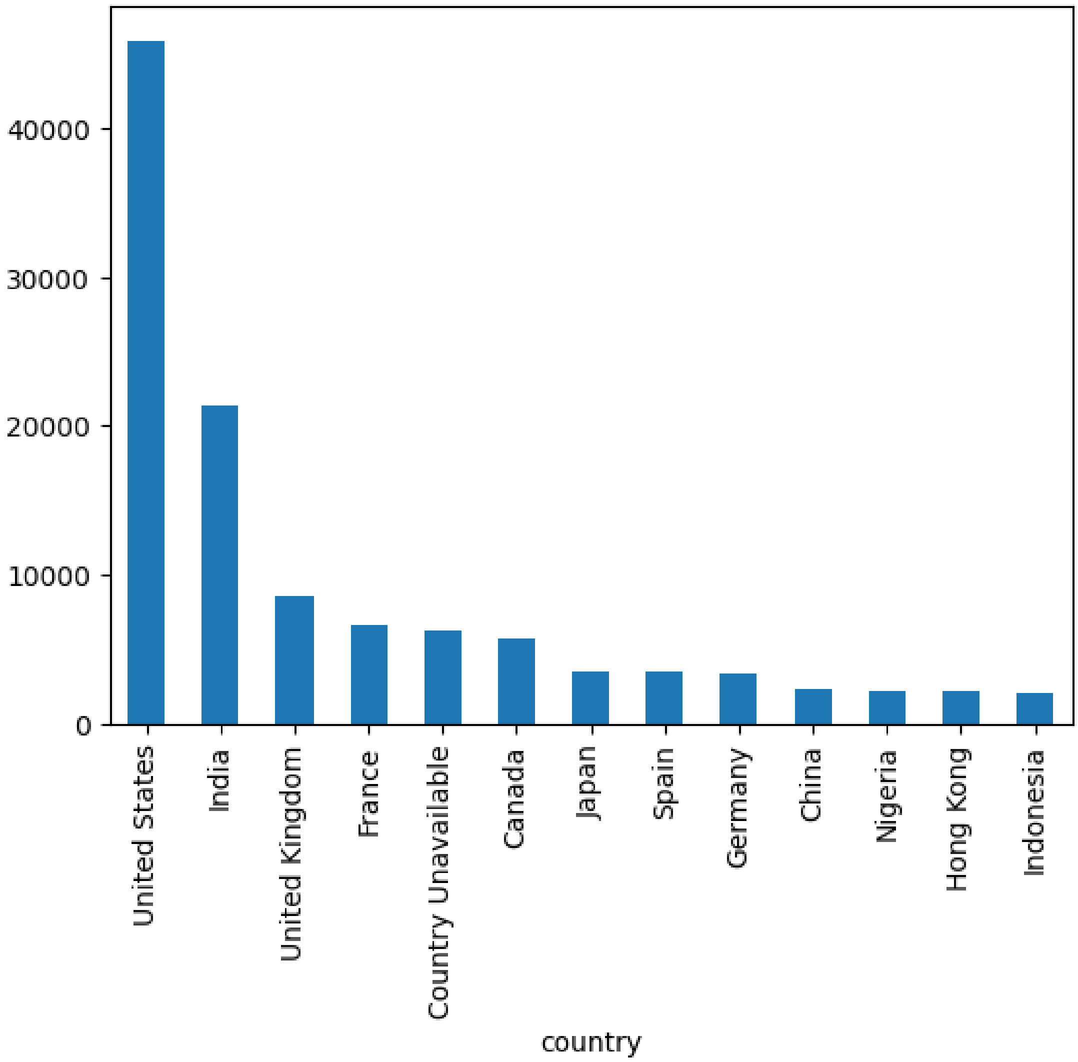
```
<Axes: xlabel='country'>
```



Top 10 countries that produce TV Shows. US is top in producing TV Shows

```
df_pre_process[['type','country']].value_counts()[:20].get('Movie')
df_pre_process[['type','country']].value_counts()
[:20].get('Movie').plot(kind='bar')
```

```
<Axes: xlabel='country'>
```



