student

August 22, 2021

0.1 Final Project Submission

Please fill out: * Student name: Huseyin Caglar * Student pace: Part time * Scheduled project review date/time:
* Instructor name: Claude Fried * Blog post URL:

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

0.2 Looking inside Data Frames

[2]:
```
# Loading Data
df_movie_gross=pd.read_csv('zippedData/bom.movie_gross.csv.gz')
df_names=pd.read_csv('zippedData/imdb.name.basics.csv.gz')
df_title_akas=pd.read_csv('zippedData/imdb.title.akas.csv.gz')
df_titles=pd.read_csv('zippedData/imdb.title.basics.csv.gz')
df_crew=pd.read_csv('zippedData/imdb.title.crew.csv.gz')
df_principals=pd.read_csv('zippedData/imdb.title.principals.csv.gz')
df_ratings=pd.read_csv('zippedData/imdb.title.ratings.csv.gz')
df_movie_info=pd.read_csv('zippedData/rt.movie_info.tsv.
 ↪gz',sep='\t',encoding='latin1')
df_reviews=pd.read_csv('zippedData/rt.reviews.tsv.
 ↪gz',sep='\t',encoding='latin1')
df_movies=pd.read_csv('zippedData/tmdb.movies.csv.gz')
df_budgets=pd.read_csv('zippedData/tn.movie_budgets.csv.gz')
```

0.2.1 Movie Gross

[3]:
```
df_movie_gross.head()
```

[3]:
```
                                         title studio  domestic_gross  \
0                                  Toy Story 3     BV     415000000.0
1                   Alice in Wonderland (2010)     BV     334200000.0
2  Harry Potter and the Deathly Hallows Part 1     WB     296000000.0
3                                    Inception     WB     292600000.0
```

```
4                         Shrek Forever After   P/DW     238700000.0

  foreign_gross  year
0     652000000  2010
1     691300000  2010
2     664300000  2010
3     535700000  2010
4     513900000  2010
```

0.2.2 Names

[4]:
```
df_names.head()
```

[4]:
```
      nconst       primary_name  birth_year  death_year  \
0  nm0061671  Mary Ellen Bauder         NaN         NaN
1  nm0061865       Joseph Bauer         NaN         NaN
2  nm0062070         Bruce Baum         NaN         NaN
3  nm0062195       Axel Baumann         NaN         NaN
4  nm0062798        Pete Baxter         NaN         NaN

                                 primary_profession  \
0        miscellaneous,production_manager,producer
1       composer,music_department,sound_department
2                        miscellaneous,actor,writer
3  camera_department,cinematographer,art_department
4  production_designer,art_department,set_decorator

                            known_for_titles
0  tt0837562,tt2398241,tt0844471,tt0118553
1  tt0896534,tt6791238,tt0287072,tt1682940
2  tt1470654,tt0363631,tt0104030,tt0102898
3  tt0114371,tt2004304,tt1618448,tt1224387
4  tt0452644,tt0452692,tt3458030,tt2178256
```

0.2.3 Title Akas

[5]:
```
df_title_akas.head()
```

[5]:
```
    title_id  ordering                                   title region  \
0  tt0369610        10                                      BG
1  tt0369610        11                        Jurashikku warudo     JP
2  tt0369610        12  Jurassic World: O Mundo dos Dinossauros     BR
3  tt0369610        13                  O Mundo dos Dinossauros     BR
4  tt0369610        14                           Jurassic World     FR

  language        types   attributes  is_original_title
0       bg          NaN          NaN                0.0
```

```
1      NaN  imdbDisplay          NaN                0.0
2      NaN  imdbDisplay          NaN                0.0
3      NaN          NaN  short title                0.0
4      NaN  imdbDisplay          NaN                0.0
```

0.2.4 Titles

[6]:
```
df_titles.head()
```

[6]:
```
      tconst                    primary_title              original_title  \
0  tt0063540                        Sunghursh                   Sunghursh
1  tt0066787  One Day Before the Rainy Season             Ashad Ka Ek Din
2  tt0069049       The Other Side of the Wind  The Other Side of the Wind
3  tt0069204                  Sabse Bada Sukh             Sabse Bada Sukh
4  tt0100275         The Wandering Soap Opera       La Telenovela Errante

   start_year  runtime_minutes                genres
0        2013            175.0    Action,Crime,Drama
1        2019            114.0       Biography,Drama
2        2018            122.0                 Drama
3        2018              NaN          Comedy,Drama
4        2017             80.0  Comedy,Drama,Fantasy
```

0.2.5 Crew

[7]:
```
df_crew.head()
```

[7]:
```
      tconst                      directors              writers
0  tt0285252                      nm0899854            nm0899854
1  tt0438973                            NaN  nm0175726,nm1802864
2  tt0462036                      nm1940585            nm1940585
3  tt0835418                      nm0151540  nm0310087,nm0841532
4  tt0878654  nm0089502,nm2291498,nm2292011            nm0284943
```

0.2.6 Principals

[8]:
```
df_principals.head()
```

[8]:
```
      tconst  ordering     nconst  category       job         characters
0  tt0111414         1  nm0246005     actor       NaN        ["The Man"]
1  tt0111414         2  nm0398271  director       NaN                NaN
2  tt0111414         3  nm3739909  producer  producer                NaN
3  tt0323808        10  nm0059247    editor       NaN                NaN
4  tt0323808         1  nm3579312   actress       NaN  ["Beth Boothby"]
```

0.2.7 Ratings

[9]:
```
df_ratings.head()
```

[9]:
```
      tconst  averagerating  numvotes
0  tt10356526            8.3        31
1  tt10384606            8.9       559
2   tt1042974            6.4        20
3   tt1043726            4.2     50352
4   tt1060240            6.5        21
```

