# Netflix Case: Business Problem

Analyze the data and generate insights that could help Netflix in deciding which type of shows/movies to produce and how they can grow the business in different countries

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
warnings.filterwarnings('ignore')
```

```
!gdown https://d2beiqkhq929f0.cloudfront.net/public_assets/assets/000/000/940/original/netflix.csv
df=pd.read_csv('netflix.csv')
df.head(3)
```

```
Downloading...
From: https://d2beiqkhq929f0.cloudfront.net/public_assets/assets/000/000/940/original/ne
To: /content/netflix.csv
100% 3.40M/3.40M [00:00<00:00, 23.6MB/s]
```

| | show_id | type | title | director | cast | country | date_added | release_year | rat |
|---|---|---|---|---|---|---|---|---|---|
| **0** | s1 | Movie | Dick Johnson Is Dead | Kirsten Johnson | NaN | United States | September 25, 2021 | 2020 | PG |

```
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
```

```
df.describe()
```

| | 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 |

Dataset contains 8807 records and 12 features for movies and TV shows released between 1925 to 2021

```
df.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
```

## Data Preprocessing

```
df.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
```

There are null values in 5 columns namely - director, cast, country, date_added, rating

```
df['director']=df['director'].fillna('NoDataAvailable')
df['country']=df['country'].fillna(df['country'].mode()[0])
df['cast'] = df['cast'].fillna('NoDataAvailable')
df['date_added'] = df['date_added'].fillna(df['date_added'].mode()[0])
df['rating'] = df['rating'].fillna(df['rating'].mode()[0])
df['duration'] = df['duration'].fillna(df['duration'].mode()[0])
print(df.isnull().sum())
```

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

```
# Since we are not working with text data here , we will drop the 'description' column
df.drop('description',axis=1,inplace=True)
```

```
# We dont need show_id so dropping it
df.drop('show_id',axis=1,inplace=True)
```

```
#converting date_added to datetime and extracting info from it
df['date_added']=pd.to_datetime(df['date_added'])
df['year']=df['date_added'].dt.year
df['month']=df['date_added'].dt.month
df['month_name']=df['date_added'].dt.month_name()
df['day_name']=df['date_added'].dt.day_name()
df.head(3)
```

| | type | title | director | cast | country | date_ |
|---|---|---|---|---|---|---|
| **0** | Movie | Dick Johnson Is | Kirsten Johnson | NoDataAvailable | United | 2021 |

```
df['rating'].value_counts()
```

```
TV-MA       3211
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: rating, dtype: int64
```

Some of the rating columns have duration values so drop these 3 rows

```
df[df['rating'].str.contains('min')]
```

| | type | title | director | cast | country | date_added | releas |
|---|---|---|---|---|---|---|---|
| **5541** | Movie | Louis C.K. 2017 | Louis C.K. | Louis C.K. | United States | 2017-04-04 | |

```
df.drop(5541, axis=0,inplace=True)
df.drop(5794, axis=0,inplace=True)
df.drop(5813, axis=0,inplace=True)
```

```
df['rating'].value_counts()
```

```
TV-MA       3211
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
Name: rating, dtype: int64
```

```
ratings_ages = {
    'TV-PG': 'Older Kids',
    'TV-MA': 'Adults',
    'TV-Y7-FV': 'Older Kids',
    'TV-Y7': 'Older Kids',
    'TV-14': 'Teens',
    'R': 'Adults',
    'TV-Y': 'Kids',
    'NR': 'Adults',
    'PG-13': 'Teens',
    'TV-G': 'Kids',
    'PG': 'Older Kids',
    'G': 'Kids',
    'UR': 'Adults',
    'NC-17': 'Adults'
}
```

```
df["ratings_ages"]=df["rating"].replace(ratings_ages)
df['ratings_ages']
```

```
0           Teens
1          Adults
2          Adults
3          Adults
4          Adults
           ...
8802       Adults
8803    Older Kids
8804       Adults
8805    Older Kids
8806        Teens
Name: ratings_ages, Length: 8804, dtype: object
```

```
df['duration']=df['duration'].apply(lambda x: str(x).split(' ')[0])
df['duration']
```

```
0        90
1         2
2         1
3         1
4         2
        ...
8802    158
8803      2
8804     88
8805     88
8806    111
Name: duration, Length: 8804, dtype: object
```

