2024W AML 2103 2 Visualization for AI and ML

Assignment 2

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Content

Inferernce and Results:

Q1. How does content differ geographically?

- The content differs widely across the countries
- the map visualisation gives clear picture on the content distribution
- The close observation gives us the insights that US is having equal amount of genere content which shows the diversity.
- India on other hand gives more focus on the Dramas,International movies (dubbed_content)
- Japan and south kora focuses on the international TV shows (series)
- Canada is the having moderate genere contents
- UK is having more documentries ratio compared with other genre than any other countries

Q2. Over time, how has the type of content that is being added, changed?

- It is observed that the trend of adding movies and TV Shoe both declined sharply in the later years, which might be due to the pandemic which started in 2019.
- movie content showed expontential growth during the years 2016 to 2018
- TV shows are constant across the time and regions.
- more analysis on the ratings are attached below

Q3. Which words recurred, among content Titles and Descriptions?

- Title: most of the shows or content has "Love" --> universal language , "2" --> signifies the part of various shows (recent trend in the decade)
- Decription: in description as well it has more words like "love", "young", "life", "world", "freinds" createing a more sense on the movie plots
- The US is obsessed with the words Christmas and American in the titles and the plots are described through words like new, life and world
- India is using their origin languages in the title with love similar words in different synonyms are present and the mumbai is used more often. Their plots are biased with preference to the male actors so the word man is kept repeating.
- In Canada, Trailer, Christmas and monsters are repeated with friends to describe the pltos

pre analysis Q4

Q4. Over a year, what changes have occurred in the overall content being added?

- various combination of content and timelines are presented here

- cumulatively the count rate has seen improvement irrespective of the content and regions
- the months November,Decmber,Jan (holiday season) is the highest content being added in all the years
- suprisingly the year 2017 and 2018 follows different pattern paving summer vaccation time to have more content (particularly the TV shows)

Q5. Which is the most popular rating-category?

- TV Mature Audience is most most popular one
- No one under 17 is the lowest know rating category in the disney+
- there are 3 UR which is not rated (might be experimental shows)

In [ ]:

In [1]:
```
# Importing Necessary Libraries
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from collections import Counter


import plotly.express as px
from wordcloud import WordCloud

import re
import nltk
from nltk.corpus import stopwords
import warnings
warnings.filterwarnings("ignore")
```

Dataset Description

We are provided with a data about Disney+ contents and the data are to be explored to get key finding or major trends. Different information about the contents are provided which are:

- Show_Id: Unique identifier for the content
- Type: Type of the content : TV Show or a Movie
- Title: Title of the content
- Director: THe ones who directed the tv show or the movie
- Cast: Main characters from the movie or tv show
- Country: Country of origin for the given content. Can have more than one values
- Date Added: The date when the content was added to disney+
- Release Year: The year when the content was released not necessarily in disney+
- Rating: Content rating which indicates its character: Family Friendly, Inclusion of violence, nudity, etc
- Duration: The timeframe length of the content if its a movie and no of seasons if it is a tv show
- listed in: The different genres it belong to or in which genre it can be found in disney+
- description: A short description about the movie or the tv show

validation

In [2]:
```
# Import the CSV file, save it in a data frame, and display the top 3 rows
df = pd.read_csv('content.csv')
df.head(3)
```

Out[2]:

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in	description
0	s1	Movie	Dick Johnson Is Dead	Kirsten Johnson	NaN	United States	September 25, 2021	2020	PG-13	90 min	Documentaries	As her father nears the end of his life, filmm...
1	s2	TV Show	Blood & Water	NaN	Ama Qamata, Khosi Ngema, Gail Mabalane, Thaban...	South Africa	September 24, 2021	2021	TV-MA	2 Seasons	International TV Shows, TV Dramas, TV Mysteries	After crossing paths at a party, a Cape Town t...
2	s3	TV Show	Ganglands	Julien Leclercq	Sami Bouajila, Tracy Gotoas, Samuel Jouy, Nabi...	NaN	September 24, 2021	2021	TV-MA	1 Season	Crime TV Shows, International TV Shows, TV Act...	To protect his family from a powerful drug lor...

In [3]:
```
print('Total no. of rows:',df.shape[0])
print('Total no. of columns:',df.shape[1])
```

```
Total no. of rows: 8807
Total no. of columns: 12
```

quick_insight

We have a total of 8807 records of the contents in the disney+. Let's check for the validity of the data whether there are any missing informations or if there are any duplicated records.

In [4]:
```
# info about the columns and its data types
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
```

It is found that the datatype for all of the columns except release_year (int) is object. Some of these columns needs to be reformatted before proceeding further.

In [5]:
```
# change the datatype for date added to datetime for better analysis
df['date_added'] = df['date_added'].apply(pd.to_datetime)
```

In [6]:
```
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   datetime64[ns]
 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: datetime64[ns](1), int64(1), object(10)
memory usage: 825.8+ KB
```

In [7]:
```
df.head(3)
```

Out[7]:

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in	description
0	s1	Movie	Dick Johnson Is Dead	Kirsten Johnson	NaN	United States	2021-09-25	2020	PG-13	90 min	Documentaries	As her father nears the end of his life, filmm...
1	s2	TV Show	Blood & Water	NaN	Ama Qamata, Khosi Ngema, Gail Mabalane, Thaban...	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows, TV Dramas, TV Mysteries	After crossing paths at a party, a Cape Town t...
2	s3	TV Show	Ganglands	Julien Leclercq	Sami Bouajila, Tracy Gotoas, Samuel Jouy, Nabi...	NaN	2021-09-24	2021	TV-MA	1 Season	Crime TV Shows, International TV Shows, TV Act...	To protect his family from a powerful drug lor...

Data Validation and Cleansing

Lets check the data for validity. This includes checking the absence of data, no of unique values in data(as a column with only one value is not relevant for analysis) , range of the data (numeric) and presence of duplicate records.

In [8]:
```
# putting the column names in a list
column_names = df.columns.tolist()
null_count = df.isnull().sum()
null_ratio = round(df.isnull().mean(),3)
nunique = df.nunique()
#display the dataframe with all the information
pd.DataFrame(np.vstack((column_names,null_count,null_ratio, nunique)).T,
             columns = ['Columns','Null Count','Null Ratio','Unique Values'])
```

Out[8]:

	Columns	Null Count	Null Ratio	Unique Values
0	show_id	0	0.0	8807
1	type	0	0.0	2
2	title	0	0.0	8807
3	director	2634	0.299	4528
4	cast	825	0.094	7692
5	country	831	0.094	748
6	date_added	10	0.001	1714
7	release_year	0	0.0	74
8	rating	4	0.0	17
9	duration	3	0.0	220
10	listed_in	0	0.0	514
11	description	0	0.0	8775

In [9]:
```
# checking presence of duplicate records
df.duplicated().sum()
```

Out[9]:
```
0
```

In [10]:
```
df['rating'].unique()
```

Out[10]:
```
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)
```

quick_insight

'74 min', '84 min', '66 min' seems to be the invalid data lets see what went wrong

In [11]:
```
invalid_rating = df[df['rating'].isin(['74 min', '84 min', '66 min'])]
invalid_rating
```

Out[11]:

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in	description
5541	s5542	Movie	Louis C.K. 2017	Louis C.K.	Louis C.K.	United States	2017-04-04	2017	74 min	NaN	Movies	Louis C.K. muses on religion, eternal love, gi...
5794	s5795	Movie	Louis C.K.: Hilarious	Louis C.K.	Louis C.K.	United States	2016-09-16	2010	84 min	NaN	Movies	Emmy-winning comedy writer Louis C.K. brings h...
5813	s5814	Movie	Louis C.K.: Live at the Comedy Store	Louis C.K.	Louis C.K.	United States	2016-08-15	2015	66 min	NaN	Movies	The comic puts his trademark hilarious/thought...

In [ ]:
```

```

hidden_issue

It seems that the duration of the content was recorded in the rating section. Lets fix this

In [12]:
```
for i,r in invalid_rating.iterrows():
    df['duration'][i] = r.loc['rating']
    df['rating'][i] = np.nan
df['rating'].unique()
```

Out[12]:
```
array(['PG-13', 'TV-MA', 'PG', 'TV-14', 'TV-PG', 'TV-Y', 'TV-Y7', 'R',
       'TV-G', 'G', 'NC-17', nan, 'NR', 'TV-Y7-FV', 'UR'], dtype=object)
```

In [13]:
```
#check validity in numerical data
df.describe()
```

Out[13]:

	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

This can be used to check the range or the distribution of the data and also give initial info about the possible outliers.

EDA

After validation, the next step would be to explore the data and check for characteristics of the procured dataset using different statistical measures and with the help of visualization using various plots. We will be checking for the distribution of data, how contents are distributed throughout the world, which type of contents are primarily prevalent in the collection, how the trend of contents being added in disney+ throughout the years, etc.

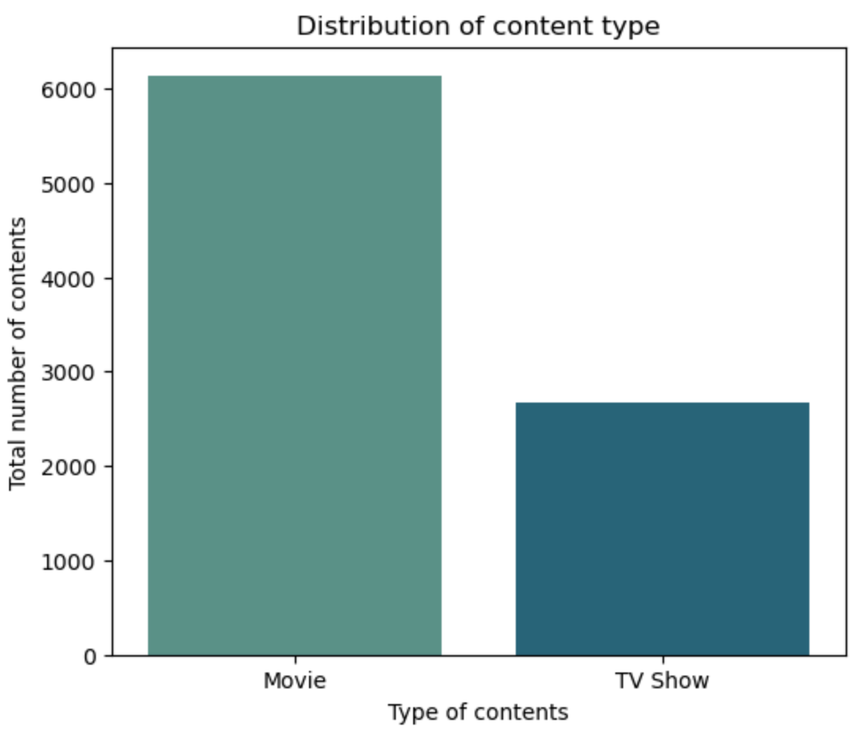
First lets look at the distribution of data.

Distribution of content type

In [14]:
```
#Distribution of Type of Contents
type_dist = df['type'].value_counts()
type_dist
```

Out[14]:
```
Movie      6131
TV Show    2676
Name: type, dtype: int64
```

In [15]:
```
#visualizing the distribution in a barplot
fig = plt.figure(figsize=(6,5)) #setting the figure size
sns.barplot(x = type_dist.index,
                      y = type_dist.values,
                      palette = 'crest')
plt.xlabel('Type of contents')
plt.ylabel('Total number of contents')
plt.title('Distribution of content type')
plt.show()
```



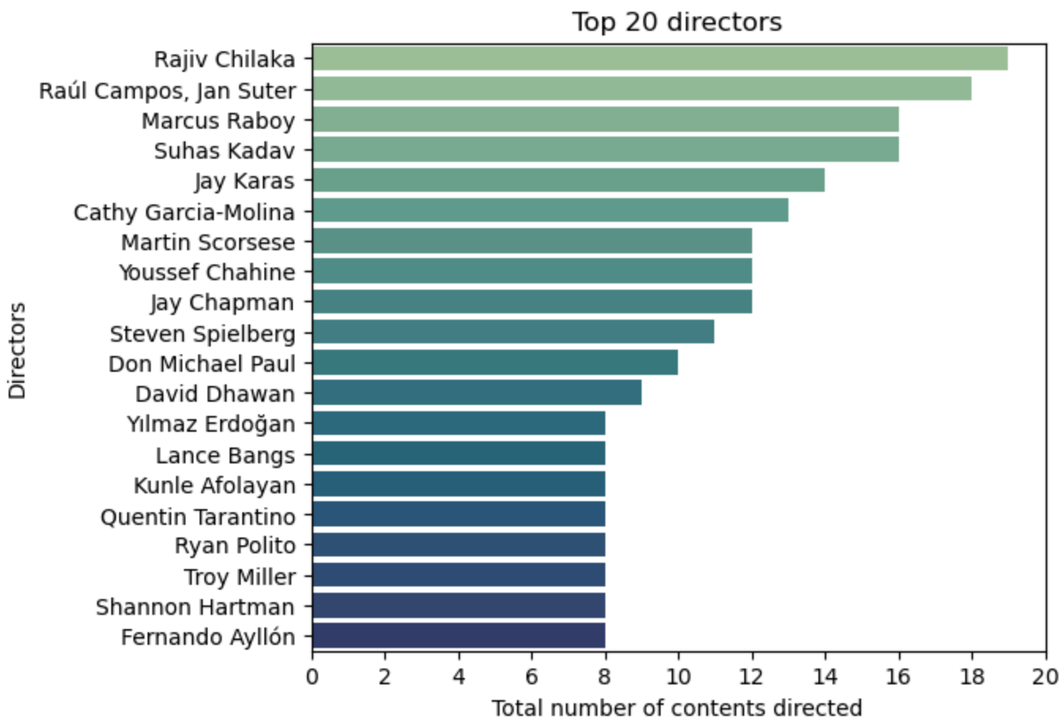
Directors with highest number of contents directed

In [16]:
```
# Top 20 directors for the contents
top20_dirs = df['director'].value_counts().head(20)
top20_dirs
```

Out[16]:
```
Rajiv Chilaka             19
Raúl Campos, Jan Suter    18
Marcus Raboy              16
Suhas Kadav               16
Jay Karas                 14
Cathy Garcia-Molina       13
Martin Scorsese           12
Youssef Chahine           12
Jay Chapman               12
Steven Spielberg          11
Don Michael Paul          10
David Dhawan               9
Yılmaz Erdoğan             8
Lance Bangs                8
Kunle Afolayan             8
Quentin Tarantino          8
Ryan Polito                8
Troy Miller                8
Shannon Hartman            8
Fernando Ayllón            8
Name: director, dtype: int64
```

In [17]:
```
#visualizing the top 20 directors in a barplot
fig = plt.figure(figsize=(6,5)) #setting the figure size
sns.barplot(x = top20_dirs.values,
            y = top20_dirs.index,
```

```
            palette = 'crest',
            )
plt.xlabel('Total number of contents directed')
plt.ylabel('Directors')
plt.title('Top 20 directors')
plt.xticks(range(0,max(top20_dirs)+2,2))

plt.show()
```



Most appearing Actors/Actresses

In [18]:
```
#printing values of cast for top 5 rows
df['cast'].head()
```

Out[18]:
```
0                                                   NaN
1    Ama Qamata, Khosi Ngema, Gail Mabalane, Thaban...
2    Sami Bouajila, Tracy Gotoas, Samuel Jouy, Nabi...
3                                                   NaN
4    Mayur More, Jitendra Kumar, Ranjan Raj, Alam K...
Name: cast, dtype: object
```

Since there are multiple cast members in a TV show or a movie, we will collect all of them in a single collection and find out the count for each.

In [19]:
```
def combine_and_count_values(data, data_name, top = None):
    # Parameters --> data: column of dataframe,
    #                data_name: string for name of data,
    #                top: int if top n numbers needed
    # Returns a dataframe with sorted values by its count


    ##combine all the non null values from the data
    data = [d for d in data if not pd.isna(d)]
```

```
    #join all the strings into one
    collection = ','.join(data)

    #separate them to a list
    list_collection = [c.strip() for c in collection.split(',')]

    #use counter library to get the counts and put them in dataframe
    counter = Counter(list_collection)

    #transpose to get desired output
    df = pd.DataFrame([list(counter.keys()),list(counter.values())]).T
    #setting the name of columns
    df.columns = [data_name,'Count']

    if top:
        return df.sort_values('Count', ascending = False, ignore_index = True).head(top) #returns top n elements
    else:
        return df.sort_values('Count', ascending = False,ignore_index = True) # returns all elements
```

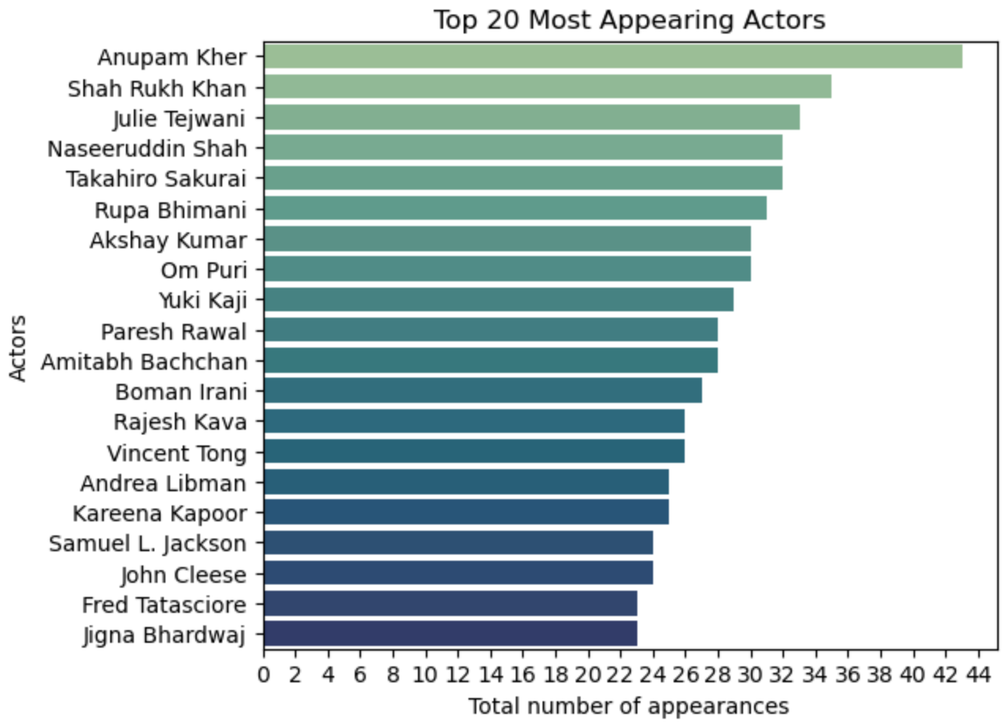
Lets find out top 20 most appearing actors or actress in disney+

In [20]:
```
top20_actors = combine_and_count_values(df['cast'], 'Cast Member', top=20)
top20_actors
```

Out[20]:

	Cast Member	Count
0	Anupam Kher	43
1	Shah Rukh Khan	35
2	Julie Tejwani	33
3	Naseeruddin Shah	32
4	Takahiro Sakurai	32
5	Rupa Bhimani	31
6	Akshay Kumar	30
7	Om Puri	30
8	Yuki Kaji	29
9	Paresh Rawal	28
10	Amitabh Bachchan	28
11	Boman Irani	27
12	Rajesh Kava	26
13	Vincent Tong	26
14	Andrea Libman	25
15	Kareena Kapoor	25
16	Samuel L. Jackson	24
17	John Cleese	24
18	Fred Tatasciore	23
19	Jigna Bhardwaj	23

In [21]:
```
#visualizing the top 20 actors in a barplot
fig = plt.figure(figsize=(6,5)) #setting the figure size
sns.barplot(x = top20_actors['Count'],
            y = top20_actors['Cast Member'],
            palette = 'crest',
            )
plt.xlabel('Total number of appearances')
plt.ylabel('Actors')
plt.title('Top 20 Most Appearing Actors')
plt.xticks(range(0,max(top20_actors.Count)+2,2))

plt.show()
```



Question 1

Largest producer Country

back

In [22]:
```
## Distribution of country
df['country'].value_counts()
```

Out[22]:
```
United States                                2818
India                                         972
United Kingdom                                419
Japan                                         245
South Korea                                   199
                                             ...
Romania, Bulgaria, Hungary                      1
Uruguay, Guatemala                              1
France, Senegal, Belgium                        1
Mexico, United States, Spain, Colombia          1
United Arab Emirates, Jordan                    1
Name: country, Length: 748, dtype: int64
```

Let's use the same method as above to find the count as some of the contents were created in multiple countries

In [23]:
```
country_data = combine_and_count_values(df['country'], 'Country')
country_data
```

Out[23]:

	Country	Count
0	United States	3690
1	India	1046
2	United Kingdom	806
3	Canada	445
4	France	393
...	...	...
118	Ecuador	1
119	Armenia	1
120	Mongolia	1
121	Bahamas	1
122	Montenegro	1

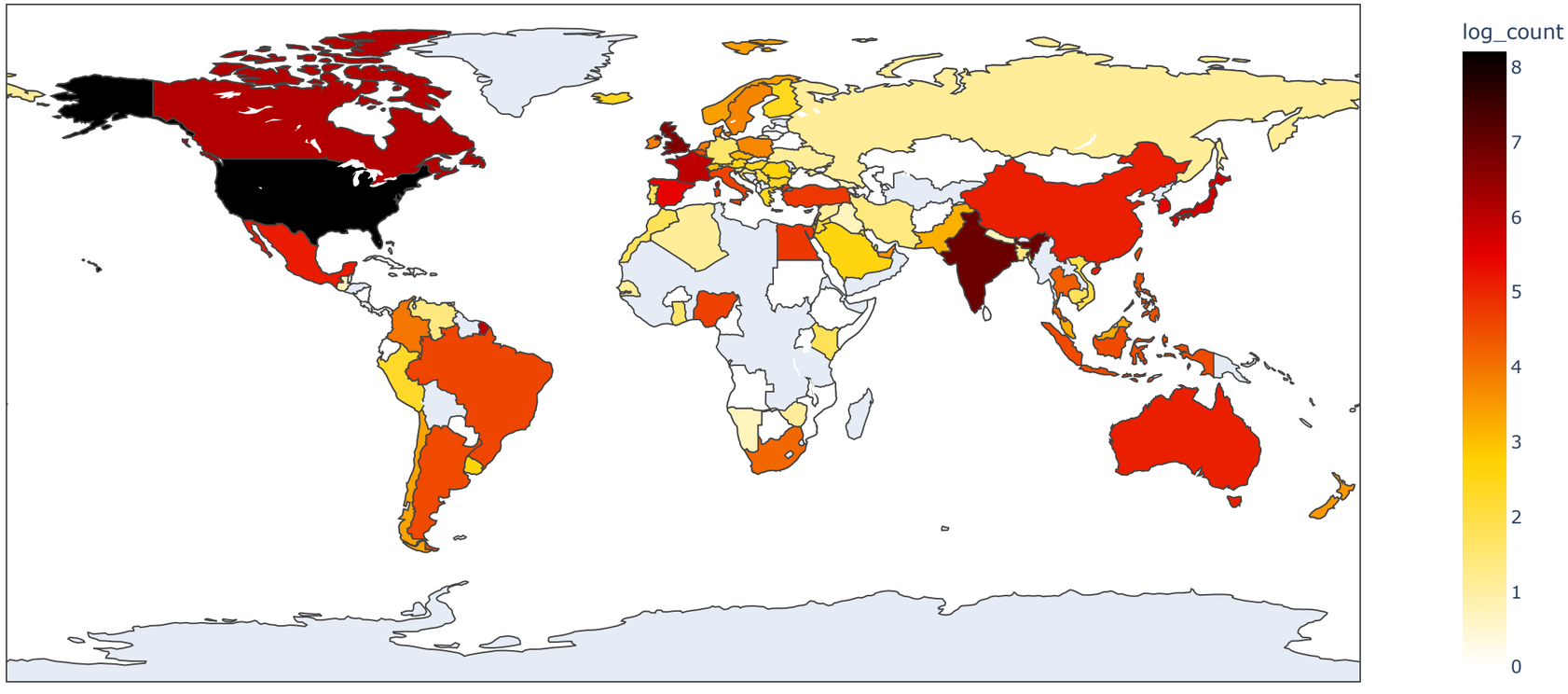
123 rows × 2 columns

map_visualization

We can use choropleth to visualize this in a world map.