0.2.8 Movie Info

[10]:
```
df_movie_info.head()
```

[10]:
```
   id                                           synopsis rating  \
0   1  This gritty, fast-paced, and innovative police…      R
1   3  New York City, not-too-distant-future: Eric Pa…      R
2   5  Illeana Douglas delivers a superb performance …      R
3   6  Michael Douglas runs afoul of a treacherous su…      R
4   7                                                NaN     NR

                                  genre          director  \
0  Action and Adventure|Classics|Drama  William Friedkin
1     Drama|Science Fiction and Fantasy  David Cronenberg
2     Drama|Musical and Performing Arts    Allison Anders
3            Drama|Mystery and Suspense    Barry Levinson
4                         Drama|Romance    Rodney Bennett

                            writer  theater_date      dvd_date currency  \
0                   Ernest Tidyman   Oct 9, 1971  Sep 25, 2001      NaN
1     David Cronenberg|Don DeLillo  Aug 17, 2012   Jan 1, 2013        $
2                   Allison Anders  Sep 13, 1996  Apr 18, 2000      NaN
3  Paul Attanasio|Michael Crichton   Dec 9, 1994  Aug 27, 1997      NaN
4                     Giles Cooper           NaN           NaN      NaN

  box_office      runtime             studio
0        NaN  104 minutes                NaN
1    600,000  108 minutes  Entertainment One
2        NaN  116 minutes                NaN
3        NaN  128 minutes                NaN
4        NaN  200 minutes                NaN
```

0.2.9 Reviews

[11]:
```
df_reviews.head()
```

```
[11]:    id                                             review rating   fresh  \
      0   3  A distinctly gallows take on contemporary fina…    3/5   fresh
      1   3  It's an allegory in search of a meaning that n…    NaN  rotten
      2   3  … life lived in a bubble in financial dealin…    NaN   fresh
      3   3  Continuing along a line introduced in last yea…    NaN   fresh
      4   3             … a perverse twist on neorealism…     NaN   fresh

                 critic  top_critic         publisher               date
      0      PJ Nabarro           0   Patrick Nabarro  November 10, 2018
      1  Annalee Newitz           0           io9.com       May 23, 2018
      2    Sean Axmaker           0  Stream on Demand    January 4, 2018
      3   Daniel Kasman           0              MUBI  November 16, 2017
      4             NaN           0      Cinema Scope   October 12, 2017
```

0.2.10 Movies

```
[12]: df_movies.head()
```

```
[12]:    Unnamed: 0            genre_ids     id original_language  \
      0           0      [12, 14, 10751]  12444                en
      1           1  [14, 12, 16, 10751]  10191                en
      2           2        [12, 28, 878]  10138                en
      3           3      [16, 35, 10751]    862                en
      4           4        [28, 878, 12]  27205                en

                                     original_title  popularity release_date  \
      0  Harry Potter and the Deathly Hallows: Part 1      33.533   2010-11-19
      1                      How to Train Your Dragon      28.734   2010-03-26
      2                                    Iron Man 2      28.515   2010-05-07
      3                                     Toy Story      28.005   1995-11-22
      4                                     Inception      27.920   2010-07-16

                                              title  vote_average  vote_count
      0  Harry Potter and the Deathly Hallows: Part 1           7.7       10788
      1                      How to Train Your Dragon           7.7        7610
      2                                    Iron Man 2           6.8       12368
      3                                     Toy Story           7.9       10174
      4                                     Inception           8.3       22186
```

0.2.11 Budgets

```
[13]: df_budgets.head()
```

```
[13]:    id  release_date                                        movie  \
      0   1  Dec 18, 2009                                       Avatar
      1   2  May 20, 2011  Pirates of the Caribbean: On Stranger Tides
      2   3   Jun 7, 2019                                  Dark Phoenix
```

```
3   4   May 1, 2015                      Avengers: Age of Ultron
4   5  Dec 15, 2017            Star Wars Ep. VIII: The Last Jedi

  production_budget domestic_gross worldwide_gross
0      $425,000,000   $760,507,625  $2,776,345,279
1      $410,600,000   $241,063,875  $1,045,663,875
2      $350,000,000    $42,762,350    $149,762,350
3      $330,600,000   $459,005,868  $1,403,013,963
4      $317,000,000   $620,181,382  $1,316,721,747
```

[14]:
```
## tight_layout()
```

0.3 Getting Inside of Business Problem

1. Which studios has the most revenue movies?
2. What type of movies most made?
3. Is there a good relation with movie budget and revenue?
4. Which directors made most revenue and why?

0.3.1 Studios

[15]:
```
#Remembering first dataframe for what is  data look like
df_movie_gross.head()
```

[15]:
```
                                         title studio  domestic_gross  \
0                                  Toy Story 3     BV     415000000.0
1                   Alice in Wonderland (2010)     BV     334200000.0
2  Harry Potter and the Deathly Hallows Part 1     WB     296000000.0
3                                    Inception     WB     292600000.0
4                          Shrek Forever After   P/DW     238700000.0

  foreign_gross  year
0     652000000  2010
1     691300000  2010
2     664300000  2010
3     535700000  2010
4     513900000  2010
```

[16]:
```
#Looking for missing data if there is any.
df_movie_gross.isna().sum()
```

[16]:
```
title                0
studio               5
domestic_gross      28
foreign_gross     1350
year                 0
dtype: int64
```

[17]:
```
# Cleaning proccess of 'foreign_gross' column.
df_movie_gross['foreign_gross'] = df_movie_gross['foreign_gross'].str.
 ↪replace(',','').astype(float)
```

[18]:
```
# Creating new column for total gross and sorting.
df_movie_gross['total_gross'] = df_movie_gross['domestic_gross']+␣
 ↪df_movie_gross['foreign_gross']
```

[19]:
```
#Grouping and sorting dataframe by studio to look studios individually.
grouped_studio = df_movie_gross.groupby('studio').sum().reset_index()
grouped_studio.sort_values(by='total_gross',ascending=False,inplace=True)
```