```
# duplicate values
df.duplicated().sum()
```

```
0
```

```
df.head(20)
```

| | type | title | director | cast | country | da |
|---|---|---|---|---|---|---|
| **0** | Movie | Dick Johnson Is Dead | Kirsten Johnson | NoDataAvailable | United States | 2 |
| **1** | TV Show | Blood & Water | NoDataAvailable | Ama Qamata, Khosi Ngema, Gail Mabalane, Thaban... | South Africa | 2 |
| **2** | TV Show | Ganglands | Julien Leclercq | Sami Bouajila, Tracy Gotoas, Samuel Jouy, Nabi... | United States | 2 |
| **3** | TV Show | Jailbirds New Orleans | NoDataAvailable | NoDataAvailable | United States | 2 |
| **4** | TV Show | Kota Factory | NoDataAvailable | Mayur More, Jitendra Kumar, Ranjan Raj, Alam K... | India | 2 |
| **5** | TV Show | Midnight Mass | Mike Flanagan | Kate Siegel, Zach Gilford, Hamish Linklater, H... | United States | 2 |

Unnesting the columns of

- cast

- director
- country
- listed_in

```
# unnesting 'cast' columnn to make a new dataframe of indiviadual cast, indexed by title
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']
filtered_cast = pd.DataFrame()
filtered_cast=df_new
filtered_cast.head(5)
```

| | title | cast |
|---|---|---|
| 0 | Dick Johnson Is Dead | NoDataAvailable |
| 1 | Blood & Water | Ama Qamata |
| 2 | Blood & Water | Khosi Ngema |
| 3 | Blood & Water | Gail Mabalane |
| 4 | Blood & Water | Thabang Molaba |

```
# unnesting 'director' columnn to make a new dataframe of individual director, indexed by title
constraint=df['director'].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','director']
filtered_director = pd.DataFrame()
filtered_director=df_new
filtered_director.head(5)
```

| | title | director |
|---|---|---|
| 0 | Dick Johnson Is Dead | Kirsten Johnson |
| 1 | Blood & Water | NoDataAvailable |
| 2 | Ganglands | Julien Leclercq |
| 3 | Jailbirds New Orleans | NoDataAvailable |
| 4 | Kota Factory | NoDataAvailable |

```
# unnesting 'country' columnn to make a new dataframe of individual country, indexed by title
constraint=df['country'].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','country']
filtered_country = pd.DataFrame()
filtered_country=df_new
filtered_country.head(5)
```

| | title | country |
|---|---|---|
| 0 | Dick Johnson Is Dead | United States |
| 1 | Blood & Water | South Africa |
| 2 | Ganglands | United States |
| 3 | Jailbirds New Orleans | United States |
| 4 | Kota Factory | India |

```
# unnesting 'listed_in' columnn to make a new dataframe of individual country, indexed by title
constraint=df['listed_in'].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','listed_in']
filtered_listed_in = pd.DataFrame()
filtered_listed_in=df_new
filtered_listed_in.head(5)
```

| | title | listed_in |
|---|---|---|
| 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 |

```
dff=filtered_cast.merge(filtered_director,on='title',how='inner')
dff=dff.merge(filtered_country,on='title',how='inner')
dff=dff.merge(filtered_listed_in,on='title',how='inner')
dff.head(5)
```

| | title | cast | director | country | listed_in |
|---|---|---|---|---|---|
| 0 | Dick Johnson Is Dead | NoDataAvailable | Kirsten Johnson | United States | Documentaries |
| 1 | Blood & Water | Ama Qamata | NoDataAvailable | South Africa | International TV Shows |
| 2 | Blood & Water | Ama Qamata | NoDataAvailable | South Africa | TV Dramas |
| 3 | Blood & Water | Ama Qamata | NoDataAvailable | South Africa | TV Mysteries |
| 4 | Blood & Water | Khosi Ngema | NoDataAvailable | South Africa | International TV Shows |

```
df_new=df[['type','title','year','month','release_year','ratings_ages','duration']]
df_new.head(5)
```

| | type | title | year | month | release_year | ratings_ages | duration |
|---|---|---|---|---|---|---|---|
| 0 | Movie | Dick Johnson Is Dead | 2021 | 9 | 2020 | Teens | 90 |
| 1 | TV Show | Blood & Water | 2021 | 9 | 2021 | Adults | 2 |
| 2 | TV Show | Ganglands | 2021 | 9 | 2021 | Adults | 1 |
| 3 | TV Show | Jailbirds New Orleans | 2021 | 9 | 2021 | Adults | 1 |
| 4 | TV Show | Kota Factory | 2021 | 9 | 2021 | Adults | 2 |