back

In [24]:
```
import math
def create_map(country_data):
    country_data['log_count'] = [math.log(count) for count in country_data['Count']]
    fig = px.choropleth(country_data, locations='Country',
                        locationmode='country names',
                        color= 'log_count', #use log to color as the difference between counts are significant
                        color_continuous_scale= px.colors.sequential.Hot_r,
                        custom_data=['Country', 'Count']
                       )

    fig.update_traces(hovertemplate='<b>%{customdata[0]}</b><br>Count: %{customdata[1]}')
    # update layout figure method
    fig.update_layout(
        title_text='',
        width=1200,
        height=600,
    )

    fig.show()
create_map(country_data)
```



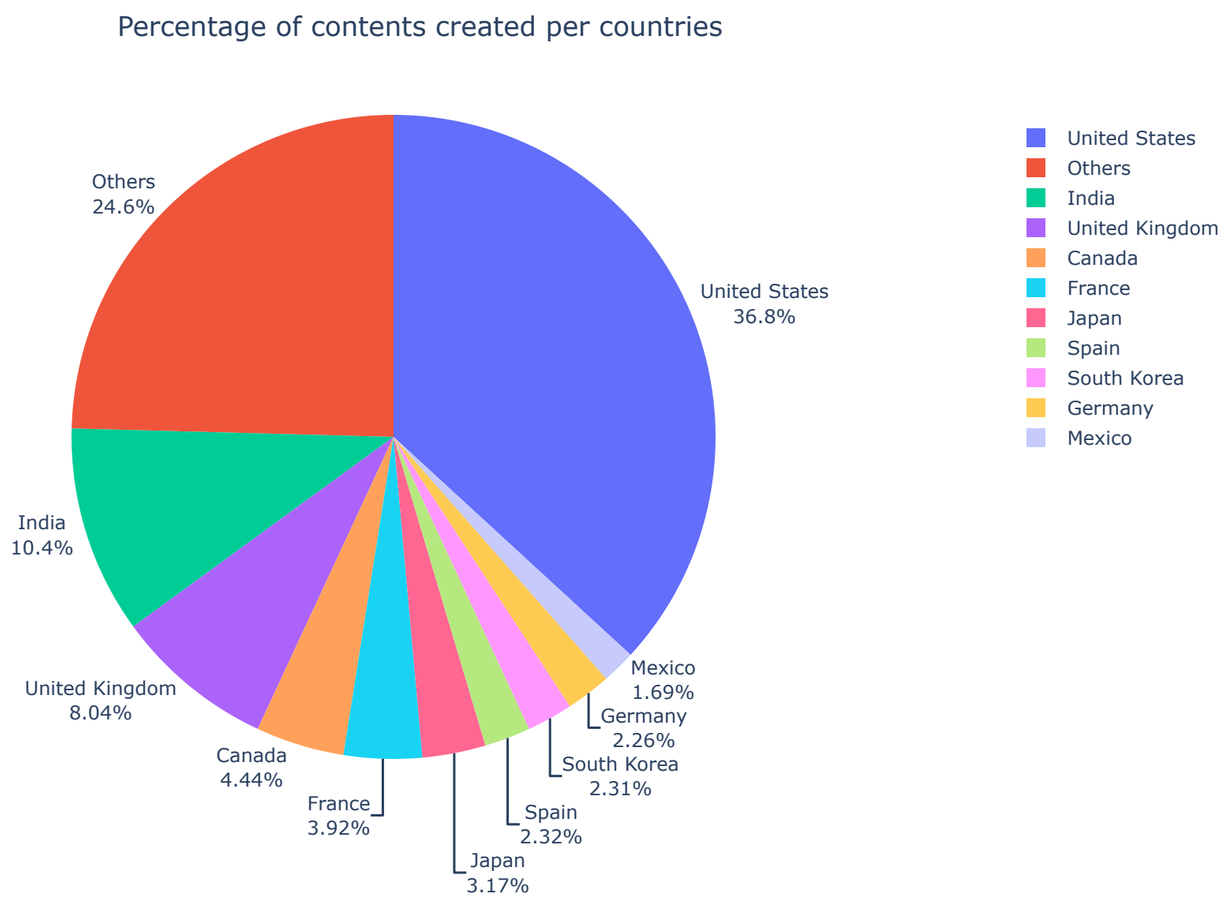
Lets also visualize this in pie chart where only top 10 are shown distinctly.

In [25]:
```
top_10_countries = country_data[['Country','Count']].head(10)
others = pd.DataFrame([['Others',np.sum(country_data[10:]['Count'])]], columns = ['Country','Count'])
top_countries = pd.concat((top_10_countries,others), axis=0)
top_countries
```

Out[25]:

	Country	Count
0	United States	3690
1	India	1046
2	United Kingdom	806
3	Canada	445
4	France	393
5	Japan	318
6	Spain	232
7	South Korea	231
8	Germany	226
9	Mexico	169
0	Others	2463

In [26]:
```
fig = px.pie(top_countries, values='Count', names='Country',
             hover_data=['Count'],
             labels={'Country':'Country'},
             title= 'Percentage of contents created per countries',
             height=600,
             width=1200)
fig.update_traces(textposition='outside', textinfo='percent+label')
fig.update_layout(title={'x':0.5, 'xanchor': 'center'})
fig.show()
```



Content Difference according to the countries

Since USA makes more than 30 percent of the contents available in disney+, it would not be wise to check which country makes most contents for a genre as it would be USA most of the times. So instead, we will find out which content type, rating type and genre is mostly created in a country.

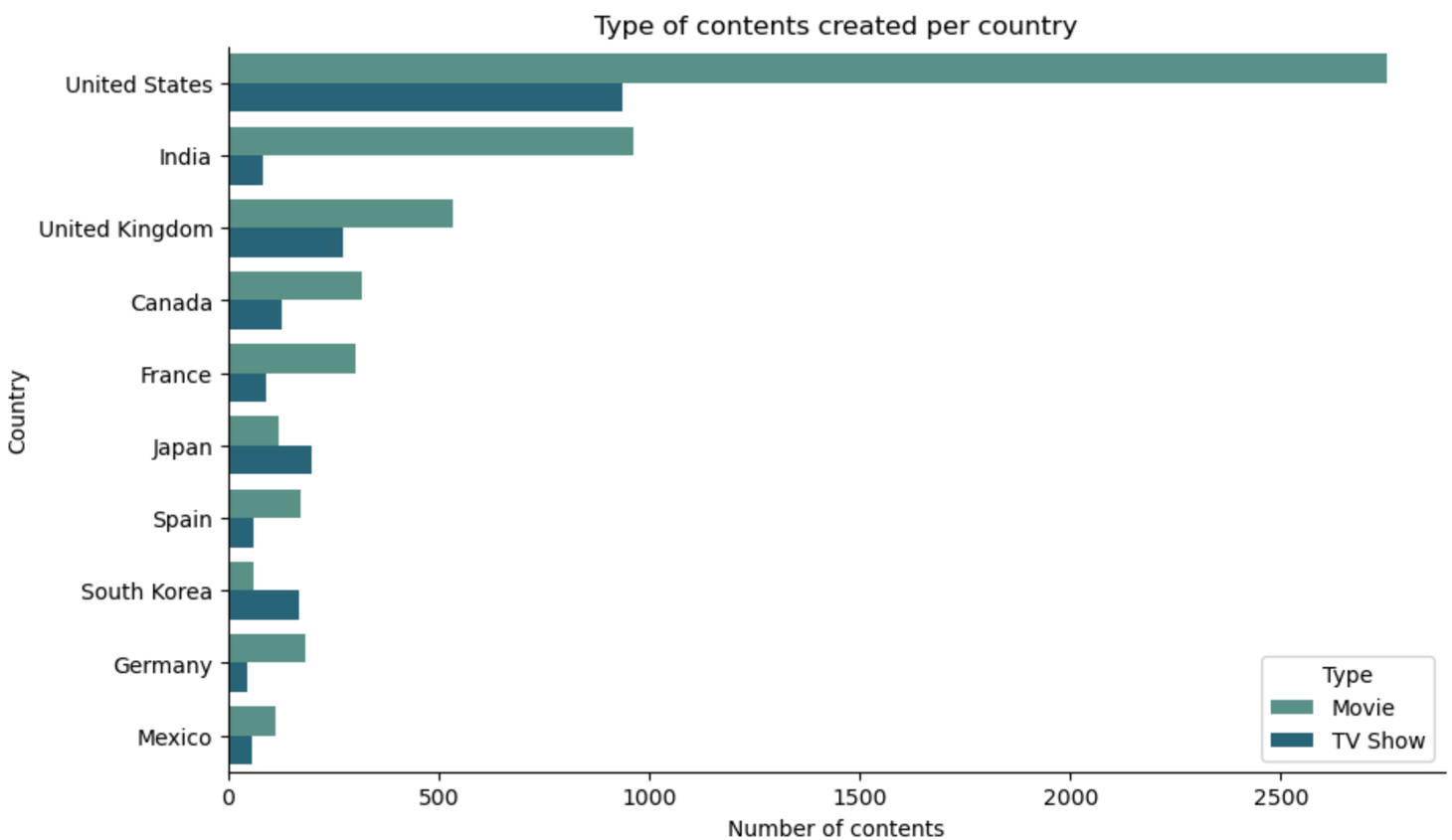
In [27]:
```
def category_per_country(cat):
    # splitting the data with , as some have multiple values and convert them in a list
    c_df = df['country'].apply(lambda x: [s.strip() for s in x.split(',')] if isinstance(x,str) else x)

    # explode creates a new record for each of the data in the list and to frame is to convert it into dataframe
    c_df = c_df.explode().to_frame()

    # create a new column cat where each country gets its value as per the index form original dataframe
    c_df[cat] = c_df.apply(lambda x:df[cat][x.index])

    # create a final table to create dummy variable for each value in table and calculate the count of each cat
    final = c_df.pivot_table(index='country', columns=cat, aggfunc='size', fill_value=0)

    #temp total column to sort the table
    final['total'] = final.sum(axis = 1)
    return final.sort_values('total', ascending = False).drop(columns =['total'])

type_dist = category_per_country('type')
```

```
top_10_countries = type_dist.head(10)
top_10_countries.reset_index(inplace = True)
top_10_countries
```

Out[27]:

type	country	Movie	TV Show
0	United States	2752	938
1	India	962	84
2	United Kingdom	534	272
3	Canada	319	126
4	France	303	90
5	Japan	119	199
6	Spain	171	61
7	South Korea	61	170
8	Germany	182	44
9	Mexico	111	58

In [28]:
```
# top_10_countries.plot(x='country'.index, y=["Movie", "TV Show"], kind="bar")
fig, ax1 = plt.subplots(figsize=(10, 6))
tidy = top_10_countries.melt(id_vars='country').rename(columns=str.title)
sns.barplot(y='Country', x='Value', hue='Type', data=tidy, ax=ax1, palette= 'crest',)
ax1.set_xlabel('Number of contents')
ax1.set_title('Type of contents created per country')
sns.despine(fig)
plt.show()
```



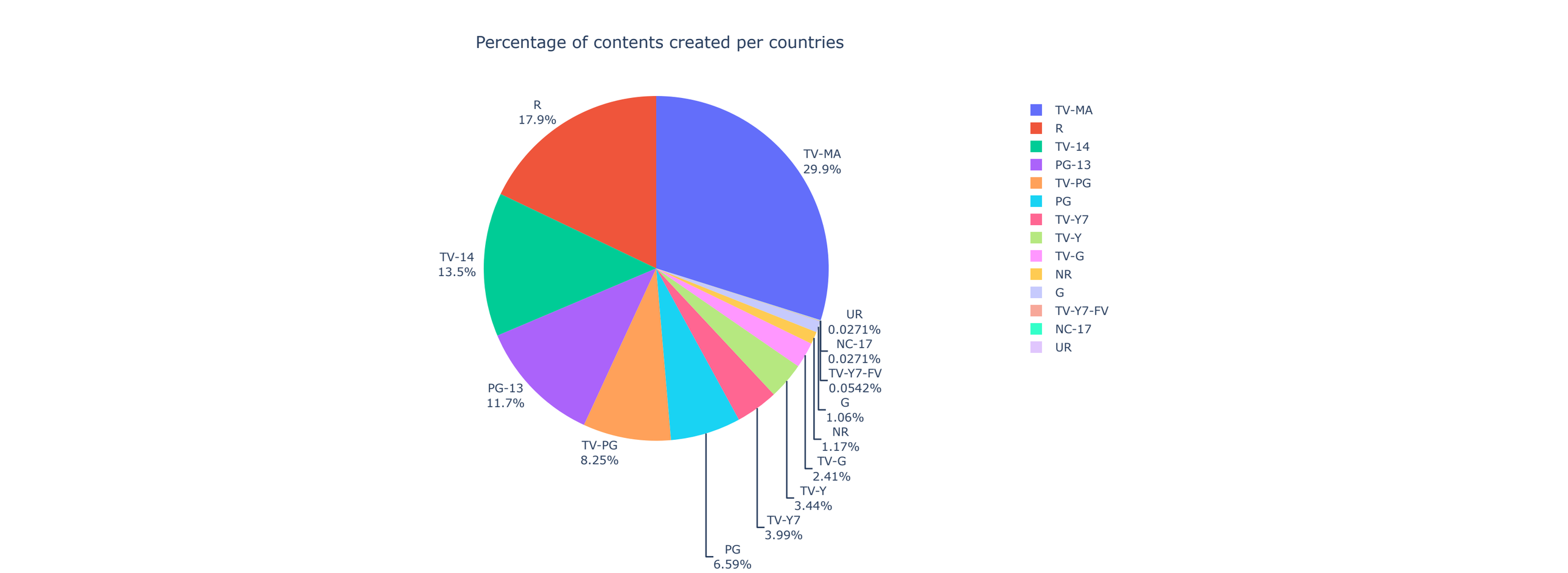
In [29]:
```
#creating rating column
rating_dist = category_per_country('rating')
rating_dist
```

Out[29]:

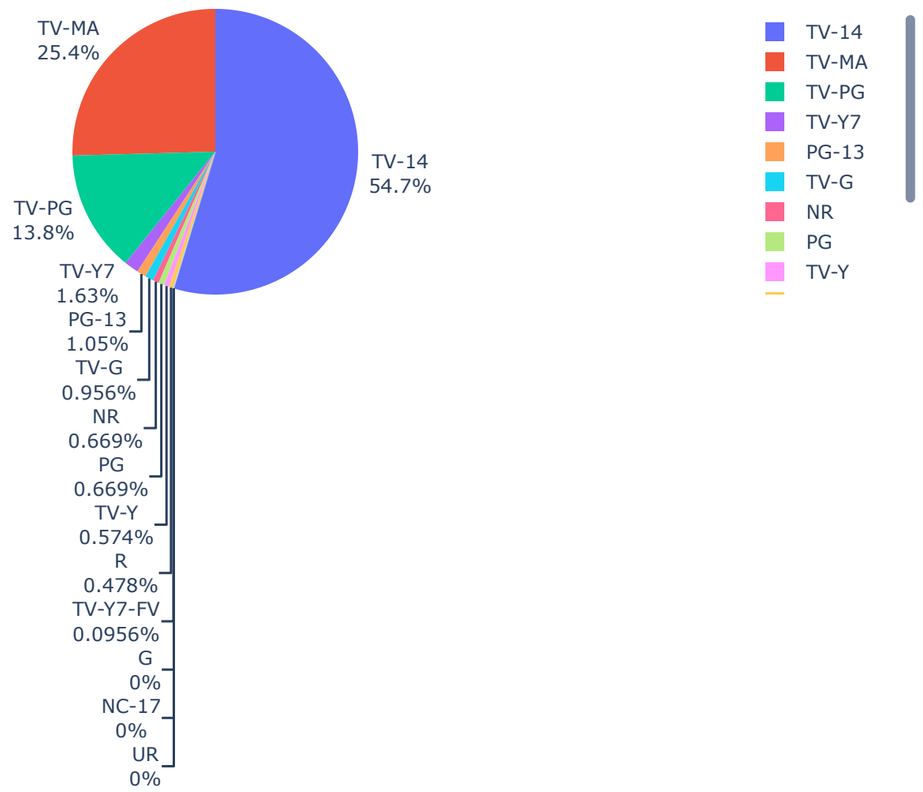
rating country	G	NC-17	NR	PG	PG-13	R	TV-14	TV-G	TV-MA	TV-PG	TV-Y	TV-Y7	TV-Y7-FV	UR
United States	39	1	43	243	433	660	497	89	1101	304	127	147	2	1
India	0	0	7	7	11	5	572	10	266	144	6	17	1	0
United Kingdom	4	0	12	35	84	145	103	25	253	98	34	12	0	1
Canada	2	1	5	33	32	79	49	17	107	39	45	35	1	0
France	2	1	4	21	35	57	48	6	163	12	21	21	0	2
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Jamaica	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Slovakia	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Nicaragua	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Ethiopia	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Liechtenstein	0	0	0	0	1	0	0	0	0	0	0	0	0	0

123 rows × 14 columns

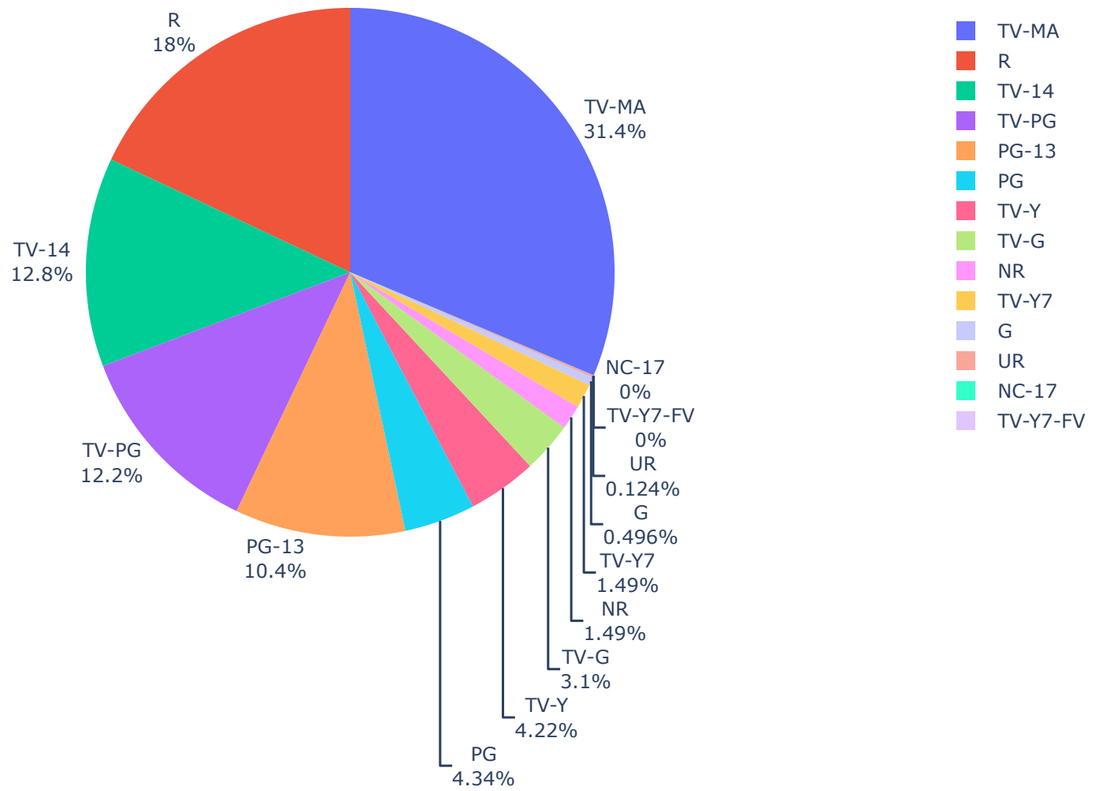
In [30]:
```
for i,country in rating_dist.head(10).iterrows():
    fig = px.pie(country.index, values=country.values,names = country.index,
                 labels={'Country':'Country'},
                 title= 'Percentage of contents created per countries',
                 height=600,
                 width=1200)
    fig.update_traces(textposition='outside', textinfo='percent+label')
    fig.update_layout(title={'x':0.5, 'xanchor': 'center'})
    fig.show()
```

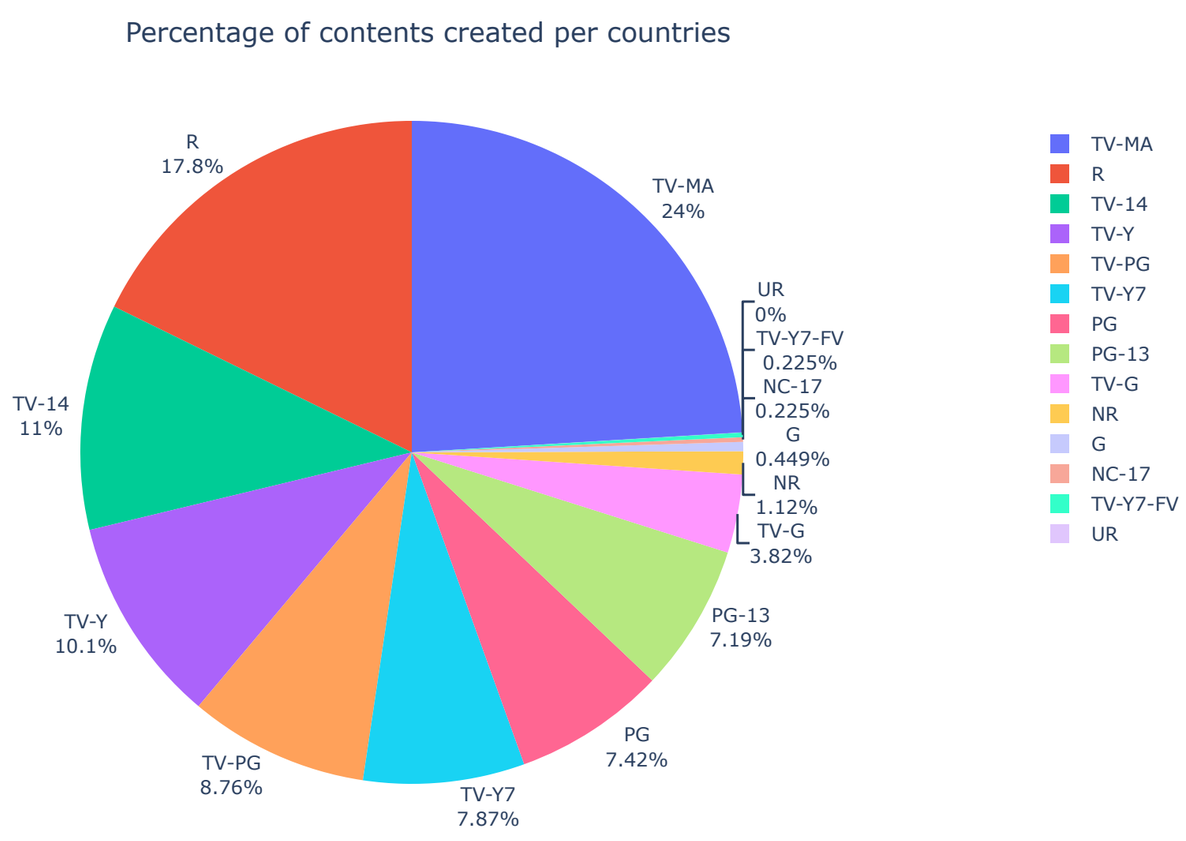

Percentage of contents created per countries
R
17.9%
TV-MA
29.9%
TV-14
13.5%
PG-13
11.7%
TV-PG
8.25%
PG
6.59%
TV-Y7
3.99%
TV-Y
3.44%
TV-G
2.41%
NR
1.17%
G
1.06%
TV-Y7-FV
0.0542%
NC-17
0.0271%
UR
0.0271%
TV-MA
R
TV-14
PG-13
TV-PG
PG
TV-Y7
TV-Y
TV-G
NR
G
TV-Y7-FV
NC-17
UR