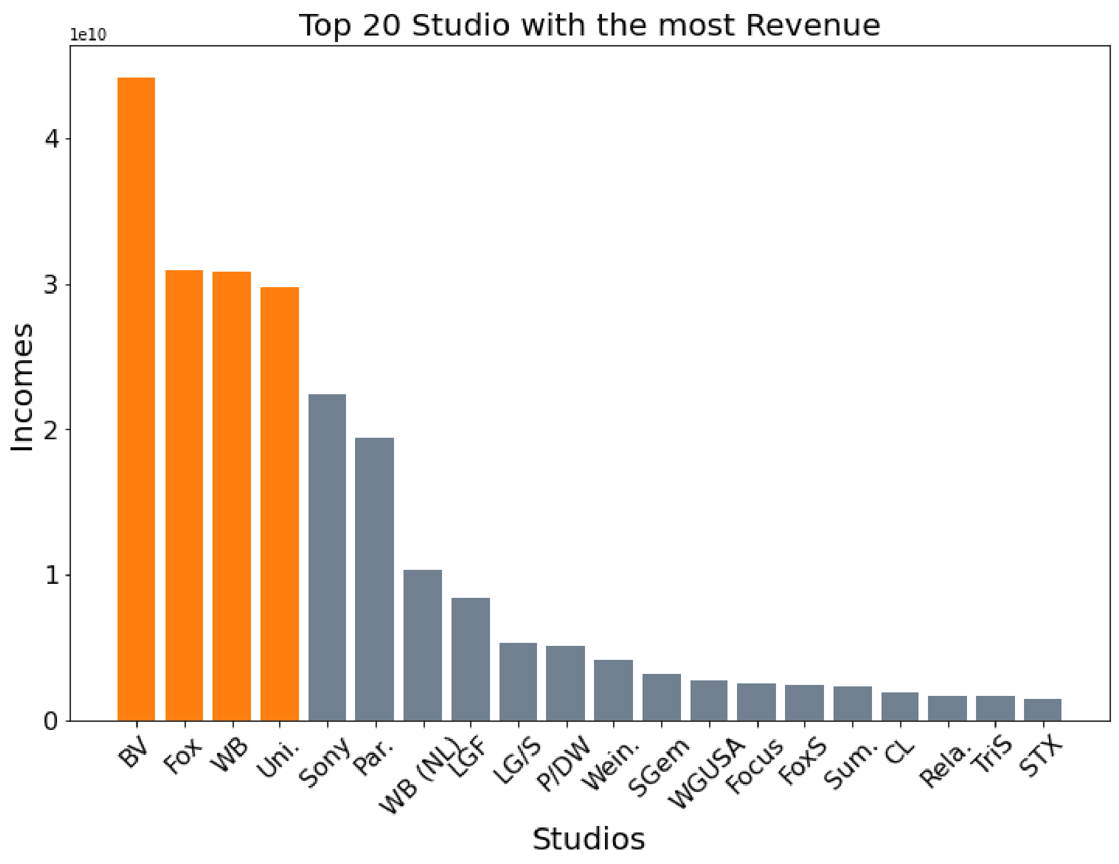
[20]:
```
#Creating variable for top 20 studios with most revenue.
most_gross_20_studio = grouped_studio[:20]
```

[21]:
```
most_gross_20_studio
```

[21]:
```
       studio  domestic_gross  foreign_gross    year   total_gross
36         BV    1.841903e+10   2.579385e+10  213451  4.419038e+10
93        Fox    1.094950e+10   2.005587e+10  273882  3.098037e+10
246        WB    1.216805e+10   1.866790e+10  281941  3.079150e+10
238      Uni.    1.290239e+10   1.685477e+10  296082  2.974681e+10
215      Sony    8.459683e+09   1.394535e+10  221575  2.240472e+10
185      Par.    7.685871e+09   1.186338e+10  203417  1.944420e+10
247   WB (NL)    3.995700e+09   6.339000e+09   90644  1.031410e+10
134       LGF    4.118963e+09   4.482619e+09  207437  8.467471e+09
133      LG/S    2.078200e+09   3.353724e+09   82599  5.318924e+09
171      P/DW    1.682900e+09   3.393600e+09   20109  5.076500e+09
251     Wein.    1.540550e+09   2.624086e+09  155022  4.095903e+09
205      SGem    1.526400e+09   1.624062e+09   70462  3.140162e+09
248     WGUSA    2.539460e+07   2.761447e+09  116902  2.778054e+09
92      Focus    1.172041e+09   1.369969e+09  120844  2.496769e+09
94       FoxS    1.061832e+09   1.497388e+09  134904  2.474688e+09
219      Sum.    9.318710e+08   1.354900e+09   30158  2.284971e+09
48         CL    1.820020e+07   2.005700e+09  149049  1.898686e+09
196     Rela.    9.432940e+08   8.228780e+08   70454  1.715417e+09
229      TriS    9.709000e+08   8.849550e+08   46320  1.713055e+09
210       STX    7.521000e+08   7.462000e+08   48406  1.474200e+09
```

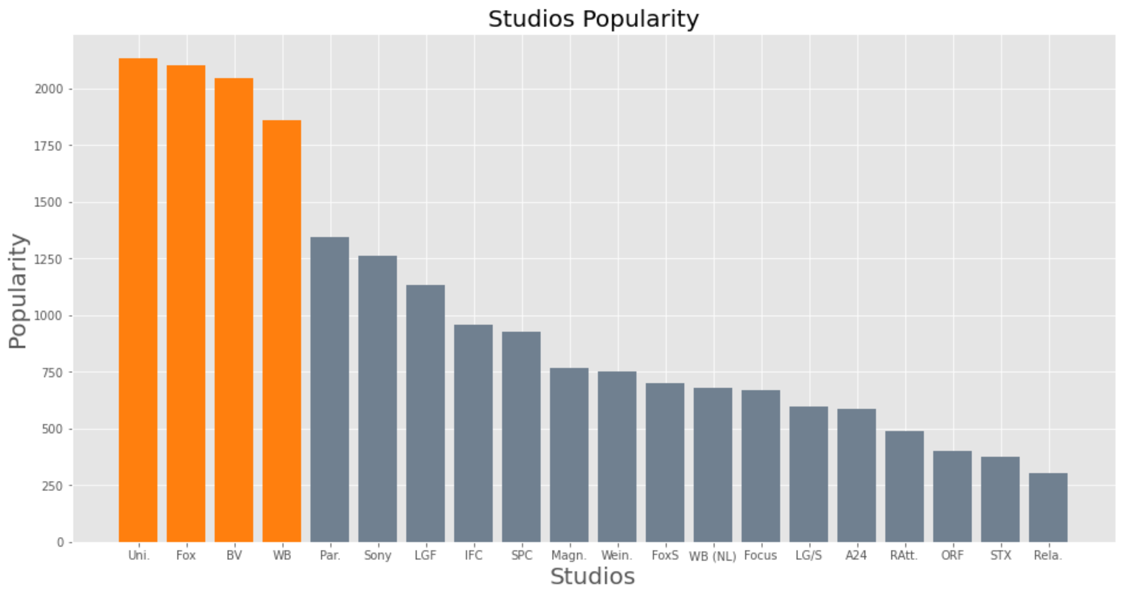
[22]:
```
#Creating for loop to highlight first three value of graph.
colors=[]
for studio in most_gross_20_studio['studio']:
    if ((studio=='BV') or (studio=='WB') or (studio=='Uni.')or (studio=='Fox')):
        colors.append('tab:orange')
    else:
        colors.append('slategray')
```

```
fig , ax = plt.subplots(figsize=(12,8))
ax.bar(most_gross_20_studio['studio'],most_gross_20_studio['total_gross'],color␣
↪= colors)
ax.set_title('Top 20 Studio with the most Revenue',fontsize=20)
ax.tick_params(axis='x', labelsize=16,rotation=45)
ax.tick_params(axis='y', labelsize=16)
plt.xlabel('Studios',fontsize=20)
plt.ylabel('Incomes',fontsize=20)
plt.style.use('ggplot')
```



