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
```

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
```

In [6]:
```
csv_files_dict = {}
for filename in csv_files:
    filename_cleaned = os.path.basename(filename).replace(".csv", "").replac
    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()
```

```
<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

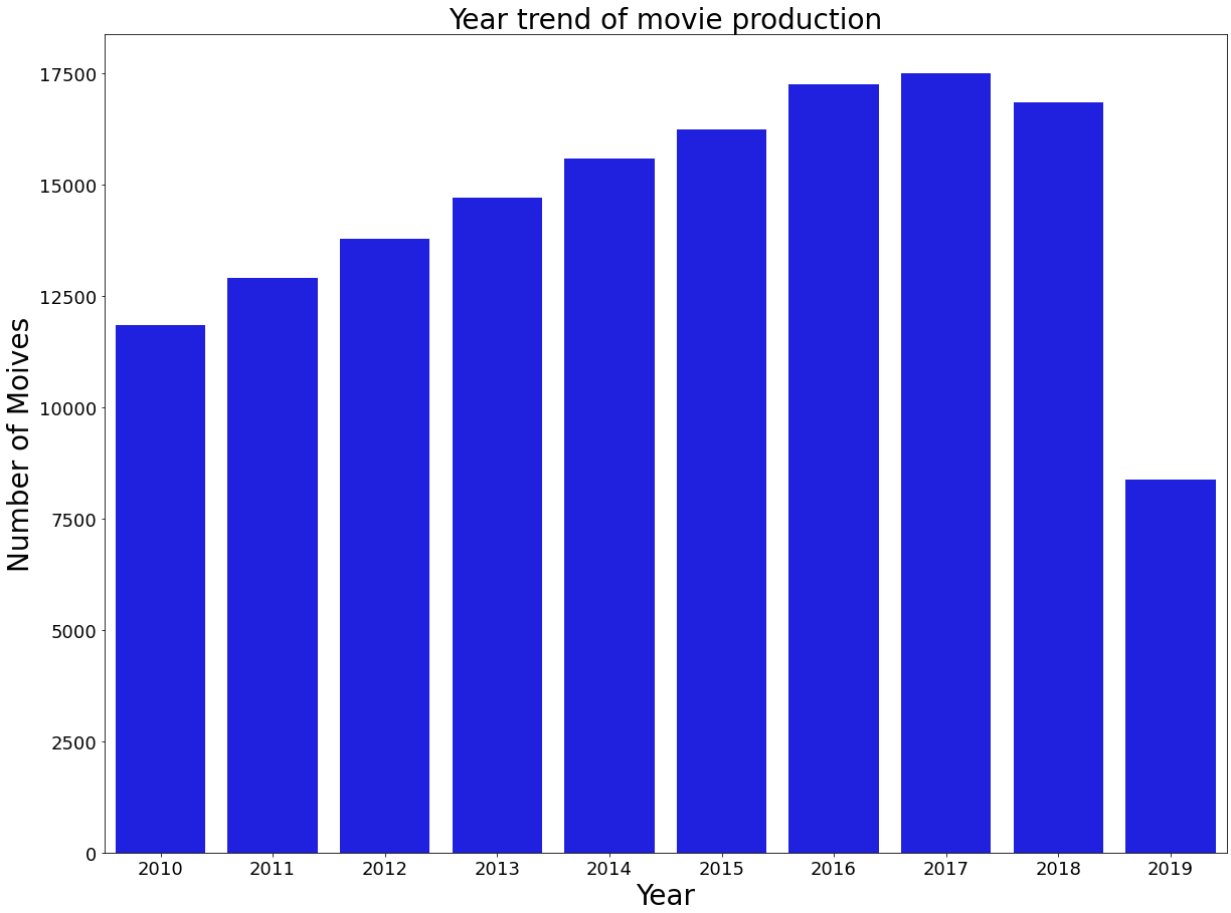
In [12]:
```
#Change column names
df_movies_years.rename(columns = {'start_year': 'Year', 'primary_title': 'nu
```

In [13]:
```
df_movies_years.head(11)
```

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
10	2020	937	936	82	900

In [14]:
```
f, ax= plt.subplots(figsize = (20, 15))
sns.barplot(x = 'Year', y = 'num_movies', data = df_movies_years[0:10], colo
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]:
```
df_studio.isna().sum()/len(df_studio)
```

Out[20]:
```
studio            0.001476
domestic_gross    0.008267
foreign_gross     0.000000
year              0.000000
dtype: float64
```

In [21]:
```
#drop all missing values of stuo and domestic_gross
df_studio_1 = df_studio.dropna()
```

In [22]:
```
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 [23]:
```
df_studio_1['foreign_gross'] = df_studio_1['foreign_gross'].str.replace(","
```

```
<ipython-input-23-b471e8019a8a>: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-do
cs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (http
s://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returni
ng-a-view-versus-a-copy)
  df_studio_1['foreign_gross'] = df_studio_1['foreign_gross'].str.replace
("," , "")
```

In [24]:
```
#change foreign_gross data types from object to float
df_studio_1.foreign_gross = df_studio_1.foreign_gross.astype('float64')
```