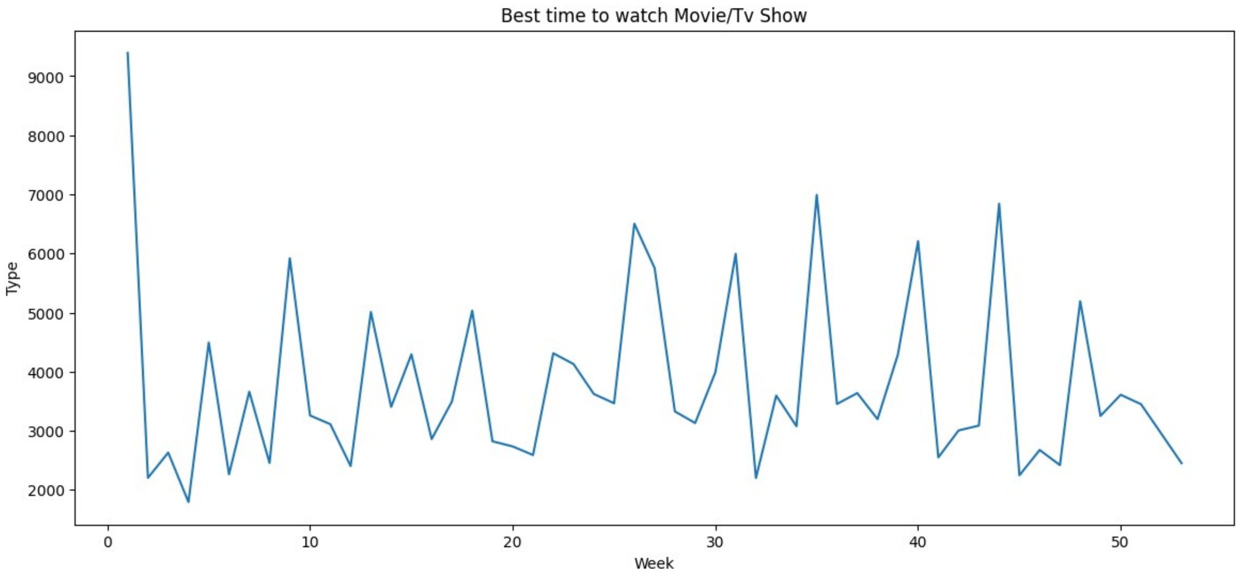
U.S and INDIA are the top countries to produce movies that are vailable in netflix

```
x = pd.to_datetime(df_pre_process['date_added'], format='%B %d, %Y',
errors='coerce')
df_pre_process['week_added'] = x.dt.isocalendar().week
df_pre_process

       show_id     type                 title          date_added  \
0           s1    Movie  Dick Johnson Is Dead  September 25, 2021
1           s2  TV Show         Blood & Water  September 24, 2021
2           s2  TV Show         Blood & Water  September 24, 2021
3           s2  TV Show         Blood & Water  September 24, 2021
4           s2  TV Show         Blood & Water  September 24, 2021
...        ...      ...                   ...                 ...
201986   s8807    Movie                Zubaan       March 2, 2019
201987   s8807    Movie                Zubaan       March 2, 2019
201988   s8807    Movie                Zubaan       March 2, 2019
```