Percentage of contents created per countries

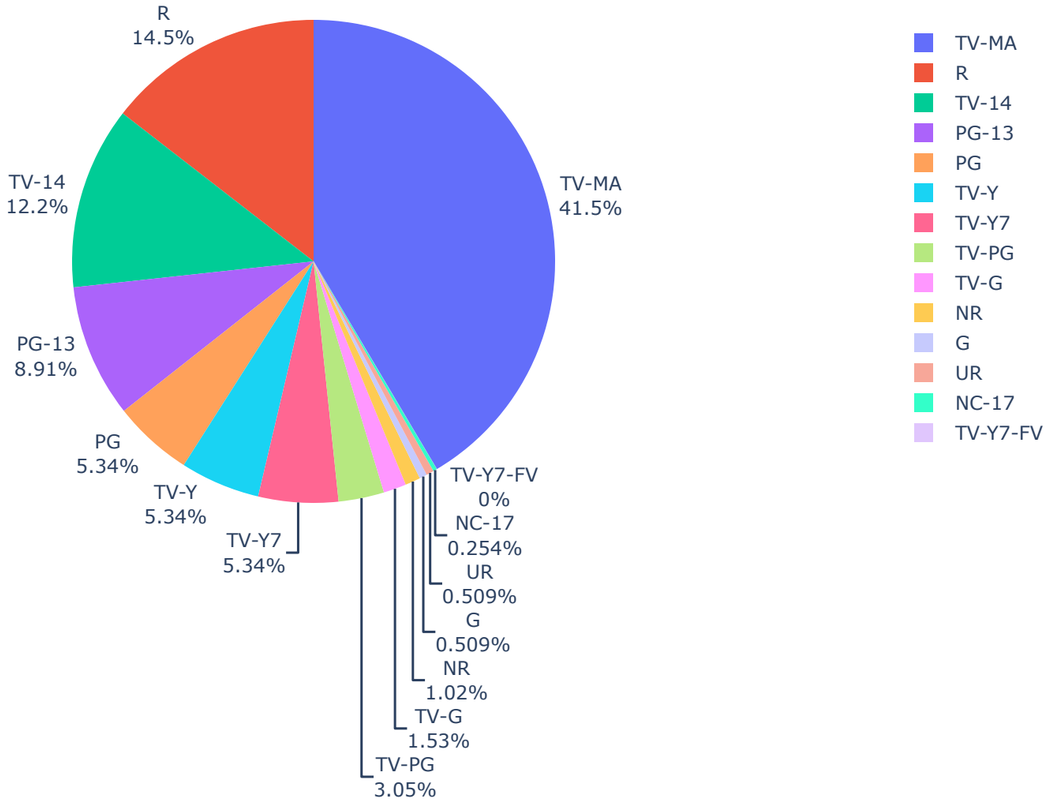


Percentage of contents created per countries

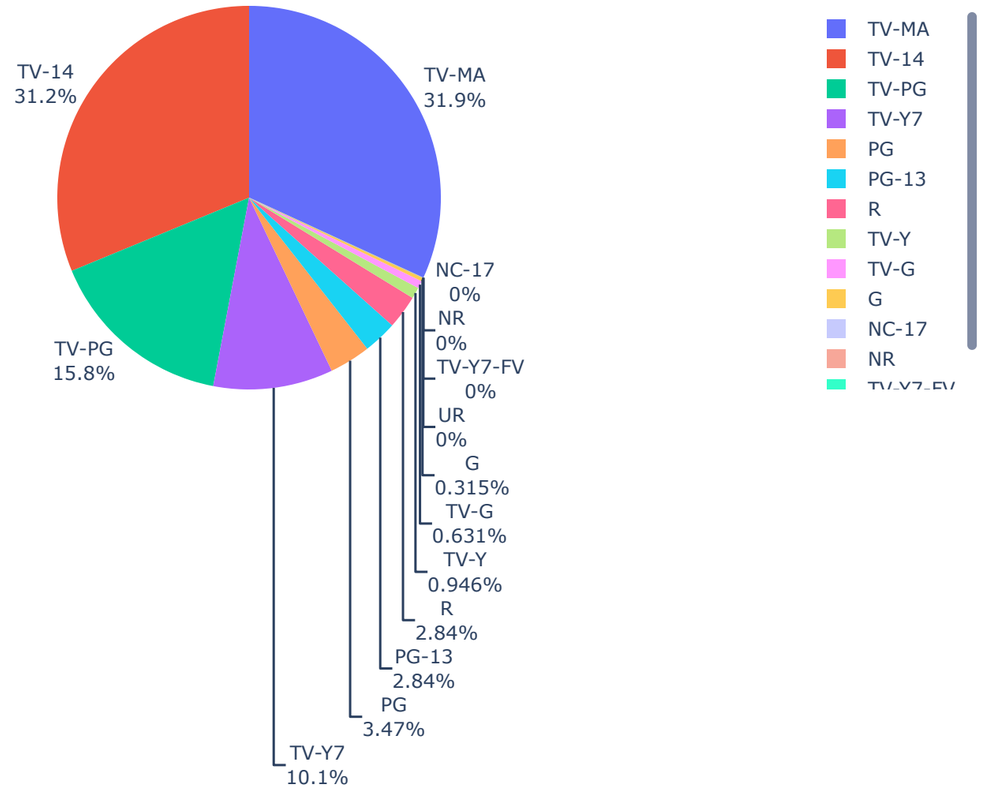


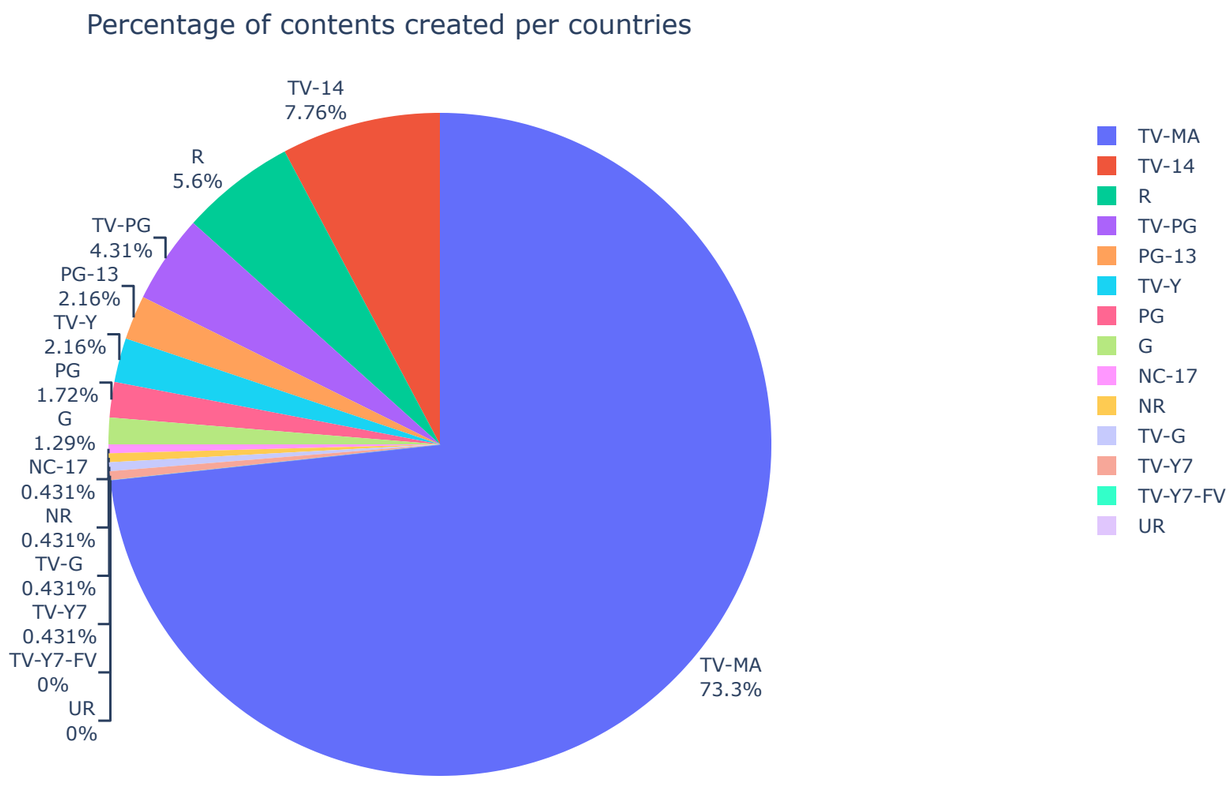

Percentage of contents created per countries
R
17.8%
TV-MA
24%
TV-14
11%
TV-Y
10.1%
TV-PG
8.76%
TV-Y7
7.87%
PG
7.42%
PG-13
7.19%
TV-G
3.82%
NR
1.12%
G
0.449%
NC-17
0.225%
TV-Y7-FV
0.225%
UR
0%
TV-MA
R
TV-14
TV-Y
TV-PG
TV-Y7
PG
PG-13
TV-G
NR
G
NC-17
TV-Y7-FV
UR

Percentage of contents created per countries

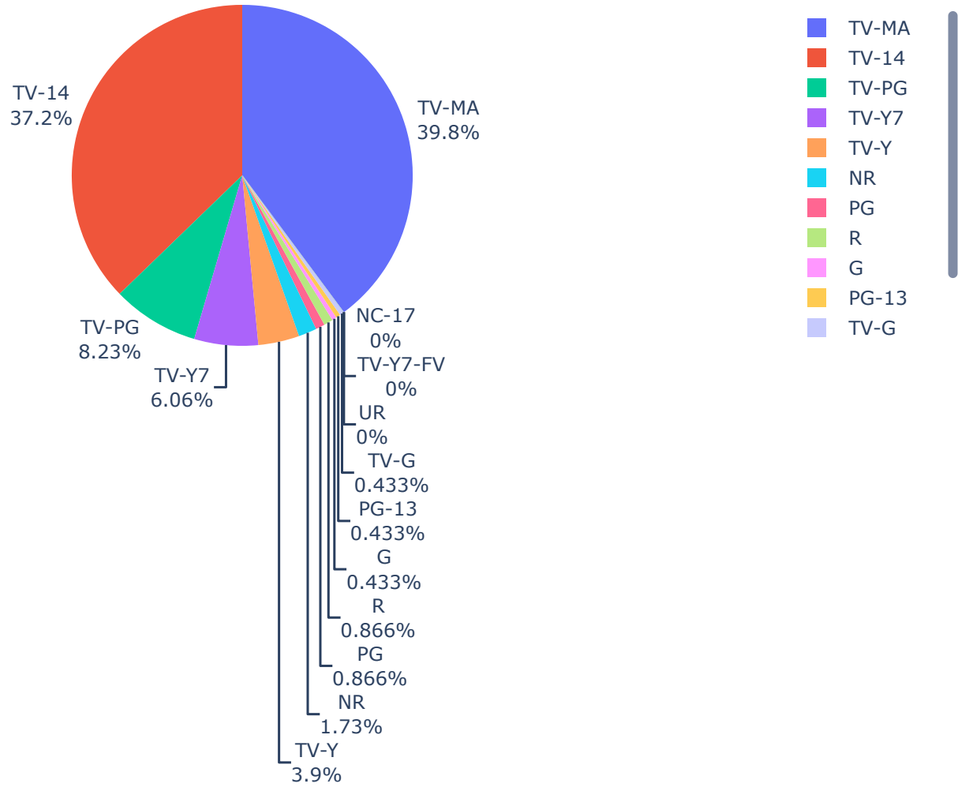


Percentage of contents created per countries

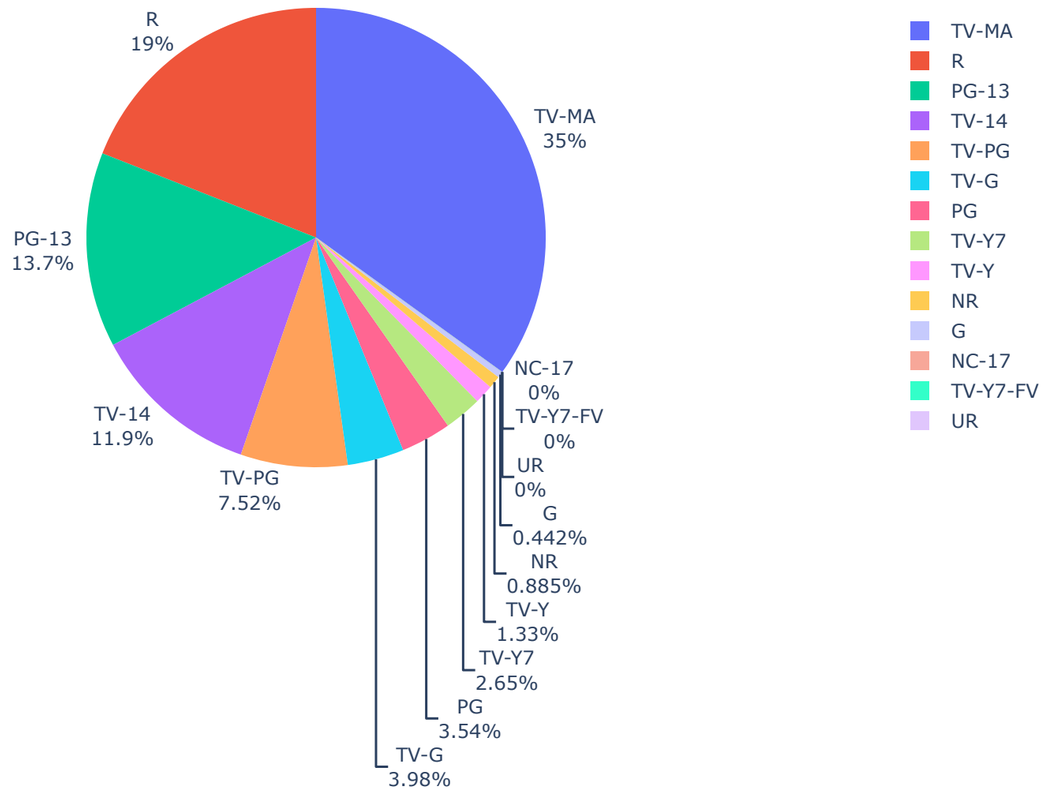


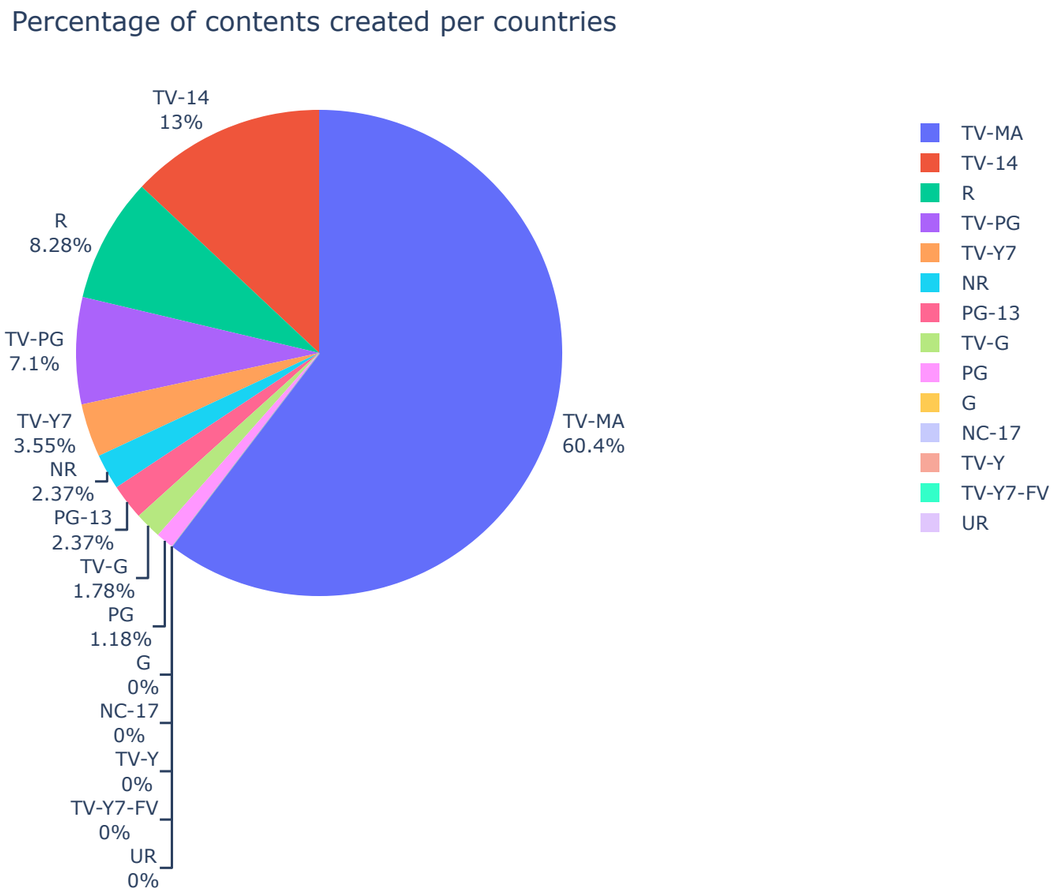

Percentage of contents created per countries
TV-14
7.76%
R
5.6%
TV-PG
4.31%
PG-13
2.16%
TV-Y
2.16%
PG
1.72%
G
1.29%
NC-17
0.431%
NR
0.431%
TV-G
0.431%
TV-Y7
0.431%
TV-Y7-FV
0%
UR
0%
TV-MA
73.3%
TV-MA
TV-14
R
TV-PG
PG-13
TV-Y
PG
G
NC-17
NR
TV-G
TV-Y7
TV-Y7-FV
UR

Percentage of contents created per countries



Percentage of contents created per countries





creating genre based table for the top 10 countries

In [31]:
```
def genere_per_country(data,count_list,top_number):
    """
    arg: data --> gets the dataframe to check and unstack the generes present in the data
    arg: count_list --> column which needs to be calculated
    arg: top_number--> most values required
    func: explode the genre column and get thhe top 10 countries most popular generes overall
    return: data table for plot, top counts of the column
    """
    data=data.copy()
    new_column='new_{}'.format(count_list)

    data[new_column]=data[count_list].str.split(', ')
    temp_explode=data.explode(new_column)
    top_countries_content=temp_explode['country'].value_counts().head(10).index
    temp_explode_1=temp_explode[temp_explode['country'].isin(top_countries_content)]
    top_new_col_count=temp_explode_1[new_column].value_counts().head(top_number).index
    temp_explode_2=temp_explode_1[temp_explode_1[new_column].isin(top_new_col_count)]
    final_table_group=temp_explode_2.groupby(['country',new_column]).size().unstack()
    count_table = temp_explode_2.groupby(['country', new_column]).size().reset_index(name='count')
    final_table_group=final_table_group.fillna(0).astype(int)
```

```
    return top_new_col_count,final_table_group,count_table
```

In [32]:
```
#calling the function
top_genere,grp_df,count_table=genere_per_country(df,'listed_in',5)
```

In [33]:
```
#top genre based on the cumulative counts for a country
top_genere
```

Out[33]:
```
Index(['Dramas', 'International Movies', 'Comedies', 'International TV Shows',
       'Documentaries'],
      dtype='object')
```

In [34]:
```
#grouped table on the top 10 countries and their top genre
grp_df
```

Out[34]:

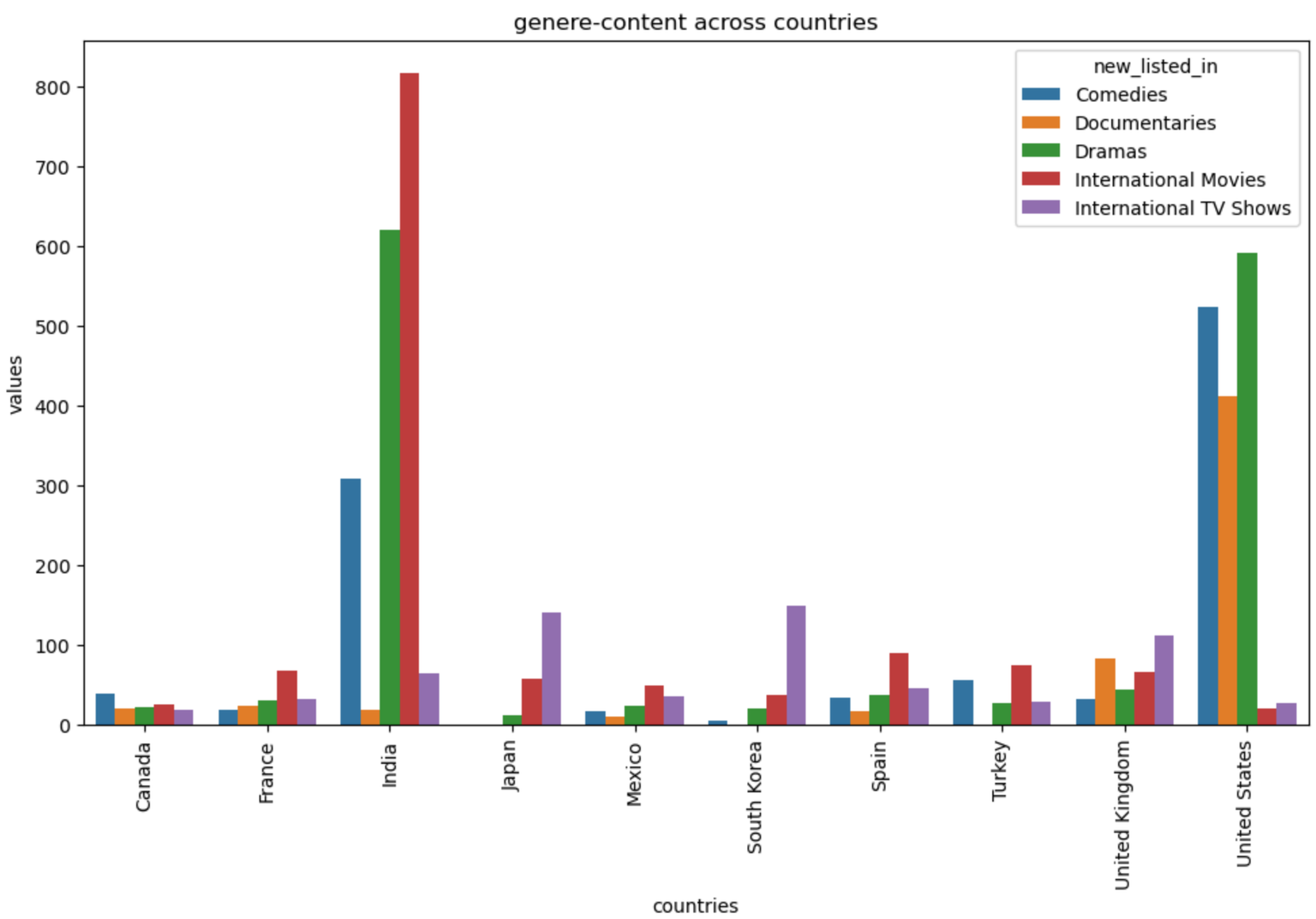
new_listed_in country	Comedies	Documentaries	Dramas	International Movies	International TV Shows
Canada	39	21	22	26	19
France	18	24	31	68	32
India	308	19	620	817	65
Japan	0	0	12	58	141
Mexico	17	10	24	49	35
South Korea	6	1	21	38	149
Spain	34	17	37	90	46
Turkey	56	0	27	74	29
United Kingdom	32	84	45	66	112
United States	524	411	591	21	27

The above grou_by table gives overall understanding of the genere based contents created in various countries.