```
dff=dff.merge(df_new,on='title',how='inner')
dff.head(5)
```

| | title | cast | director | country | listed_in | type | year | month | release_year | ratings_ages | duration |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | Dick Johnson Is Dead | NoDataAvailable | Kirsten Johnson | United States | Documentaries | Movie | 2021 | 9 | 2020 | Teens | 90 |
| 1 | Blood & Water | Ama Qamata | NoDataAvailable | South Africa | International TV Shows | TV Show | 2021 | 9 | 2021 | Adults | 2 |
| 2 | Blood & Water | Ama Qamata | NoDataAvailable | South Africa | TV Dramas | TV Show | 2021 | 9 | 2021 | Adults | 2 |
| 3 | Blood & Water | Ama Qamata | NoDataAvailable | South Africa | TV Mysteries | TV Show | 2021 | 9 | 2021 | Adults | 2 |

This is our final clean unnested data

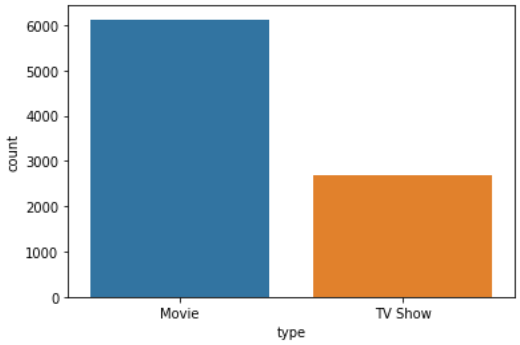
## Data Analysis

## Distribution of content type

```
df['type'].value_counts(normalize=True)
```

```
Movie      0.696047
TV Show    0.303953
Name: type, dtype: float64
```

```
sns.countplot(x='type', data=df)
plt.show()
```



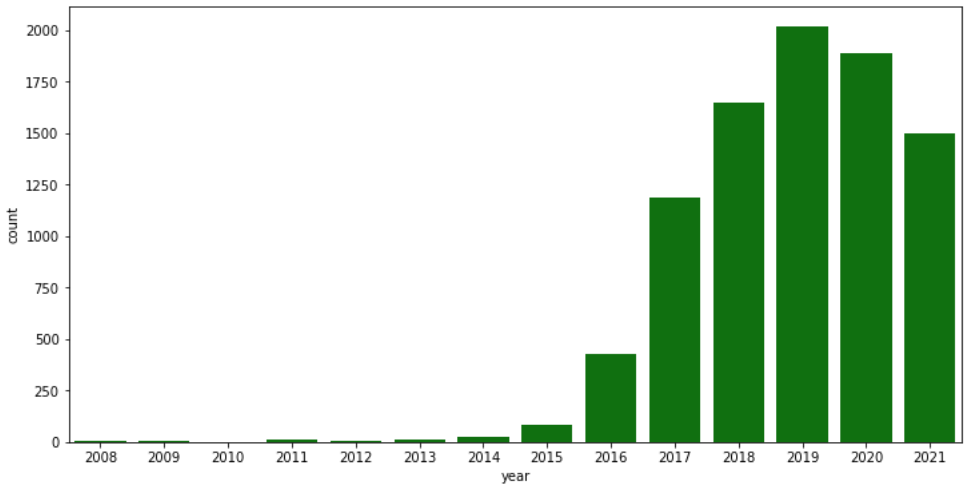

It is clear that about 69.6% content was Movies and 30.3% content was TV-shows.

---

## Content added over years

```
plt.figure(figsize=(12,6))
sns.countplot(x='year',data=df,color='green')
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f8f0c7d0f70>
```

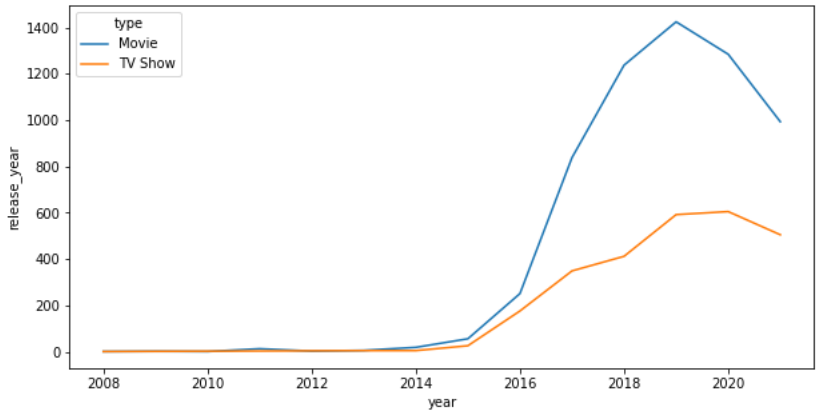



Not much content was uploaded on Netflix upto 2014. Number of movies and tv shows began to rise from 2015 and peaked in 2019 and started dipping from 2020 onwards.