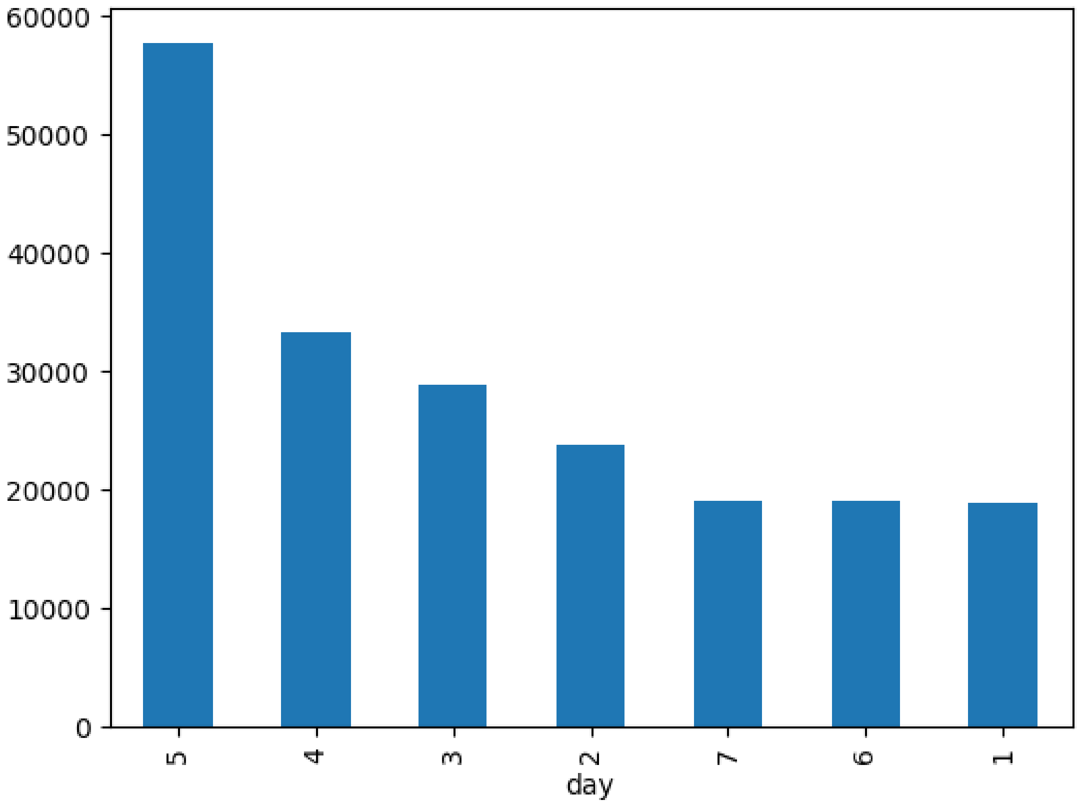
```
201989   s8807    Movie                Zubaan       March 2, 2019
201990   s8807    Movie                Zubaan       March 2, 2019

        release_year rating   duration  \
0               2020  PG-13     90 min
1               2021  TV-MA  2 Seasons
2               2021  TV-MA  2 Seasons
3               2021  TV-MA  2 Seasons
4               2021  TV-MA  2 Seasons
...              ...    ...        ...
201986          2015  TV-14    111 min
201987          2015  TV-14    111 min
201988          2015  TV-14    111 min
201989          2015  TV-14    111 min
201990          2015  TV-14    111 min

                                              description  \
0       As her father nears the end of his life, filmm...
1       After crossing paths at a party, a Cape Town t...
2       After crossing paths at a party, a Cape Town t...
3       After crossing paths at a party, a Cape Town t...
4       After crossing paths at a party, a Cape Town t...
...                                                   ...
201986  A scrappy but poor boy worms his way into a ty...
201987  A scrappy but poor boy worms his way into a ty...
201988  A scrappy but poor boy worms his way into a ty...
201989  A scrappy but poor boy worms his way into a ty...
201990  A scrappy but poor boy worms his way into a ty...

                         cast        country
genre  \
0                     No Cast  United States           Documentaries

1                  Ama Qamata   South Africa  International TV Shows

2                  Ama Qamata   South Africa               TV Dramas

3                  Ama Qamata   South Africa            TV Mysteries

4                 Khosi Ngema   South Africa  International TV Shows

...                       ...            ...                     ...

201986         Anita Shabdish          India    International Movies

201987         Anita Shabdish          India        Music & Musicals

201988  Chittaranjan Tripathy          India                  Dramas

201989  Chittaranjan Tripathy          India    International Movies
```

```
201990  Chittaranjan Tripathy          India         Music & Musicals


                 director  week_added
0          Kirsten Johnson          38
1              No Director          38
2              No Director          38
3              No Director          38
4              No Director          38
...                    ...         ...
201986         Mozez Singh           9
201987         Mozez Singh           9
201988         Mozez Singh           9
201989         Mozez Singh           9
201990         Mozez Singh           9

[201991 rows x 13 columns]
```

```
weekly_counts = df_pre_process.groupby('week_added')['type'].count()

plt.figure(figsize=(14, 6))
weekly_counts.plot(kind='line')
plt.title('Best time to watch Movie/Tv Show')
plt.xlabel('Week')
plt.ylabel('Type')
plt.show()
```



```
day_counts = x.dt.isocalendar().day
day_counts.value_counts().plot(kind='bar')

<Axes: xlabel='day'>
```