- The close observation gives us the insights that US is having equal amount of genere content which shows the diversity.
- India on other hand gives more focus on the Dramas,International movies (dubbed_content)
- Japan and south kora focuses on the international TV shows (series)
- Canada is the having moderate genere contents
- UK is having more documentries ratio compared with other genre than any other countries

In [35]:
```
## visualization of the above sorted table
```

In [36]:
```
plt.figure(figsize=(10,6))
sns.barplot(y='count',x='country',hue='new_listed_in',data=count_table)
plt.xlabel('countries')
plt.ylabel('values')
plt.title('genere-content across countries')
plt.tight_layout()
plt.xticks(rotation=90)
plt.show()
```



Question 2

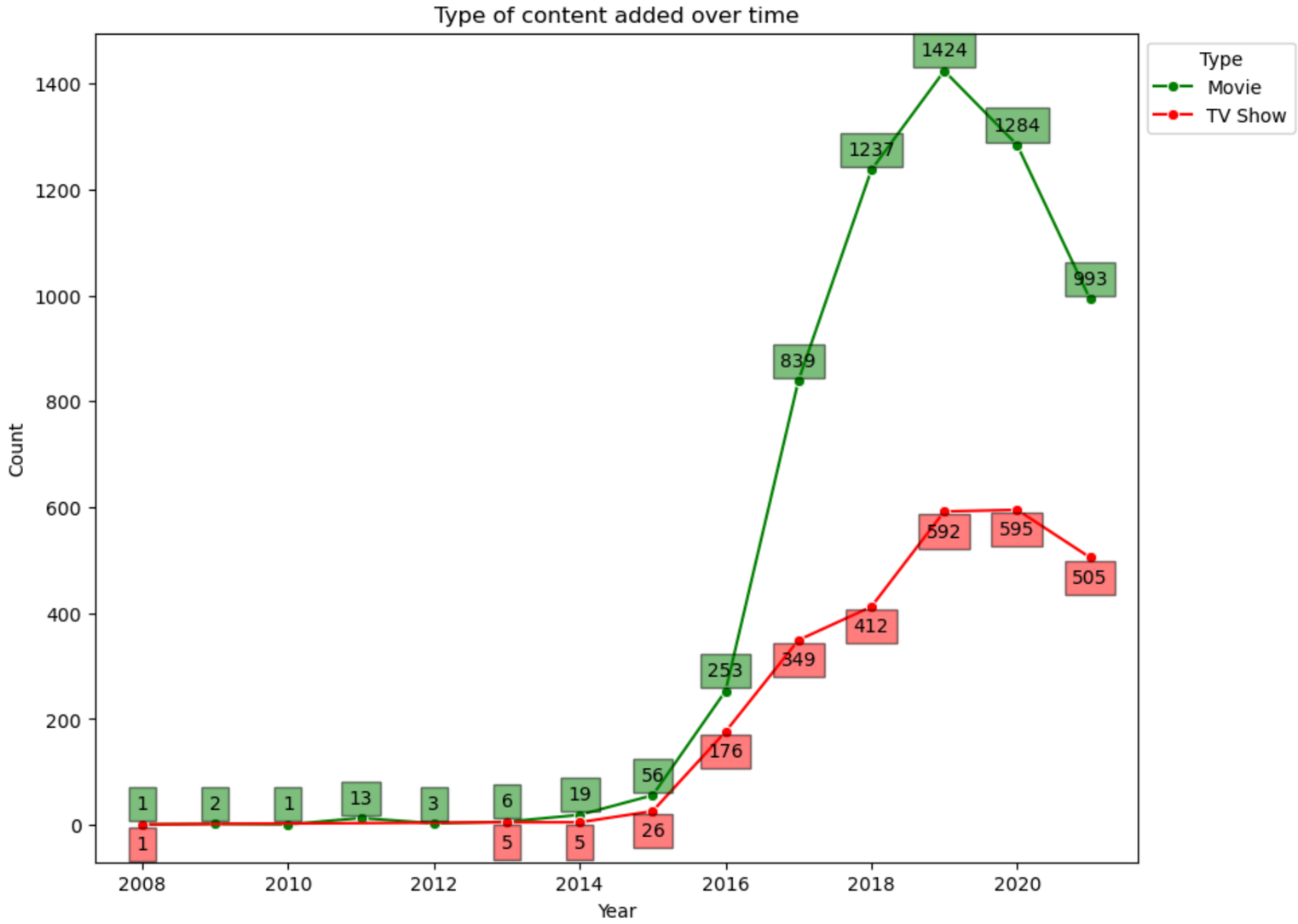
Type over the time

different contents were added. since disney+ is a fairly new platform, the contents should be mostly added during the last 5 years.

back

In [37]:
```
va=['top','bottom']
color = ['red','green']
margin = [-20,20]
plt.figure(figsize=(10,8))
for t in df['type'].unique():
    a = df[df['type']==t]
    #grouping by just the year of the date added
    year_group = a.groupby(df['date_added'].map(lambda x: x.year))['show_id'].count()
```

```
    color_ = color.pop()
    va_ = va.pop()
    margin_ = margin.pop()
    sns.lineplot(x = year_group.index,
                 y = year_group.values,
                 label = t,
                 color = color_,
                 marker = 'o')

    for x, y in zip(year_group.index,year_group.values):
        plt.text(x,
                 y+margin_,
                 y,
                 horizontalalignment='center',
                 verticalalignment=va_,
                 bbox=dict(facecolor=color_, alpha = 0.5)) #some decorations
# Add labels and title
plt.title('Type of content added over time')
plt.legend(title='Type', bbox_to_anchor=(1, 1), loc='upper left')
plt.xlabel('Year')
plt.ylabel('Count')
plt.show()
```



It is observed that the trend of adding movies and TV Shoe both declined sharply in the later years, which might be due to the pandemic which started in 2019.

Popular Word Choices

Popular word choices for the title of the contents

To find the populating of a text snippet we can use word cloud which accumulates all the word and creates a word collection whose size is propertionate to the number of time it hads been used.

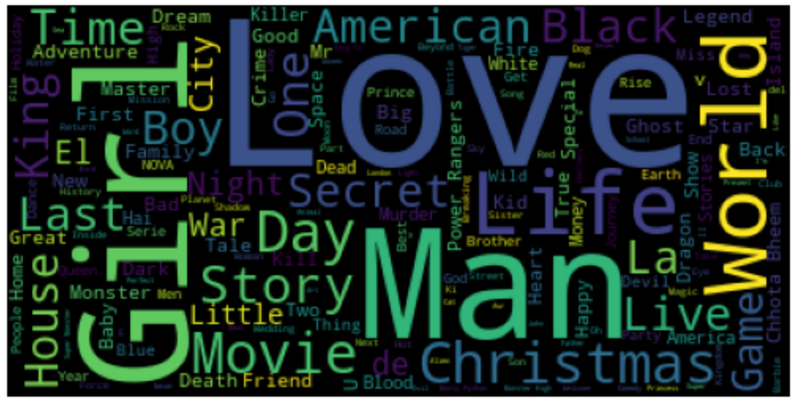
back

In [38]:
```
from nltk.corpus import stopwords
```

In [39]:
```
stop_words = stopwords.words('english')
```

In [100…
```
titles = df['title']
# Create and generate a word cloud image:
```

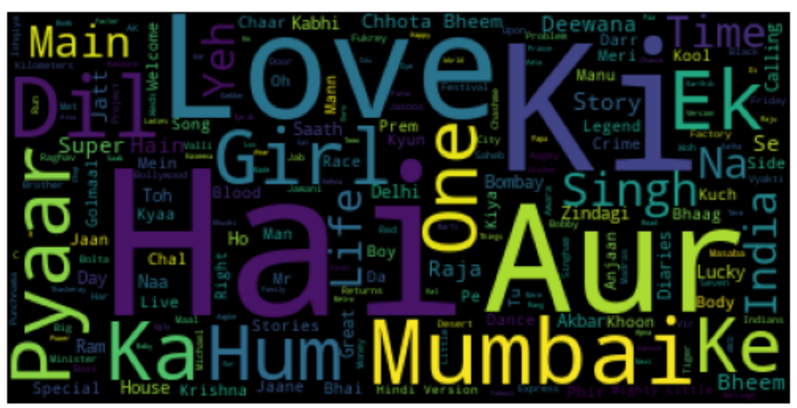
```
title_wordcloud = WordCloud(stopwords=stop_words).generate(' '.join(titles))

# Display the generated image:
plt.imshow(title_wordcloud)
plt.axis("off")
plt.show()
```



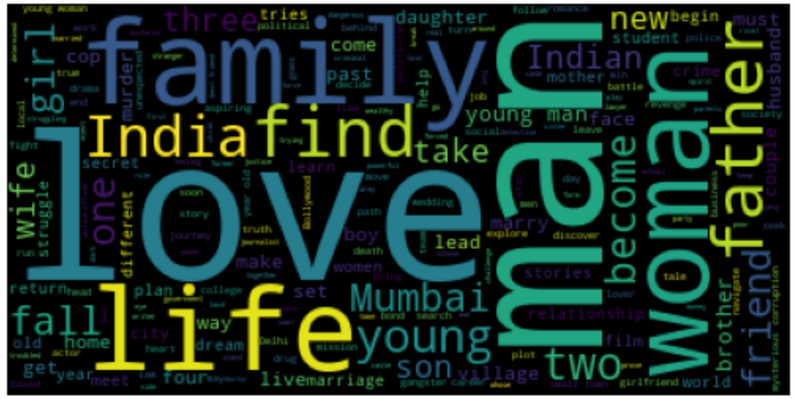
In [101…
```
# title_wordcloud.words_
```

In [102…
```
# df[df['country']=='India']['title']
```

In [103…
```
titles = df[df['country']=='India']['title']
# Create and generate a word cloud image:
title_wordcloud = WordCloud(stopwords=stop_words).generate(' '.join(titles))

# Display the generated image:
plt.imshow(title_wordcloud)
plt.axis("off")
plt.show()
```



In [104…
```
desc = df[df['country']=='India']['description']
# Create and generate a word cloud image:
desc_wordcloud = WordCloud(stopwords=stop_words).generate(' '.join(desc))

# Display the generated image:
plt.imshow(desc_wordcloud)
plt.axis("off")
plt.show()
```

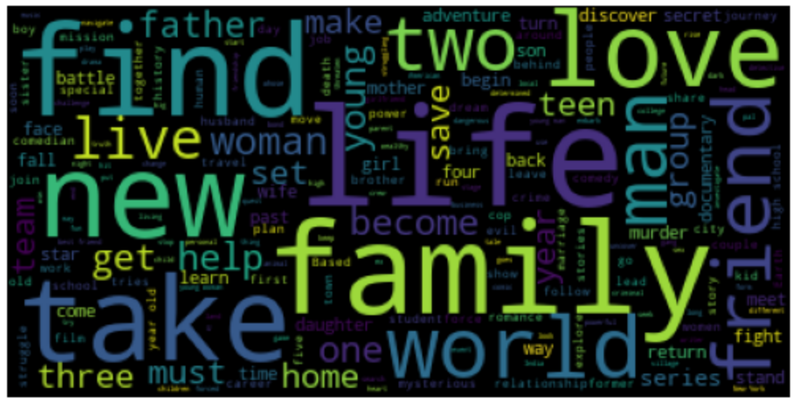


In [107…

```
titles = df[df['country']=='Canada']['title']
# Create and generate a word cloud image:
title_wordcloud = WordCloud(stopwords=stop_words).generate(' '.join(titles))

# Display the generated image:
plt.imshow(title_wordcloud)
plt.axis("off")
plt.show()
```

In [105…

```
desc = df['description']
# Create and generate a word cloud image:
desc_wordcloud = WordCloud(stopwords=stop_words).generate(' '.join(desc))

# Display the generated image:
plt.imshow(desc_wordcloud)
plt.axis("off")
plt.show()
```



In [106…
```
## words analysis with value counts
```

In [80]:
```
def word_analysis(df,columns):
    #lowering the text
    title_process_1=" ".join(df[columns]).lower().split()
    description_process_1=" ".join(df['description']).lower().split()
    #removing punctuation using regex
    title_process_2=[re.sub(r"[^\w\s]",'',t_token) for t_token in title_process_1]
    description_process_2=[re.sub(r"[^\w\s]",'',d_token) for d_token in description_process_1]
    #removing stopwords
    processed_title=[final for final in title_process_2 if final not in stop_words]
    processed_descrp=[final for final in description_process_2 if final not in stop_words]

    #using counter function to  get the top 10 most common words
    title_recurrance=Counter(processed_title).most_common(11)[1:]
    description_recuurance=Counter(processed_descrp).most_common(11)[1:]

    return title_recurrance,description_recuurance
```

In [81]:
```
tile,des=word_analysis(df,'title')
```

In [82]:
```
tile
```

Out[82]:
```
[('love', 170),
 ('2', 129),
 ('man', 81),
 ('christmas', 78),
 ('life', 76),
 ('story', 75),
 ('movie', 73),
 ('world', 70),
 ('little', 64),
 ('one', 63)]
```

In [83]:
```
des
```

Out[83]:
```
[('life', 774),
 ('young', 728),
 ('new', 699),
 ('family', 570),
 ('love', 497),
 ('two', 495),
 ('man', 491),
 ('world', 491),
 ('friends', 466),
 ('woman', 452)]
```

Title: most of the shows or content has "Love" --> universal language , "2" --> signifies the part of various shows (recent trend in the decade)

Decription: in description as well it has more words like "love", "young", "life", "world", "freinds" createing a more sense on the movie plots

In [84]:
```
tile,des=word_analysis(df[df['country']=='India'],'title')
```

In [85]:
```
tile
```

Out[85]:
```
[('2', 16),
 ('ki', 15),
 ('', 14),
 ('aur', 11),
 ('bheem', 10),
 ('love', 10),
 ('mumbai', 10),
 ('dil', 9),
 ('ka', 8),
 ('pyaar', 8)]
```

In [86]:
```
des
```

Out[86]:
```
[('man', 123),
 ('woman', 95),
 ('love', 95),
 ('', 92),
 ('life', 76),
 ('family', 75),
 ('two', 64),
 ('father', 58),
 ('mumbai', 54),
 ('friends', 50)]
```

In [89]:
```
tile,des=word_analysis(df[df['country']=='United States'],'title')
```

In [90]:
```
tile
```

Out[90]:
```
[('christmas', 47),
 ('american', 41),
 ('2', 39),
 ('love', 35),
 ('story', 34),
 ('man', 25),
 ('high', 25),
 ('power', 23),
 ('one', 23),
 ('last', 22)]
```

In [91]:
```
des
```

Out[91]:
```
[('new', 287),
 ('life', 274),
 ('documentary', 169),
 ('series', 156),
 ('two', 153),
 ('world', 150),
 ('family', 148),
 ('young', 144),
 ('friends', 134),
 ('school', 127)]
```

In [93]:
```
tile,des=word_analysis(df[df['country']=='Canada'],'title')
```

In [94]:
```
tile
```

Out[94]:
```
[('trailer', 10),
 ('boys', 10),
 ('true', 8),
 ('christmas', 8),
 ('monsters', 5),
 ('cop', 5),
 ('day', 4),
 ('', 4),
 ('la', 4),
 ('bad', 4)]
```

In [95]:
```
des
```

Out[95]:
```
[('', 20),
 ('two', 13),
 ('friends', 12),
 ('world', 11),
 ('series', 11),
 ('school', 11),
 ('young', 10),
 ('three', 10),
 ('documentary', 9),
 ('true', 9)]
```

In [ ]:
```

```

In [47]:
```
df['date_added'] = df['date_added'].apply(pd.to_datetime)
```

In [48]:
```
last_date = max(df['date_added'])
last_date
```

Out[48]:
```
Timestamp('2021-09-25 00:00:00')
```

Question 4 pre_analysis

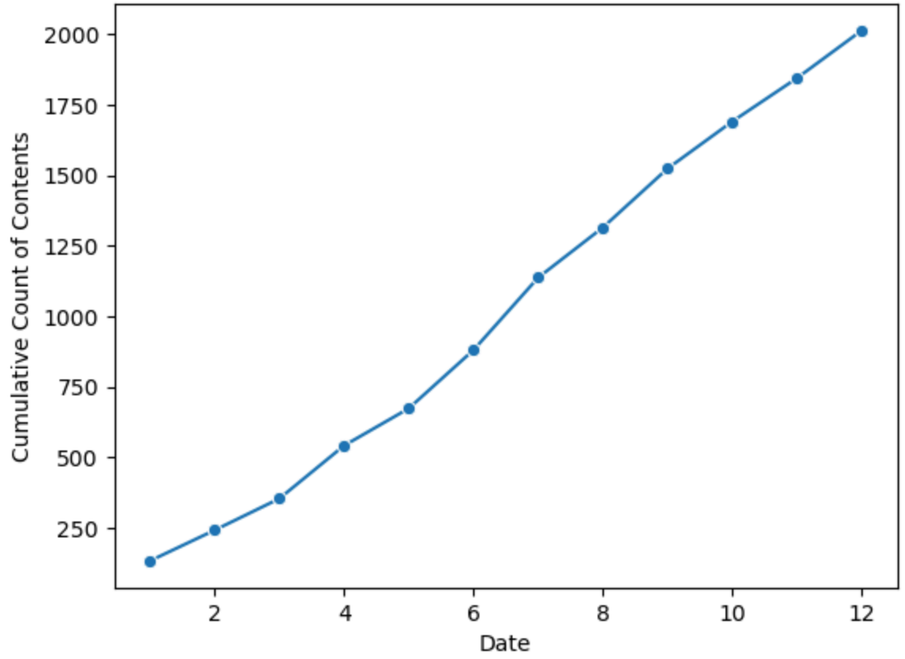
back

In [49]:
```
last_year_data = df[df['date_added'] > last_date - pd.Timedelta(days = 365)]
last_year_data.head()
```

Out[49]:

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in	description
0	s1	Movie	Dick Johnson Is Dead	Kirsten Johnson	NaN	United States	2021-09-25	2020	PG-13	90 min	Documentaries	As her father nears the end of his life, filmm...
1	s2	TV Show	Blood & Water	NaN	Ama Qamata, Khosi Ngema, Gail Mabalane, Thaban...	South Africa	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows, TV Dramas, TV Mysteries	After crossing paths at a party, a Cape Town t...
2	s3	TV Show	Ganglands	Julien Leclercq	Sami Bouajila, Tracy Gotoas, Samuel Jouy, Nabi...	NaN	2021-09-24	2021	TV-MA	1 Season	Crime TV Shows, International TV Shows, TV Act...	To protect his family from a powerful drug lor...
3	s4	TV Show	Jailbirds New Orleans	NaN	NaN	NaN	2021-09-24	2021	TV-MA	1 Season	Docuseries, Reality TV	Feuds, flirtations and toilet talk go down amo...
4	s5	TV Show	Kota Factory	NaN	Mayur More, Jitendra Kumar, Ranjan Raj, Alam K...	India	2021-09-24	2021	TV-MA	2 Seasons	International TV Shows, Romantic TV Shows, TV ...	In a city of coaching centers known to train I...

In [50]:
```
month_group = last_year_data.groupby(last_year_data['date_added'].map(lambda x: x.month))['show_id'].count()
# Calculating cumulative sum
cumulative_sum = month_group.cumsum()

# Plotting the cumulative sum
sns.lineplot(x=month_group.index, y=cumulative_sum, marker = 'o')
plt.xlabel('Date')
plt.ylabel('Cumulative Count of Contents')
plt.title('Cumulative Count of Contents over the year')
plt.show()
```

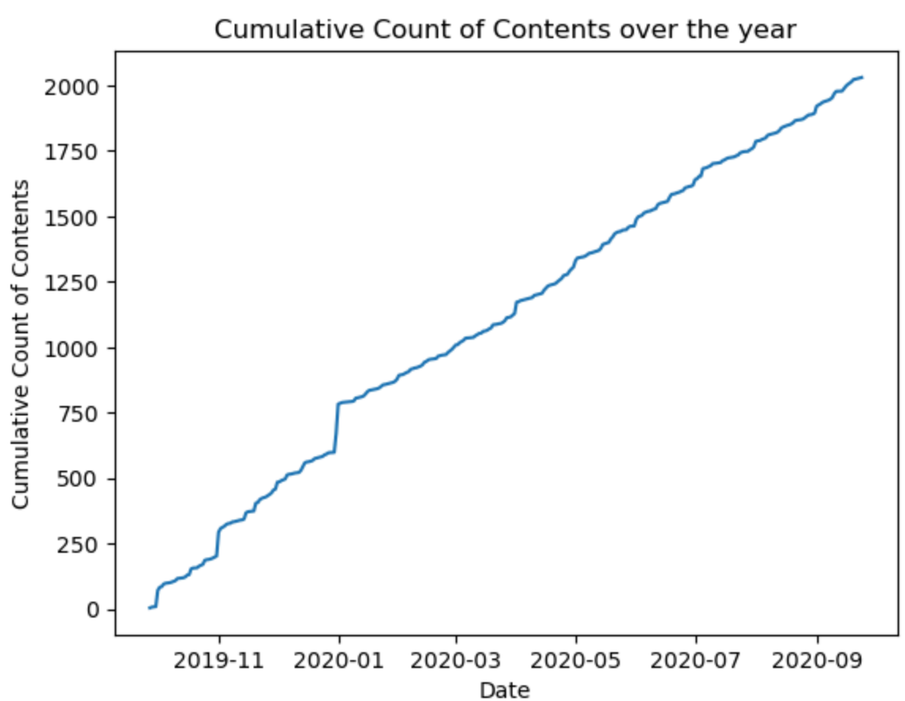


In [51]:
```
second_last_year_data = df[(df['date_added'] < last_date - pd.Timedelta(days = 365)) & (df['date_added'] > last_date - pd.Timedelta(days = 2*365))]
second_last_year_data.head()
```

Out[51]:

	show_id	type	title	director	cast	country	date_added	release_year	rating	duration	listed_in	description
1957	s1958	Movie	Real Steel	Shawn Levy	Hugh Jackman, Dakota Goyo, Evangeline Lilly, A...	United States, India	2020-09-24	2011	PG-13	127 min	Action & Adventure, Sci-Fi & Fantasy, Sports M...	A struggling fighter-turned-promoter reconnect...
1958	s1959	TV Show	The Chef Show	NaN	Jon Favreau, Roy Choi	United States	2020-09-24	2020	TV-MA	4 Seasons	Docuseries	Writer, director and food enthusiast Jon Favre...
1959	s1960	Movie	Enola Holmes	Harry Bradbeer	Millie Bobby Brown, Henry Cavill, Sam Claflin,...	United Kingdom	2020-09-23	2020	PG-13	124 min	Action & Adventure, Children & Family Movies, ...	While searching for her missing mother, intrep...
1960	s1961	Movie	Kiss the Ground	Joshua Tickell, Rebecca Harrell Tickell	Woody Harrelson	United States	2020-09-22	2020	TV-G	85 min	Documentaries	Science experts and celebrity activists unpack...
1961	s1962	TV Show	The Playbook	NaN	NaN	United States	2020-09-22	2020	TV-MA	1 Season	Docuseries	Coaches with championship résumés share their ...

