Final Project Submission

Please fill out:

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- Student pace: **full time**
- Scheduled project review date/time: **12th March 2023**
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- Blog post URL:

Business Understanding

Movie production is an expensive venture which can lead to serious losses especially when ventured carelessly without adequate knowledge of the video type ,Genre , and amount used in production. Therefore, this project is aimed at helping the head of Microsoft's New Movie Studio study various film types produced by companies that create original film. Reviews and ratings from past movies and tv shows produced will be studied, analysed and visualized. Insights drawn from the study will be used in the decision making of the type of movie to be produced by the upcoming Microsoft's New Movie Studio.

This study focuses mainly to help the stakeholders who are Microsoft get answers to movie genre they should venture in, averange returns to expect, and movie length that attracts most viewers.

Data Understanding

- *bom.movie.csv* This is a CSV file that is found in the file path "Data/bom.movie_gross.csv". Contained in the file is information about various movies showing year of production,company of production, and money fetched from local market, and foreign market. Original data before cleaning contained 3387 rows and 5 columns.

Columns present in the file are:

- **title** - It contains movie names
- **studio** - Contains production studio
- **domestic gross** - Contains money fetched from selling to buyers in the production country
- **foreign gross** - money fetched sales around the world
- **year** - year of production.

In [114]:
```
# Your code here - remember to use markdown cells for comments as wel
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline
```

i. bom.movie_gross.csv

In [115]:
```
# importing the Dataframe and displaying the head
Bom_Movie = pd.read_csv('Data/bom.movie_gross.csv')
Bom_Movie.head(10)
```

Out[115]:

	title	studio	domestic_gross	foreign_gross	year
0	Toy Story 3	BV	415000000.0	652000000	2010
1	Alice in Wonderland (2010)	BV	334200000.0	691300000	2010
2	Harry Potter and the Deathly Hallows Part 1	WB	296000000.0	664300000	2010
3	Inception	WB	292600000.0	535700000	2010
4	Shrek Forever After	P/DW	238700000.0	513900000	2010
5	The Twilight Saga: Eclipse	Sum.	300500000.0	398000000	2010
6	Iron Man 2	Par.	312400000.0	311500000	2010
7	Tangled	BV	200800000.0	391000000	2010
8	Despicable Me	Uni.	251500000.0	291600000	2010
9	How to Train Your Dragon	P/DW	217600000.0	277300000	2010

In [116]:
```
# checking for duplicates
Bom_Movie.duplicated().sum()
```

Out[116]:
```
0
```

In [117]:
```
# There are no duplicates in the above dataframe.
# Checking for Nan Values and removing if possible.
Bom_Movie.isna().sum()
```

Out[117]:
```
title                0
studio               5
domestic_gross      28
foreign_gross     1350
year                 0
dtype: int64
```

From the above we have null values in foreign gross, studio, and domestic gross. Foreign_gross, has many misssing values hence will be dropped.

In [118]:
```
# dropping foreign_gross, year,and title.
# year and title will not be very useful in the analysis.
Bom_Movie.drop(['title', 'year', 'foreign_gross'], axis=1, inplace=Tı
```

In [119]:
```
# New dataframe
Bom_Movie
```

Out[119]:

	studio	domestic_gross
0	BV	415000000.0
1	BV	334200000.0
2	WB	296000000.0
3	WB	292600000.0
4	P/DW	238700000.0
...	...	...
3382	Magn.	6200.0
3383	FM	4800.0
3384	Sony	2500.0
3385	Synergetic	2400.0
3386	Grav.	1700.0

3387 rows × 2 columns

In [120]:
```
Bom_Movie.isna().sum()
# From the above we will drop null values present in the studio colu
```

Out[120]:
```
studio             5
domestic_gross    28
dtype: int64
```

In [121]:
```
Bom_Movie.describe()
```

Out[121]:

	domestic_gross
count	3.359000e+03
mean	2.874585e+07
std	6.698250e+07
min	1.000000e+02
25%	1.200000e+05
50%	1.400000e+06
75%	2.790000e+07
max	9.367000e+08

In [122]:
```
# Filling missing values in domestic_gross
Bom_Movie['domestic_gross'].fillna(
    Bom_Movie['domestic_gross'].median(), inplace=True)
```

In [123]:
```
Bom_Movie.isna().sum()
```

Out[123]:
```
studio            5
domestic_gross    0
dtype: int64
```

In [124]:
```
Bom_Movie.dropna(inplace=True)
```

In [125]:
```
# confirming there are no missing values.
Bom_Movie.isna().sum()
```

Out[125]:
```
studio            0
domestic_gross    0
dtype: int64
```

In [126]:
```
# sorting the DataFrame
Bom_Movie_New = Bom_Movie.groupby('studio')['domestic_gross'].mean()
Bom_Movie_New = Bom_Movie_New.sort_values(ascending=False).head(10)
Bom_Movie_New
```

Out[126]:
```
studio
BV         1.737644e+08
P/DW       1.682900e+08
WB (NL)    8.879333e+07
Uni.       8.777138e+07
WB         8.691461e+07
Fox        8.051103e+07
Sony       7.691894e+07
Par.       7.609773e+07
MGM        6.666667e+07
Sum.       6.212473e+07
Name: domestic_gross, dtype: float64
```

In [127]:
```
# converting the data to a dataframe
Bom_Movie_New_df1 = pd.DataFrame(Bom_Movie_New)
type(Bom_Movie_New_df1)
```

Out[127]:
```
pandas.core.frame.DataFrame
```

In [128]:
```
# Data Analysis and Visualization
# displaying the dataframe
Bom_Movie_New_df2 = Bom_Movie_New_df1.reset_index('studio')
```

In [129]:
```
Bom_Movie_New_df2
```

Out[129]:

	studio	domestic_gross
0	BV	1.737644e+08
1	P/DW	1.682900e+08
2	WB (NL)	8.879333e+07
3	Uni.	8.777138e+07
4	WB	8.691461e+07
5	Fox	8.051103e+07
6	Sony	7.691894e+07
7	Par.	7.609773e+07
8	MGM	6.666667e+07
9	Sum.	6.212473e+07

ii. Movie Basics

In [130]:
```
import sqlite3
conn = sqlite3.connect('Data/im.db')

# Check tables present in the data base

table_name_query = """SELECT name
                      AS 'Table Names'
                      FROM sqlite_master
                      WHERE type='table';"""

pd.read_sql(table_name_query, conn)
```

Out[130]:

	Table Names
0	movie_basics
1	directors
2	known_for
3	movie_akas
4	movie_ratings
5	persons
6	principals
7	writers

In [131]:
```
# selecting the movie_basics table
db_data = pd.read_sql("""SELECT * FROM movie_basics""", conn)
db_data.head()
```

Out[131]:

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

In [132]:
```
# checking information of the Movie_basics table for presence of dup
db_data.duplicated().sum()
```

Out[132]:
```
0
```

In [133]:
```
# Checking the tables information
db_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 146144 entries, 0 to 146143
Data columns (total 6 columns):
 #   Column           Non-Null Count   Dtype
---  ------           --------------   -----
 0   movie_id         146144 non-null  object
 1   primary_title    146144 non-null  object
 2   original_title   146123 non-null  object
 3   start_year       146144 non-null  int64
 4   runtime_minutes  114405 non-null  float64
 5   genres           140736 non-null  object
dtypes: float64(1), int64(1), object(4)
memory usage: 6.7+ MB
```

In [134]:
```
# check missing values in the movie_basics table
db_data.isna().sum()
```

Out[134]:
```
movie_id               0
primary_title          0
original_title        21
start_year             0
runtime_minutes    31739
genres              5408
dtype: int64
```

The results above show the presence of missing values in runtime_minutes, genres and original_title.

In [135]:
```
# Droping the title columns in the table above.
db_data.drop('original_title', axis=1, inplace=True)
```

In [136]:
```
db_data
```

Out[136]:

	movie_id	primary_title	start_year	runtime_minutes	genres
0	tt0063540	Sunghursh	2013	175.0	Action,Crime,Drama
1	tt0066787	One Day Before the Rainy Season	2019	114.0	Biography,Drama
2	tt0069049	The Other Side of the Wind	2018	122.0	Drama
3	tt0069204	Sabse Bada Sukh	2018	NaN	Comedy,Drama
4	tt0100275	The Wandering Soap Opera	2017	80.0	Comedy,Drama,Fantasy
...	...	...	...	...	...
146139	tt9916538	Kuambil Lagi Hatiku	2019	123.0	Drama
146140	tt9916622	Rodolpho Teóphilo - O Legado de um Pioneiro	2015	NaN	Documentary
146141	tt9916706	Dankyavar Danka	2013	NaN	Comedy
146142	tt9916730	6 Gunn	2017	116.0	None
146143	tt9916754	Chico Albuquerque - Revelações	2013	NaN	Documentary

146144 rows × 5 columns

In [137]:
```
# Droping the primary title column
db_data.drop('primary_title', axis=1, inplace=True)
```

To avoid introduction of disturbances in the data, we will drop all the rows that have null values.