```
content=df.groupby(['type','year'])['release_year'].count().reset_index()
content.head(5)
```

| | type | year | release_year |
|---|---|---|---|
| 0 | Movie | 2008 | 1 |

```
plt.figure(figsize=(10,5))
sns.lineplot(x='year',y='release_year',data=content,hue='type')
plt.show()
```




The above trend shows that not much content was added upto 2014, however between 2015-2019 the content increased and peaked in 2019 after that started to decline again. Most of the content was movies all throughout.

## Countries with highest number of uploads

```
top10=dff[['country']].value_counts().sort_values(ascending=False).head(10)
top10=top10.to_frame()
top10.reset_index(inplace=True)
top10.columns=['country','num_content']
top10
```

| | country | num_content |
|---|---|---|
| 0 | United States | 71243 |
| 1 | India | 22814 |
| 2 | United Kingdom | 12945 |
| 3 | Japan | 8679 |
| 4 | France | 8254 |
| 5 | Canada | 7915 |
| 6 | Spain | 5315 |
| 7 | South Korea | 5043 |
| 8 | Germany | 4383 |
| 9 | Mexico | 3941 |

```
plt.figure(figsize=(10,5))
sns.barplot(y='country',x='num_content',data=top10,color='orange')
plt.show()
```

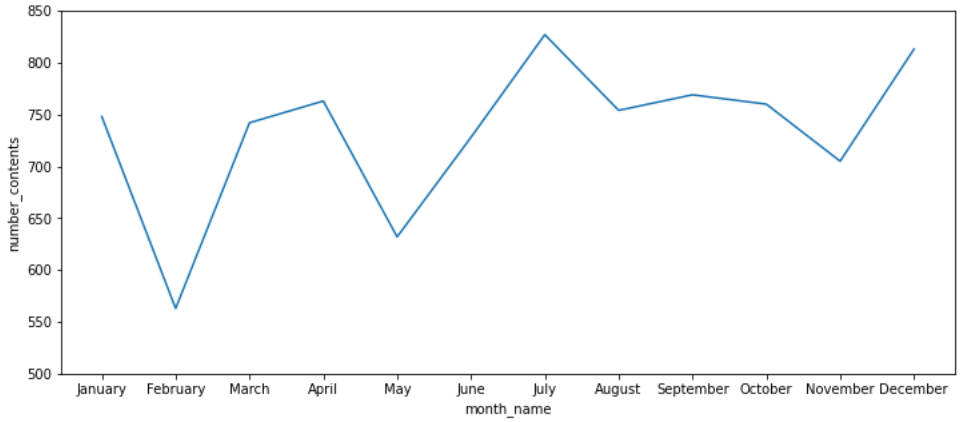

Clearly, US uploaded most number of content with India being second and UK being the third.

## Monthly and weekly trend

```
monthly=df[['month_name','month']].value_counts().reset_index()
monthly.rename(columns={0:"number_contents"}, inplace=True)
monthly=monthly.sort_values('month')
monthly
```

| | month_name | month | number_contents |
|---|---|---|---|
| **6** | January | 1 | 748 |
| **11** | February | 2 | 563 |
| **7** | March | 3 | 742 |
| **3** | April | 4 | 763 |
| **10** | May | 5 | 632 |
| **8** | June | 6 | 728 |
| **0** | July | 7 | 827 |
| **5** | August | 8 | 754 |
| **2** | September | 9 | 769 |
| **4** | October | 10 | 760 |
| **9** | November | 11 | 705 |
| **1** | December | 12 | 813 |