In [52]:
```
day_group = second_last_year_data.groupby('date_added')['show_id'].count()
# Calculating cumulative sum
cumulative_sum = day_group.cumsum()

# Plotting the cumulative sum
sns.lineplot(x=day_group.index, y=cumulative_sum)
plt.xlabel('Date')
plt.ylabel('Cumulative Count of Contents')
plt.title('Cumulative Count of Contents over the year')
plt.show()
```



In [53]:
```
df.columns
```

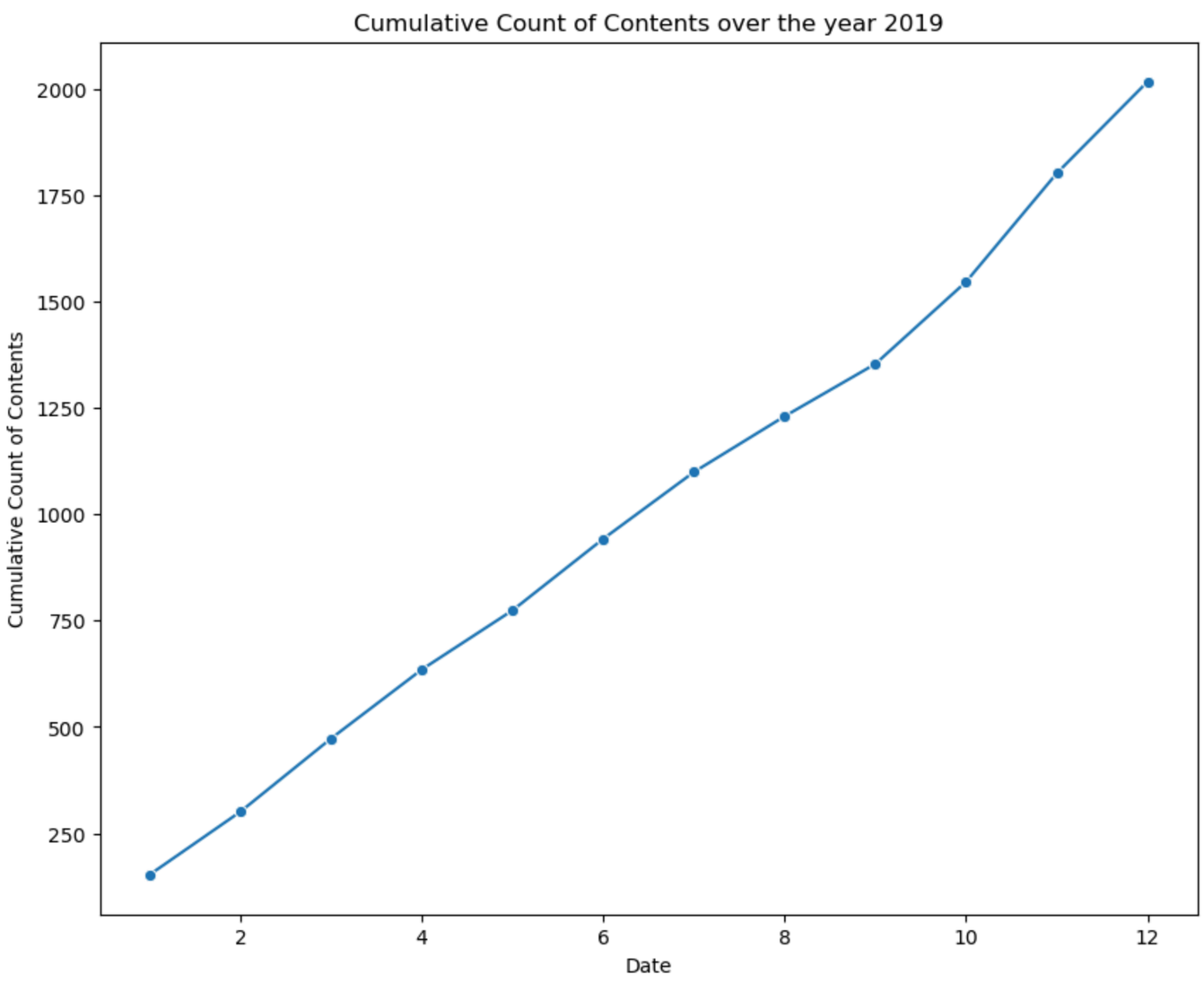
Out[53]:
```
Index(['show_id', 'type', 'title', 'director', 'cast', 'country', 'date_added',
       'release_year', 'rating', 'duration', 'listed_in', 'description'],
      dtype='object')
```

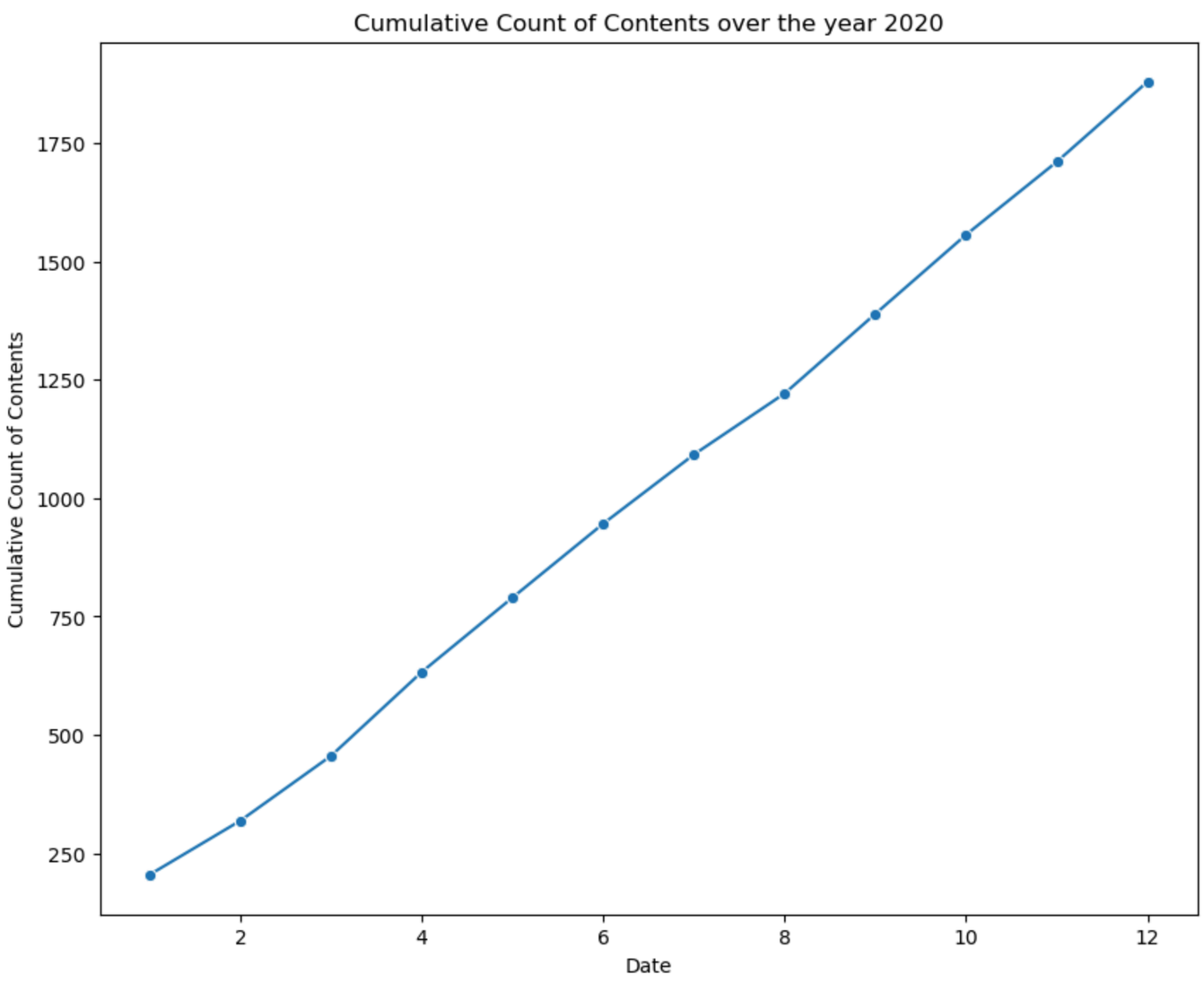
In [54]:
```
years=df['date_added'].dt.year.value_counts().index.to_list()
```

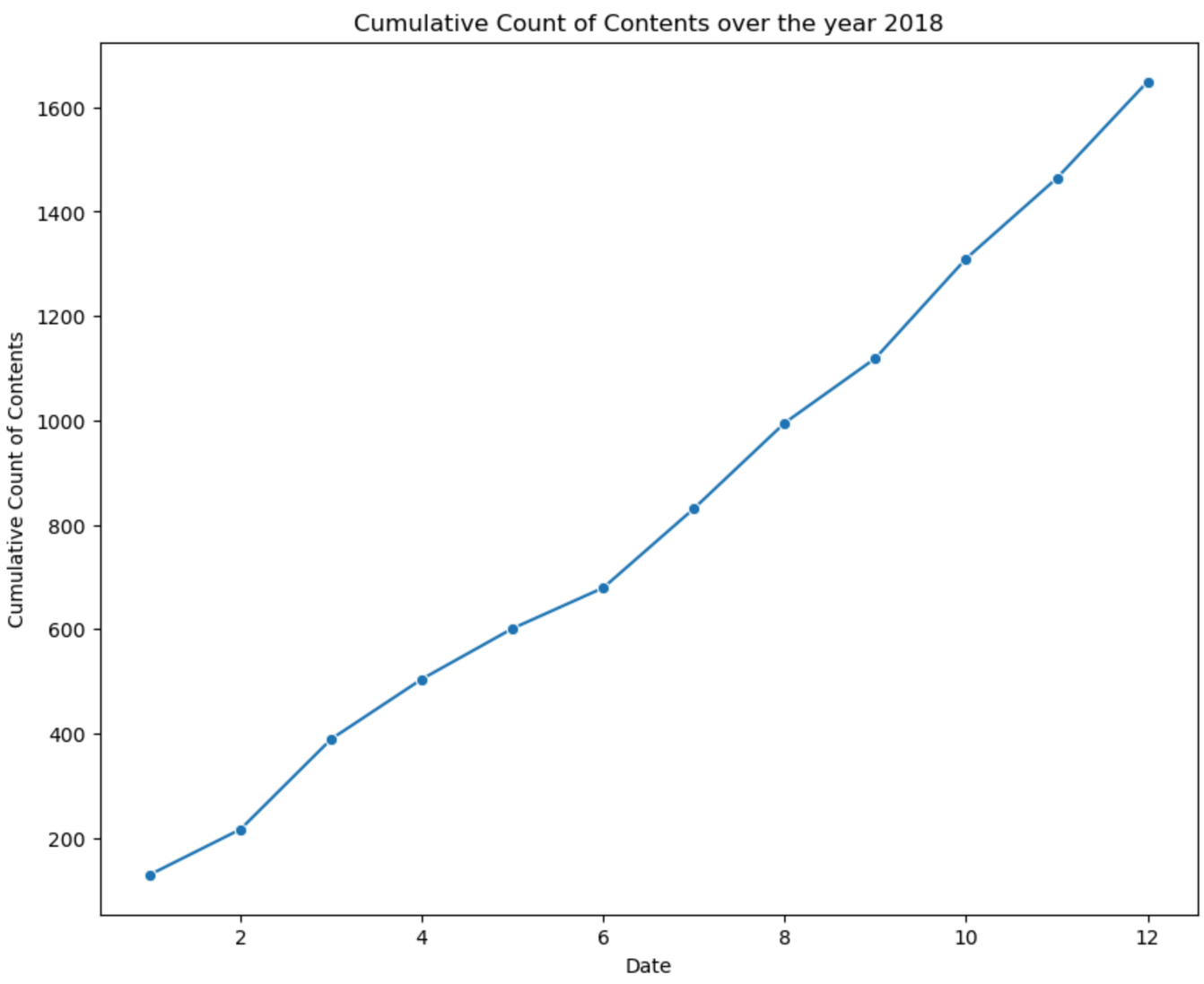
In [55]:
```
years
```

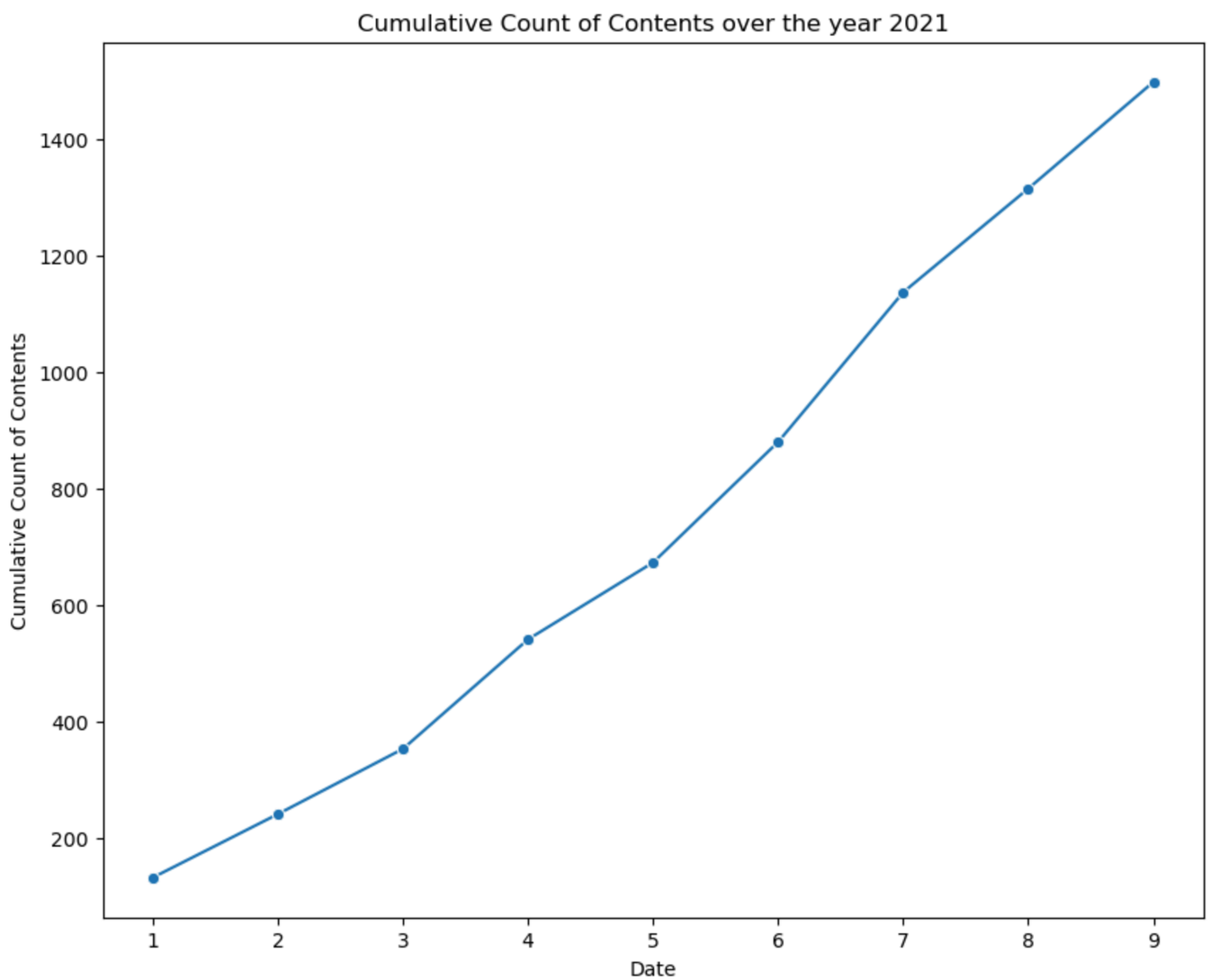
Out[55]:
```
[2019.0,
 2020.0,
 2018.0,
 2021.0,
 2017.0,
 2016.0,
 2015.0,
 2014.0,
 2011.0,
 2013.0,
 2012.0,
 2009.0,
 2008.0,
 2010.0]
```

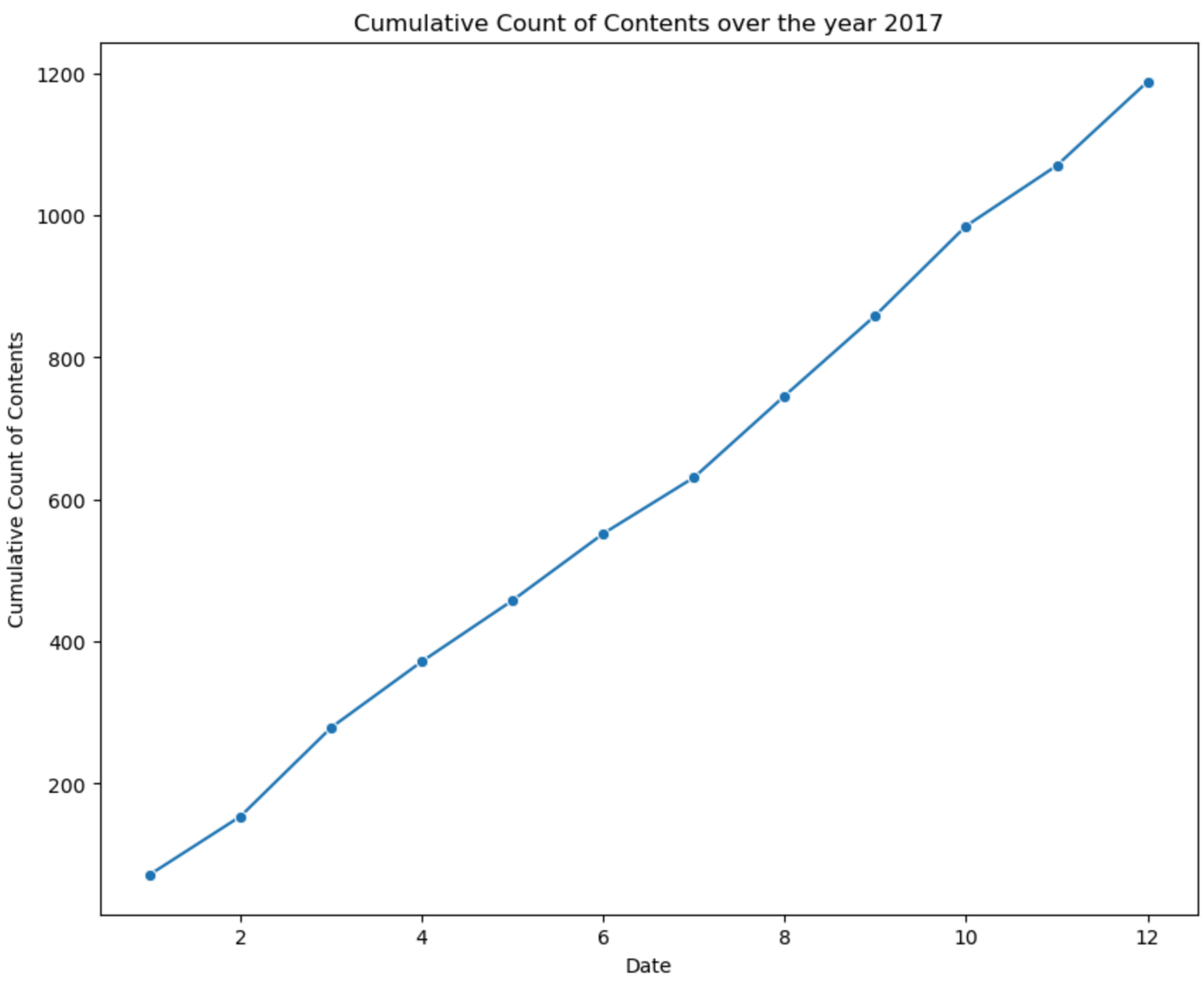
In [56]:
```
for year in years:
    year_data = df[df['date_added'].dt.year == year]
    month_data = year_data.groupby(year_data['date_added'].dt.month)['show_id'].count()
    # Calculating cumulative sum
    cumulative_sum = month_data.cumsum()

    plt.figure(figsize= (10,8))
    # Plotting the cumulative sum
    sns.lineplot(x=month_data.index, y=cumulative_sum, marker = 'o')
    plt.xlabel('Date')
    plt.ylabel('Cumulative Count of Contents')
    plt.title(f'Cumulative Count of Contents over the year {str(year)[:-2]}')
    plt.show()
```

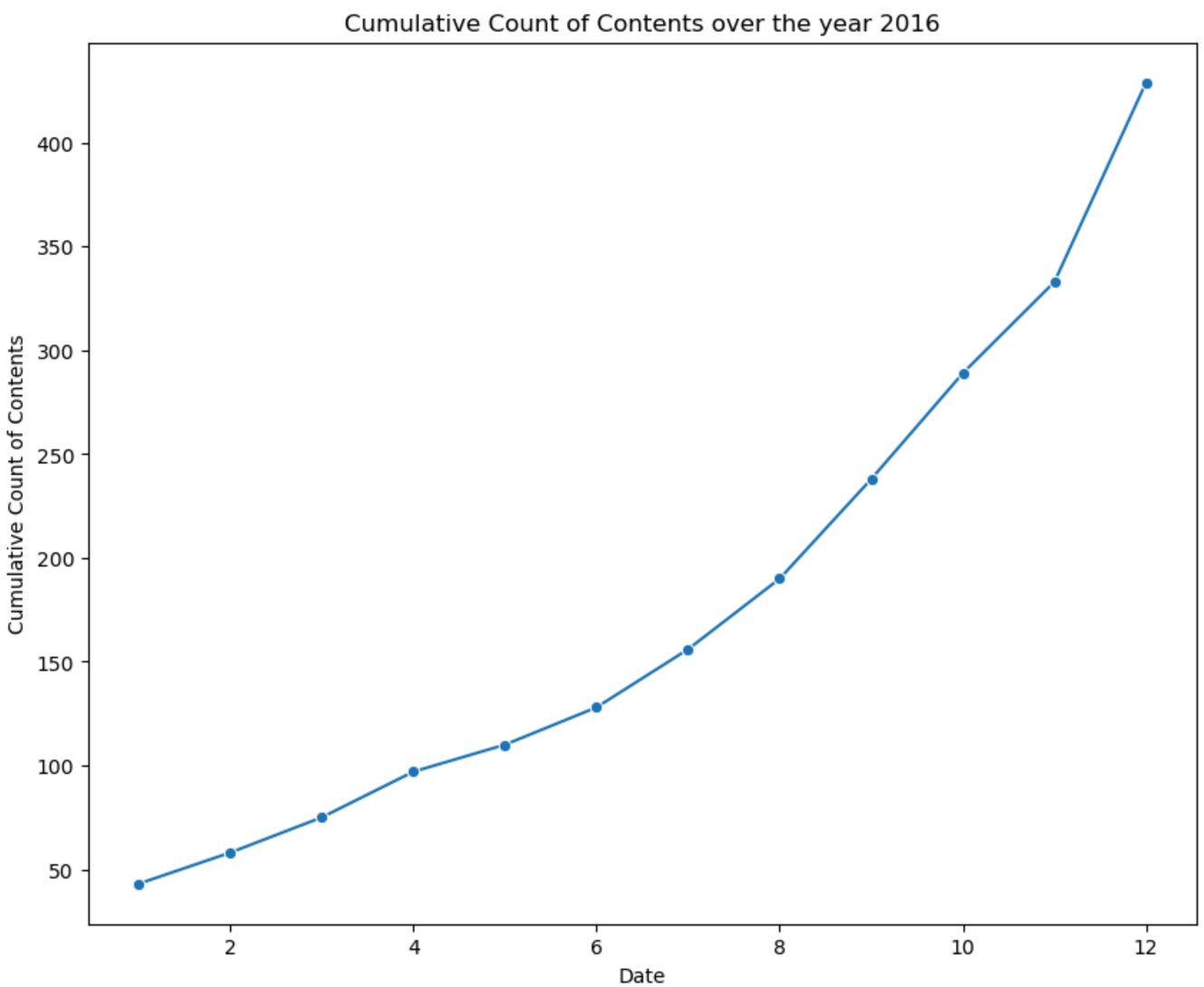

Cumulative Count of Contents over the year 2019
Cumulative Count of Contents
2000
1750
1500
1250
1000
750
500
250
2
4
6
8
10
12
Date