[23]:
```
#Merging to dataframe to look studio and popularity and sorting by popularity.
df_popularity = df_movie_gross.merge(df_movies)
popularity_grouped = df_popularity.groupby('studio').sum().reset_index()
popularity_sorted = popularity_grouped.
↪sort_values(by='popularity',ascending=False)
#Creating colors to hightlight first three popular ones.
colors=[]
for studio in popularity_sorted[:20]['studio']:
    if ((studio == 'Uni.') or (studio == 'Fox') or (studio == 'BV')or (studio␣
↪== 'WB')):
        colors.append('tab:orange')
    else:
        colors.append('slategray')

fig , ax = plt.subplots(figsize=(16,8))
ax.bar(popularity_sorted[:20]['studio'],popularity_sorted[:
↪20]['popularity'],color=colors)
ax.set_title('Studios Popularity', fontsize=20)
ax.set_xlabel('Studios', fontsize=20)
ax.set_ylabel('Popularity', fontsize=20)
```

[23]:
```
Text(0, 0.5, 'Popularity')
```

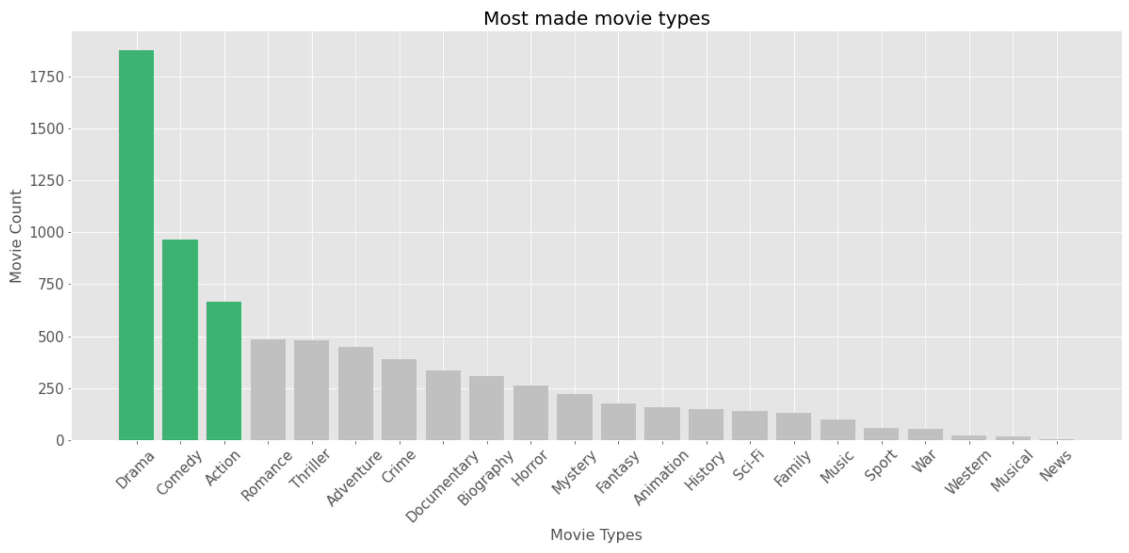


0.3.2 Movie types

[24]:
```
# Need to some changing on column name. So both dataframes could have same␣
↪column name to merge on(`title`column).
df_titles.rename(columns={'primary_title':'title'},inplace=True)
df_gross_and_titles = df_movie_gross.merge(df_titles)
```

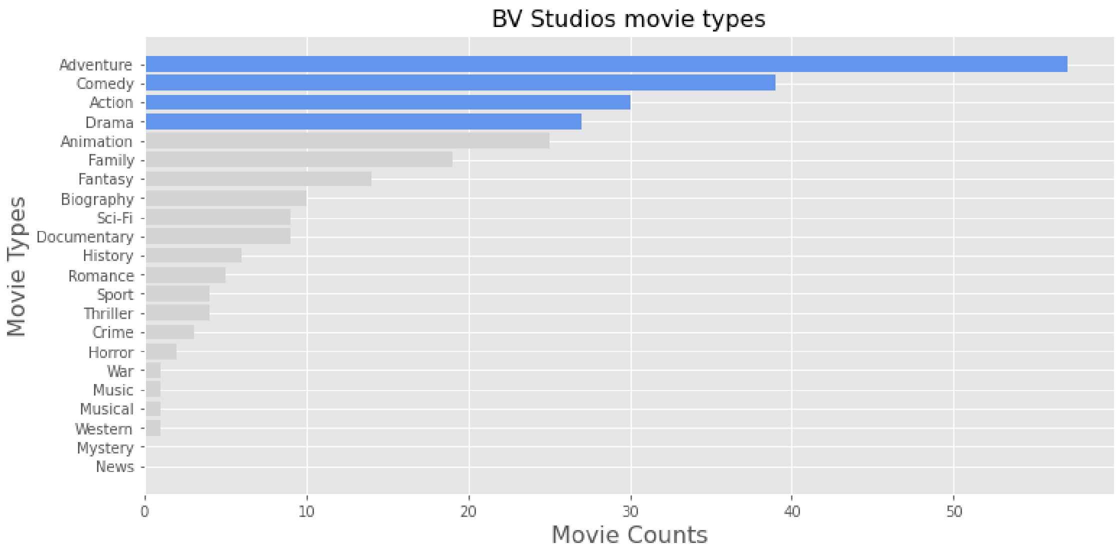
[25]:
```
#Cleaning and sorting process of genres column.
clean_genres = df_gross_and_titles['genres'].str.get_dummies(',').sum()
sorted_genres = clean_genres.sort_values(ascending=False)

colors=[]
[colors.append('mediumseagreen')  if((i␣
↪=='Drama')or(i=='Action')or(i=='Comedy'))
```