From above lineplot and barplot we can say that in 1st Week, that is and on Holidays and on Day 5 that is Friday More viewers are present watching Netflix

```
df_pre_process['month_added'] = x.dt.month
df_pre_process

       show_id     type                  title          date_added  \
0           s1    Movie   Dick Johnson Is Dead  September 25, 2021   
1           s2  TV Show          Blood & Water  September 24, 2021   
2           s2  TV Show          Blood & Water  September 24, 2021   
3           s2  TV Show          Blood & Water  September 24, 2021   
4           s2  TV Show          Blood & Water  September 24, 2021   
...        ...      ...                    ...                 ...   
201986   s8807    Movie                 Zubaan       March 2, 2019   
201987   s8807    Movie                 Zubaan       March 2, 2019   
201988   s8807    Movie                 Zubaan       March 2, 2019   
201989   s8807    Movie                 Zubaan       March 2, 2019   
201990   s8807    Movie                 Zubaan       March 2, 2019   

        release_year rating   duration  \
0               2020  PG-13     90 min   
1               2021  TV-MA  2 Seasons   
2               2021  TV-MA  2 Seasons   
3               2021  TV-MA  2 Seasons   
4               2021  TV-MA  2 Seasons   
```

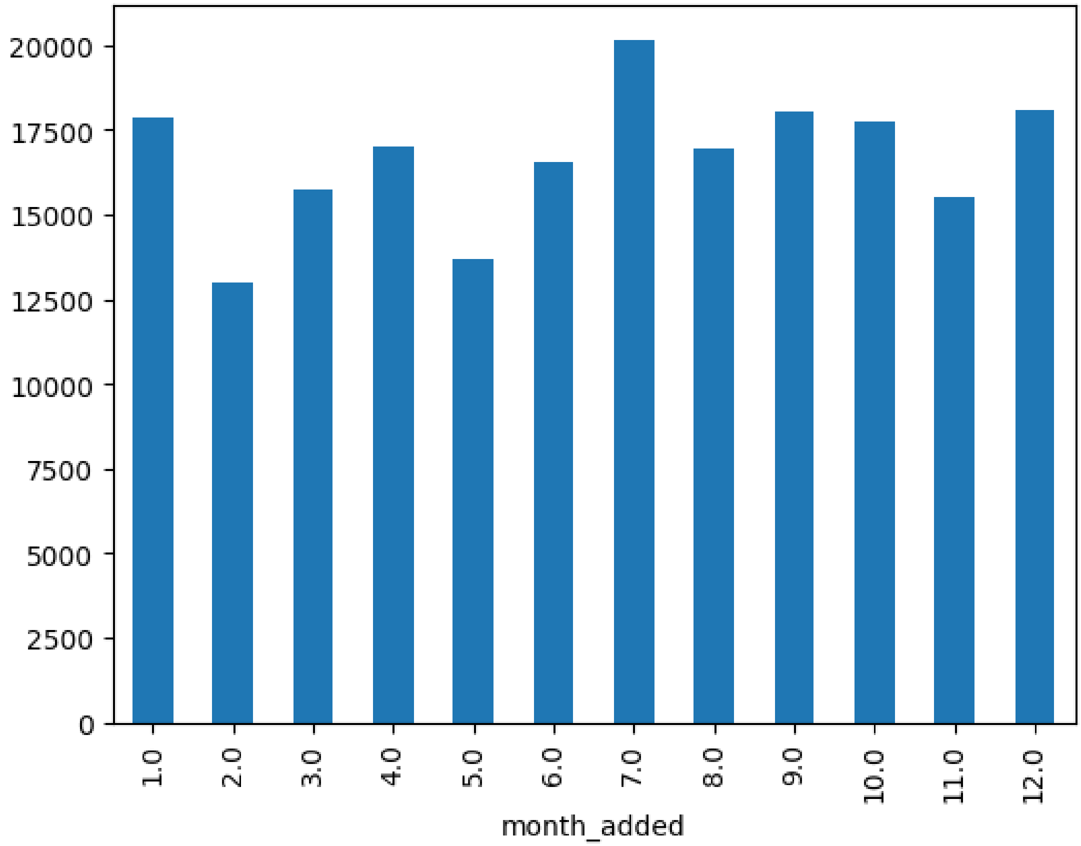
```
...              ...   ...        ...
201986          2015  TV-14    111 min
201987          2015  TV-14    111 min
201988          2015  TV-14    111 min
201989          2015  TV-14    111 min
201990          2015  TV-14    111 min

                                              description  \
0       As her father nears the end of his life, filmm...
1       After crossing paths at a party, a Cape Town t...
2       After crossing paths at a party, a Cape Town t...
3       After crossing paths at a party, a Cape Town t...
4       After crossing paths at a party, a Cape Town t...
...                                                   ...
201986  A scrappy but poor boy worms his way into a ty...
201987  A scrappy but poor boy worms his way into a ty...
201988  A scrappy but poor boy worms his way into a ty...
201989  A scrappy but poor boy worms his way into a ty...
201990  A scrappy but poor boy worms his way into a ty...

                         cast        country  
genre  \
0                     No Cast  United States           Documentaries   

1                  Ama Qamata   South Africa  International TV Shows   

2                  Ama Qamata   South Africa               TV Dramas   

3                  Ama Qamata   South Africa            TV Mysteries   

4                 Khosi Ngema   South Africa  International TV Shows   

...                       ...            ...                     ...   

201986         Anita Shabdish          India    International Movies   

201987         Anita Shabdish          India        Music & Musicals   

201988  Chittaranjan Tripathy          India                  Dramas   

201989  Chittaranjan Tripathy          India    International Movies   

201990  Chittaranjan Tripathy          India        Music & Musicals   


               director  week_added  month_added
0       Kirsten Johnson          38          9.0
1           No Director          38          9.0
2           No Director          38          9.0
3           No Director          38          9.0
4           No Director          38          9.0
```

```
...                 ...         ...          ...
201986      Mozez Singh           9          3.0
201987      Mozez Singh           9          3.0
201988      Mozez Singh           9          3.0
201989      Mozez Singh           9          3.0
201990      Mozez Singh           9          3.0

[201991 rows x 14 columns]
```

```
monthly_counts = df_pre_process.groupby('month_added')['type'].count()
```