```
plt.figure(figsize=(12,5))
sns.lineplot(x='month_name',y='number_contents',data=monthly)
plt.ylim(500,850)
plt.show()
```




Most of the content was added in second half of the year

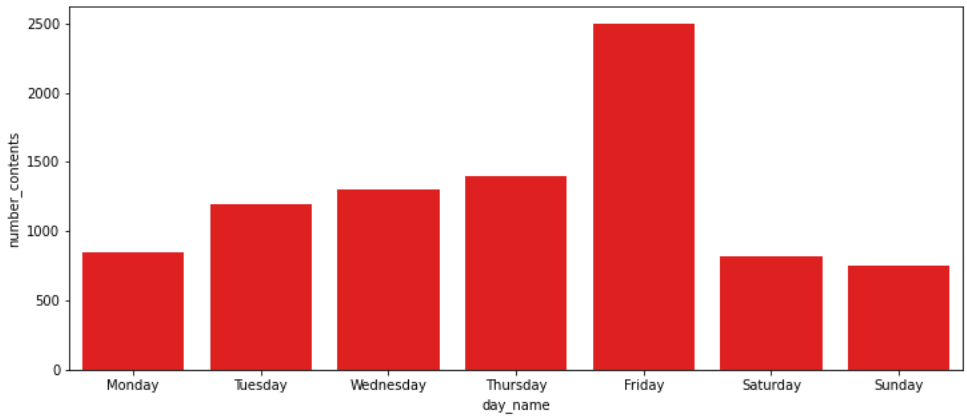
```
weekly=df[['day_name']].value_counts().reset_index()
weekly.rename(columns={0:"number_contents"}, inplace=True)
weekly=weekly.sort_values('day_name')
weekly
```

| | day_name | number_contents |
|---|---|---|
| 0 | Friday | 2497 |
| 4 | Monday | 850 |
| 5 | Saturday | 816 |
| 6 | Sunday | 751 |
| 1 | Thursday | 1396 |

```
# ordering weekdays
weekly['day_name']=weekly['day_name'].astype('category')
weekly['day_name']=weekly['day_name'].cat.reorder_categories(['Monday','Tuesday','Wednesday','Thursday','Friday','Saturday','Sunday'])
weekly
```

| | day_name | number_contents |
|---|---|---|
| 0 | Friday | 2497 |
| 4 | Monday | 850 |
| 5 | Saturday | 816 |
| 6 | Sunday | 751 |
| 1 | Thursday | 1396 |
| 3 | Tuesday | 1196 |
| 2 | Wednesday | 1298 |

```
plt.figure(figsize=(12,5))
sns.barplot(x='day_name',y='number_contents',data=weekly,color='red')
#plt.ylim(500,850)
plt.show()
```



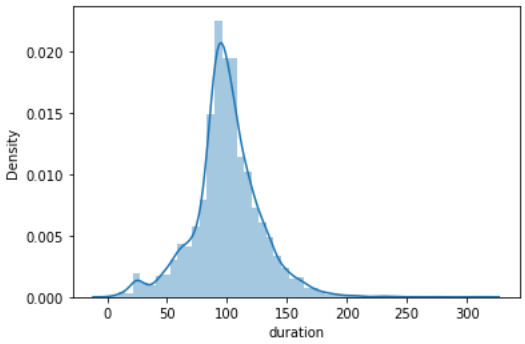

The number of uploaded content is significantly higher on Friday

## Content Duration

```
movie=df[['title','type','duration']][df['type']=='Movie']
movie.head(5)
```

| | title | type | duration |
|---|---|---|---|
| 0 | Dick Johnson Is Dead | Movie | 90 |
| 6 | My Little Pony: A New Generation | Movie | 91 |
| 7 | Sankofa | Movie | 125 |
| 9 | The Starling | Movie | 104 |
| 12 | Je Suis Karl | Movie | 127 |

```
sns.distplot(movie['duration'])
plt.show()
```




Most of the movies have duration between 70-120 minutes

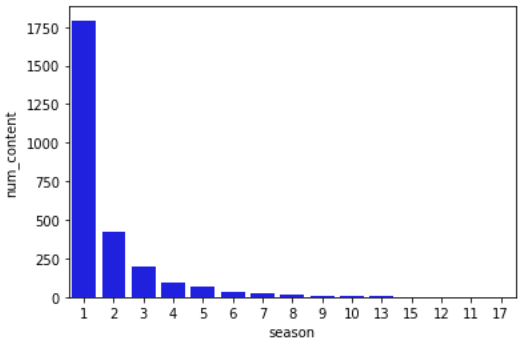
```
show=df[['title','type','duration']][df['type']=='TV Show']
show.head(5)
```

| | title | type | duration |
|---|---|---|---|
| **1** | Blood & Water | TV Show | 2 |
| **2** | Ganglands | TV Show | 1 |
| **3** | Jailbirds New Orleans | TV Show | 1 |
| **4** | Kota Factory | TV Show | 2 |
| **5** | Midnight Mass | TV Show | 1 |