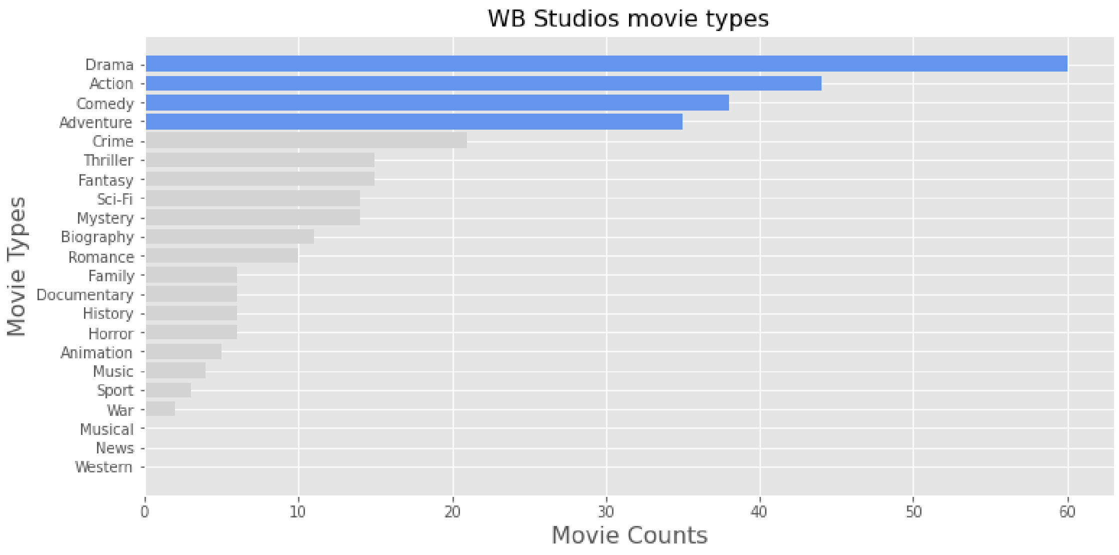
```
 else colors.append('silver')for i in sorted_genres.index]

fig , ax = plt.subplots(figsize=(20,8))
ax.bar(sorted_genres.index,sorted_genres,color=colors)
ax.set_title('Most made movie types',fontsize=20)
ax.set_xlabel('Movie Types',fontsize=16)
ax.set_ylabel('Movie Count',fontsize=16)
plt.tick_params(labelsize = 15)
plt.xticks(rotation=45)
plt.show()
```

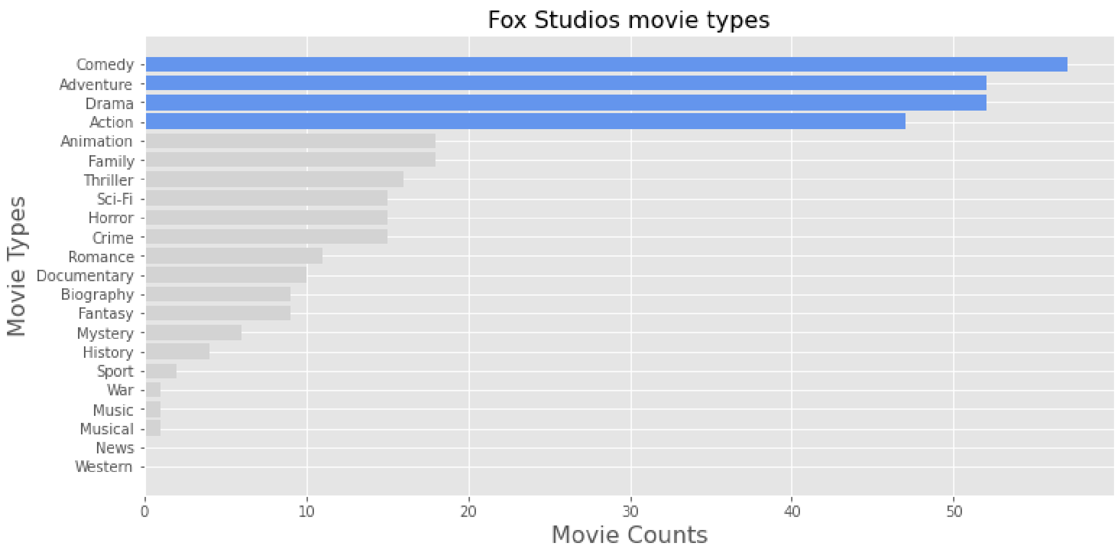


[26]:
```
# Need to seperate multiple value of genres column as down below line and sort␣
 ↪them to visualize.
grouped_genres = df_gross_and_titles['genres'].str.get_dummies(sep=',').
 ↪groupby(df_gross_and_titles['studio']).sum()
sorted_values_BV = grouped_genres.T['BV'].sort_values()
sorted_values_WB = grouped_genres.T['WB'].sort_values()
sorted_values_Fox = grouped_genres.T['Fox'].sort_values()

#Creating colors to hightlight most made movie types.
colors=[]
[colors.append('lightgray')  if i<=29 else colors.append('cornflowerblue')for i␣
 ↪in sorted_values_WB]

fig , axs = plt.subplots(3,figsize=(12,8))
axs[0].barh(sorted_values_BV.index,sorted_values_BV,color=colors)
axs[0].set_title('BV Studios movie types',fontsize=16)
axs[0].set_xlabel('Movie Counts',fontsize=16)
```

```
axs[0].set_ylabel('Movie Types',fontsize=16)
axs[1].barh(sorted_values_WB.index,sorted_values_WB,color=colors)
axs[1].set_title('WB Studios movie types',fontsize=16)
axs[1].set_xlabel('Movie Counts',fontsize=16)
axs[1].set_ylabel('Movie Types',fontsize=16)
axs[2].barh(sorted_values_Fox.index,sorted_values_Fox,color=colors)
axs[2].set_title('Fox Studios movie types',fontsize=16)
axs[2].set_xlabel('Movie Counts',fontsize=16)
axs[2].set_ylabel('Movie Types',fontsize=16)
fig.subplots_adjust(top=2)
```


BV Studios movie types
Adventure
Comedy
Action
Drama
Animation
Family
Fantasy
Biography
Sci-Fi
Documentary
History
Romance
Sport
Thriller
Crime
Horror
War
Music
Musical
Western
Mystery
News
Movie Types
0
10
20
30
40
50
Movie Counts