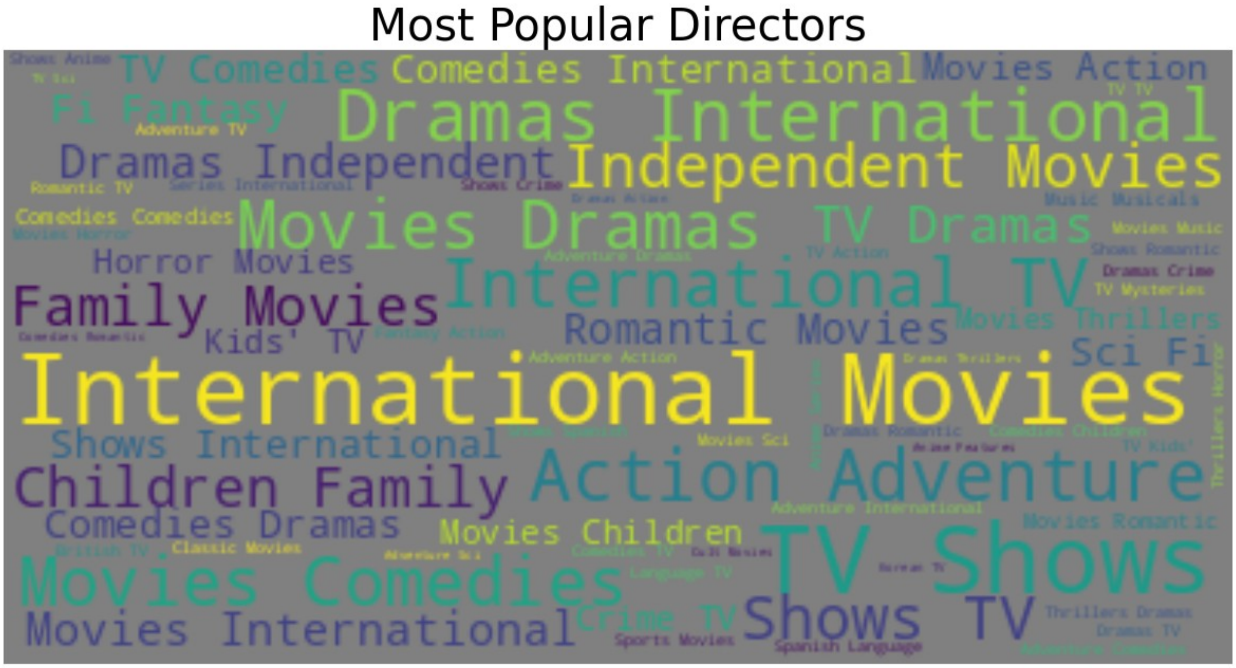
```
monthly_counts.plot(kind='bar')
```

```
<Axes: xlabel='month_added'>
```



From above Graph we can say that best month to watch Movies/Tv Shows in Netflix is July that is 7th Month

```
#pip install wordcloud matplotlib

from wordcloud import WordCloud, ImageColorGenerator
text = " ".join(str(each) for each in df_pre_process.genre)
# Create and generate a word cloud image:
wordcloud = WordCloud(max_words=200,
background_color="gray").generate(text)
plt.figure(figsize=(10,6))
plt.figure(figsize=(15,10))
# Display the generated image:
plt.imshow(wordcloud, interpolation='Bilinear')
plt.title('Most Popular Directors',fontsize = 30)
plt.axis("off")
plt.show()

<Figure size 1000x600 with 0 Axes>
```