```
shows=show['duration'].value_counts().reset_index()
shows.rename(columns={'index':'season','duration':'num_content'},inplace=True)
shows.head(5)
```

| | season | num_content |
|---|---|---|
| **0** | 1 | 1793 |
| **1** | 2 | 425 |
| **2** | 3 | 199 |
| **3** | 4 | 95 |
| **4** | 5 | 65 |

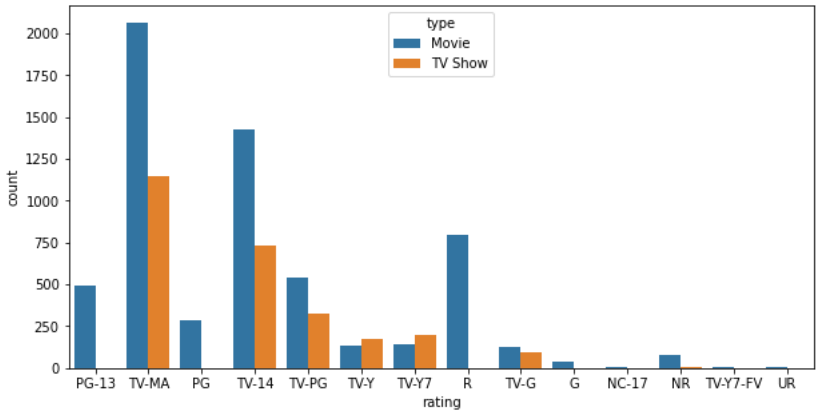
```
sns.barplot(x='season',y='num_content',data=shows,color='blue')
plt.show()
```




Most of the TV shows have 1 season.

## Ratings of contents

```
plt.figure(figsize=(10,5))
sns.countplot(data=df,x='rating',hue='type')
plt.show()
```

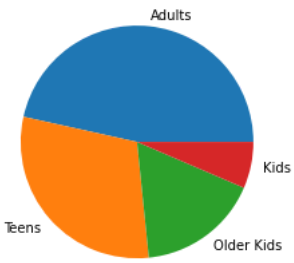



Most of the content in both Movies and TV shows is rated TV-MA, more suitable for adults rather than kids. Second highest content is rated for 14 years and above.

```
ratings=df['ratings_ages'].value_counts().reset_index()
ratings
```

| | index | ratings_ages |
|---|---|---|
| 0 | Adults | 4096 |
| 1 | Teens | 2650 |
| 2 | Older Kids | 1490 |
| 3 | Kids | 568 |

```
plt.pie(ratings['ratings_ages'],labels=ratings['index'])
plt.show()
```

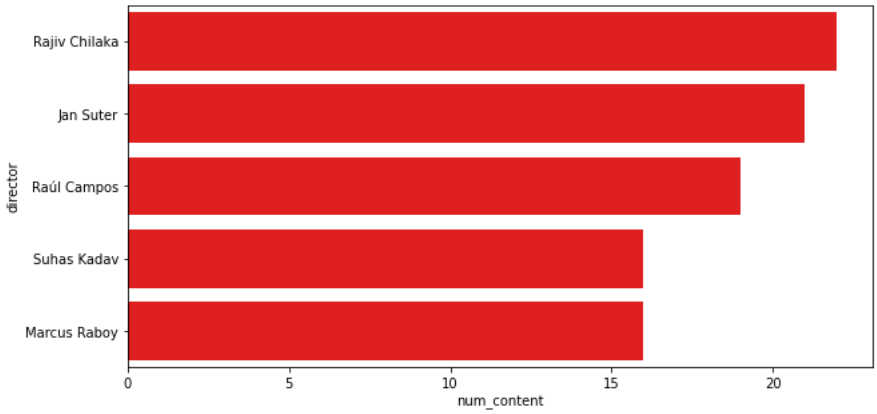



## Top Director