WB Studios movie types
Drama
Action
Comedy
Adventure
Crime
Thriller
Fantasy
Sci-Fi
Mystery
Biography
Romance
Family
Documentary
History
Horror
Animation
Music
Sport
War
Musical
News
Western
Movie Types
0
10
20
30
40
50
60
Movie Counts


Fox Studios movie types
Comedy
Adventure
Drama
Action
Animation
Family
Thriller
Sci-Fi
Horror
Crime
Romance
Documentary
Biography
Fantasy
Mystery
History
Sport
War
Music
Musical
News
Western
Movie Types
0
10
20
30
40
50
Movie Counts

0.3.3 Budget Relations

[27]:
```
#Cleaning process of production_budget column.
df_budgets['production_budget'] = df_budgets['production_budget'].str.
 ↪replace(',','')
df_budgets['production_budget'] = df_budgets['production_budget'].str.
 ↪replace('$','').astype(float)
```

[28]:
```
#Cleaning process of worldwide_gross column.
df_budgets['worldwide_gross'] = df_budgets['worldwide_gross'].str.
 ↪replace(',','')
df_budgets['worldwide_gross'] = df_budgets['worldwide_gross'].str.
 ↪replace('$','').astype(float)
```

[29]:
```
#Sorted dataframe by descending worldwide_gross column.
df_budgets.sort_values(by='worldwide_gross',ascending=False,inplace=True)
```

[30]:
```
#Creating function to create 3 category.
def split_budget(budget):
    if budget < 1e8:
        return 'Under 100 million.'
    if budget < 2e8:
        return 'Under 200 million.'
    return 'Over 200 million.'
```

[31]:
```
#Using function into the dataframe to create new column and categorize values.
df_budgets['split_budget'] = df_budgets['production_budget'].apply(split_budget)
```

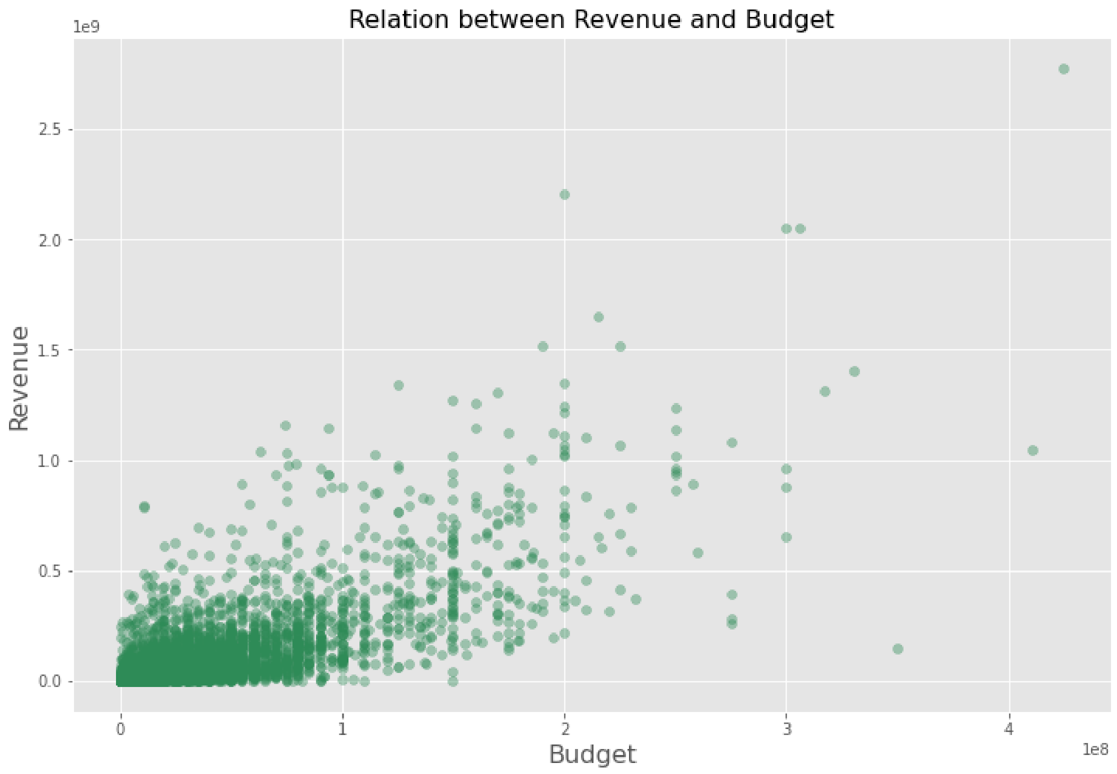
[32]:
```
#Looking again data.
df_budgets
```

[32]:
```
      id  release_date                                 movie  \
0      1  Dec 18, 2009                                Avatar
42    43  Dec 19, 1997                               Titanic
5      6  Dec 18, 2015  Star Wars Ep. VII: The Force Awakens
6      7  Apr 27, 2018               Avengers: Infinity War
33    34  Jun 12, 2015                        Jurassic World
…     ..           …                                     …
5474  75  Dec 31, 2005                       Insomnia Manica
5473  74  Jul 17, 2012                       Girls Gone Dead
5472  73   Apr 3, 2012                        Enter Nowhere
5471  72  Dec 31, 2010                               Drones
4068  69  Dec 12, 2008               The Kings of Appletown
```

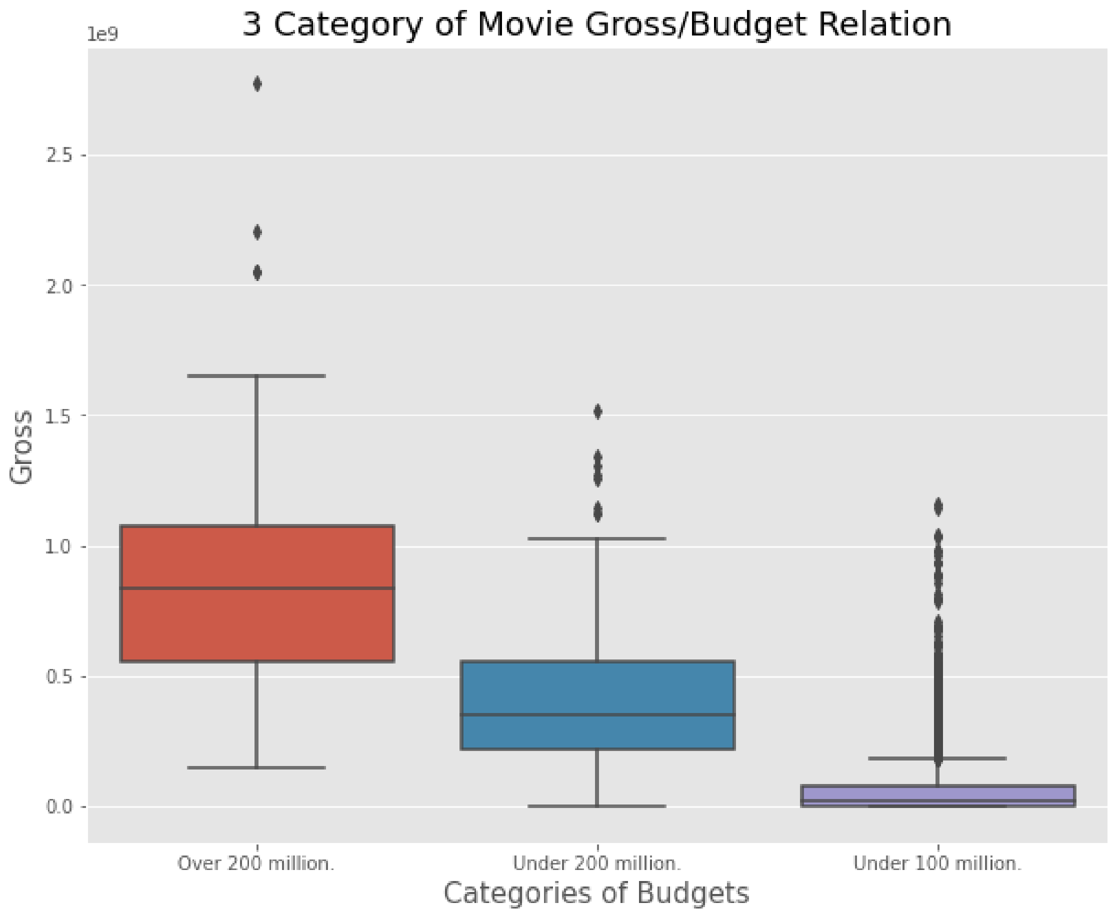
```
      production_budget domestic_gross  worldwide_gross        split_budget
0           425000000.0   $760,507,625     2.776345e+09   Over 200 million.
42          200000000.0   $659,363,944     2.208208e+09   Over 200 million.
5           306000000.0   $936,662,225     2.053311e+09   Over 200 million.
6           300000000.0   $678,815,482     2.048134e+09   Over 200 million.
33          215000000.0   $652,270,625     1.648855e+09   Over 200 million.
…                 …             …               …              …
5474           500000.0             $0     0.000000e+00  Under 100 million.
5473           500000.0             $0     0.000000e+00  Under 100 million.
5472           500000.0             $0     0.000000e+00  Under 100 million.
5471           500000.0             $0     0.000000e+00  Under 100 million.
4068          7000000.0             $0     0.000000e+00  Under 100 million.

[5782 rows x 7 columns]
```

[33]:

```
#Creating scatterplot to see relationship between budget and gross.

fig , ax = plt.subplots(figsize=(12,8))
ax.scatter(df_budgets['production_budget'],df_budgets['worldwide_gross']␣
 ↪,c='seagreen',alpha=0.4)
ax.set_title('Relation between Revenue and Budget',fontsize=16)
ax.set_xlabel('Budget',fontsize=16)
ax.set_ylabel('Revenue',fontsize=16)
plt.show()
```



[34]:
```
#Creating boxplot for 3 different budget category.

fig, ax = plt.subplots(figsize = (10,8))
ax = sns.boxplot(x='split_budget',y='worldwide_gross',data=df_budgets)
ax.set_xlabel('Categories of Budgets', fontsize = 15)
ax.set_ylabel ('Gross', fontsize = 15)
ax.set_title('3 Category of Movie Gross/Budget Relation', fontsize = 18)
plt.show()
```



0.3.4 Directors

[35]:
```
#Merging names and principals dataframes.
df_names_principals = df_names.merge(df_principals)
df_names_principals
```

[35]:
```
            nconst        primary_name  birth_year  death_year  \
0        nm0061671    Mary Ellen Bauder         NaN         NaN
1        nm0061865        Joseph Bauer         NaN         NaN
2        nm0061865        Joseph Bauer         NaN         NaN
3        nm0061865        Joseph Bauer         NaN         NaN
4        nm0061865        Joseph Bauer         NaN         NaN
…              …                   …          …          …
1027907  nm9990381        Susan Grobes         NaN         NaN
1027908  nm9990690         Joo Yeon So         NaN         NaN
1027909  nm9991320      Madeline Smith         NaN         NaN
1027910  nm9991786  Michelle Modigliani         NaN         NaN
1027911  nm9993380       Pegasus Envoyé         NaN         NaN

                               primary_profession  \
0         miscellaneous,production_manager,producer
1        composer,music_department,sound_department
2        composer,music_department,sound_department
3        composer,music_department,sound_department
4        composer,music_department,sound_department
…                                              …
1027907                                     actress
1027908                                     actress
1027909                                     actress
1027910                                    producer
1027911                        director,actor,writer

                               known_for_titles     tconst  ordering  \
0        tt0837562,tt2398241,tt0844471,tt0118553  tt2398241         9
1        tt0896534,tt6791238,tt0287072,tt1682940  tt0433397         7
2        tt0896534,tt6791238,tt0287072,tt1682940  tt1681372         8
3        tt0896534,tt6791238,tt0287072,tt1682940  tt2387710         8
4        tt0896534,tt6791238,tt0287072,tt1682940  tt2281215         7
…                                            …          …        …
1027907                                      NaN  tt6527982         2
1027908                      tt9090932,tt8737130  tt8737130         4
1027909                      tt8734436,tt9615610  tt8734436         3
1027910                                      NaN  tt8739240         9
1027911                                tt8743182  tt8743182         5

         category       job        characters
0        producer  producer               NaN
1        composer       NaN               NaN
2        composer       NaN               NaN
3        composer       NaN               NaN
4        composer       NaN               NaN
…             …        …                 …
1027907   actress       NaN  ["Cheryl","Gypsy"]
```

```
1027908   actress       NaN                NaN
1027909   actress       NaN            ["Anna"]
1027910  producer  producer                NaN
1027911  director       NaN                NaN

[1027912 rows x 11 columns]
```