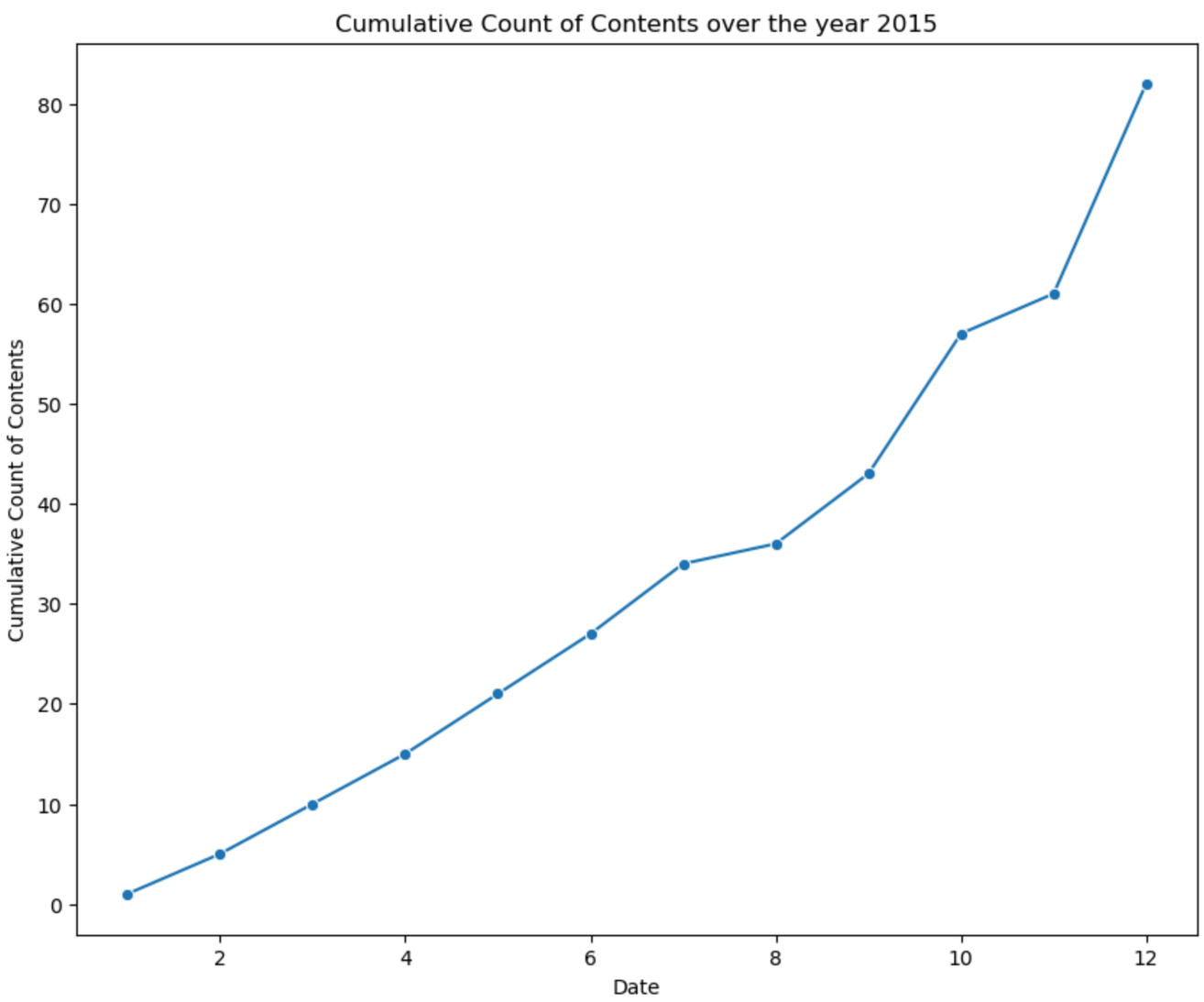

Cumulative Count of Contents over the year 2020
Cumulative Count of Contents
1750
1500
1250
1000
750
500
250
2
4
6
8
10
12
Date

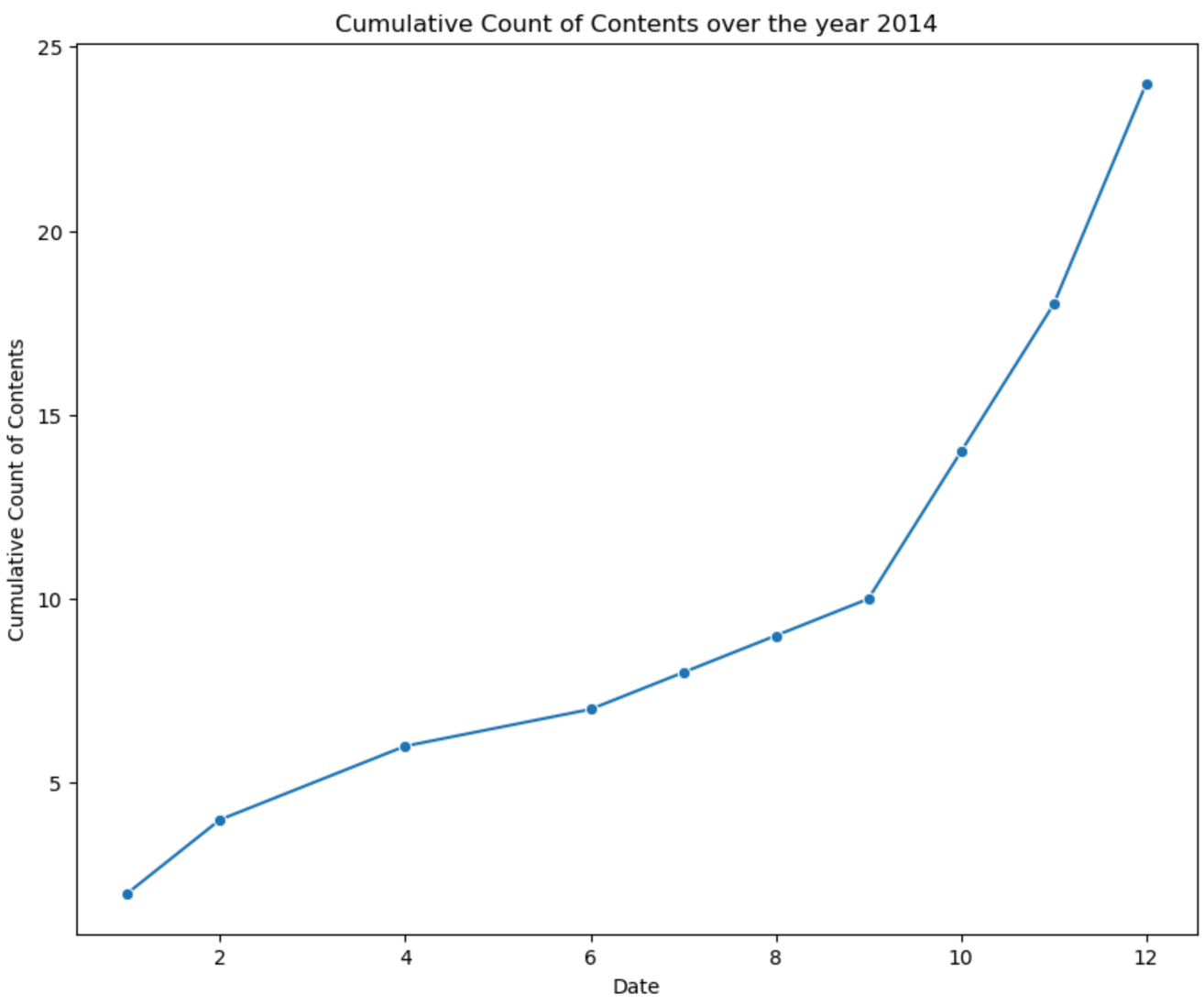

Cumulative Count of Contents over the year 2018
Cumulative Count of Contents
1600
1400
1200
1000
800
600
400
200
2
4
6
8
10
12
Date

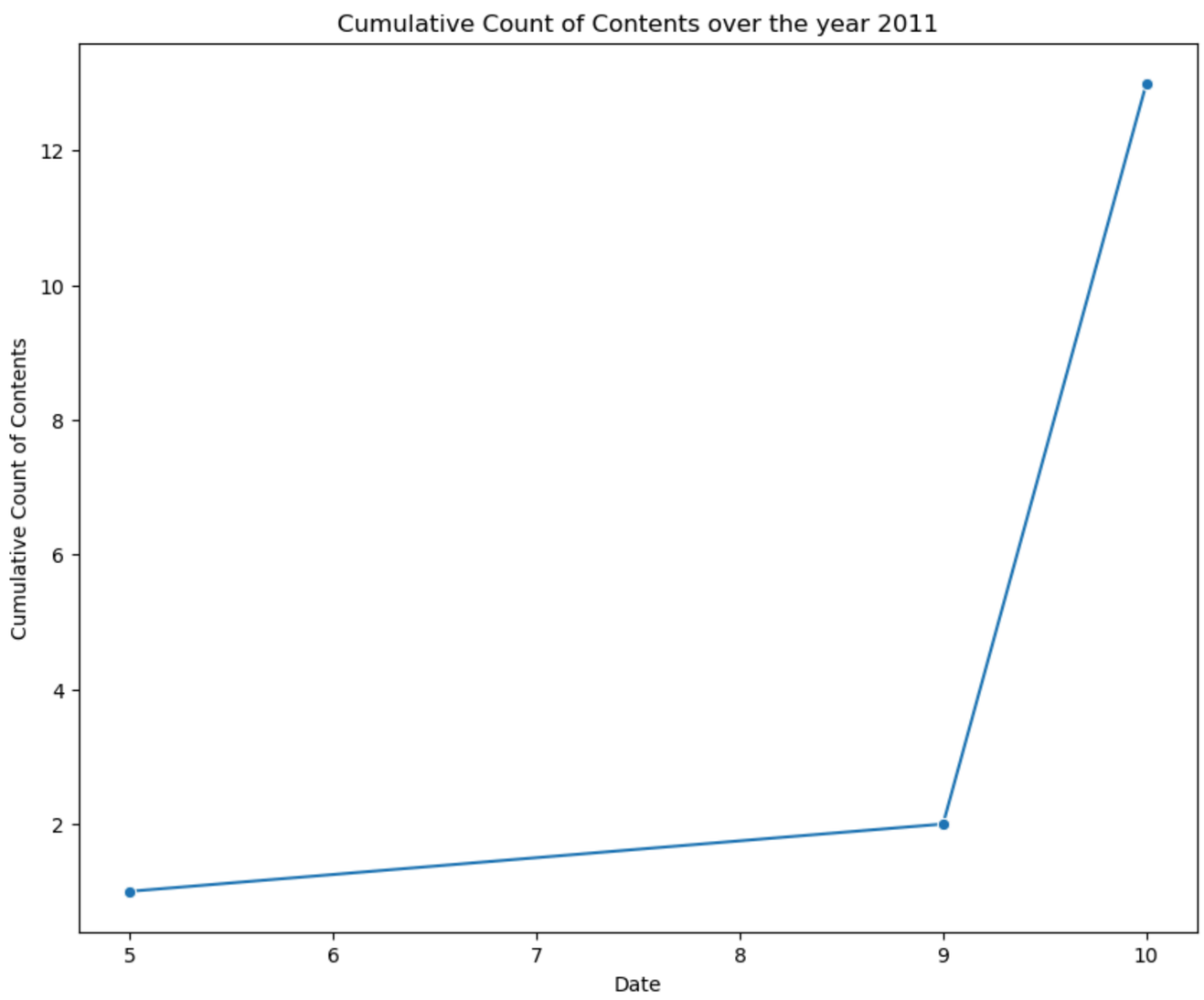

Cumulative Count of Contents over the year 2021
Cumulative Count of Contents
1400
1200
1000
800
600
400
200
1
2
3
4
5
6
7
8
9
Date

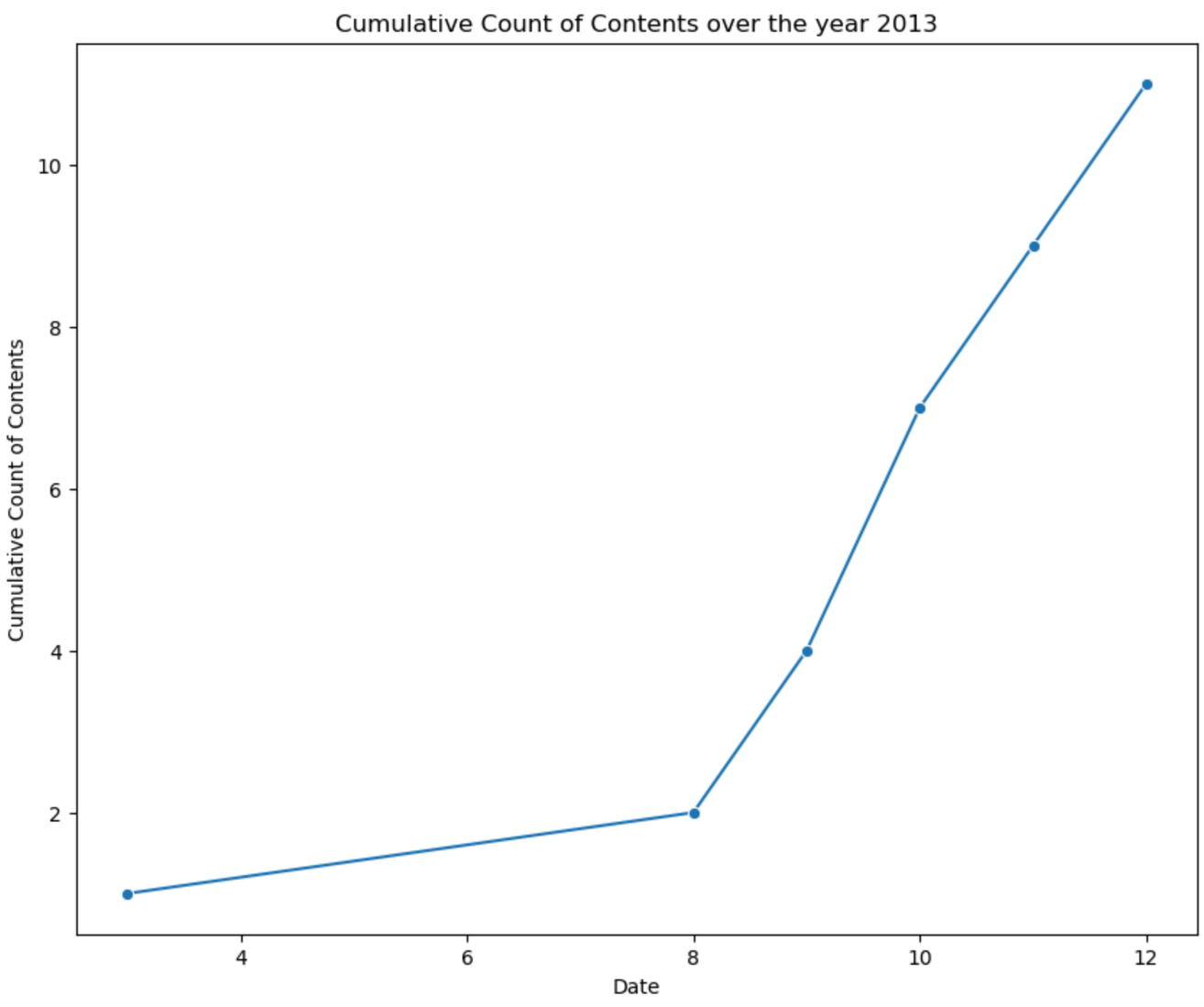

Cumulative Count of Contents over the year 2017
Cumulative Count of Contents
1200
1000
800
600
400
200
2
4
6
8
10
12
Date

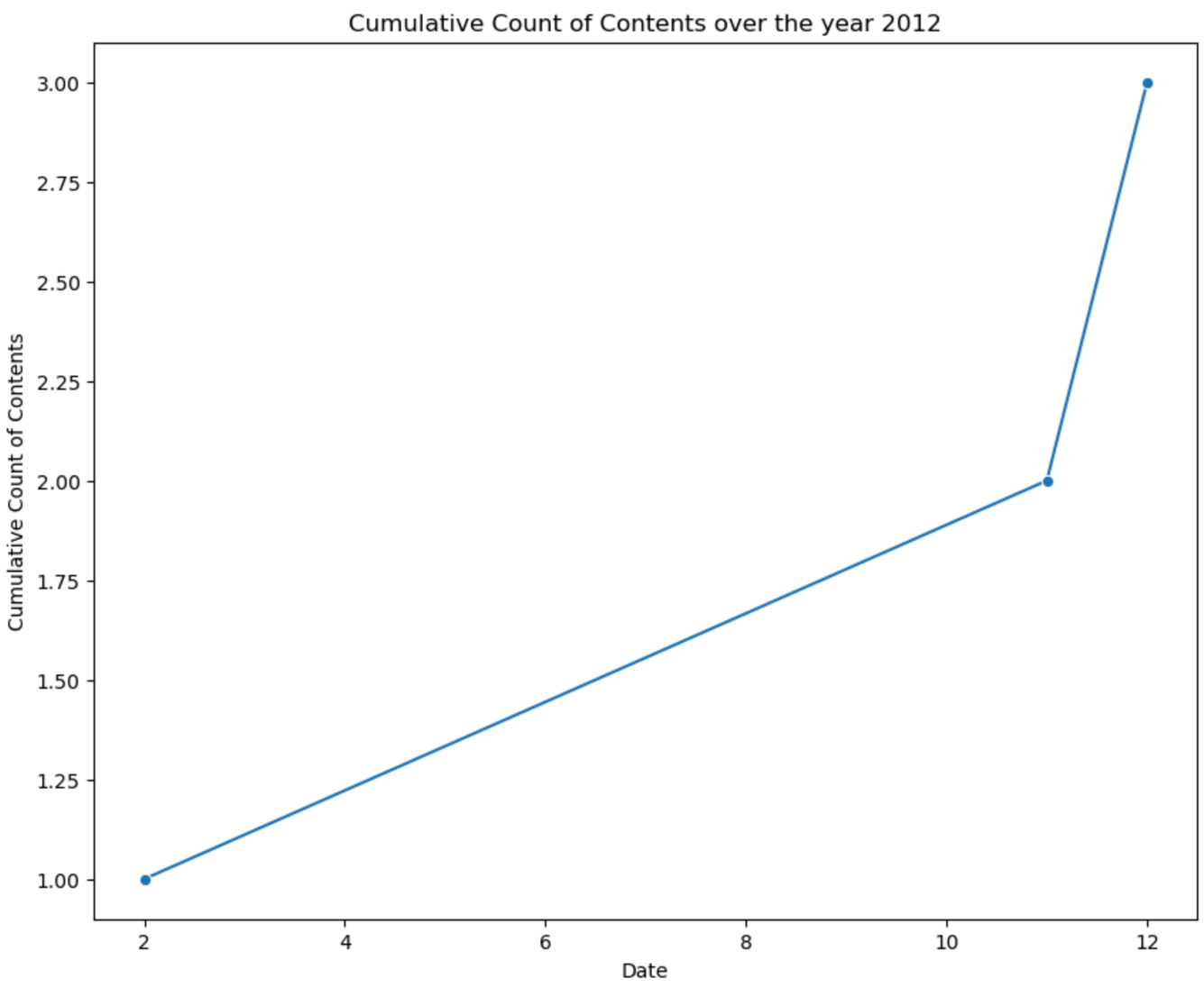

Cumulative Count of Contents over the year 2016
Cumulative Count of Contents
400
350
300
250
200
150
100
50
2
4
6
8
10
12
Date

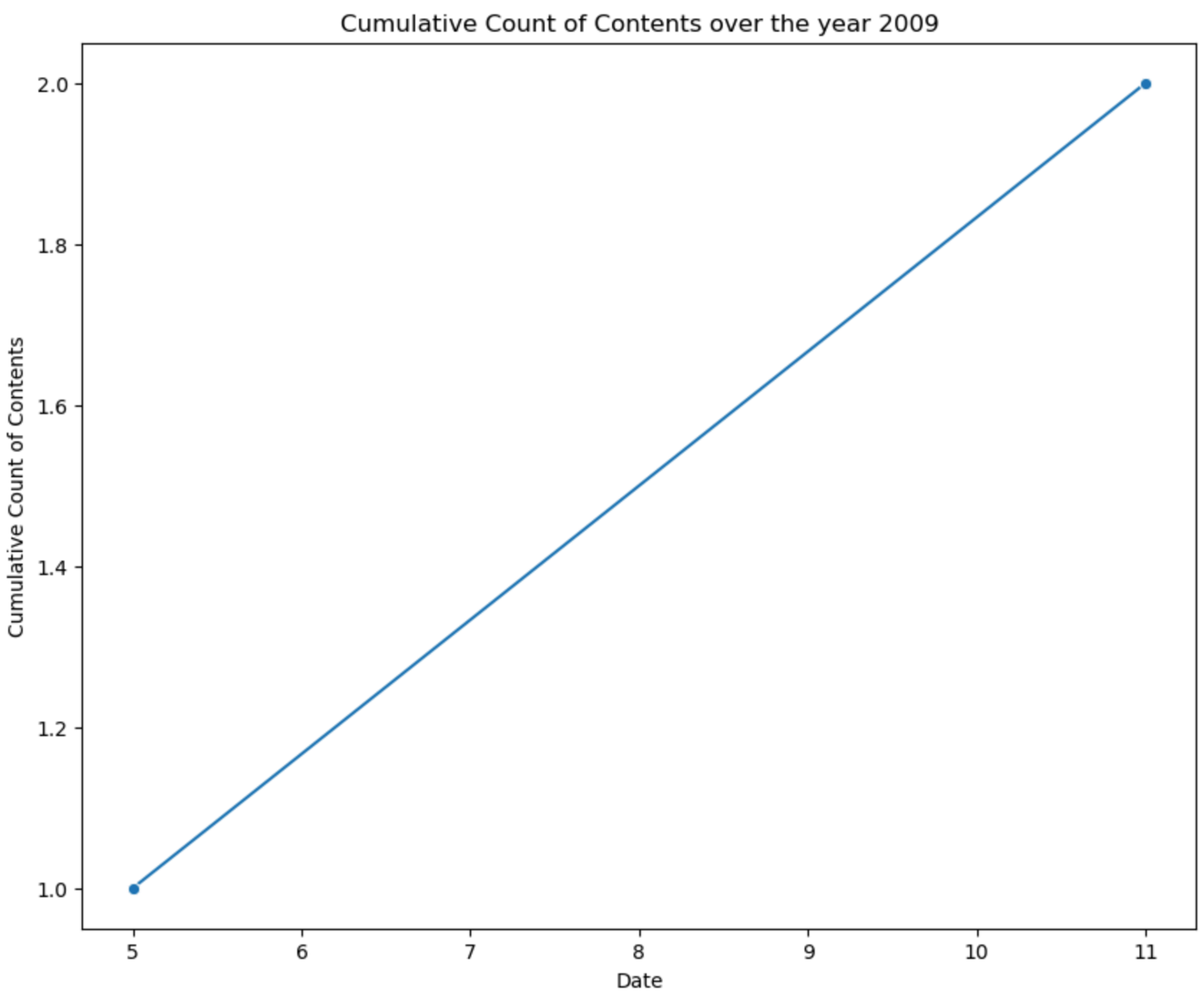

Cumulative Count of Contents over the year 2015
Cumulative Count of Contents
0
10
20
30
40
50
60
70
80
2
4
6
8
10
12
Date

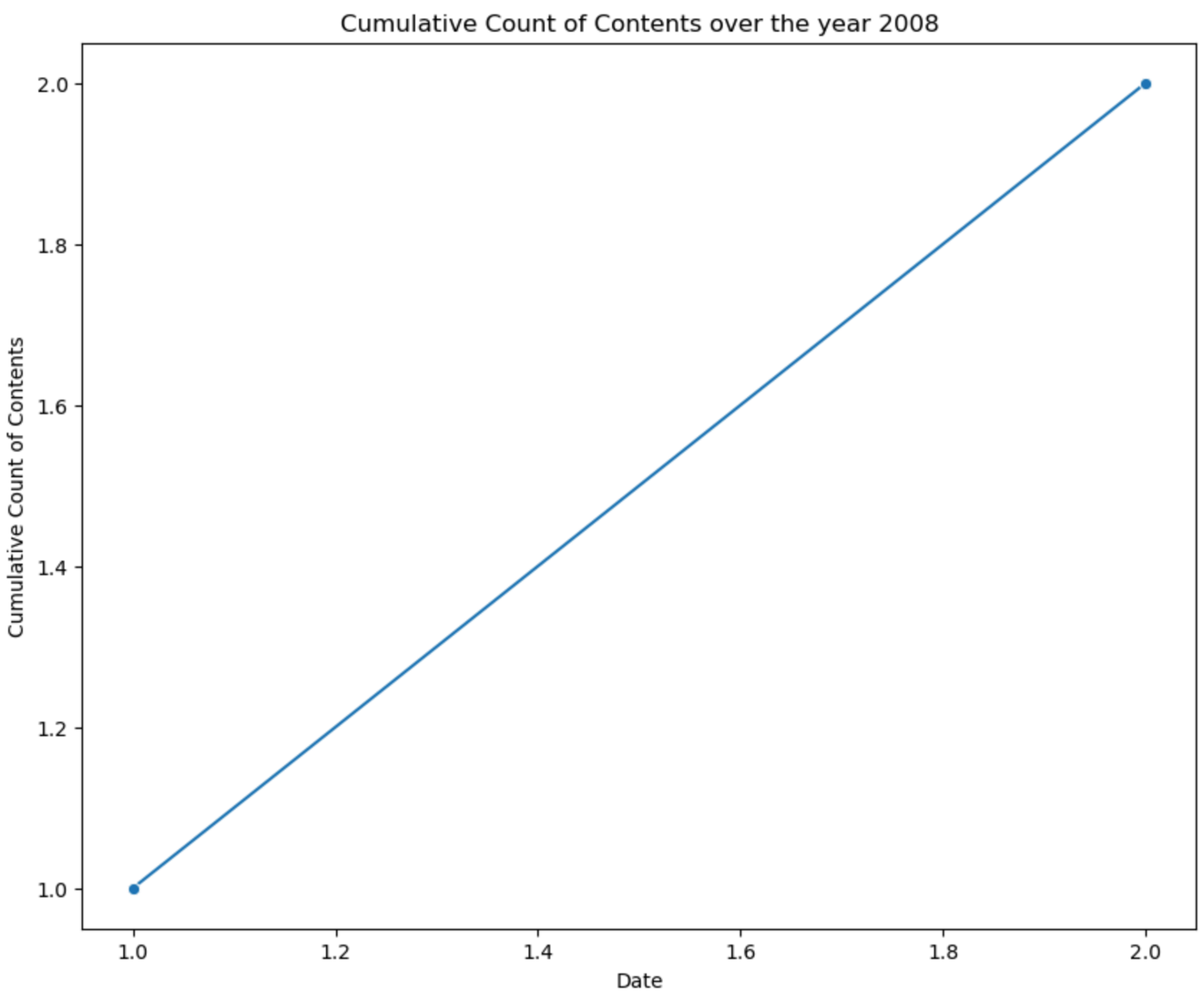

Cumulative Count of Contents over the year 2014
Cumulative Count of Contents
Date
25
20
15
10
5
2
4
6
8
10
12