From above plot it is clear that International Movies Genre is produced more in netflix

```
df_pre_process

        show_id     type                  title          date_added  \
0            s1    Movie   Dick Johnson Is Dead  September 25, 2021   
1            s2  TV Show          Blood & Water  September 24, 2021   
2            s2  TV Show          Blood & Water  September 24, 2021   
3            s2  TV Show          Blood & Water  September 24, 2021   
4            s2  TV Show          Blood & Water  September 24, 2021   
...         ...      ...                    ...                 ...   
201986    s8807    Movie                 Zubaan       March 2, 2019   
201987    s8807    Movie                 Zubaan       March 2, 2019   
201988    s8807    Movie                 Zubaan       March 2, 2019   
201989    s8807    Movie                 Zubaan       March 2, 2019   
201990    s8807    Movie                 Zubaan       March 2, 2019   

        release_year rating   duration  \
0               2020  PG-13     90 min
1               2021  TV-MA  2 Seasons
2               2021  TV-MA  2 Seasons
3               2021  TV-MA  2 Seasons
4               2021  TV-MA  2 Seasons
...              ...    ...        ...
201986          2015  TV-14    111 min
201987          2015  TV-14    111 min
201988          2015  TV-14    111 min
201989          2015  TV-14    111 min
201990          2015  TV-14    111 min

                                              description  \
0       As her father nears the end of his life, filmm...
1       After crossing paths at a party, a Cape Town t...
2       After crossing paths at a party, a Cape Town t...
3       After crossing paths at a party, a Cape Town t...
4       After crossing paths at a party, a Cape Town t...
...                                                   ...
201986  A scrappy but poor boy worms his way into a ty...
201987  A scrappy but poor boy worms his way into a ty...
201988  A scrappy but poor boy worms his way into a ty...
201989  A scrappy but poor boy worms his way into a ty...
201990  A scrappy but poor boy worms his way into a ty...

                         cast        country
genre  \
0                     No Cast  United States           Documentaries

1                  Ama Qamata   South Africa  International TV Shows

2                  Ama Qamata   South Africa               TV Dramas

3                  Ama Qamata   South Africa            TV Mysteries

4                 Khosi Ngema   South Africa  International TV Shows

...                       ...            ...                     ...

201986         Anita Shabdish          India    International Movies

201987         Anita Shabdish          India        Music & Musicals

201988  Chittaranjan Tripathy          India                  Dramas

201989  Chittaranjan Tripathy          India    International Movies

201990  Chittaranjan Tripathy          India        Music & Musicals


               director  week_added  month_added
```

```
0       Kirsten Johnson          38           9.0
1           No Director          38           9.0
2           No Director          38           9.0
3           No Director          38           9.0
4           No Director          38           9.0
...                 ...         ...           ...
201986      Mozez Singh           9           3.0
201987      Mozez Singh           9           3.0
201988      Mozez Singh           9           3.0
201989      Mozez Singh           9           3.0
201990      Mozez Singh           9           3.0

[201991 rows x 14 columns]
```

Finally the case study on netflix is done with above infrences and below are some recommendations based on above inferences

Recommendations

RECOMMENDATIONS

- Netflix has to focus on TV Shows also because there are people who likes to see tv shows rather than movies
- By approaching the top director we can plan some more movies/tv shows in order to increase the popularity
- Not only reaching top director we can also see the director with less no of movies and having high rating as there may be some financial issues or anything so inorder to get good content netflix can reach to them and netflix can produce the movie and give the director a chance.
- We have seen most no of international movies genre so need to give priority to other geners like hooro,comedy..etc
- In TV Shows we may focus on thriller genre which will be helpfull for having more no of seasons
- Most of the movies released in ott is in a year 2019 so we need to go on increasing this value in order to attract people by showing that getting subscription is usefull as netflix is releasing more movies per year
- Mainly the release in ott should focus on the festival holidays, year end and week ends which is to be mainly focussed
- Some movies can be released directly into ott which has some positive talk which may help in improving subscriptions
- Should focus on a actor who has immense following and make use of it by doing a TV Shows or web series
- Advertisement in the country which has very less movies released should be increased and attract people of that country by making their native TV Shows