```
D:\ANACONDA\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-do
cs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (http
s://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returni
ng-a-view-versus-a-copy)
  self[name] = value
```

In [25]:
```
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 [26]:
```
df_studio_1['foreign_gross'] = df_studio_1['foreign_gross'].fillna(0)
```

```
<ipython-input-26-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-do
cs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (http
s://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returni
ng-a-view-versus-a-copy)
  df_studio_1['foreign_gross'] = df_studio_1['foreign_gross'].fillna(0)
```

In [27]:
```
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 [28]:
```
#creat a new column of total_gross by adding doemstic_gross and foreign_gros
df_studio_1['Total_gross'] = df_studio_1['domestic_gross'] + df_studio_1['fo
```

```
<ipython-input-28-9be4cac17c88>: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-do
cs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (http
s://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returni
ng-a-view-versus-a-copy)
  df_studio_1['Total_gross'] = df_studio_1['domestic_gross'] + df_studio_
1['foreign_gross']
```

In [29]:
```
df_studio_1.head()
```

Out[29]:

title	studio	domestic_gross	foreign_gross	year	Total_gross
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 [30]:
```
# group by studios and sum all the data for each studio
df_studio_2 = df_studio_1.groupby(['studio']).sum().sort_values(by = 'Total_
```

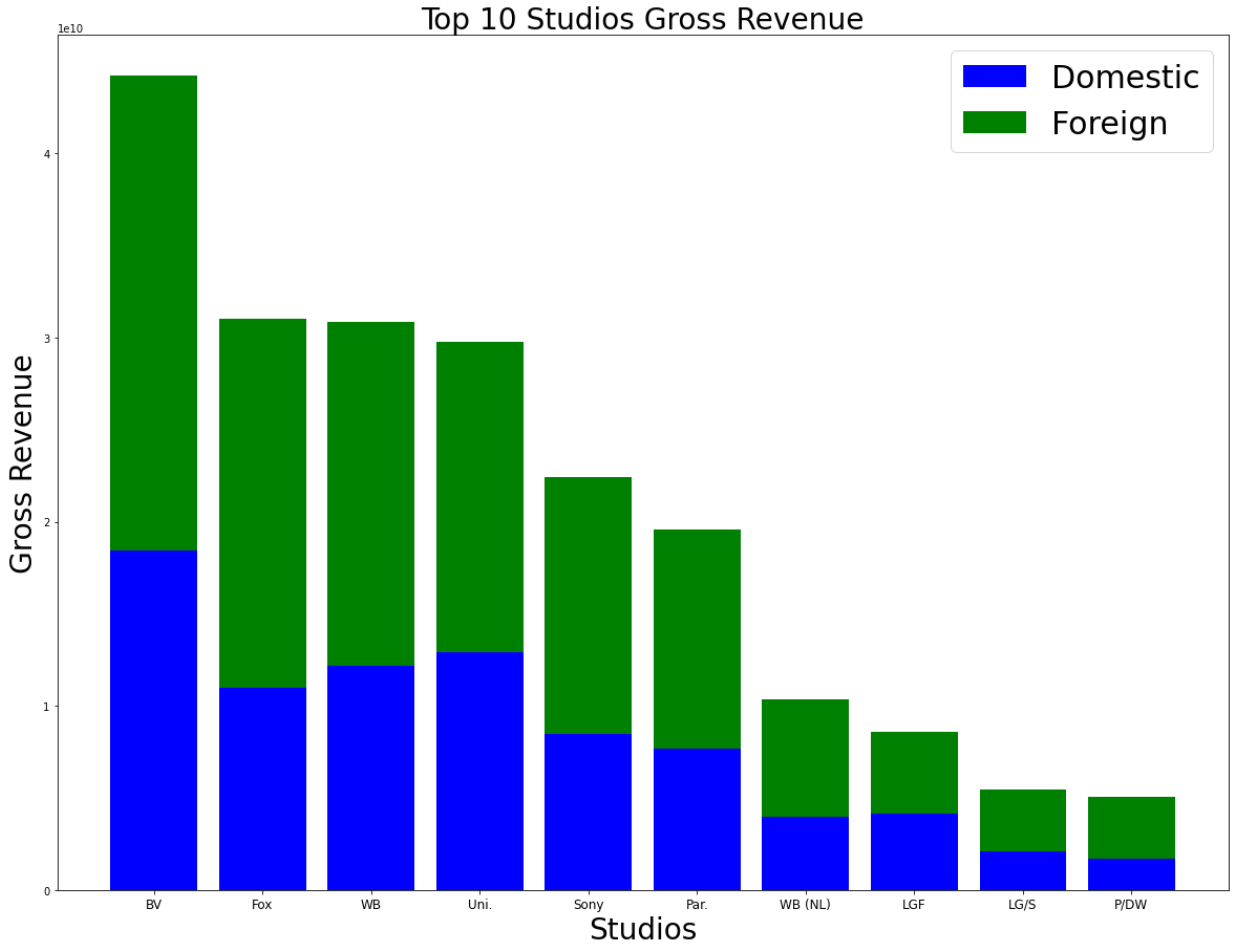
In [31]:
```
# data cleaning, drop the column that I dont need
df_studio_3 = df_studio_2[0:10].drop(columns = ['year'])
```

In [32]:
```
#final dataframe, be ready to plot the graph
df_studio_3
```

Out[32]:

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 [33]:
```
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', bottor
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 [34]:
```
df_basics.head()
```

Out[34]:

tconst	primary_title	original_title	start_year	runtime_minutes	genres
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 [35]:
```
# reset index
df_basics_1 = df_basics.reset_index()
```

In [36]:
```
#drop columns which I dont need
data_clean_1 = df_basics_1 .drop(columns = ['runtime_minutes','original_titl
```

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

Out[37]:

	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 [38]:
```
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 [39]:
```
data_clean_1.isna().sum()/len(data_clean_1)
```

Out[39]:
```
tconst           0.000000
primary_title    0.000000
start_year       0.000000
genres           0.037005
dtype: float64
```

In [40]:
```
#Since the missing data of genres is only 3.7% of entire dataset, dropping i
data_clean_2 = data_clean_1.dropna()
```

In [41]:
```
data_clean_2.isna().sum()
```

Out[41]:
```
tconst           0
primary_title    0
start_year       0
genres           0
dtype: int64
```

In [42]:
```
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 [43]:
```
#another dropping column that I dont need
data_clean_3 = data_clean_2.drop(columns = 'tconst')
```

In [44]:
```
#get movie genres column and do data cleaning
movie_genres = data_clean_3['genres']
```

In [45]:
```
movie_genres.head()
```

Out[45]:
```
0      Action,Crime,Drama
1         Biography,Drama
2                   Drama
3            Comedy,Drama
4    Comedy,Drama,Fantasy
Name: genres, dtype: object
```

In [46]:
```
# Change Series to list
genres_list = [i for i in movie_genres]
```

In [47]:
```
# split ',' for each item in the list
genres_list = [i.split(sep = ',') for i in movie_genres]
```

In [48]:
```
# creat a new list
genres_list_1 = []
for i in genres_list:
    for j in i:
        genres_list_1.append(j)
```

In [49]:
```
#get unique data and change list to array
genres_list_unique = np.unique(genres_list_1)
```

In [50]:
```
genres_list_unique
```

Out[50]:
```
array(['Action', 'Adult', 'Adventure', 'Animation', 'Biography', 'Comed
y',
       '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 [51]:
```
# creat a new 0*0 dataframe. Columns are different genres, index is the  mov
genre_zero = pd.DataFrame(np.zeros((data_clean_3.shape[0], genres_list_uniqu
                          , index=data_clean_3["primary_title"])
```

In [52]:
```
genre_zero
```

Out[52]:

	Action	Adult	Adventure	Animation	Biography	Comedy	Crime	Do
primary_title								
Sunghursh	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	
The Other Side of the Wind	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	
The Wandering Soap Opera	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	
Kuambil Lagi Hatiku	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	
Dankyavar Danka	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	

140736 rows × 27 columns

In [53]:
```
# Iterating over every item in genres_list and fill values in to column.
# if the movie belongs to that genre it 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
```

Out[53]:

	Action	Adult	Adventure	Animation	Biography	Comedy	Crime	Do
primary_title								
Sunghursh	1.0	0.0	0.0	0.0	0.0	0.0	1.0	
One Day Before the Rainy Season	0.0	0.0	0.0	0.0	1.0	0.0	0.0	
The Other Side of the Wind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Sabse Bada Sukh	0.0	0.0	0.0	0.0	0.0	1.0	0.0	
The Wandering Soap Opera	0.0	0.0	0.0	0.0	0.0	1.0	0.0	
...	...	...	...	...	...	...	...	
The Secret of China	0.0	0.0	1.0	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	
Rodolpho Teóphilo - O Legado de um Pioneiro	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	
Chico Albuquerque - Revelações	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

140736 rows × 27 columns

In [54]:
```
genre_zero.sum().sort_values(ascending = False)
```

Out[54]:
```
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 [55]:
```
# creat a new datafrome only including moive genres and the sum numbers for
a = list(genre_zero.sum().keys())
```

In [56]:
```
b = list(genre_zero.sum().values)
```

In [57]:
```
d = {'Movie': a, 'Number': b}
```

In [58]:
```
aaa = pd.DataFrame(data = d)
```

In [59]:
```
aaa_1 = aaa.set_index('Movie')
```

In [60]:
```
aaa_2 = aaa_1.sort_values(by = 'Number',ascending = False)
```

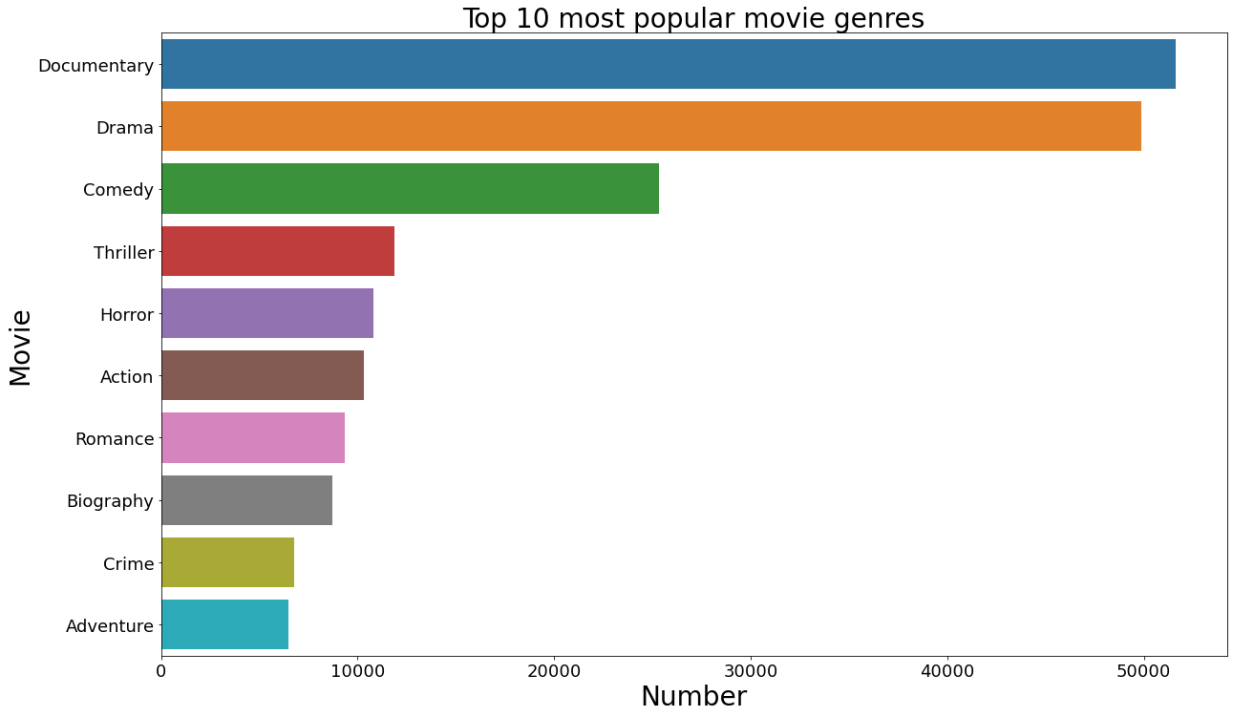
In [61]:
```
aaa_3 = aaa_2.reset_index()
```

In [62]:
```
aaa_3.head(10)
```

Out[62]:

	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 [63]:
```
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 [64]:
```
genre_top_10 = genre_zero.drop(columns=['Adult', 'Animation', 'Family', 'Far
```

In [65]:
```
genre_top_10
```

Out[65]:

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

140736 rows × 10 columns

In [66]:
```
data_clean_4 = data_clean_3.drop(columns = 'genres')
```

In [67]:
```
data_clean_4.head()
```

Out[67]:

	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 [68]:
```
data_clean_5 = data_clean_4.set_index('primary_title')
```

In [69]:
```
data_clean_5
```

Out[69]:

	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 [70]:
```
#merge datafrmes
genres_counts_year = pd.concat([genre_top_10,data_clean_5],axis=1)
```

In [71]:
```
genres_counts_year
```

Out[71]:

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

140736 rows × 11 columns

In [72]:
```
genres_counts_year_1 = genres_counts_year.groupby('start_year').sum()
```

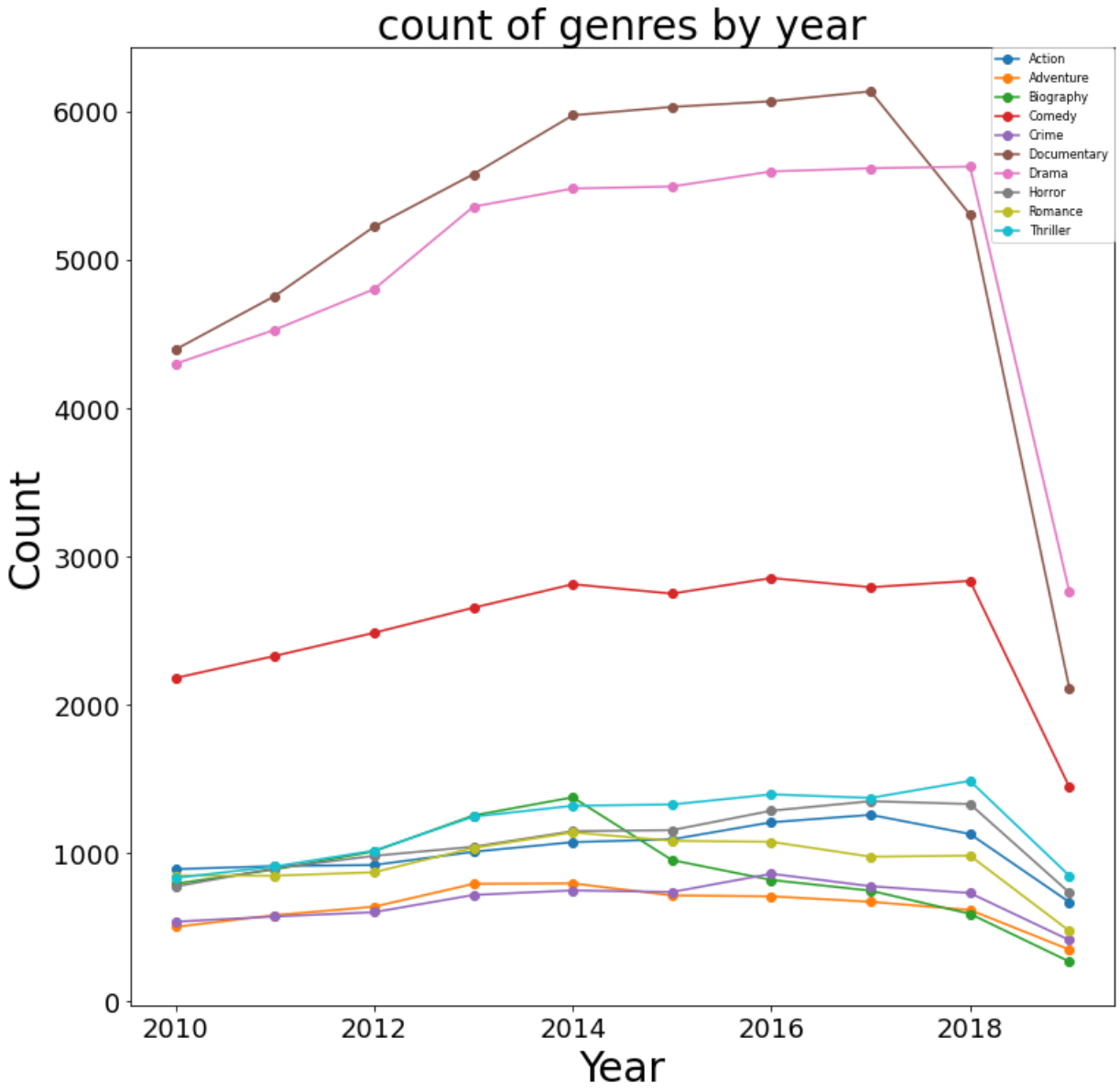
In [73]:
```
genres_counts_year_1
```

Out[73]:

start_year	Action	Adventure	Biography	Comedy	Crime	Documentary	Drama
2010	891.0	502.0	793.0	2179.0	537.0	4393.0	4297.0
2011	912.0	581.0	889.0	2328.0	572.0	4754.0	4526.0
2012	919.0	638.0	1011.0	2484.0	601.0	5221.0	4800.0
2013	1008.0	792.0	1253.0	2653.0	717.0	5575.0	5356.0
2014	1073.0	795.0	1375.0	2811.0	748.0	5972.0	5478.0
2015	1092.0	714.0	952.0	2748.0	737.0	6028.0	5492.0
2016	1207.0	708.0	818.0	2853.0	860.0	6066.0	5593.0
2017	1257.0	671.0	746.0	2791.0	776.0	6133.0	5615.0
2018	1128.0	616.0	590.0	2834.0	730.0	5302.0	5626.0
2019	669.0	349.0	268.0	1446.0	413.0	2112.0	2762.0
2020	137.0	70.0	24.0	165.0	54.0	79.0	309.0
2021	28.0	21.0	3.0	17.0	6.0	3.0	22.0
2022	10.0	3.0	0.0	3.0	2.0	2.0	4.0
2023	2.0	2.0	0.0	0.0	0.0	0.0	2.0
2024	0.0	1.0	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
2026	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
2115	0.0	0.0	0.0	0.0	0.0	0.0	1.0

In [74]:
```
f,ax=plt.subplots(figsize=(12,12))
genres_counts_year_1[0:10].plot(ax=ax,fontsize=14,marker = 'o')
ax.set_xlabel('Year',fontsize=28)
ax.set_ylabel('Count',fontsize=28)
ax.legend(ncol=2,fontsize=18)
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 meth

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 [75]:
```
df_movie_budget_gross = csv_files_dict['tn_movie_budgets_gz']
```

In [76]:
```
df_movie_budget_gross .head()
```

Out[76]:

id	release_date	movie	production_budget	domestic_gross	worldwide_gross
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 [77]:
```
def convert_col_to_int(df, col):
    df[col] = df[col].str.replace("$", "").str.replace(",", "").astype('int6
    return df
```

In [78]:
```
df_movie_budget_gross.head()
```

Out[78]:

id	release_date	movie	production_budget	domestic_gross	worldwide_gross
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 [79]:
```
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 [80]:
```
df_movie_budget_gross.head()
```

Out[80]:

id	release_date	movie	production_budget	domestic_gross	worldwide_gross
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 [81]:
```
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 [82]:
```
df_movie_budget_gross['movie_profit'] = df_movie_budget_gross['worldwide_gr
```

In [83]:
```
df_movie_budget_gross['ROI'] = df_movie_budget_gross['movie_profit']/df_movi
```

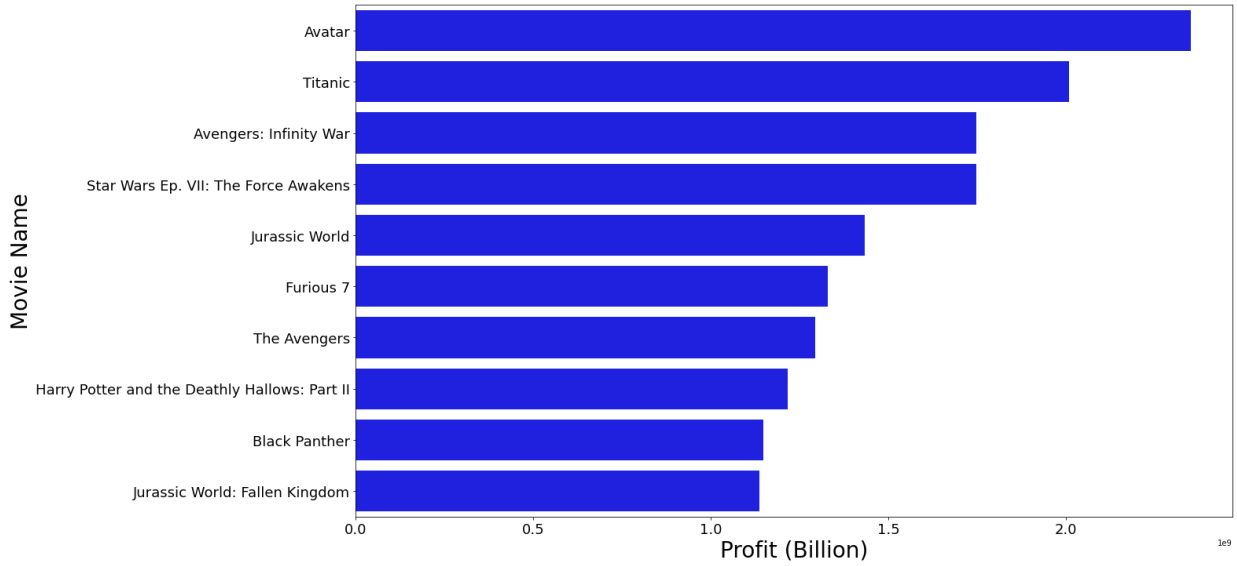
In [84]:
```
df_movie_budget_gross.sort_values(by = 'movie_profit' , ascending = False).h
```

Out[84]:

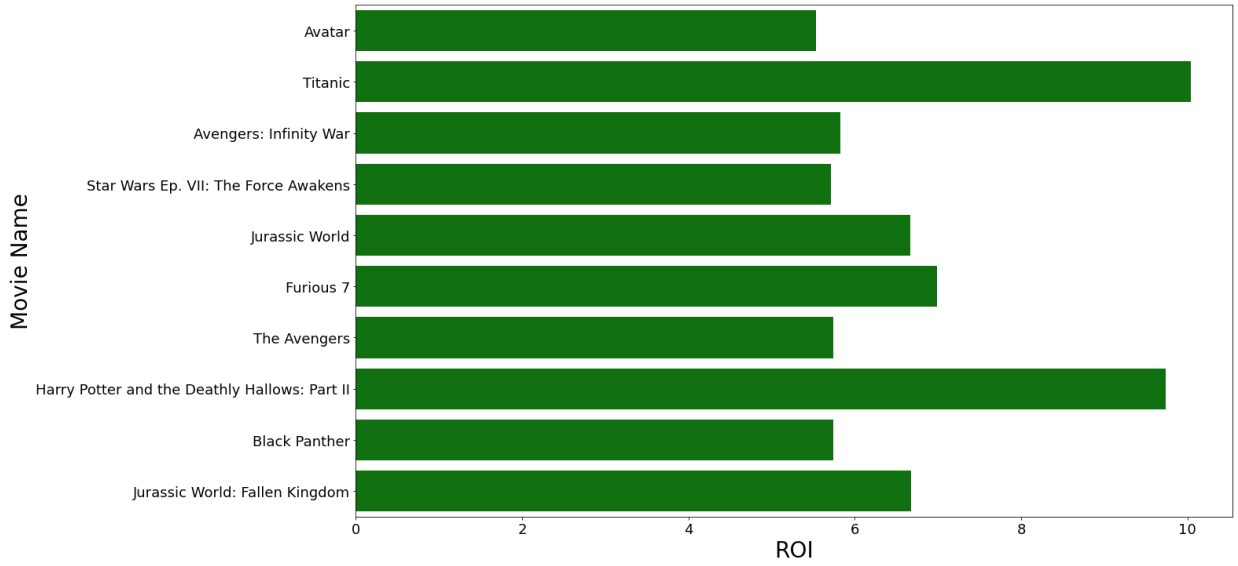
id	release_date	movie	production_budget	domestic_gross	worldwide_gross	movie_
1	Dec 18, 2009	Avatar	425000000	760507625	2776345279	235
43	Dec 19, 1997	Titanic	200000000	659363944	2208208395	200
7	Apr 27, 2018	Avengers: Infinity War	300000000	678815482	2048134200	174
6	Dec 18, 2015	Star Wars Ep. VII: The Force Awakens	306000000	936662225	2053311220	174
34	Jun 12, 2015	Jurassic World	215000000	652270625	1648854864	143
67	Apr 3, 2015	Furious 7	190000000	353007020	1518722794	132
27	May 4, 2012	The Avengers	225000000	623279547	1517935897	129
61	Jul 15, 2011	Harry Potter and the Deathly Hallows: Part II	125000000	381193157	1341693157	121
42	Feb 16, 2018	Black Panther	200000000	700059566	1348258224	114
13	Jun 22, 2018	Jurassic World: Fallen Kingdom	170000000	417719760	1305772799	113

In [85]:

```
f, ax= plt.subplots(figsize = (20, 12))
sns.barplot(x = 'movie_profit', y = 'movie', data = df_movie_budget_gross.sc
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 [86]:
```
f, ax= plt.subplots(figsize = (20, 12))
sns.barplot(x = 'ROI', y = 'movie', data = df_movie_budget_gross.sort_values
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')
```



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

In [87]:
```
#pick the top 10 most pofitable movies
df_movie_b_g_positive = df_movie_budget_gross.sort_values(by = 'movie_profit
```

In [88]:
```
df_movie_b_g_positive_1 = df_movie_b_g_positive[0:10]
```

In [89]:
```
#data cleaning. drop the columns that I dont need
df_movie_b_g_positive_2 = df_movie_b_g_positive_1.drop(columns = ['release_
```

In [117]:
```
#reset index
df_movie_b_g_positive_3 = df_movie_b_g_positive_2.reset_index(drop = True)
```

In [91]:
```
df_movie_b_g_positive_3
```

Out[91]:

	movie	movie_profit	ROI
0	Avatar	2351345279	5.532577
1	Titanic	2008208395	10.041042
2	Avengers: Infinity War	1748134200	5.827114
3	Star Wars Ep. VII: The Force Awakens	1747311220	5.710167
4	Jurassic World	1433854864	6.669092
5	Furious 7	1328722794	6.993278
6	The Avengers	1292935897	5.746382
7	Harry Potter and the Deathly Hallows: Part II	1216693157	9.733545
8	Black Panther	1148258224	5.741291
9	Jurassic World: Fallen Kingdom	1135772799	6.681016

In [92]:
```
df_p_r = csv_files_dict['tmdb_movies_gz']
```

In [93]:
```
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 [94]:
```
df_p_r_1 = df_p_r.drop(columns = ['id','original_language','original_title',
```

In [95]:
```
df_p_r_1.head()
```

Out[95]:

	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 [96]:
```
df_p_r_2 = df_p_r_1.set_index('title')
```

In [97]:
```
df_p_r_2.head()
```

Out[97]:

	genre_ids	popularity	vote_average	vote_count
title				
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 [98]:
```
df_movie_b_g_positive_4 = df_movie_b_g_positive_3.set_index('movie')
```

In [99]:
```
df_movie_b_g_positive_4
```

movie		
Avatar	2351345279	5.532577
Titanic	2008208395	10.041042
Avengers: Infinity War	1748134200	5.827114
Star Wars Ep. VII: The Force Awakens	1747311220	5.710167
Jurassic World	1433854864	6.669092
Furious 7	1328722794	6.993278
The Avengers	1292935897	5.746382
Harry Potter and the Deathly Hallows: Part II	1216693157	9.733545
Black Panther	1148258224	5.741291
Jurassic World: Fallen Kingdom	1135772799	6.681016

In [100]:
```
#right join two dataframes
df_p_r_3 = df_p_r_2.join(df_movie_b_g_positive_4,how = 'right')
```

In [101]:
```
df_p_r_4 = df_p_r_3.sort_values(by = 'movie_profit' , ascending = False)
```

In [102]:
```
df_p_r_5 = df_p_r_4.drop(columns = ['vote_count'])
```

In [103]:
```
df_p_r_5
```

Out[103]:

	genre_ids	popularity	vote_average	movie_profit	ROI
Avatar	[28, 12, 14, 878]	26.526	7.4	2351345279	5.532577
Titanic	NaN	NaN	NaN	2008208395	10.041042
Avengers: Infinity War	[12, 28, 14]	80.773	8.3	1748134200	5.827114
Star Wars Ep. VII: The Force Awakens	NaN	NaN	NaN	1747311220	5.710167
Jurassic World	[28, 12, 878, 53]	20.709	6.6	1433854864	6.669092
Furious 7	[28, 80, 53]	20.396	7.3	1328722794	6.993278
The Avengers	[878, 28, 12]	50.289	7.6	1292935897	5.746382
Harry Potter and the Deathly Hallows: Part II	NaN	NaN	NaN	1216693157	9.733545

In [104]:
```
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 Kingdor
```

In [105]:
```
df_p_r_5
```

Out[105]:

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

In [118]:
```
df_p_r_5.drop(columns = 'popularity')
```

Out[118]:

	genre_ids	vote_average	movie_profit	ROI
Avatar	[28, 12, 14, 878]	7.4	2351345279	5.532577
Titanic	NaN	NaN	2008208395	10.041042
Avengers: Infinity War	[12, 28, 14]	8.3	1748134200	5.827114
Star Wars Ep. VII: The Force Awakens	NaN	NaN	1747311220	5.710167
Jurassic World	[28, 12, 878, 53]	6.6	1433854864	6.669092
Furious 7	[28, 80, 53]	7.3	1328722794	6.993278
The Avengers	[878, 28, 12]	7.6	1292935897	5.746382
Harry Potter and the Deathly Hallows: Part II	NaN	NaN	1216693157	9.733545
Black Panther DEL	[28, 16]	5.1	1148258224	5.741291
Black Panther	[28, 12, 14, 878]	7.4	1148258224	5.741291
Jurassic World: Fallen Kingdom	[28, 12, 878]	6.5	1135772799	6.681016

In [119]:
```
df_p_r_6 = df_p_r_5.drop(index = 'Black Panther DEL')
```

In [120]:
```
#fill the missing values
df_p_r_6.genre_ids[1] ='[28,12]'
```

```
<ipython-input-120-28f5658b1b87>:2: 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.genre_ids[1] ='[28,12]'
```

In [121]:
```
df_p_r_6.vote_average[1] = 7.8
```

```
<ipython-input-121-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 [122]:
```
df_p_r_6.vote_average[3] = 7.9
```

```
<ipython-input-122-0c5e22a5a99c>: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-do
cs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (http
s://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returni
ng-a-view-versus-a-copy)
  df_p_r_6.vote_average[3] = 7.9
```

In [123]:
```
df_p_r_6.vote_average[7] = 8.1
```

```
<ipython-input-123-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-do
cs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (http
s://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returni
ng-a-view-versus-a-copy)
  df_p_r_6.vote_average[7] = 8.1
```

In [124]:
```
df_p_r_6.genre_ids[7] = '[14,12,10751]'
```

```
<ipython-input-124-cf4b2dbb64b9>: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-do
cs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (http
s://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returni
ng-a-view-versus-a-copy)
  df_p_r_6.genre_ids[7] = '[14,12,10751]'
```

In [125]:
```
df_p_r_6.genre_ids[3] = '[28,12,14]'
```

```
<ipython-input-125-a7d95e4a64f3>: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-do
cs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (http
s://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returni
ng-a-view-versus-a-copy)
  df_p_r_6.genre_ids[3] = '[28,12,14]'
```

In [127]:
```
#df_p_r_7 = df_p_r_6.drop(columns = 'popularity')
```

In [128]:
```
df_p_r_7
```

Out[128]:

	genre_ids	vote_average	movie_profit	ROI
Avatar	[28, 12, 14, 878]	7.4	2351345279	5.532577
Titanic	[28,12]	7.8	2008208395	10.041042
Avengers: Infinity War	[12, 28, 14]	8.3	1748134200	5.827114
Star Wars Ep. VII: The Force Awakens	[28,12,14]	7.9	1747311220	5.710167
Jurassic World	[28, 12, 878, 53]	6.6	1433854864	6.669092
Furious 7	[28, 80, 53]	7.3	1328722794	6.993278
The Avengers	[878, 28, 12]	7.6	1292935897	5.746382
Harry Potter and the Deathly Hallows: Part II	[14,12,10751]	8.1	1216693157	9.733545
Black Panther	[28, 12, 14, 878]	7.4	1148258224	5.741291
Jurassic World: Fallen Kingdom	[28, 12, 878]	6.5	1135772799	6.681016

In [116]:
```
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, pos
df_p_r_7.vote_average.plot(kind='bar', color='green', ax=ax2, width=width, p
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')
```