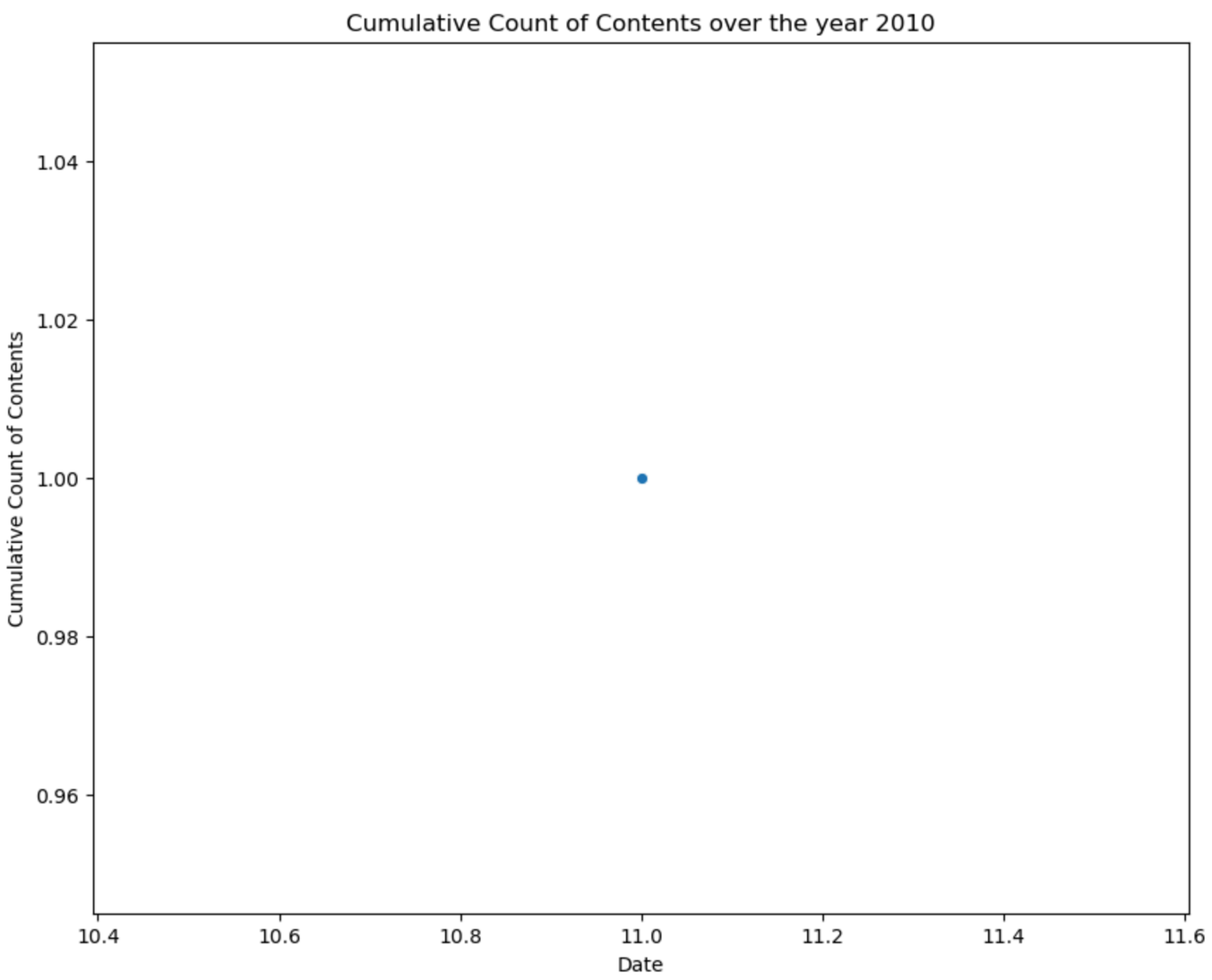

Cumulative Count of Contents over the year 2011
Cumulative Count of Contents
12
10
8
6
4
2
5
6
7
8
9
10
Date


Cumulative Count of Contents over the year 2013
Cumulative Count of Contents
10
8
6
4
2
4
6
8
10
12
Date


Cumulative Count of Contents over the year 2012
Cumulative Count of Contents
3.00
2.75
2.50
2.25
2.00
1.75
1.50
1.25
1.00
2
4
6
8
10
12
Date


Cumulative Count of Contents over the year 2009
Cumulative Count of Contents
2.0
1.8
1.6
1.4
1.2
1.0
5
6
7
8
9
10
11
Date


Cumulative Count of Contents over the year 2008
Cumulative Count of Contents
2.0
1.8
1.6
1.4
1.2
1.0
1.0
1.2
1.4
1.6
1.8
2.0
Date



year and month analysis

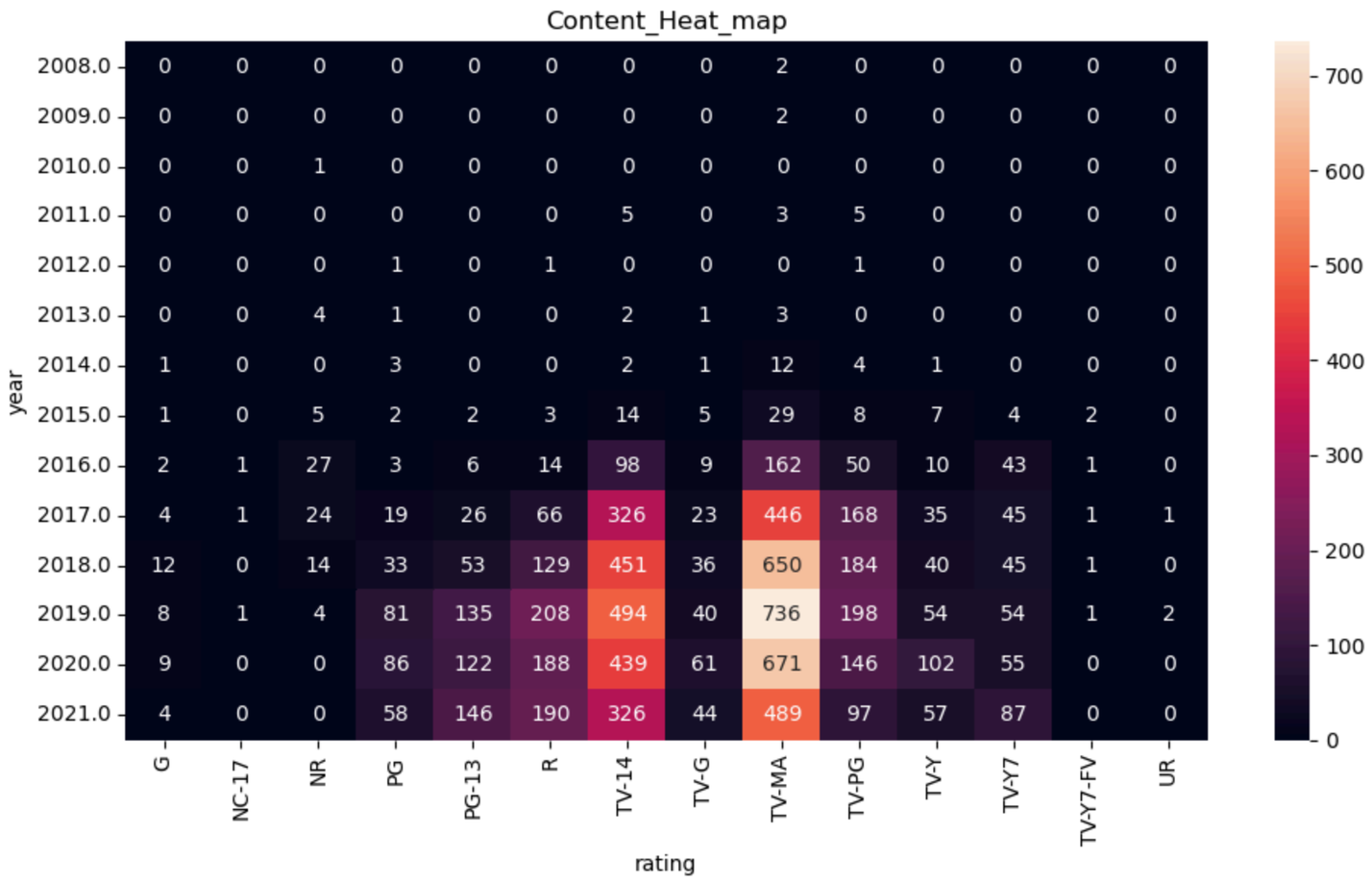
back

In [57]:
```python
def gran_check(df):
    #converting and creating required data,month timeframes
    df['date_added']=pd.to_datetime(df['date_added'])
    df['year']=df['date_added'].dt.year
    df['month']=df['date_added'].dt.month_name()

    #year wise grp table
    over_year_count=df.groupby(['year','rating']).size().unstack()
    #filling the null values and change the float to int
    over_year_count=over_year_count.fillna(0).astype(int)


    #month wise grp table
```

```
    month_count_table=df.groupby(['year','month']).size().unstack().fillna(0).astype(int)


    return over_year_count,month_count_table
```

In [58]:
```
over_year_count,month_count_table=gran_check(df)
```

In [59]:
```
#plotting the heatamp to visualize the rating-content counts
plt.figure(figsize=(10,6))
sns.heatmap(over_year_count,annot=True,fmt='g')
plt.title('Content_Heat_map')
plt.xlabel('rating')
plt.ylabel('year')
plt.xticks(rotation=90)
plt.tight_layout()
plt.show()
```



Question 4

back

In [60]:
```
over_year_count
```

Out[60]:

rating	G	NC-17	NR	PG	PG-13	R	TV-14	TV-G	TV-MA	TV-PG	TV-Y	TV-Y7	TV-Y7-FV	UR
year														
2008.0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
2009.0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
2010.0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2011.0	0	0	0	0	0	0	5	0	3	5	0	0	0	0
2012.0	0	0	0	1	0	1	0	0	0	1	0	0	0	0
2013.0	0	0	4	1	0	0	2	1	3	0	0	0	0	0
2014.0	1	0	0	3	0	0	2	1	12	4	1	0	0	0
2015.0	1	0	5	2	2	3	14	5	29	8	7	4	2	0
2016.0	2	1	27	3	6	14	98	9	162	50	10	43	1	0
2017.0	4	1	24	19	26	66	326	23	446	168	35	45	1	1
2018.0	12	0	14	33	53	129	451	36	650	184	40	45	1	0
2019.0	8	1	4	81	135	208	494	40	736	198	54	54	1	2
2020.0	9	0	0	86	122	188	439	61	671	146	102	55	0	0
2021.0	4	0	0	58	146	190	326	44	489	97	57	87	0	0

In [61]:
```
month_list=df.month.value_counts().index.to_list()
year_list=month_count_table.index.to_list()
```

In [62]:
```
month_list
```

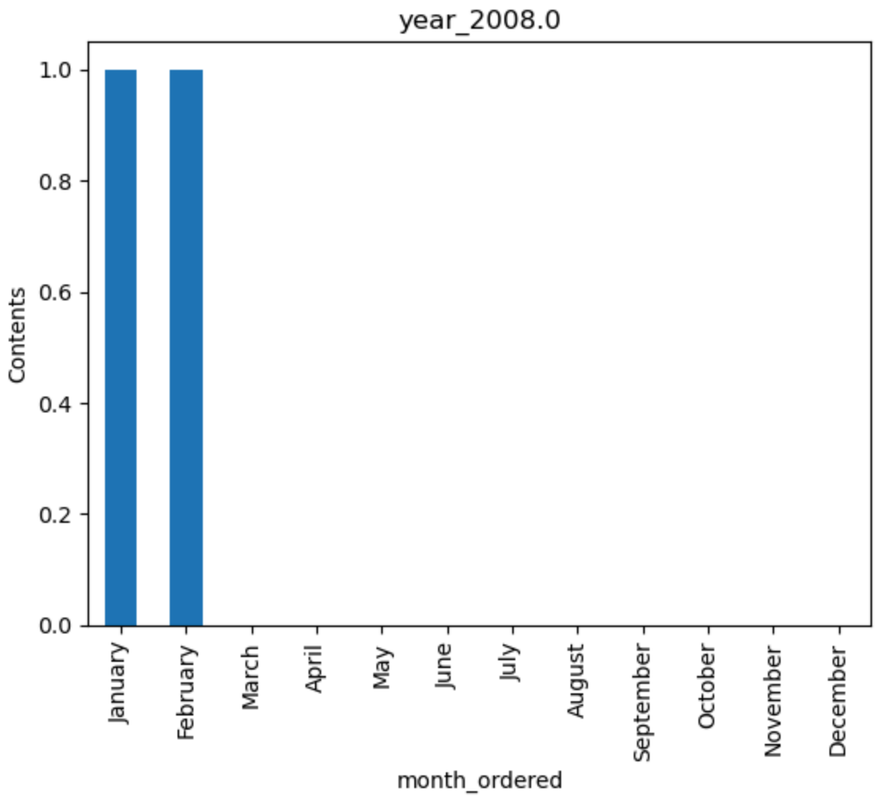
Out[62]:
```
['July',
 'December',
 'September',
 'April',
 'October',
 'August',
 'March',
 'January',
 'June',
 'November',
 'May',
 'February']
```

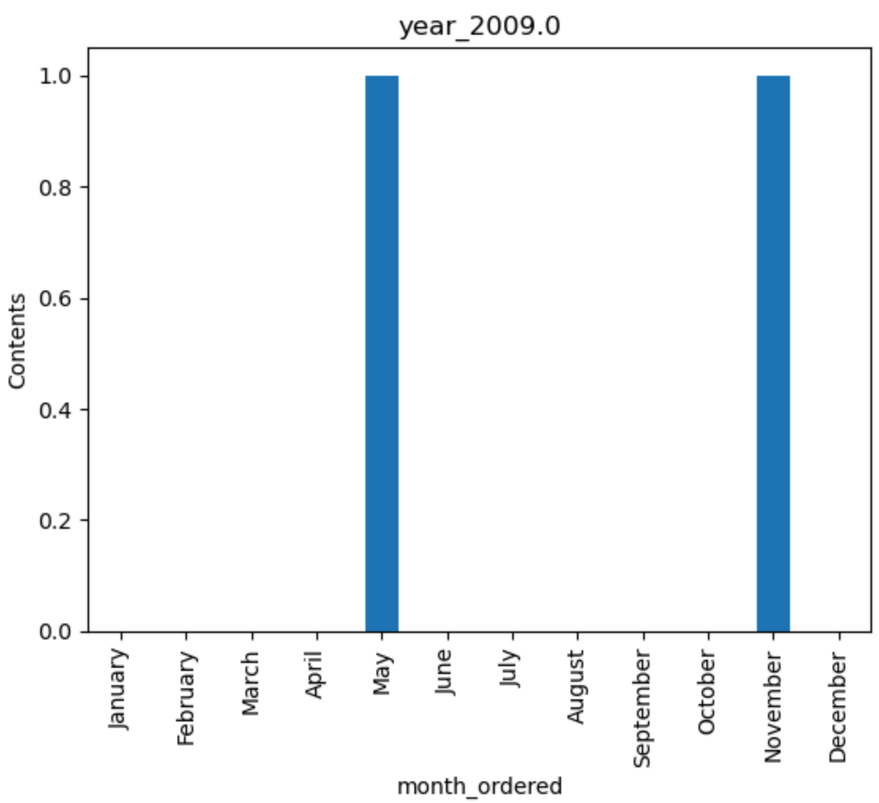
In [63]:
```
academic_year_month_order=['January','February','March','April','May','June'
                           ,'July','August','September','October','November','December']
```

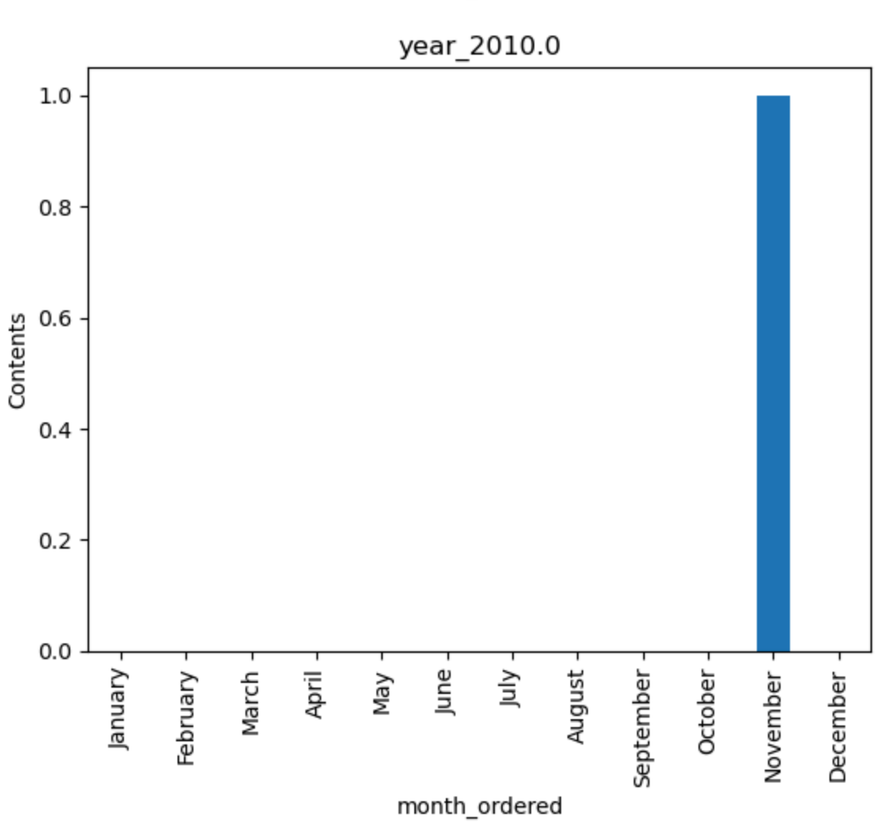
month wise analysis

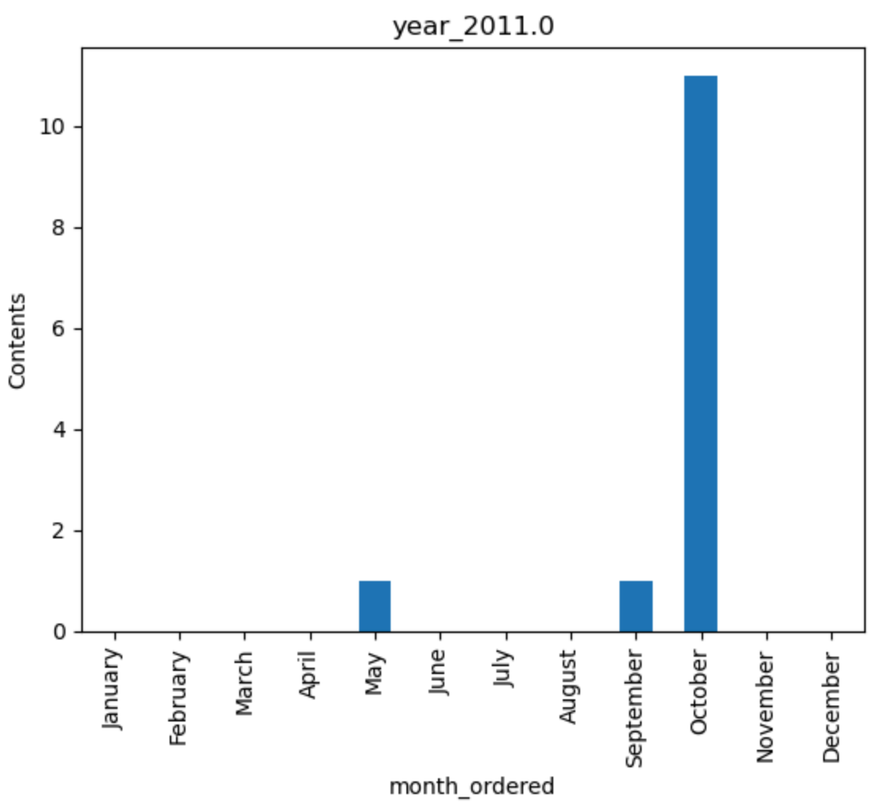
In [64]:
```
for year in year_list:
    month_count_table.loc[year].loc[academic_year_month_order].plot(kind='bar')
    plt.xlabel("month_ordered")
    plt.ylabel("Contents")
    plt.xticks(rotation=90)
```

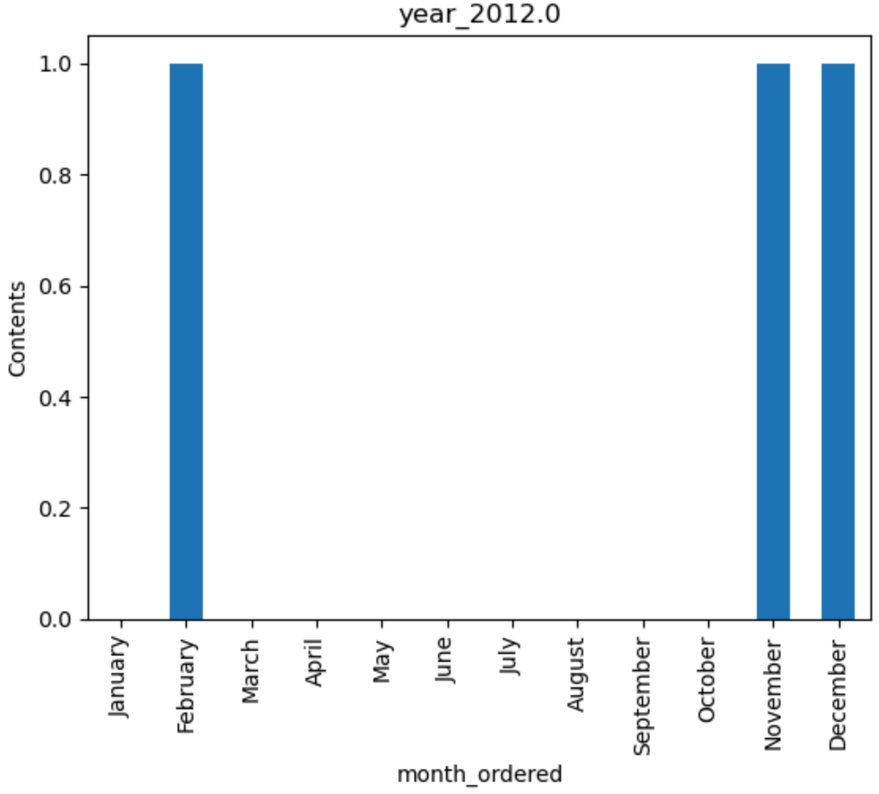
```
    plt.title("year_{}".format(year))
    plt.show()
```