```
director=filtered_director.groupby(['director'])['title'].count().sort_values(ascending=False).reset_index().head(11)
director.rename(columns={'title':'num_content'},inplace=True)
director
```

| | director | num_content |
|---|---|---|
| 0 | NoDataAvailable | 2634 |
| 1 | Rajiv Chilaka | 22 |
| 2 | Jan Suter | 21 |
| 3 | Raúl Campos | 19 |

```
plt.figure(figsize=(10,5))
sns.barplot(y='director',x='num_content',data=director[1:6],color='red')
plt.show()
```



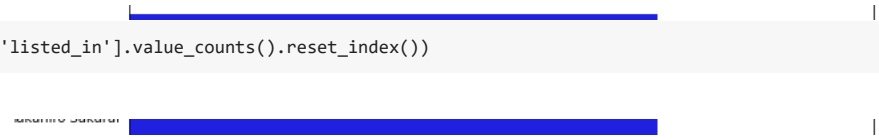

## Top actor

```
actor=filtered_cast.groupby(['cast'])['title'].count().sort_values(ascending=False).reset_index().head(11)
actor.rename(columns={'cast':'actor','title':'num_content'},inplace=True)
actor
```

| | actor | num_content |
|---|---|---|
| 0 | NoDataAvailable | 825 |
| 1 | Anupam Kher | 43 |
| 2 | Shah Rukh Khan | 35 |
| 3 | Julie Tejwani | 33 |
| 4 | Naseeruddin Shah | 32 |
| 5 | Takahiro Sakurai | 32 |
| 6 | Rupa Bhimani | 31 |
| 7 | Om Puri | 30 |
| 8 | Akshay Kumar | 30 |
| 9 | Yuki Kaji | 29 |
| 10 | Amitabh Bachchan | 28 |

```
plt.figure(figsize=(10,5))
sns.barplot(y='actor',x='num_content',data=actor[1:6],color='blue')
plt.show()
```


## Top Genres



```
len(dff['listed_in'].value_counts().reset_index())
```

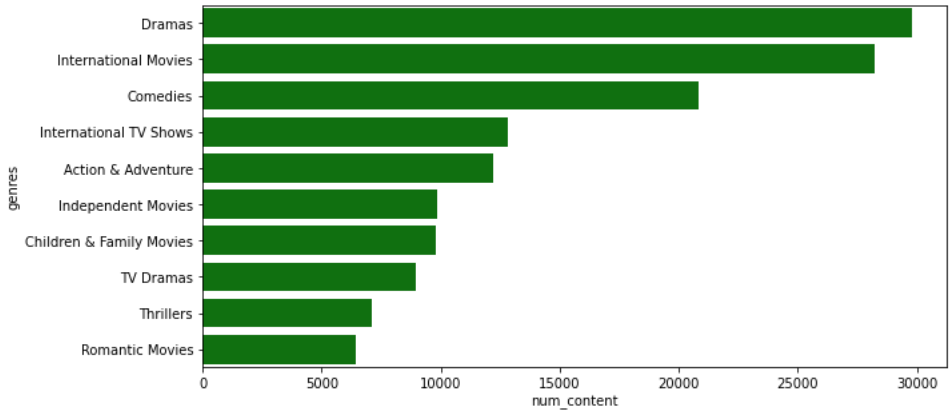
```
42
```

42 genres available

```
genres=dff['listed_in'].value_counts().reset_index().head(10)
genres.rename(columns={'index':'genres','listed_in':'num_content'},inplace=True)
genres
```

| | genres | num_content |
|---|---|---|
| 0 | Dramas | 29775 |
| 1 | International Movies | 28211 |
| 2 | Comedies | 20829 |
| 3 | International TV Shows | 12845 |
| 4 | Action & Adventure | 12216 |
| 5 | Independent Movies | 9834 |
| 6 | Children & Family Movies | 9771 |
| 7 | TV Dramas | 8942 |
| 8 | Thrillers | 7107 |
| 9 | Romantic Movies | 6412 |

```
plt.figure(figsize=(10,5))
sns.barplot(y='genres',x='num_content',data=genres,color='green')
plt.show()
```




Drama was the most preferred genre

## Findings-

- Most of the content released was movies 66% and only 33% were TV shows.
- USA produced most content followed by India.
- Max content was uploaded in 2019.
- Friday is the day of maximum uploaded content.

- Second half of the year sees more content upload.
- 42 genres of movies and shows are available, most popular being Dramas.
- Most movies have duration 70-120 mins.
- Most TV shows have 1 season.
- Most of the content is rated for adults followed by teens and very little for kids.