[36]:
```
#Dropping unnecessary and missing columns.
df_names_principals.
↪drop(['primary_profession','birth_year','death_year','known_for_titles','job','characters']
                        ,axis=1,inplace=True)
```

[37]:
```
#Creating directors dataframe.
df_directors = df_names_principals.
↪loc[df_names_principals['category']=='director']
```

[38]:
```
df_directors
```

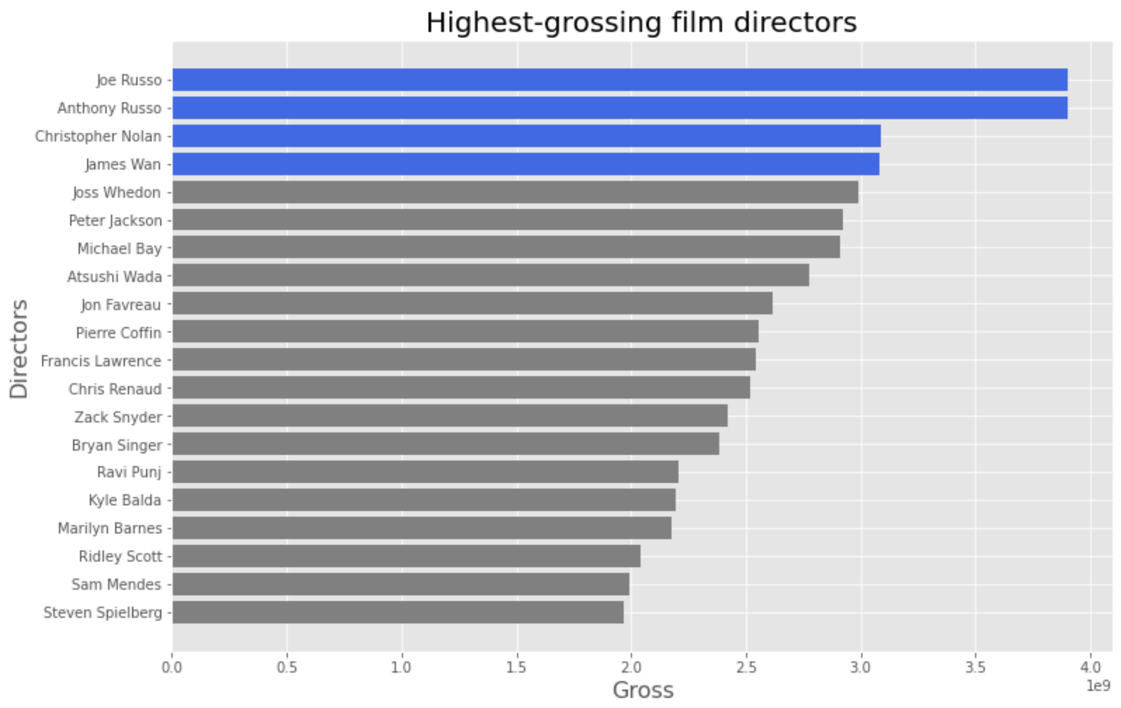
[38]:
```
            nconst    primary_name     tconst  ordering  category
12       nm0062879  Ruel S. Bayani  tt2057445         5  director
13       nm0062879  Ruel S. Bayani  tt1592569         5  director
14       nm0062879  Ruel S. Bayani  tt2590280         5  director
15       nm0062879  Ruel S. Bayani  tt8421806         5  director
48       nm0064023   Bryan Beasley  tt3501180         2  director
…              …               …          …         …       …
1027881  nm9971456       Zheng Wei  tt8697720         1  director
1027889  nm9980896  Rama Narayanan  tt8715016         5  director
1027890  nm9980896  Rama Narayanan  tt8919136         5  director
1027891  nm9981679     Samir Eshra  tt8717234         1  director
1027911  nm9993380  Pegasus Envoyé  tt8743182         5  director

[146393 rows x 5 columns]
```

[39]:
```
#Merging to dataframes to merge another one.
titles_directors = df_directors.merge(df_titles)

#Renaming column name to merge on df_budgets dataframe.
titles_directors.rename(columns={'title':'movie'},inplace=True)

#Merging third dataframe.
budget_and_directors = titles_directors.merge(df_budgets)
```

[40]:
```
#Sorting dataframe by descending worldwide gross.
budget_and_directors.
↪sort_values(by='worldwide_gross',ascending=False,inplace=True)
```

[48]:
```
grouped_directors = budget_and_directors.groupby('primary_name').sum()
sorted_directors = grouped_directors.
 ↪sort_values(by='worldwide_gross',ascending=True)

colors=[]
[colors.append('royalblue') if ((i =='Anthony Russo')or (i=='Joe␣
 ↪Russo')or(i=='Christopher Nolan')or(i=='James Wan'))
 else colors.append('gray')for i in sorted_directors.tail(20).index]

fig , ax = plt.subplots(figsize=(12,8))
ax.barh(sorted_directors.tail(20).index,sorted_directors.
 ↪tail(20)['worldwide_gross'] ,color=colors)
ax.set_title('Highest-grossing film directors',fontsize=20)
ax.set_xlabel('Gross',fontsize=16)
ax.set_ylabel('Directors',fontsize=16)
```

[48]:
```
Text(0, 0.5, 'Directors')
```



0.4 Conclusion :

```
As seems in first visualization BV, Fox, WB, Uni. made most revenue movies at all time.
And at the second
visualization same studios leads at the popularity.
```

At the section 3.2 shows us most made types of movies as Drama,Comedy and Action as general.
If we want to look top 3 highest revenue and popular studios made movie types ;
it seems Drama,Action,Adventure and Comedy.

At the section 3.3 we can see there is positive relationship between budget and revenue.
Also for more information about budget second visualization at this section
3 category of budget shows us more budget provides to more revenue.

Lastly it seems Russo brothers(Avengers: Endgame), Christopher Nolan(The Dark Knight Rises)
and James Wan(Furious 7) have the most revenue as directors.

We can recommend to new studio to make movie with one of these directors,
on action,adventure,comedy or drama.
And give as much as possible budget.
And further look what BV and Fox studios are doing to have most revenue
and become most popular.