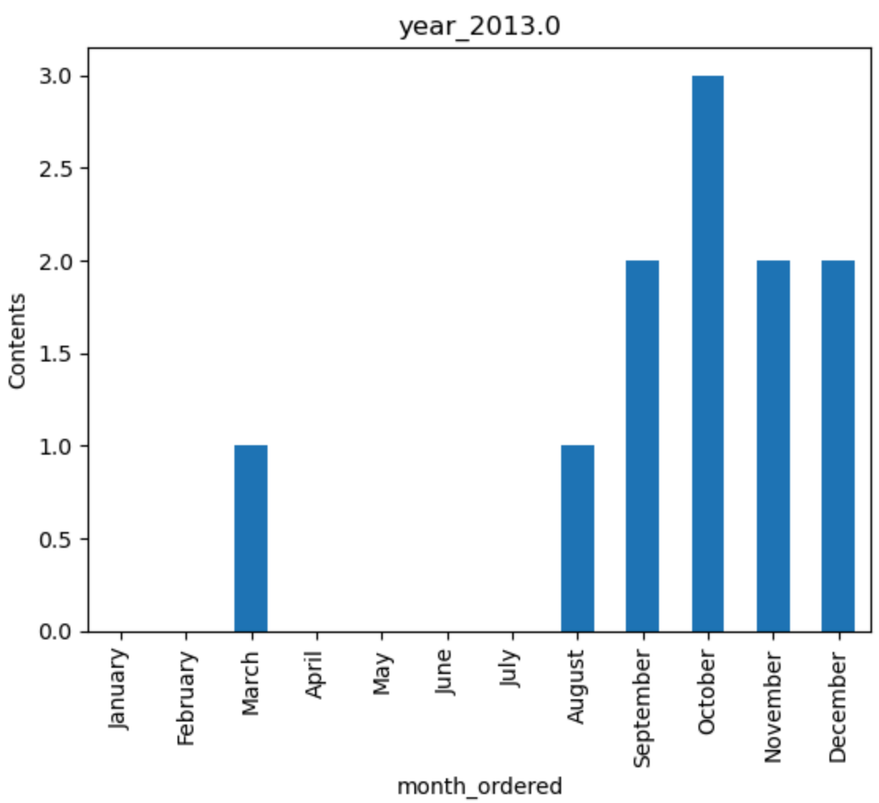


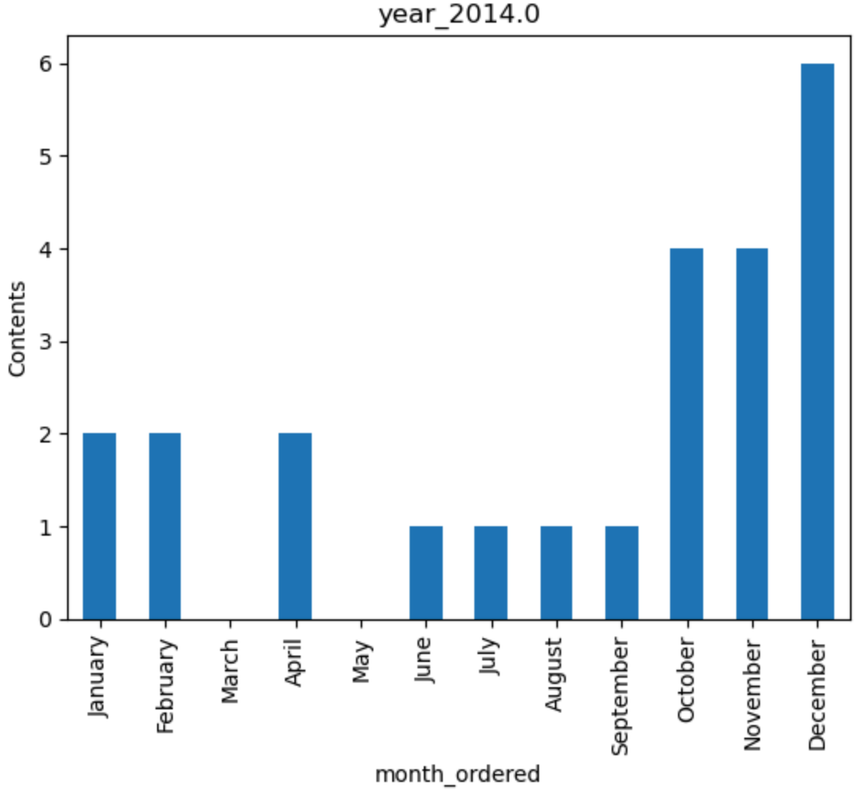

year_2009.0
Contents
0.0
0.2
0.4
0.6
0.8
1.0
January
February
March
April
May
June
July
August
September
October
November
December
month_ordered

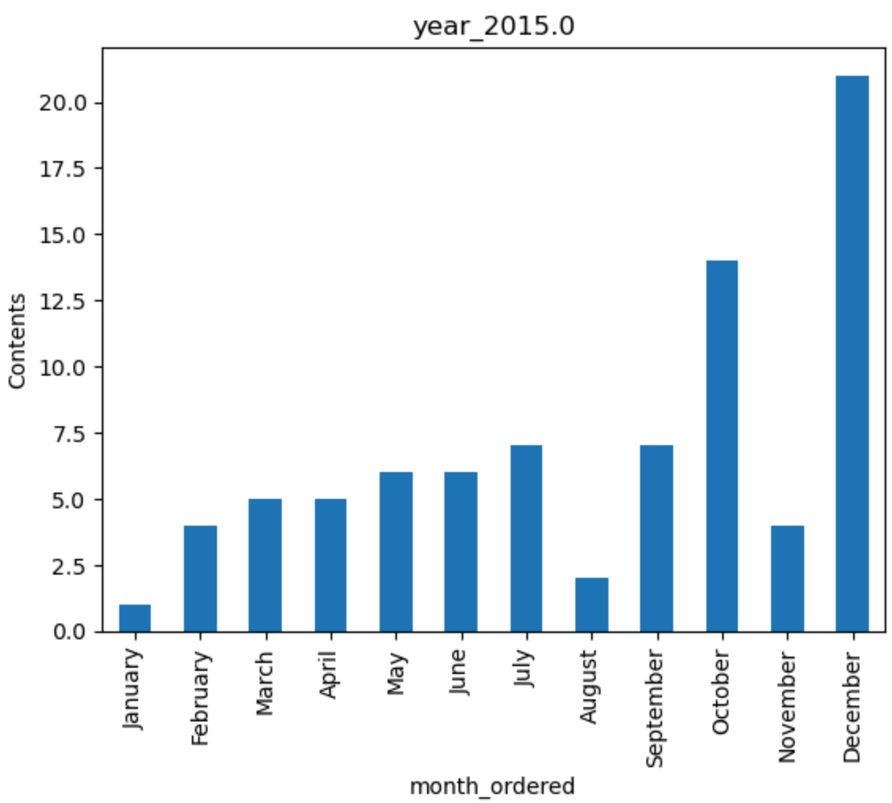

year_2010.0
Contents
0.0
0.2
0.4
0.6
0.8
1.0
January
February
March
April
May
June
July
August
September
October
November
December
month_ordered

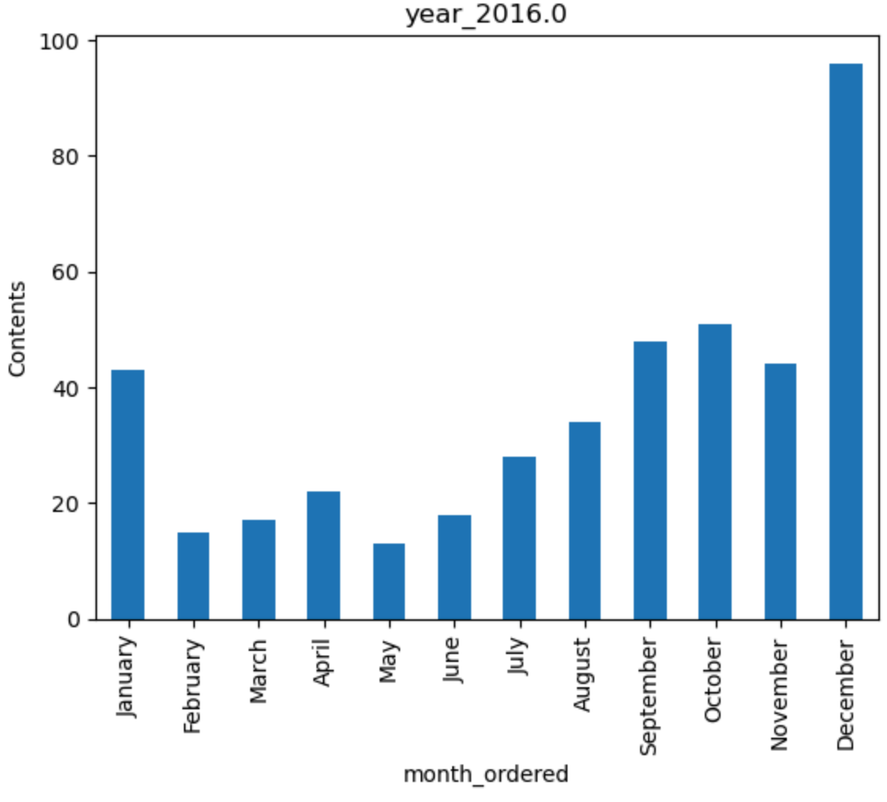

year_2011.0
Contents
0
2
4
6
8
10
January
February
March
April
May
June
July
August
September
October
November
December
month_ordered

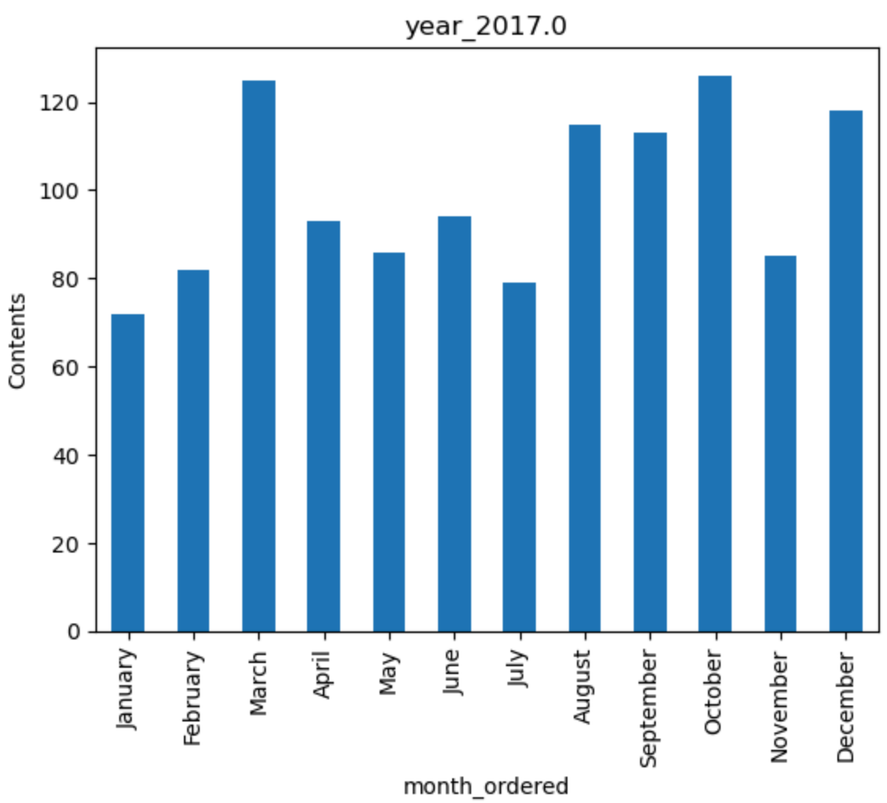

year_2012.0
Contents
0.0
0.2
0.4
0.6
0.8
1.0
January
February
March
April
May
June
July
August
September
October
November
December
month_ordered

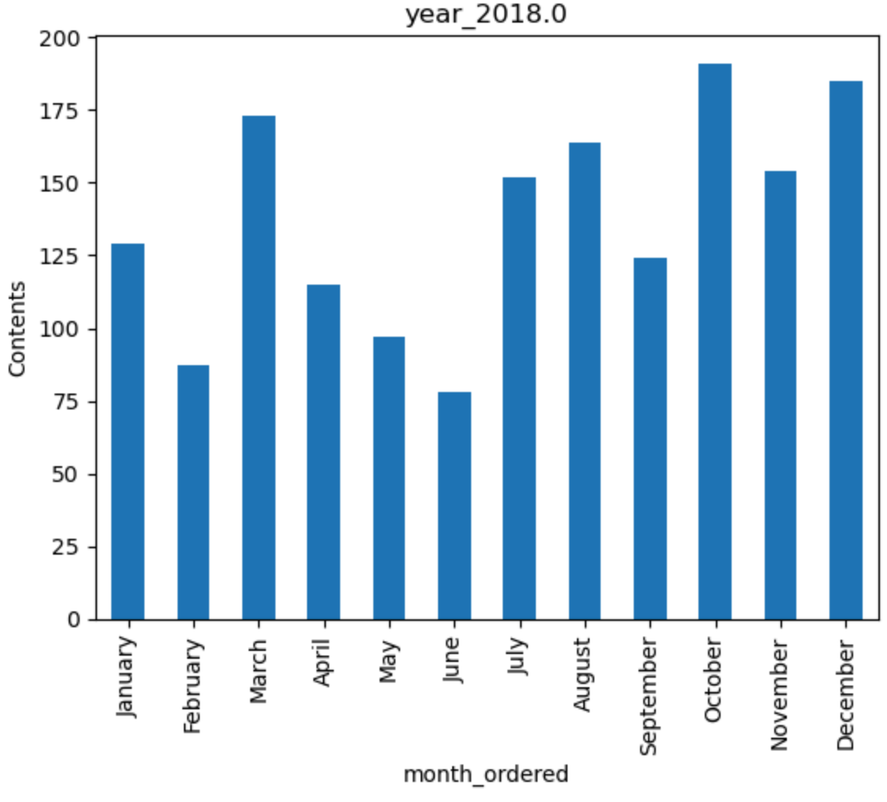

year_2013.0
Contents
0.0
0.5
1.0
1.5
2.0
2.5
3.0
January
February
March
April
May
June
July
August
September
October
November
December
month_ordered

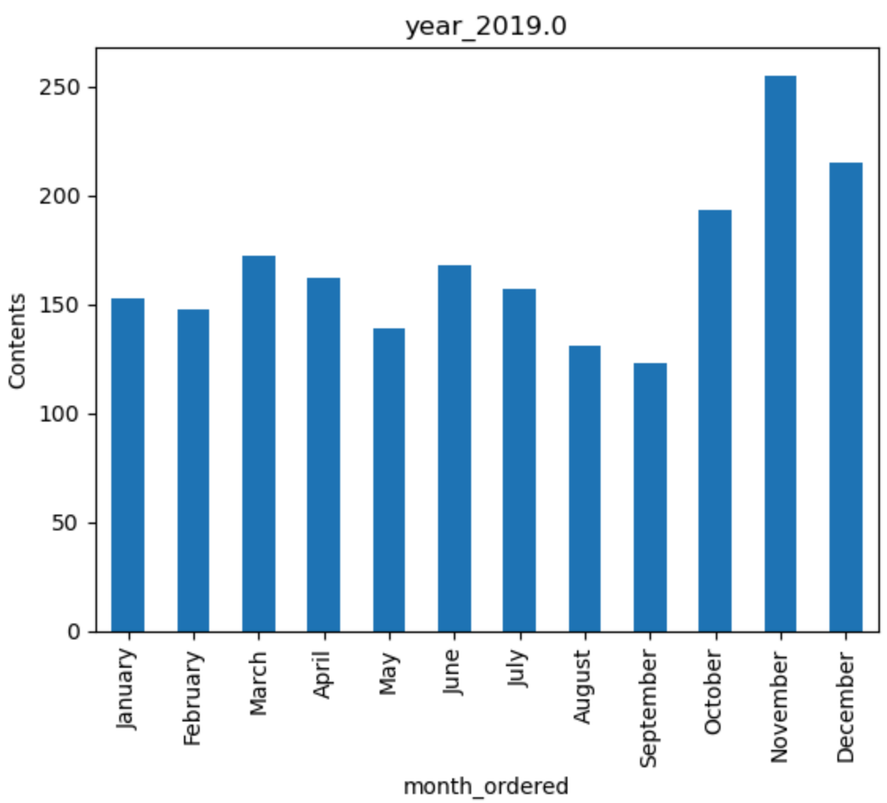

year_2014.0
Contents
0
1
2
3
4
5
6
January
February
March
April
May
June
July
August
September
October
November
December
month_ordered

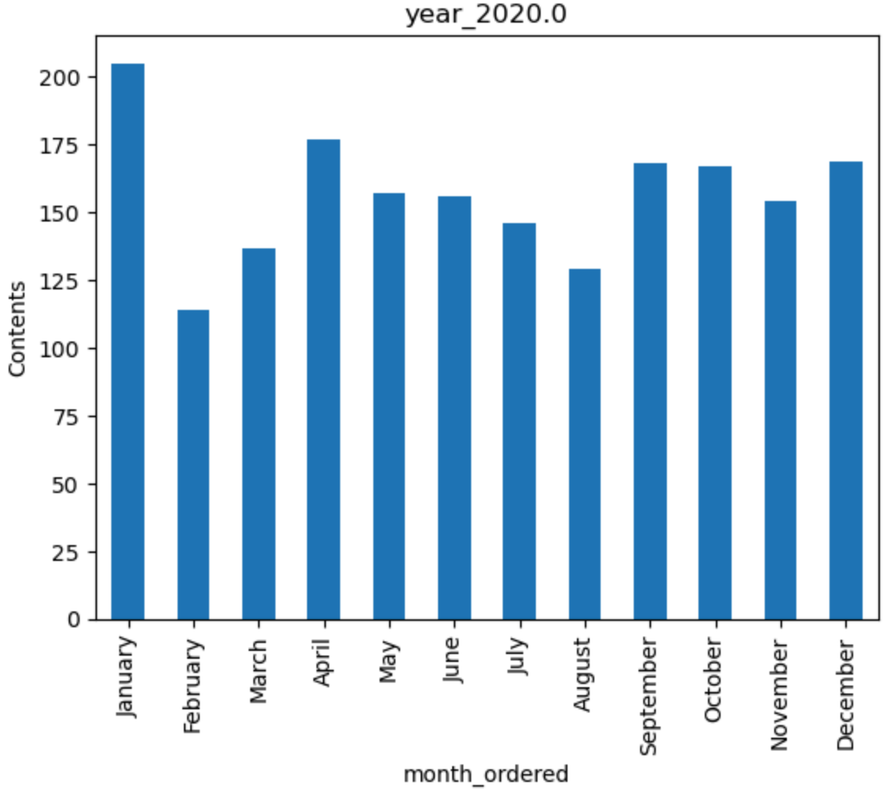

year_2015.0
Contents
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
January
February
March
April
May
June
July
August
September
October
November
December
month_ordered

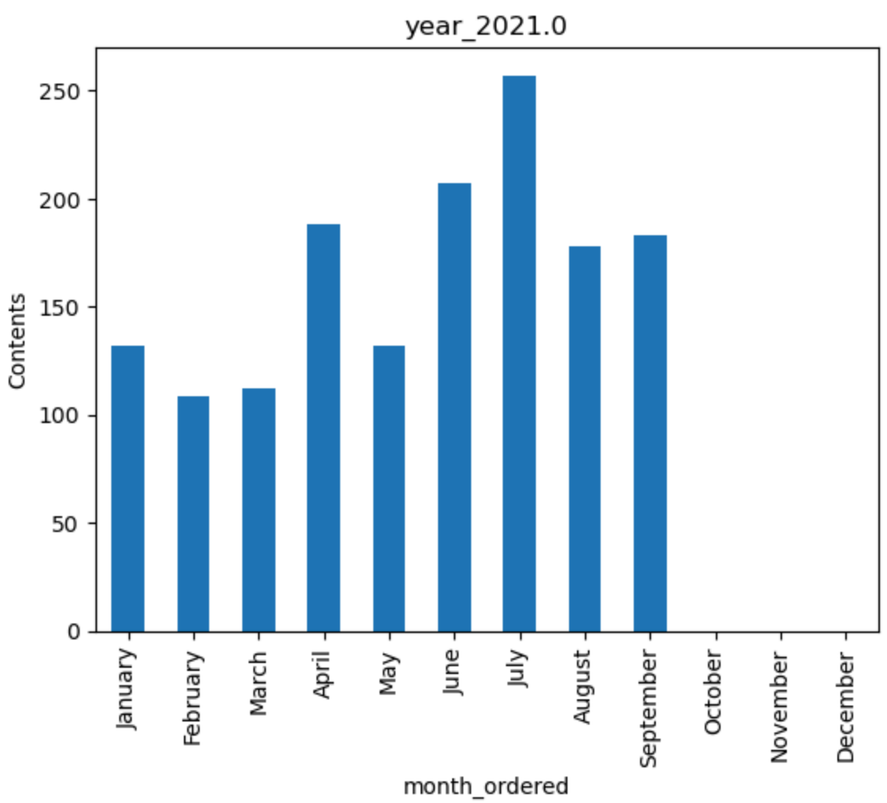

year_2016.0
Contents
0
20
40
60
80
100
January
February
March
April
May
June
July
August
September
October
November
December
month_ordered


year_2017.0
Contents
0
20
40
60
80
100
120
January
February
March
April
May
June
July
August
September
October
November
December
month_ordered


year_2018.0
Contents
0
25
50
75
100
125
150
175
200
January
February
March
April
May
June
July
August
September
October
November
December
month_ordered


year_2019.0
Contents
0
50
100
150
200
250
January
February
March
April
May
June
July
August
September
October
November
December
month_ordered

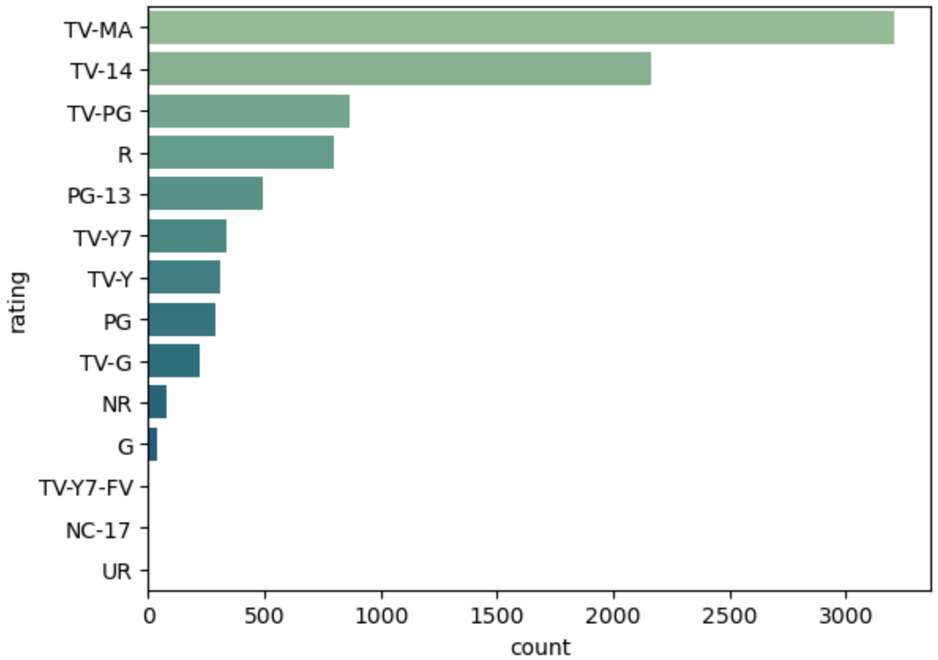

year_2020.0
Contents
0
25
50
75
100
125
150
175
200
January
February
March
April
May
June
July
August
September
October
November
December
month_ordered



most popular rating

back

In [65]:
```
sns.countplot(data = df, y = 'rating', order = df['rating'].value_counts().index.tolist(), palette = 'crest')
plt.show()
```



In [66]:
```
df['rating'].value_counts().index.tolist()
```

Out[66]:
```
['TV-MA',
 'TV-14',
 'TV-PG',
 'R',
 'PG-13',
 'TV-Y7',
 'TV-Y',
 'PG',
 'TV-G',
 'NR',
 'G',
 'TV-Y7-FV',
 'NC-17',
 'UR']
```

In [67]:
```
pd.DataFrame(df['rating'].value_counts())
```

Out[67]:

	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

In [ ]:

==========

In [ ]:

In [ ]: