Final Project Submission

Please fill out:

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- Student pace: Full time
- Scheduled project review date/time: Thu Dec 10, 2020 10am – 10:45am Eastern Time - New York
- Instructor name: Abhineet.Kulkarni
- Blog post URL:https://pjsun2012.medium.com/sql-joins-a-beginner-study-guide-to-data-analysis-using-sql-95cc2ebb5cfc (https://pjsun2012.medium.com/sql-joins-a-beginner-study-guide-to-data-analysis-using-sql-95cc2ebb5cfc)

Project Overview

Use exploratory data analysis to generate insights for a business stakeholder.

Business Problem

Microsoft sees all the big companies creating original video content and they want to get in on the fun. They have decided to create a new movie studio, but they don't know anything about creating movies. You are charged with exploring what types of films are currently doing the best at the box office. You must then translate those findings into actionable insights that the head of Microsoft's new movie studio can use to help decide what type of films to create.

The Data

The datasets from:

- IMDb.title.basics
- Bom.movie.gross
- Tn.moive.Budgets
- Tmdb.movies

Import Necessary Packeages

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

Import Dataset

In [2]:
```
from glob import glob
#The glob module finds all the pathnames matching a specified pattern according to the rules used by the Unix shell,
#although results are returned in arbitrary order.
```

In [3]:
```
csv_files = glob("zippedData/*.csv.gz")
```

In [4]:
```
csv_files
```

Out[4]:
```
['zippedData\\bom.movie_gross.csv.gz',
 'zippedData\\imdb.name.basics.csv.gz',
 'zippedData\\imdb.title.akas.csv.gz',
 'zippedData\\imdb.title.basics.csv.gz',
 'zippedData\\imdb.title.crew.csv.gz',
 'zippedData\\imdb.title.principals.csv.gz',
 'zippedData\\imdb.title.ratings.csv.gz',
 'zippedData\\tmdb.movies.csv.gz',
 'zippedData\\tn.movie_budgets.csv.gz']
```

In [5]:
```
import os
#This module provides a portable way of using operating system dependent functionality.
```

In [6]:

```
csv_files_dict = {}
for filename in csv_files:
    filename_cleaned = os.path.basename(filename).replace(".csv", "").replace(".", "_")
    filename_df = pd.read_csv(filename, index_col = 0)
    csv_files_dict[filename_cleaned] = filename_df
```

Qustion1: How is the whole movie industry?

1. Year Trend of Movie Production

In [7]:

```
df_basics = csv_files_dict['imdb_title_basics_gz']
```

In [8]:

```
df_basics.info()
#For the columns data that I need, 'primary_title' and 'start_year', there is no missing data.
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 146144 entries, tt0063540 to tt9916754
Data columns (total 5 columns):
 #   Column           Non-Null Count   Dtype  
---  ------           --------------   -----  
 0   primary_title    146144 non-null  object 
 1   original_title   146123 non-null  object 
 2   start_year       146144 non-null  int64  
 3   runtime_minutes  114405 non-null  float64
 4   genres           140736 non-null  object 
dtypes: float64(1), int64(1), object(3)
memory usage: 6.7+ MB
```

In [9]:

```
df_movies_years= df_basics.groupby('start_year').count()
```

In [10]:

```
df_movies_years.reset_index(inplace = True)
```

In [11]:

```
df_movies_years
```

Out[11]:

	start_year	primary_title	original_title	runtime_minutes	genres
0	2010	11849	11849	9986	11452
1	2011	12900	12900	10707	12432
2	2012	13787	13786	11405	13356
3	2013	14709	14708	12308	14298
4	2014	15589	15589	12964	15095
5	2015	16243	16242	13252	15569
6	2016	17272	17269	13514	16353
7	2017	17504	17494	13466	16816
8	2018	16849	16846	12213	16293
9	2019	8379	8378	4501	8058
10	2020	937	936	82	900
11	2021	83	83	4	83
12	2022	32	32	3	23
13	2023	5	5	0	3
14	2024	2	2	0	1
15	2025	1	1	0	1
16	2026	1	1	0	1
17	2027	1	1	0	1
18	2115	1	1	0	1

In [12]:

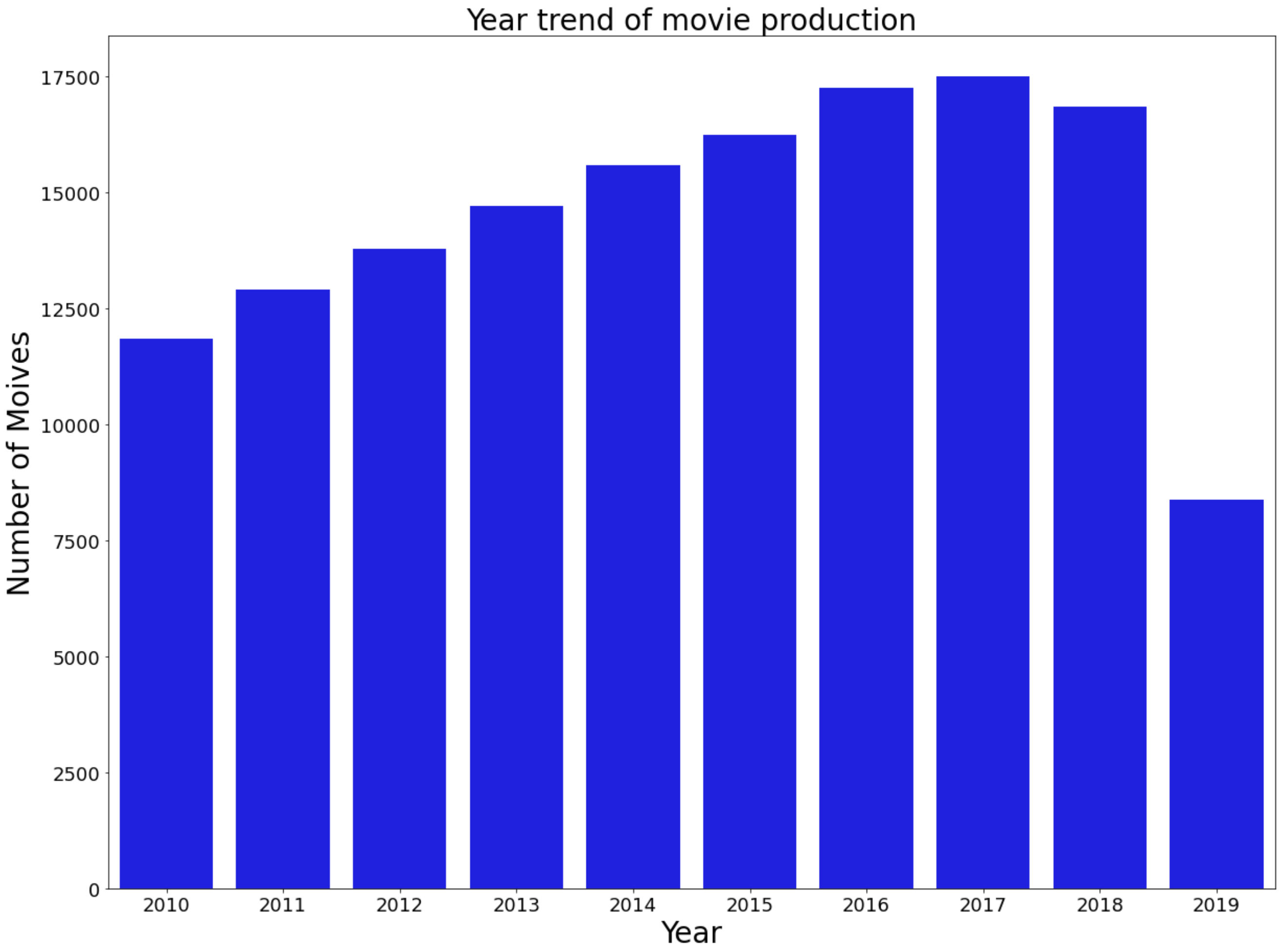
```
#Change column names
df_movies_years.rename(columns = {'start_year': 'Year', 'primary_title': 'num_movies'} , inplace = True)
```

In [13]:
```
df_movies_years.head(10)
```

Out[13]:

	Year	num_movies	original_title	runtime_minutes	genres
0	2010	11849	11849	9986	11452
1	2011	12900	12900	10707	12432
2	2012	13787	13786	11405	13356
3	2013	14709	14708	12308	14298
4	2014	15589	15589	12964	15095
5	2015	16243	16242	13252	15569
6	2016	17272	17269	13514	16353
7	2017	17504	17494	13466	16816
8	2018	16849	16846	12213	16293
9	2019	8379	8378	4501	8058

In [14]:
```
f, ax= plt.subplots(figsize = (20, 15))
sns.barplot(x = 'Year', y = 'num_movies', data = df_movies_years[0:10], color = 'blue')
ax.set_xlabel('Year',fontsize=28)
ax.set_ylabel('Number of Moives',fontsize=28)
ax.tick_params(axis='x',labelsize=18)
ax.tick_params(axis='y',labelsize=18)
plt.title('Year trend of movie production', fontsize=28)
plt.savefig('1')
```



2. Other movie studios gross revenue

In [15]:
```
df_studio = csv_files_dict['bom_movie_gross_gz']
```

In [16]:
```
df_studio.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 3387 entries, Toy Story 3 to An Actor Prepares
Data columns (total 4 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   studio          3382 non-null   object 
 1   domestic_gross  3359 non-null   float64
 2   foreign_gross   2037 non-null   object 
 3   year            3387 non-null   int64  
dtypes: float64(1), int64(1), object(2)
memory usage: 132.3+ KB
```

In [17]:
```
# figure out the data is from 2010 to 2018
df_studio.groupby('year').count()
```

Out[17]:

year	studio	domestic_gross	foreign_gross
2010	327	323	314
2011	398	397	293
2012	399	393	250
2013	350	345	205
2014	394	391	238
2015	450	449	191
2016	436	433	195
2017	320	320	178
2018	308	308	173

In [18]:
```
# Find out missing value
df_studio.isna().sum()/len(df_studio)
```

Out[18]:
```
studio            0.001476
domestic_gross    0.008267
foreign_gross     0.398583
year              0.000000
dtype: float64
```

In [19]:
```
#fill missing vlaues for foreign_gross
df_studio['foreign_gross'] = df_studio['foreign_gross'].fillna(0)
```

In [20]:
```
#drop all missing values of stuo and domestic_gross
df_studio_1 = df_studio.dropna()
```

In [21]:
```
df_studio_1.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 3356 entries, Toy Story 3 to An Actor Prepares
Data columns (total 4 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   studio          3356 non-null   object 
 1   domestic_gross  3356 non-null   float64
 2   foreign_gross   3356 non-null   object 
 3   year            3356 non-null   int64  
dtypes: float64(1), int64(1), object(2)
memory usage: 131.1+ KB
```

In [22]:
```
df_studio_1['foreign_gross'] = df_studio_1['foreign_gross'].str.replace("," , "")
#leanred!!
```

```
<ipython-input-22-cfb697f5d0ae>:1: SettingWithCopyWarning: 
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning
-a-view-versus-a-copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-
a-copy)
  df_studio_1['foreign_gross'] = df_studio_1['foreign_gross'].str.replace("," , "")
```

In [23]:

```
#change foreign_gross data types from object to float
df_studio_1.foreign_gross = df_studio_1.foreign_gross.astype('float64')
```

```
C:\Users\pjsun\anaconda3\envs\learn-env\lib\site-packages\pandas\core\generic.py:5168: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning
-a-view-versus-a-copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-
a-copy)
  self[name] = value
```

In [24]:

```
df_studio_1.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 3356 entries, Toy Story 3 to An Actor Prepares
Data columns (total 4 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   studio          3356 non-null   object 
 1   domestic_gross  3356 non-null   float64
 2   foreign_gross   2007 non-null   float64
 3   year            3356 non-null   int64  
dtypes: float64(2), int64(1), object(1)
memory usage: 131.1+ KB
```

In [25]:

```
df_studio_1['foreign_gross'] = df_studio_1['foreign_gross'].fillna(0)
```

```
<ipython-input-25-c3ccea579927>:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning
-a-view-versus-a-copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-
a-copy)
  df_studio_1['foreign_gross'] = df_studio_1['foreign_gross'].fillna(0)
```

In [26]:

```
df_studio_1.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 3356 entries, Toy Story 3 to An Actor Prepares
Data columns (total 4 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   studio          3356 non-null   object 
 1   domestic_gross  3356 non-null   float64
 2   foreign_gross   3356 non-null   float64
 3   year            3356 non-null   int64  
dtypes: float64(2), int64(1), object(1)
memory usage: 131.1+ KB
```

In [27]:

```
#creat a new column of total_gross by adding doemstic_gross and foreign_gross
df_studio_1['Total_gross'] = df_studio_1['domestic_gross'] + df_studio_1['foreign_gross']
```

```
<ipython-input-27-9be4cac17c88>:2: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning
-a-view-versus-a-copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-
a-copy)
  df_studio_1['Total_gross'] = df_studio_1['domestic_gross'] + df_studio_1['foreign_gross']
```

In [28]:

```
df_studio_1.head()
```

Out[28]:

	studio	domestic_gross	foreign_gross	year	Total_gross
title					
Toy Story 3	BV	415000000.0	652000000.0	2010	1.067000e+09
Alice in Wonderland (2010)	BV	334200000.0	691300000.0	2010	1.025500e+09
Harry Potter and the Deathly Hallows Part 1	WB	296000000.0	664300000.0	2010	9.603000e+08
Inception	WB	292600000.0	535700000.0	2010	8.283000e+08
Shrek Forever After	P/DW	238700000.0	513900000.0	2010	7.526000e+08

In [29]:

```
# group by studios and sum all the data for each studio
df_studio_2 = df_studio_1.groupby(['studio']).sum().sort_values(by = 'Total_gross', ascending = False)
```

In [30]:

```
# data cleaning, drop the column that I dont need
df_studio_3 = df_studio_2[0:10].drop(columns = ['year'])
```

In [31]:

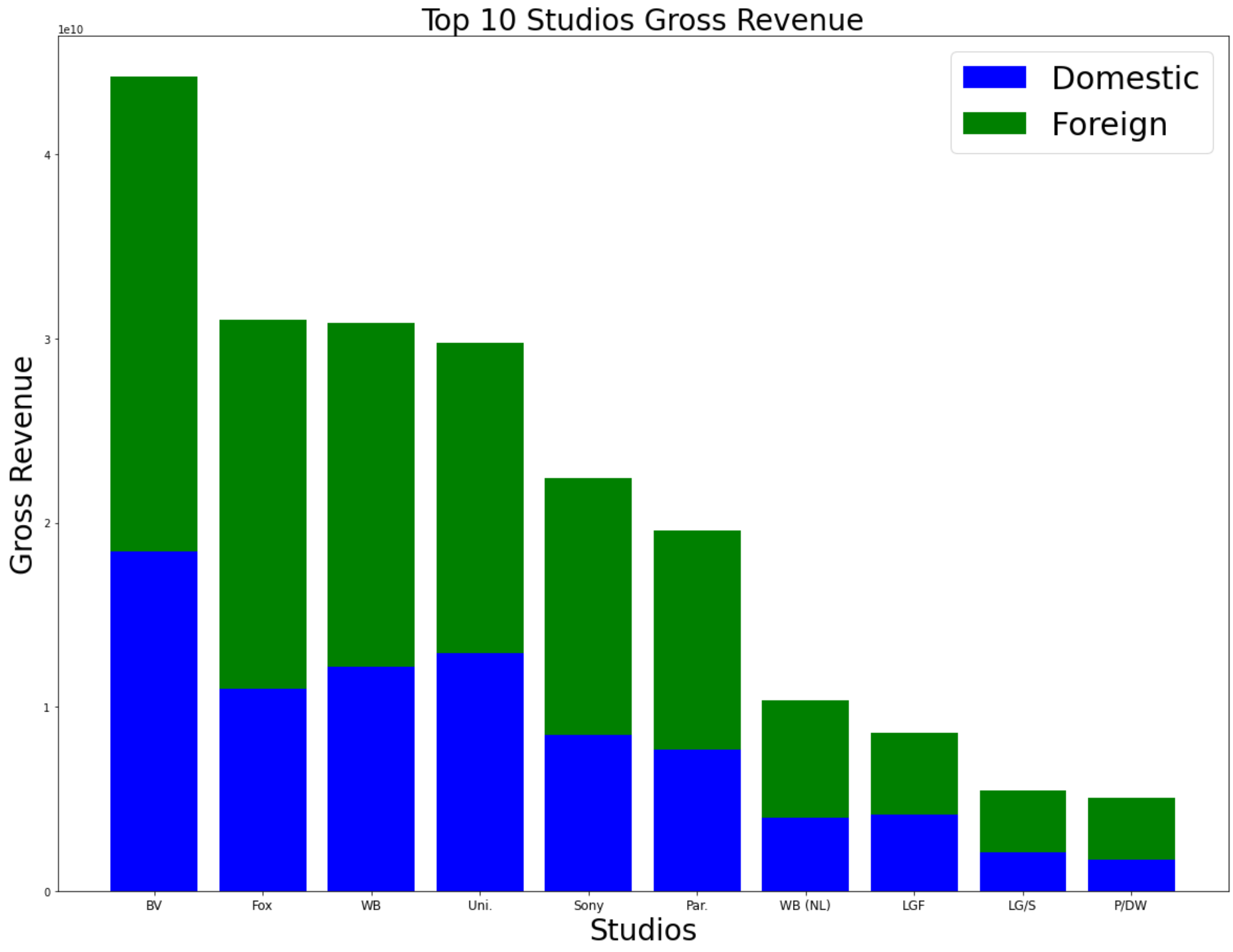
```
#final dataframe, be ready to plot the graph
df_studio_3
```

Out[31]:

studio	domestic_gross	foreign_gross	Total_gross
BV	1.841903e+10	2.579385e+10	4.421288e+10
Fox	1.094950e+10	2.005587e+10	3.100537e+10
WB	1.216805e+10	1.866790e+10	3.083595e+10
Uni.	1.290239e+10	1.685477e+10	2.975716e+10
Sony	8.459683e+09	1.394524e+10	2.240492e+10
Par.	7.685871e+09	1.186338e+10	1.954926e+10
WB (NL)	3.995700e+09	6.339000e+09	1.033470e+10
LGF	4.118963e+09	4.475619e+09	8.594583e+09
LG/S	2.078200e+09	3.353724e+09	5.431924e+09
P/DW	1.682900e+09	3.393600e+09	5.076500e+09

In [32]:

```
labels = df_studio_3.index
plt.figure(figsize=(20,15))
plt.bar(range(len(labels)), df_studio_3.domestic_gross, color='blue')
plt.bar(range(len(labels)), df_studio_3.foreign_gross, color='green', bottom =  df_studio_3.domestic_gross)
plt.xticks(range(len(labels)), labels, fontsize = 12)
plt.legend(['Domestic', 'Foreign'], fontsize = 30)
plt.title('Top 10 Studios Gross Revenue', fontsize=28)
plt.xlabel('Studios', fontsize=28)
plt.ylabel('Gross Revenue', fontsize=28)
plt.savefig('2')
```



Question 2: What are the top 10 most popular movie genres? What is the count of genres by year?

In [33]:
```
df_basics.head()
```

Out[33]:

	primary_title	original_title	start_year	runtime_minutes	genres
tconst					
tt0063540	Sunghursh	Sunghursh	2013	175.0	Action,Crime,Drama
tt0066787	One Day Before the Rainy Season	Ashad Ka Ek Din	2019	114.0	Biography,Drama
tt0069049	The Other Side of the Wind	The Other Side of the Wind	2018	122.0	Drama
tt0069204	Sabse Bada Sukh	Sabse Bada Sukh	2018	NaN	Comedy,Drama
tt0100275	The Wandering Soap Opera	La Telenovela Errante	2017	80.0	Comedy,Drama,Fantasy

In [34]:
```
# reset index
df_basics_1 = df_basics.reset_index()
```

In [35]:
```
#drop columns which I dont need
data_clean_1 = df_basics_1 .drop(columns = ['runtime_minutes','original_title'])
```

In [36]:
```
data_clean_1.head()
```

Out[36]:

	tconst	primary_title	start_year	genres
0	tt0063540	Sunghursh	2013	Action,Crime,Drama
1	tt0066787	One Day Before the Rainy Season	2019	Biography,Drama
2	tt0069049	The Other Side of the Wind	2018	Drama
3	tt0069204	Sabse Bada Sukh	2018	Comedy,Drama
4	tt0100275	The Wandering Soap Opera	2017	Comedy,Drama,Fantasy

In [37]:
```
data_clean_1.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 146144 entries, 0 to 146143
Data columns (total 4 columns):
 #   Column         Non-Null Count   Dtype 
---  ------         --------------   ----- 
 0   tconst         146144 non-null  object
 1   primary_title  146144 non-null  object
 2   start_year     146144 non-null  int64 
 3   genres         140736 non-null  object
dtypes: int64(1), object(3)
memory usage: 4.5+ MB
```

In [38]:
```
data_clean_1.isna().sum()/len(data_clean_1)
```

Out[38]:
```
tconst           0.000000
primary_title    0.000000
start_year       0.000000
genres           0.037005
dtype: float64
```

In [39]:
```
#Since the missing data of genres is only 3.7% of entire dataset, dropping rows that contain missing values is a good s
data_clean_2 = data_clean_1.dropna()
```

In [40]:
```
data_clean_2.isna().sum()
```

Out[40]:
```
tconst           0
primary_title    0
start_year       0
genres           0
dtype: int64
```

In [41]:
```
data_clean_2.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 140736 entries, 0 to 146143
Data columns (total 4 columns):
 #   Column         Non-Null Count   Dtype 
---  ------         --------------   ----- 
 0   tconst         140736 non-null  object
 1   primary_title  140736 non-null  object
 2   start_year     140736 non-null  int64 
 3   genres         140736 non-null  object
dtypes: int64(1), object(3)
memory usage: 5.4+ MB
```

In [42]:
```
#another dropping column that I dont need
data_clean_3 = data_clean_2.drop(columns = 'tconst')
```

In [43]:
```
#get movie genres column and do data cleaning
movie_genres = data_clean_3['genres']
```

In [44]:
```
movie_genres.head()
```

Out[44]:
```
0      Action,Crime,Drama
1         Biography,Drama
2                   Drama
3            Comedy,Drama
4    Comedy,Drama,Fantasy
Name: genres, dtype: object
```

In [45]:
```
# Change Series to list
genres_list = [i for i in movie_genres]
```

In [46]:
```
# split ',' for each item in the list
genres_list = [i.split(sep = ',') for i in movie_genres]
```

In [47]:
```
# creat a new list
genres_list_1 = []
for i in genres_list:
    for j in i:
        genres_list_1.append(j)
```

In [48]:
```
#change list to array and return the unique values of an array
genres_list_unique = np.unique(genres_list_1)
```

In [49]:
```
genres_list_unique
```

Out[49]:
```
array(['Action', 'Adult', 'Adventure', 'Animation', 'Biography', 'Comedy',
       'Crime', 'Documentary', 'Drama', 'Family', 'Fantasy', 'Game-Show',
       'History', 'Horror', 'Music', 'Musical', 'Mystery', 'News',
       'Reality-TV', 'Romance', 'Sci-Fi', 'Short', 'Sport', 'Talk-Show',
       'Thriller', 'War', 'Western'], dtype='<U11')
```

In [50]:
```
data_clean_3.shape[0]# total numbers of rows
```

Out[50]:
```
140736
```

In [51]:
```
genres_list_unique.shape[0]#total number of elements
```

Out[51]:
```
27
```

In [52]:
```
# creat a new 0*0 dataframe. Columns are unique genres list array, index is the  movies name.
genre_zero = pd.DataFrame(np.zeros((data_clean_3.shape[0], genres_list_unique.shape[0])), columns=genres_list_unique
                          , index=data_clean_3["primary_title"])
```

In [53]:
```
genre_zero
```

Out[53]:

	Action	Adult	Adventure	Animation	Biography	Comedy	Crime	Documentary	Drama	Family	...	News	Reality-TV	Romance	Sci-Fi	Short	Spo
primary_title																	
Sunghursh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.
One Day Before the Rainy Season	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.
The Other Side of the Wind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.
Sabse Bada Sukh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.
The Wandering Soap Opera	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.
The Secret of China	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.
Kuambil Lagi Hatiku	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.
Rodolpho Teóphilo - O Legado de um Pioneiro	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.
Dankyavar Danka	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.
Chico Albuquerque - Revelações	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.

140736 rows × 27 columns

In [54]:
```
len(genres_list)
```

Out[54]:
```
140736
```

In [55]:
```
genres_list[0]
```

Out[55]:
```
['Action', 'Crime', 'Drama']
```

In [56]:
```
genre_zero.columns.get_indexer(genres_list[0])#learned
```

Out[56]:
```
array([0, 6, 8], dtype=int64)
```

In [57]:
```
# Iterating over every item in genres_list and fill values in to column.
# if the movie belongs to that genre it's value will be 1 otherwise 0
for i  in range(data_clean_3.shape[0]):
    genre_zero.iloc[i, genre_zero.columns.get_indexer(genres_list[i])] = 1
genre_zero
```

Soap Opera																
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
The Secret of China	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0
Kuambil Lagi Hatiku	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	...	0.0	0.0	0.0	0.0	0.0
Rodolpho Teóphilo - O Legado de um Pioneiro	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0
Dankyavar Danka	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0

In [58]:

```
genre_zero.sum().sort_values(ascending = False)
```

Out[58]:

```
Documentary    51640.0
Drama          49883.0
Comedy         25312.0
Thriller       11883.0
Horror         10805.0
Action         10335.0
Romance         9372.0
Biography       8722.0
Crime           6753.0
Adventure       6465.0
Family          6227.0
History         6225.0
Mystery         4659.0
Music           4314.0
Fantasy         3516.0
Sci-Fi          3365.0
Animation       2799.0
Sport           2234.0
News            1551.0
Musical         1430.0
War             1405.0
Western          467.0
Reality-TV        98.0
Talk-Show         50.0
Adult             25.0
Short             11.0
Game-Show          4.0
dtype: float64
```

In [59]:

```
# creat a new datafrome only including moive genres and the sum numbers for each type
a = list(genre_zero.sum().keys())
```

In [60]:

```
b = list(genre_zero.sum().values)
```

In [61]:

```
d = {'Movie': a, 'Number': b}
```

In [62]:

```
aaa = pd.DataFrame(data = d)
```

In [63]:

```
aaa_1 = aaa.set_index('Movie')
```

In [64]:

```
aaa_2 = aaa_1.sort_values(by = 'Number',ascending = False)
```

In [65]:

```
aaa_3 = aaa_2.reset_index()
```

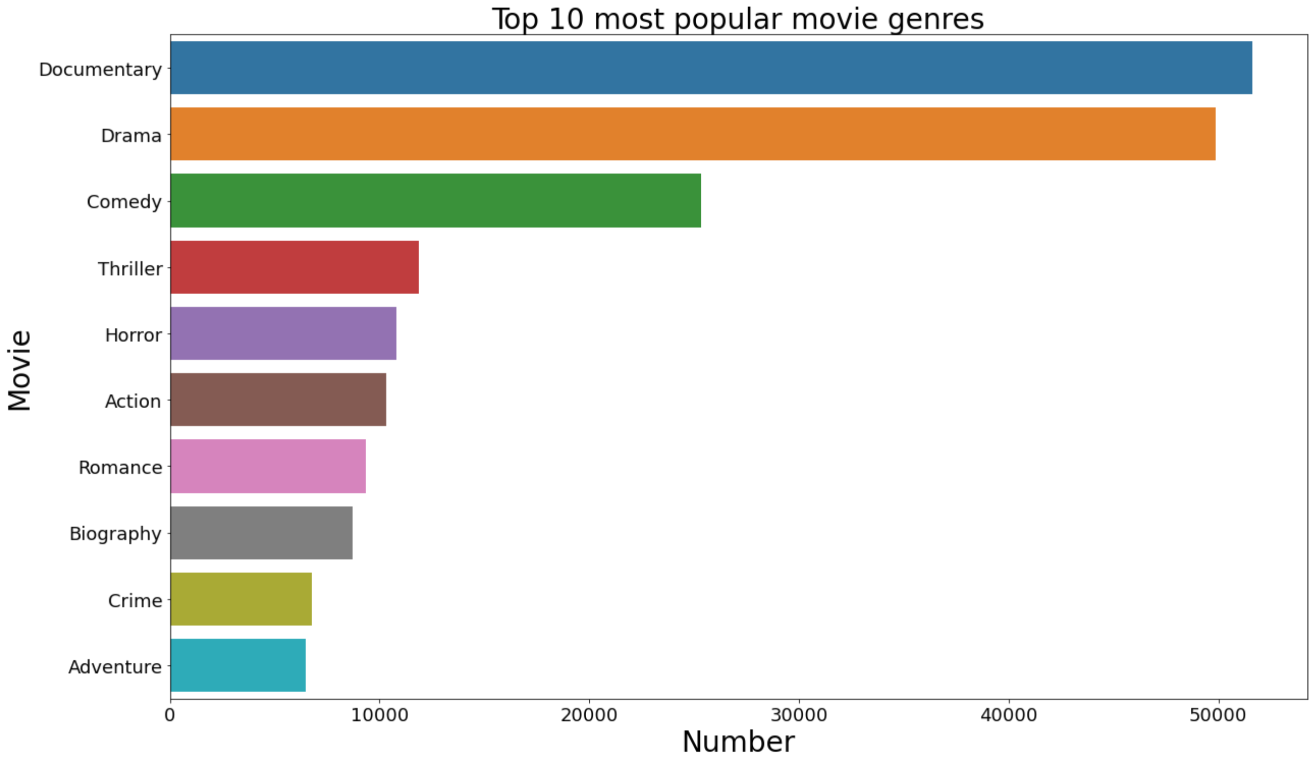
In [66]:

```
aaa_3.head(10)
```

Out[66]:

	Movie	Number
0	Documentary	51640.0
1	Drama	49883.0
2	Comedy	25312.0
3	Thriller	11883.0
4	Horror	10805.0
5	Action	10335.0
6	Romance	9372.0
7	Biography	8722.0
8	Crime	6753.0
9	Adventure	6465.0

In [67]:
```
f, ax= plt.subplots(figsize = (20, 12))
sns.barplot(x = 'Number', y = 'Movie', data = aaa_3[:10], ax = ax)
ax.set_xlabel('Number',fontsize=28)
ax.set_ylabel('Movie',fontsize=28)
ax.tick_params(axis='x',labelsize=18)
ax.tick_params(axis='y',labelsize=18)
ax.set_title('Top 10 most popular movie genres',fontsize=28)
plt.savefig('3')
```



2. Count of genres by year

In [68]:
```
genre_top_10 = genre_zero.drop(columns=['Adult', 'Animation', 'Family', 'Fantasy', 'Game-Show','History', 'Music', 'Mus
```

In [69]:
```
genre_top_10
```

Out[69]:

	Action	Adventure	Biography	Comedy	Crime	Documentary	Drama	Horror	Romance	Thriller
primary_title										
Sunghursh	1.0	0.0	0.0	0.0	1.0	0.0	1.0	0.0	0.0	0.0
One Day Before the Rainy Season	0.0	0.0	1.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
The Other Side of the Wind	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Sabse Bada Sukh	0.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	0.0
The Wandering Soap Opera	0.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	0.0
...	...	...	...	...	...	...	...	...	...	...
The Secret of China	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kuambil Lagi Hatiku	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Rodolpho Teóphilo - O Legado de um Pioneiro	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0
Dankyavar Danka	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
Chico Albuquerque - Revelações	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0

140736 rows × 10 columns

In [70]:
```
data_clean_4 = data_clean_3.drop(columns = 'genres')
```

In [71]:
```
data_clean_4.head()
```

Out[71]:

	primary_title	start_year
0	Sunghursh	2013
1	One Day Before the Rainy Season	2019
2	The Other Side of the Wind	2018
3	Sabse Bada Sukh	2018
4	The Wandering Soap Opera	2017

In [72]:
```
data_clean_5 = data_clean_4.set_index('primary_title')
```

In [73]:
```
data_clean_5
```

Out[73]:

	start_year
primary_title	
Sunghursh	2013
One Day Before the Rainy Season	2019
The Other Side of the Wind	2018
Sabse Bada Sukh	2018
The Wandering Soap Opera	2017
...	...
The Secret of China	2019
Kuambil Lagi Hatiku	2019
Rodolpho Teóphilo - O Legado de um Pioneiro	2015
Dankyavar Danka	2013
Chico Albuquerque - Revelações	2013

140736 rows × 1 columns

In [74]:
```
#merge datafrmes
genres_counts_year = pd.concat([genre_top_10,data_clean_5],axis=1)
```

In [75]:
```
genres_counts_year
```

Out[75]:

	Action	Adventure	Biography	Comedy	Crime	Documentary	Drama	Horror	Romance	Thriller	start_year
primary_title											
Sunghursh	1.0	0.0	0.0	0.0	1.0	0.0	1.0	0.0	0.0	0.0	2013
One Day Before the Rainy Season	0.0	0.0	1.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	2019
The Other Side of the Wind	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	2018
Sabse Bada Sukh	0.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	0.0	2018
The Wandering Soap Opera	0.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	0.0	2017
...	...	...	...	...	...	...	...	...	...	...	...
The Secret of China	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2019
Kuambil Lagi Hatiku	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	2019
Rodolpho Teóphilo - O Legado de um Pioneiro	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	2015
Dankyavar Danka	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	2013
Chico Albuquerque - Revelações	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	2013

140736 rows × 11 columns

In [76]:
```
genres_counts_year_1 = genres_counts_year.groupby('start_year').sum()
```

In [77]:

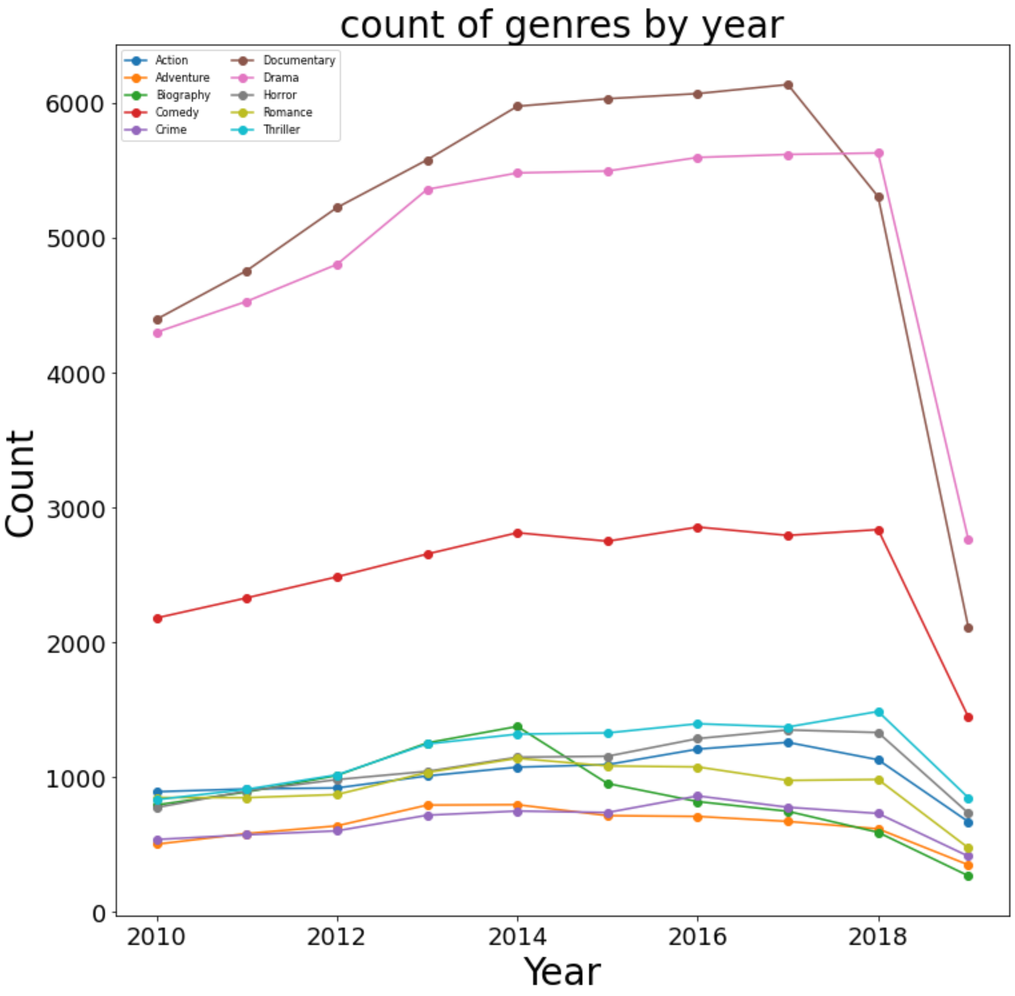
```
genres_counts_year_1
```

Out[77]:

	Action	Adventure	Biography	Comedy	Crime	Documentary	Drama	Horror	Romance	Thriller
start_year										
2010	891.0	502.0	793.0	2179.0	537.0	4393.0	4297.0	774.0	848.0	832.0
2011	912.0	581.0	889.0	2328.0	572.0	4754.0	4526.0	897.0	847.0	909.0
2012	919.0	638.0	1011.0	2484.0	601.0	5221.0	4800.0	981.0	870.0	1016.0
2013	1008.0	792.0	1253.0	2653.0	717.0	5575.0	5356.0	1042.0	1034.0	1245.0
2014	1073.0	795.0	1375.0	2811.0	748.0	5972.0	5478.0	1147.0	1139.0	1318.0
2015	1092.0	714.0	952.0	2748.0	737.0	6028.0	5492.0	1154.0	1082.0	1327.0
2016	1207.0	708.0	818.0	2853.0	860.0	6066.0	5593.0	1285.0	1075.0	1395.0
2017	1257.0	671.0	746.0	2791.0	776.0	6133.0	5615.0	1349.0	975.0	1371.0
2018	1128.0	616.0	590.0	2834.0	730.0	5302.0	5626.0	1330.0	982.0	1486.0
2019	669.0	349.0	268.0	1446.0	413.0	2112.0	2762.0	733.0	475.0	847.0
2020	137.0	70.0	24.0	165.0	54.0	79.0	309.0	107.0	42.0	132.0
2021	28.0	21.0	3.0	17.0	6.0	3.0	22.0	5.0	3.0	3.0
2022	10.0	3.0	0.0	3.0	2.0	2.0	4.0	1.0	0.0	2.0
2023	2.0	2.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0
2024	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2025	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2026	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2027	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2115	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0

In [78]:

```
f,ax=plt.subplots(figsize=(12,12))
genres_counts_year_1[0:10].plot(fontsize=14,marker = 'o', ax = ax)
ax.set_xlabel('Year',fontsize=28)
ax.set_ylabel('Count',fontsize=28)
ax.legend(ncol=2,fontsize=8,loc = 0)
ax.tick_params(axis='x',labelsize=18)
ax.tick_params(axis='y',labelsize=18)
ax.set_title('count of genres by year',fontsize=28)
#plt.legend(bbox_to_anchor=(1.0, 1.0),borderaxespad=0,fontsize = 8)# the method that modify legend locations
plt.savefig('4')
```



Question 3: What is top 10 profitable movies over the past 10 years and what is the ROI for each of them?

In [79]:

```
df_movie_budget_gross = csv_files_dict['tn_movie_budgets_gz']
```

In [80]:

```
df_movie_budget_gross .head()
```

Out[80]:

	release_date	movie	production_budget	domestic_gross	worldwide_gross
id					
1	Dec 18, 2009	Avatar	$425,000,000	$760,507,625	$2,776,345,279
2	May 20, 2011	Pirates of the Caribbean: On Stranger Tides	$410,600,000	$241,063,875	$1,045,663,875
3	Jun 7, 2019	Dark Phoenix	$350,000,000	$42,762,350	$149,762,350
4	May 1, 2015	Avengers: Age of Ultron	$330,600,000	$459,005,868	$1,403,013,963
5	Dec 15, 2017	Star Wars Ep. VIII: The Last Jedi	$317,000,000	$620,181,382	$1,316,721,747

In [81]:

```
def convert_col_to_int(df, col):
    df[col] = df[col].str.replace("$", "").str.replace(",", "").astype('int64')
    return df
```

In [82]:
```
df_movie_budget_gross.head()
```

Out[82]:

	release_date	movie	production_budget	domestic_gross	worldwide_gross
id					
1	Dec 18, 2009	Avatar	$425,000,000	$760,507,625	$2,776,345,279
2	May 20, 2011	Pirates of the Caribbean: On Stranger Tides	$410,600,000	$241,063,875	$1,045,663,875
3	Jun 7, 2019	Dark Phoenix	$350,000,000	$42,762,350	$149,762,350
4	May 1, 2015	Avengers: Age of Ultron	$330,600,000	$459,005,868	$1,403,013,963
5	Dec 15, 2017	Star Wars Ep. VIII: The Last Jedi	$317,000,000	$620,181,382	$1,316,721,747

In [83]:
```
cols_to_convert = ['production_budget', 'domestic_gross', 'worldwide_gross']

for col in cols_to_convert:
    df_movie_budget_gross = convert_col_to_int(df_movie_budget_gross, col)
```

In [84]:
```
df_movie_budget_gross.head()
```

Out[84]:

	release_date	movie	production_budget	domestic_gross	worldwide_gross
id					
1	Dec 18, 2009	Avatar	425000000	760507625	2776345279
2	May 20, 2011	Pirates of the Caribbean: On Stranger Tides	410600000	241063875	1045663875
3	Jun 7, 2019	Dark Phoenix	350000000	42762350	149762350
4	May 1, 2015	Avengers: Age of Ultron	330600000	459005868	1403013963
5	Dec 15, 2017	Star Wars Ep. VIII: The Last Jedi	317000000	620181382	1316721747

In [85]:
```
df_movie_budget_gross.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 5782 entries, 1 to 82
Data columns (total 5 columns):
 #   Column             Non-Null Count  Dtype 
---  ------             --------------  ----- 
 0   release_date       5782 non-null   object
 1   movie              5782 non-null   object
 2   production_budget  5782 non-null   int64 
 3   domestic_gross     5782 non-null   int64 
 4   worldwide_gross    5782 non-null   int64 
dtypes: int64(3), object(2)
memory usage: 271.0+ KB
```

In [86]:
```
df_movie_budget_gross['movie_profit'] = df_movie_budget_gross['worldwide_gross'] - df_movie_budget_gross['production_bu
```

In [87]:
```
df_movie_budget_gross['ROI'] = df_movie_budget_gross['movie_profit']/df_movie_budget_gross['production_budget']
```

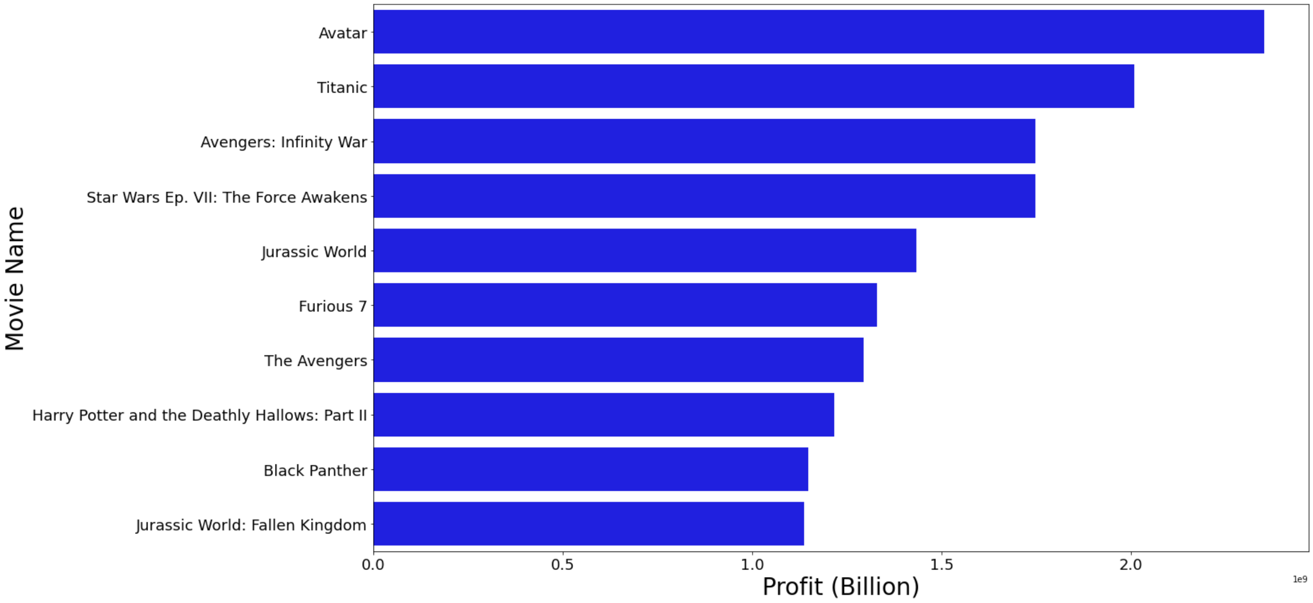
In [88]:
```
df_movie_budget_gross.sort_values(by = 'movie_profit' , ascending = False).head(10)
```

Out[88]:

	release_date	movie	production_budget	domestic_gross	worldwide_gross	movie_profit	ROI
id							
1	Dec 18, 2009	Avatar	425000000	760507625	2776345279	2351345279	5.532577
43	Dec 19, 1997	Titanic	200000000	659363944	2208208395	2008208395	10.041042
7	Apr 27, 2018	Avengers: Infinity War	300000000	678815482	2048134200	1748134200	5.827114
6	Dec 18, 2015	Star Wars Ep. VII: The Force Awakens	306000000	936662225	2053311220	1747311220	5.710167
34	Jun 12, 2015	Jurassic World	215000000	652270625	1648854864	1433854864	6.669092
67	Apr 3, 2015	Furious 7	190000000	353007020	1518722794	1328722794	6.993278
27	May 4, 2012	The Avengers	225000000	623279547	1517935897	1292935897	5.746382
61	Jul 15, 2011	Harry Potter and the Deathly Hallows: Part II	125000000	381193157	1341693157	1216693157	9.733545
42	Feb 16, 2018	Black Panther	200000000	700059566	1348258224	1148258224	5.741291
13	Jun 22, 2018	Jurassic World: Fallen Kingdom	170000000	417719760	1305772799	1135772799	6.681016

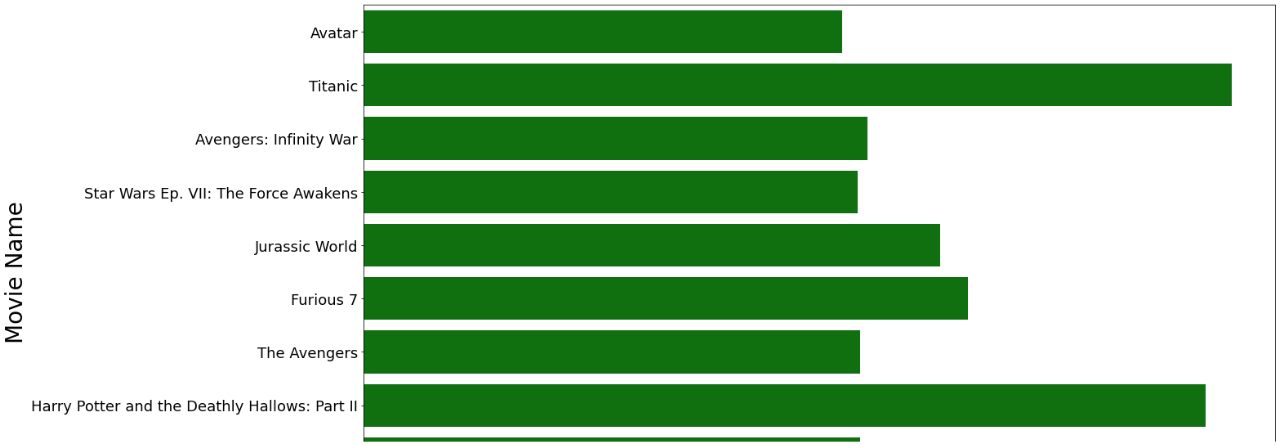
In [89]:

```
f, ax= plt.subplots(figsize = (20, 12))
sns.barplot(x = 'movie_profit', y = 'movie', data = df_movie_budget_gross.sort_values(by = 'movie_profit',ascending = Fa
ax.set_xlabel('Profit (Billion)',fontsize=28)
ax.set_ylabel('Movie Name',fontsize=28)
ax.tick_params(axis='x',labelsize=18)
ax.tick_params(axis='y',labelsize=18)
plt.savefig('5')
```



In [90]:

```
f, ax= plt.subplots(figsize = (20, 12))
sns.barplot(x = 'ROI', y = 'movie', data = df_movie_budget_gross.sort_values(by = 'movie_profit',ascending = False)[:10]
ax.set_xlabel('ROI',fontsize=28)
ax.set_ylabel('Movie Name',fontsize=28)
ax.tick_params(axis='x',labelsize=18)
ax.tick_params(axis='y',labelsize=18)
plt.savefig('6')
```



Which month is the best month for movie realease?

In [91]:
```
df_movie_budget_gross.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 5782 entries, 1 to 82
Data columns (total 7 columns):
 #   Column             Non-Null Count  Dtype  
---  ------             --------------  -----  
 0   release_date       5782 non-null   object 
 1   movie              5782 non-null   object 
 2   production_budget  5782 non-null   int64  
 3   domestic_gross     5782 non-null   int64  
 4   worldwide_gross    5782 non-null   int64  
 5   movie_profit       5782 non-null   int64  
 6   ROI                5782 non-null   float64
dtypes: float64(1), int64(4), object(2)
memory usage: 361.4+ KB
```

In [92]:
```
df_movie_budget_gross['release_date']
```

Out[92]:
```
id
1     Dec 18, 2009
2     May 20, 2011
3      Jun 7, 2019
4      May 1, 2015
5     Dec 15, 2017
          ...     
78    Dec 31, 2018
79     Apr 2, 1999
80    Jul 13, 2005
81    Sep 29, 2015
82     Aug 5, 2005
Name: release_date, Length: 5782, dtype: object
```

In [93]:
```
df_movie_budget_gross['release_date_1']= pd.to_datetime(df_movie_budget_gross['release_date'])
```

In [94]:
```
df_movie_budget_gross.head()
```

Out[94]:

	release_date	movie	production_budget	domestic_gross	worldwide_gross	movie_profit	ROI	release_date_1
id								
1	Dec 18, 2009	Avatar	425000000	760507625	2776345279	2351345279	5.532577	2009-12-18
2	May 20, 2011	Pirates of the Caribbean: On Stranger Tides	410600000	241063875	1045663875	635063875	1.546673	2011-05-20
3	Jun 7, 2019	Dark Phoenix	350000000	42762350	149762350	-200237650	-0.572108	2019-06-07
4	May 1, 2015	Avengers: Age of Ultron	330600000	459005868	1403013963	1072413963	3.243841	2015-05-01
5	Dec 15, 2017	Star Wars Ep. VIII: The Last Jedi	317000000	620181382	1316721747	999721747	3.153696	2017-12-15

In [95]:
```
df1 = df_movie_budget_gross.groupby(df_movie_budget_gross['release_date_1'].apply(lambda x: x.month))
```

In [99]:
```
df_month_movie_count = df1.count()
```

In [100]:
```
df_month_movie_count['month'] = ['Jan.','Feb.','Mar.','Apr.','May','Jun.','Jul.','Aug.','Sep.','Oct.','Nov.','Dec.']
```

In [101]:
```
df_month_movie_count
```

Out[101]:

	release_date	movie	production_budget	domestic_gross	worldwide_gross	movie_profit	ROI	release_date_1	month
release_date_1									
1	347	347	347	347	347	347	347	347	Jan.
2	392	392	392	392	392	392	392	392	Feb.
3	470	470	470	470	470	470	470	470	Mar.
4	454	454	454	454	454	454	454	454	Apr.
5	407	407	407	407	407	407	407	407	May
6	479	479	479	479	479	479	479	479	Jun.
7	440	440	440	440	440	440	440	440	Jul.
8	496	496	496	496	496	496	496	496	Aug.
9	493	493	493	493	493	493	493	493	Sep.
10	573	573	573	573	573	573	573	573	Oct.
11	486	486	486	486	486	486	486	486	Nov.
12	745	745	745	745	745	745	745	745	Dec.

In [103]:
```
df_month_movie_worldwide_gross = df1.sum()
```

In [104]:
```
df_month_movie_worldwide_gross['month'] = ['Jan.','Feb.','Mar.','Apr.','May','Jun.','Jul.','Aug.','Sep.','Oct.','Nov.','
```

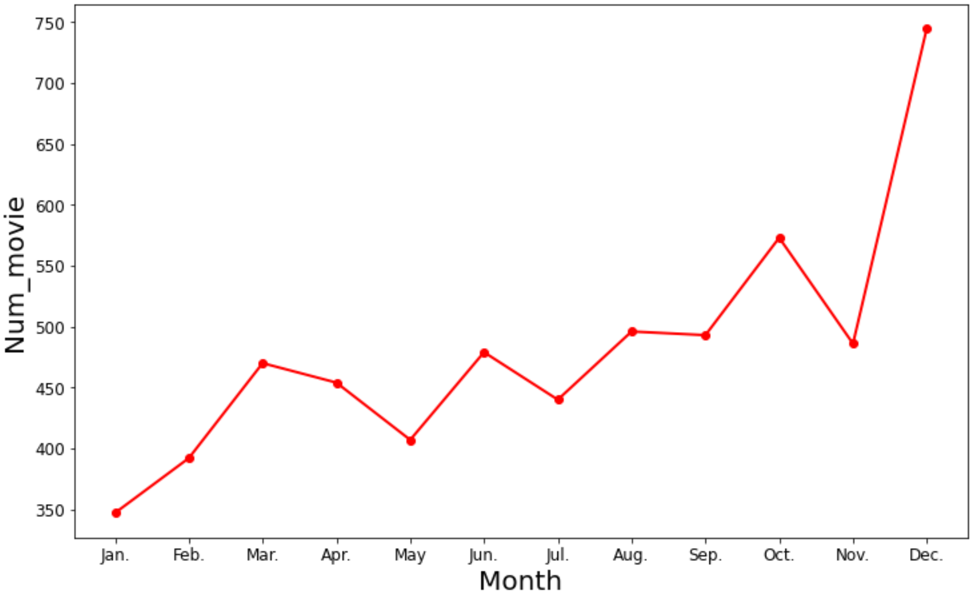
In [105]:
```
df_month_movie_worldwide_gross
```

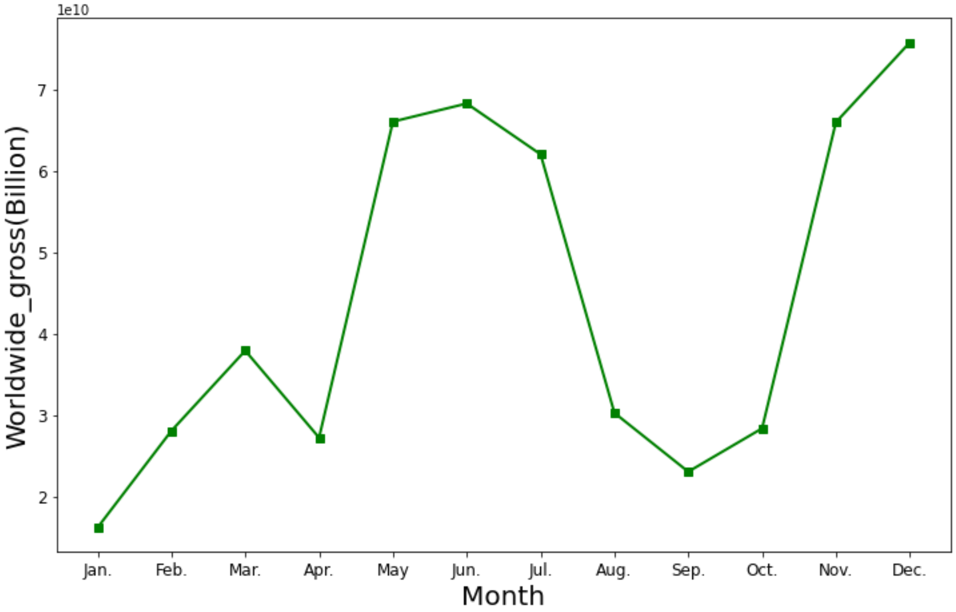
Out[105]:

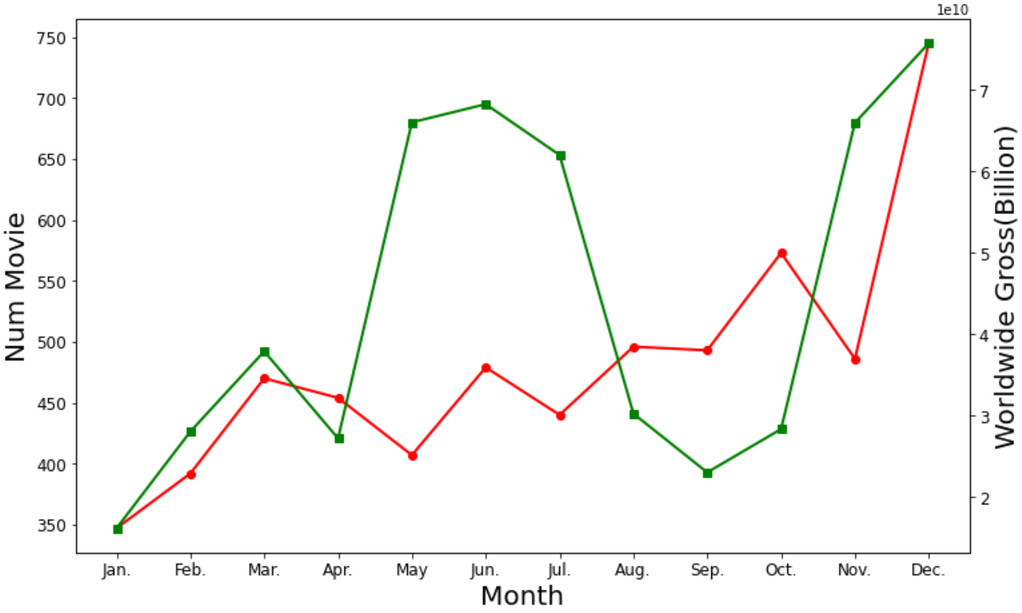
	production_budget	domestic_gross	worldwide_gross	movie_profit	ROI	month
release_date_1						
1	7232691000	8310517342	16157646936	8924955936	1110.048184	Jan.
2	10994196247	13882543926	28045454121	17051257874	1390.742258	Feb.
3	14467577021	18129303397	37897684431	23430107410	1621.333791	Mar.
4	10806485000	12407092932	27203797390	16397312390	1260.633824	Apr.
5	19184024596	27146065077	66043077615	46859053019	1770.868905	May
6	20644478311	31531570976	68268531657	47624053346	3300.173244	Jun.
7	18720308775	26720337439	62023990453	43303681678	2217.649812	Jul.
8	12675822719	15955429870	30245291880	17569469161	2172.666499	Aug.
9	10753760847	11412894262	23019987786	12266226939	1392.483419	Sep.
10	11684993000	13994662807	28343193867	16658200867	2343.080249	Oct.
11	20703628016	28276049992	65970430672	45266802656	1702.727848	Nov.
12	24772446000	34345107925	75761412153	50988966153	1690.124983	Dec.

In [106]:

```
fig = plt.figure(figsize=(12,25))
ax = fig.add_subplot(311)
ax2 = fig.add_subplot(312)
ax3 = fig.add_subplot(313)
ax4 = ax3.twinx()
ax.plot(df_month_movie_count.month, df_month_movie_count.movie, color = 'red', linewidth = 2, marker = 'o')
ax.set_xlabel('Month',fontsize=20)
ax.set_ylabel('Num_movie',fontsize=20)
ax.tick_params(axis='x',labelsize=12)
ax.tick_params(axis='y',labelsize=12)
ax2.plot(df_month_movie_worldwide_gross.month,df_month_movie_worldwide_gross.worldwide_gross, color = 'green', linewidth
ax2.set_xlabel('Month',fontsize=20)
ax2.set_ylabel('Worldwide_gross(Billion)',fontsize=20)
ax2.tick_params(axis='x',labelsize=12)
ax2.tick_params(axis='y',labelsize=12)
ax3.plot(df_month_movie_count.month, df_month_movie_count.movie, color = 'red', linewidth = 2, marker = 'o')
ax4.plot(df_month_movie_worldwide_gross.month,df_month_movie_worldwide_gross.worldwide_gross, color = 'green', linewidth
ax3.set_ylabel('Num Movie', fontsize = 20)
ax4.set_ylabel('Worldwide Gross(Billion)', fontsize = 20)
ax3.set_xlabel('Month',fontsize = 20)
ax3.tick_params(axis='x', labelsize=12)
ax3.tick_params(axis='y',labelsize=12)
ax4.tick_params(axis='y',labelsize=12)
```


Num_movie
750
700
650
600
550
500
450
400
350
Jan.
Feb.
Mar.
Apr.
May
Jun.
Jul.
Aug.
Sep.
Oct.
Nov.
Dec.
Month


1e10
Worldwide_gross(Billion)
7
6
5
4
3
2
Jan.
Feb.
Mar.
Apr.
May
Jun.
Jul.
Aug.
Sep.
Oct.
Nov.
Dec.
Month


Num Movie
750
700
650
600
550
500
450
400
350
1e10
Worldwide Gross(Billion)
7
6
5
4
3
2
Jan.
Feb.
Mar.
Apr.
May
Jun.
Jul.
Aug.
Sep.
Oct.
Nov.
Dec.
Month

Question 4:What is the relationship between top 10 most profitable movies and audience ratings scores?

In [107]:
```
#pick the top 10 most pofitable movies
df_movie_b_g_positive = df_movie_budget_gross.sort_values(by = 'movie_profit', ascending = False)
```

In [108]:
```
df_movie_b_g_positive_1 = df_movie_b_g_positive[0:10]
```

In [109]:
```
#data cleaning. drop the columns that I dont need
df_movie_b_g_positive_2 = df_movie_b_g_positive_1.drop(columns = ['release_date','production_budget','domestic_gross','
```

In [110]:
```
#reset index
df_movie_b_g_positive_3 = df_movie_b_g_positive_2.reset_index(drop = True)
```

In [111]:
```
df_movie_b_g_positive_3
```

Out[111]:

	movie	movie_profit	ROI	release_date_1
0	Avatar	2351345279	5.532577	2009-12-18
1	Titanic	2008208395	10.041042	1997-12-19
2	Avengers: Infinity War	1748134200	5.827114	2018-04-27
3	Star Wars Ep. VII: The Force Awakens	1747311220	5.710167	2015-12-18
4	Jurassic World	1433854864	6.669092	2015-06-12
5	Furious 7	1328722794	6.993278	2015-04-03
6	The Avengers	1292935897	5.746382	2012-05-04
7	Harry Potter and the Deathly Hallows: Part II	1216693157	9.733545	2011-07-15
8	Black Panther	1148258224	5.741291	2018-02-16
9	Jurassic World: Fallen Kingdom	1135772799	6.681016	2018-06-22

In [112]:
```
df_p_r = csv_files_dict['tmdb_movies_gz']
```

In [113]:
```
df_p_r.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 26517 entries, 0 to 26516
Data columns (total 9 columns):
 #   Column             Non-Null Count  Dtype  
---  ------             --------------  -----  
 0   genre_ids          26517 non-null  object 
 1   id                 26517 non-null  int64  
 2   original_language  26517 non-null  object 
 3   original_title     26517 non-null  object 
 4   popularity         26517 non-null  float64
 5   release_date       26517 non-null  object 
 6   title              26517 non-null  object 
 7   vote_average       26517 non-null  float64
 8   vote_count         26517 non-null  int64  
dtypes: float64(2), int64(2), object(5)
memory usage: 2.0+ MB
```

In [114]:
```
df_p_r_1 = df_p_r.drop(columns = ['id','original_language','original_title','release_date'])
```

In [115]:
```
df_p_r_1.head()
```

Out[115]:

	genre_ids	popularity	title	vote_average	vote_count
0	[12, 14, 10751]	33.533	Harry Potter and the Deathly Hallows: Part 1	7.7	10788
1	[14, 12, 16, 10751]	28.734	How to Train Your Dragon	7.7	7610
2	[12, 28, 878]	28.515	Iron Man 2	6.8	12368
3	[16, 35, 10751]	28.005	Toy Story	7.9	10174
4	[28, 878, 12]	27.920	Inception	8.3	22186

In [116]:
```
df_p_r_2 = df_p_r_1.set_index('title')
```

In [117]:
```
df_p_r_2.head()
```

Out[117]:

title	genre_ids	popularity	vote_average	vote_count
Harry Potter and the Deathly Hallows: Part 1	[12, 14, 10751]	33.533	7.7	10788
How to Train Your Dragon	[14, 12, 16, 10751]	28.734	7.7	7610
Iron Man 2	[12, 28, 878]	28.515	6.8	12368
Toy Story	[16, 35, 10751]	28.005	7.9	10174
Inception	[28, 878, 12]	27.920	8.3	22186

In [118]:
```
df_movie_b_g_positive_4 = df_movie_b_g_positive_3.set_index('movie')
```

In [119]:
```
df_movie_b_g_positive_4
```

Out[119]:

movie	movie_profit	ROI	release_date_1
Avatar	2351345279	5.532577	2009-12-18
Titanic	2008208395	10.041042	1997-12-19
Avengers: Infinity War	1748134200	5.827114	2018-04-27
Star Wars Ep. VII: The Force Awakens	1747311220	5.710167	2015-12-18
Jurassic World	1433854864	6.669092	2015-06-12
Furious 7	1328722794	6.993278	2015-04-03
The Avengers	1292935897	5.746382	2012-05-04
Harry Potter and the Deathly Hallows: Part II	1216693157	9.733545	2011-07-15
Black Panther	1148258224	5.741291	2018-02-16
Jurassic World: Fallen Kingdom	1135772799	6.681016	2018-06-22

In [120]:
```
#right join two dataframes
df_p_r_3 = df_p_r_2.join(df_movie_b_g_positive_4,how = 'right')
```

In [121]:
```
df_p_r_4 = df_p_r_3.sort_values(by = 'movie_profit' , ascending = False)
```

In [122]:
```
df_p_r_5 = df_p_r_4.drop(columns = ['vote_count'])
```

In [123]:
```
df_p_r_5
```

Out[123]:

	genre_ids	popularity	vote_average	movie_profit	ROI	release_date_1
Avatar	[28, 12, 14, 878]	26.526	7.4	2351345279	5.532577	2009-12-18
Titanic	NaN	NaN	NaN	2008208395	10.041042	1997-12-19
Avengers: Infinity War	[12, 28, 14]	80.773	8.3	1748134200	5.827114	2018-04-27
Star Wars Ep. VII: The Force Awakens	NaN	NaN	NaN	1747311220	5.710167	2015-12-18
Jurassic World	[28, 12, 878, 53]	20.709	6.6	1433854864	6.669092	2015-06-12
Furious 7	[28, 80, 53]	20.396	7.3	1328722794	6.993278	2015-04-03
The Avengers	[878, 28, 12]	50.289	7.6	1292935897	5.746382	2012-05-04
Harry Potter and the Deathly Hallows: Part II	NaN	NaN	NaN	1216693157	9.733545	2011-07-15
Black Panther	[28, 16]	2.058	5.1	1148258224	5.741291	2018-02-16
Black Panther	[28, 12, 14, 878]	44.140	7.4	1148258224	5.741291	2018-02-16
Jurassic World: Fallen Kingdom	[28, 12, 878]	34.958	6.5	1135772799	6.681016	2018-06-22

In [124]:
```
df_p_r_5.index = ['Avatar', 'Titanic', 'Avengers: Infinity War',
         'Star Wars Ep. VII: The Force Awakens', 'Jurassic World', 'Furious 7',
         'The Avengers', 'Harry Potter and the Deathly Hallows: Part II',
         'Black Panther DEL', 'Black Panther', 'Jurassic World: Fallen Kingdom']
```

In [125]:
```
df_p_r_5
```

Out[125]:

	genre_ids	popularity	vote_average	movie_profit	ROI	release_date_1
Avatar	[28, 12, 14, 878]	26.526	7.4	2351345279	5.532577	2009-12-18
Titanic	NaN	NaN	NaN	2008208395	10.041042	1997-12-19
Avengers: Infinity War	[12, 28, 14]	80.773	8.3	1748134200	5.827114	2018-04-27
Star Wars Ep. VII: The Force Awakens	NaN	NaN	NaN	1747311220	5.710167	2015-12-18
Jurassic World	[28, 12, 878, 53]	20.709	6.6	1433854864	6.669092	2015-06-12
Furious 7	[28, 80, 53]	20.396	7.3	1328722794	6.993278	2015-04-03
The Avengers	[878, 28, 12]	50.289	7.6	1292935897	5.746382	2012-05-04
Harry Potter and the Deathly Hallows: Part II	NaN	NaN	NaN	1216693157	9.733545	2011-07-15
Black Panther DEL	[28, 16]	2.058	5.1	1148258224	5.741291	2018-02-16
Black Panther	[28, 12, 14, 878]	44.140	7.4	1148258224	5.741291	2018-02-16
Jurassic World: Fallen Kingdom	[28, 12, 878]	34.958	6.5	1135772799	6.681016	2018-06-22

In [126]:
```
df_p_r_5.drop(columns = 'popularity')
```

Out[126]:

	genre_ids	vote_average	movie_profit	ROI	release_date_1
Avatar	[28, 12, 14, 878]	7.4	2351345279	5.532577	2009-12-18
Titanic	NaN	NaN	2008208395	10.041042	1997-12-19
Avengers: Infinity War	[12, 28, 14]	8.3	1748134200	5.827114	2018-04-27
Star Wars Ep. VII: The Force Awakens	NaN	NaN	1747311220	5.710167	2015-12-18
Jurassic World	[28, 12, 878, 53]	6.6	1433854864	6.669092	2015-06-12
Furious 7	[28, 80, 53]	7.3	1328722794	6.993278	2015-04-03
The Avengers	[878, 28, 12]	7.6	1292935897	5.746382	2012-05-04
Harry Potter and the Deathly Hallows: Part II	NaN	NaN	1216693157	9.733545	2011-07-15
Black Panther DEL	[28, 16]	5.1	1148258224	5.741291	2018-02-16
Black Panther	[28, 12, 14, 878]	7.4	1148258224	5.741291	2018-02-16
Jurassic World: Fallen Kingdom	[28, 12, 878]	6.5	1135772799	6.681016	2018-06-22

In [127]:
```
df_p_r_6 = df_p_r_5.drop(index = 'Black Panther DEL')
```

In [128]:
```
df_p_r_6.vote_average[1] = 7.8
```

```
<ipython-input-128-c4ad8b63e149>:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning
-a-view-versus-a-copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-
a-copy)
  df_p_r_6.vote_average[1] = 7.8
```

In [129]:
```
df_p_r_6.vote_average[3] = 7.9
```

```
<ipython-input-129-0c5e22a5a99c>:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning
-a-view-versus-a-copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-
a-copy)
  df_p_r_6.vote_average[3] = 7.9
```

In [130]:
```
df_p_r_6.vote_average[7] = 8.1
```

```
<ipython-input-130-b7bafee69be5>:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning
-a-view-versus-a-copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-
a-copy)
  df_p_r_6.vote_average[7] = 8.1
```

In [133]:
```
df_p_r_6
```

Out[133]:

	genre_ids	popularity	vote_average	movie_profit	ROI	release_date_1
Avatar	[28, 12, 14, 878]	26.526	7.4	2351345279	5.532577	2009-12-18
Titanic	NaN	NaN	7.8	2008208395	10.041042	1997-12-19
Avengers: Infinity War	[12, 28, 14]	80.773	8.3	1748134200	5.827114	2018-04-27
Star Wars Ep. VII: The Force Awakens	NaN	NaN	7.9	1747311220	5.710167	2015-12-18
Jurassic World	[28, 12, 878, 53]	20.709	6.6	1433854864	6.669092	2015-06-12
Furious 7	[28, 80, 53]	20.396	7.3	1328722794	6.993278	2015-04-03
The Avengers	[878, 28, 12]	50.289	7.6	1292935897	5.746382	2012-05-04
Harry Potter and the Deathly Hallows: Part II	NaN	NaN	8.1	1216693157	9.733545	2011-07-15
Black Panther	[28, 12, 14, 878]	44.140	7.4	1148258224	5.741291	2018-02-16
Jurassic World: Fallen Kingdom	[28, 12, 878]	34.958	6.5	1135772799	6.681016	2018-06-22

In [134]:
```
df_p_r_7 = df_p_r_6.drop(columns = ['popularity','genre_ids'])
```

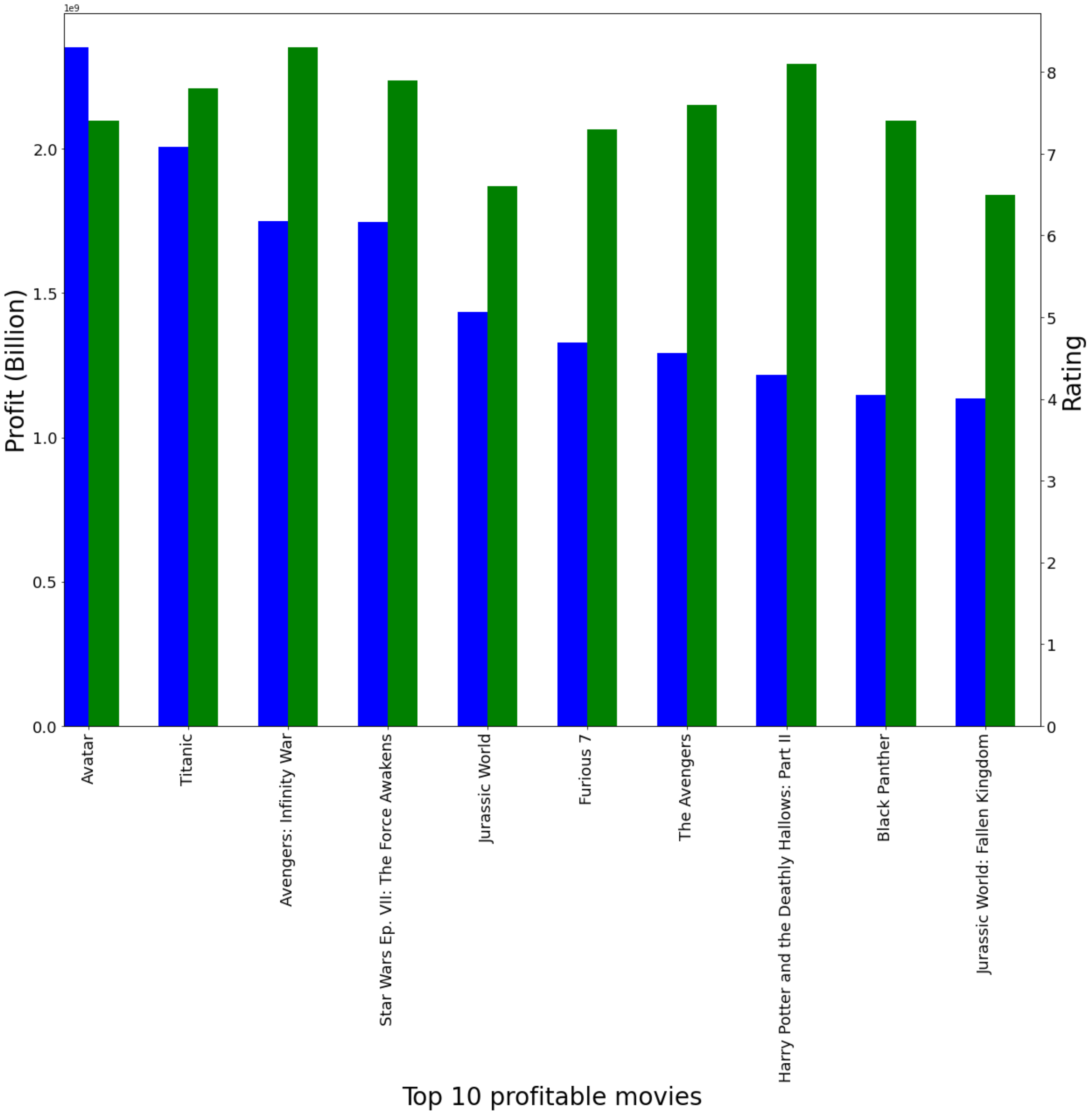
In [135]:
```
df_p_r_7
```

Out[135]:

	vote_average	movie_profit	ROI	release_date_1
Avatar	7.4	2351345279	5.532577	2009-12-18
Titanic	7.8	2008208395	10.041042	1997-12-19
Avengers: Infinity War	8.3	1748134200	5.827114	2018-04-27
Star Wars Ep. VII: The Force Awakens	7.9	1747311220	5.710167	2015-12-18
Jurassic World	6.6	1433854864	6.669092	2015-06-12
Furious 7	7.3	1328722794	6.993278	2015-04-03
The Avengers	7.6	1292935897	5.746382	2012-05-04
Harry Potter and the Deathly Hallows: Part II	8.1	1216693157	9.733545	2011-07-15
Black Panther	7.4	1148258224	5.741291	2018-02-16
Jurassic World: Fallen Kingdom	6.5	1135772799	6.681016	2018-06-22

In [132]:

```
f,ax=plt.subplots(figsize=(20,15))
ax2 = ax.twinx()
width = 0.3
df_p_r_7.movie_profit.plot(kind='bar', color='blue', ax=ax, width=width, position=1)
df_p_r_7.vote_average.plot(kind='bar', color='green', ax=ax2, width=width, position=0)
ax.set_ylabel('Profit (Billion)', fontsize = 28)
ax2.set_ylabel('Rating', fontsize = 28)
ax.set_xlabel('Top 10 profitable movies',fontsize = 28)
ax.tick_params(axis='x',labelsize=18)
ax.tick_params(axis='y',labelsize=18)
ax2.tick_params(axis='y',labelsize=18)
plt.savefig('7')
```


1e9
Profit (Billion)
Rating
Avatar
Titanic
Avengers: Infinity War
Star Wars Ep. VII: The Force Awakens
Jurassic World
Furious 7
The Avengers
Harry Potter and the Deathly Hallows: Part II
Black Panther
Jurassic World: Fallen Kingdom
Top 10 profitable movies