In [138]:
```
db_data = db_data.dropna(axis=0)
```

In [139]:
```
# new data set's head
db_data.head(10)
```

Out[139]:

	movie_id	start_year	runtime_minutes	genres
0	tt0063540	2013	175.0	Action,Crime,Drama
1	tt0066787	2019	114.0	Biography,Drama
2	tt0069049	2018	122.0	Drama
4	tt0100275	2017	80.0	Comedy,Drama,Fantasy
5	tt0111414	2018	75.0	Comedy
7	tt0137204	2017	83.0	Adventure,Animation,Comedy
9	tt0144449	2012	82.0	Biography
10	tt0146592	2010	136.0	Drama
11	tt0154039	2010	100.0	History
12	tt0159369	2013	180.0	Documentary

*** data analysis ***

In [140]:
```
# measuring central tendency for the data
db_data.describe()
```

Out[140]:

	start_year	runtime_minutes
count	112233.000000	112233.000000
mean	2014.402101	86.261902
std	2.639042	167.895938
min	2010.000000	1.000000
25%	2012.000000	70.000000
50%	2014.000000	87.000000
75%	2017.000000	99.000000
max	2022.000000	51420.000000

From the above description, the averange runtime in minutes is 86 minutes from the 112233 responses available.

iii. Movie_ Rating

In [141]:
```
# Reading the mvie rating column
Movie_Ratingdf = pd.read_sql("""
SELECT *
FROM Movie_ratings;
""", conn)
```

In [142]:
```
# Displaying the head
Movie_Ratingdf.head(10)
```

Out[142]:

	movie_id	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
5	tt1069246	6.2	326
6	tt1094666	7.0	1613
7	tt1130982	6.4	571
8	tt1156528	7.2	265
9	tt1161457	4.2	148

In [143]:
```
# checking the info of the table
Movie_Ratingdf.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 73856 entries, 0 to 73855
Data columns (total 3 columns):
 #   Column         Non-Null Count  Dtype  
---  ------         --------------  -----  
 0   movie_id       73856 non-null  object 
 1   averagerating  73856 non-null  float64
 2   numvotes       73856 non-null  int64  
dtypes: float64(1), int64(1), object(1)
memory usage: 1.7+ MB
```

In [144]:
```
# checking presence of repetition
Movie_Ratingdf.duplicated().sum()
```

Out[144]: 0

In [145]:
```
# Checking for Null values
Movie_Ratingdf.isna().sum()
```

Out[145]:
```
movie_id         0
averagerating    0
numvotes         0
dtype: int64
```

The table above has no repetitions, null values, and missing values. Therefore, since they have almost related columns we join the two tables.

In [146]:
```
q ='''SELECT movie_id, original_title, runtime_minutes, genres, avera
FROM movie_basics
JOIN movie_ratings
USING(movie_id)
;
'''
imdb = pd.read_sql(q,conn)
```

Data Analysis

i. bom.movie

In [147]:
```
# displaying the dataset
Bom_Movie_New_df2
```

Out[147]:

	studio	domestic_gross
0	BV	1.737644e+08
1	P/DW	1.682900e+08
2	WB (NL)	8.879333e+07
3	Uni.	8.777138e+07
4	WB	8.691461e+07
5	Fox	8.051103e+07
6	Sony	7.691894e+07
7	Par.	7.609773e+07
8	MGM	6.666667e+07
9	Sum.	6.212473e+07

In [148]:
```
# measurements of central tendency for the data
Bom_Movie_New_df2.describe()
```

Out[148]:

	domestic_gross
count	1.000000e+01
mean	9.678529e+07
std	4.010714e+07
min	6.212473e+07
25%	7.630303e+07
50%	8.371282e+07
75%	8.853785e+07
max	1.737644e+08

In [149]:
```
# which movie studio has the highest domestic gross
Bom_Movie_New_df3 = Bom_Movie_New_df2.domestic_gross.groupby(
    Bom_Movie_New_df2['studio']).max()
Bom_Movie_New_df4 = Bom_Movie_New_df3.sort_values(ascending=False).he
Bom_Movie_New_df4
```

Out[149]:
```
studio
BV         1.737644e+08
P/DW       1.682900e+08
WB (NL)    8.879333e+07
Uni.       8.777138e+07
WB         8.691461e+07
Fox        8.051103e+07
Sony       7.691894e+07
Par.       7.609773e+07
MGM        6.666667e+07
Sum.       6.212473e+07
Name: domestic_gross, dtype: float64
```

Studio BV has the highest domestic_gross of 1.737e+08 followed by P/DW with 1.683e+08

ii. Movie db

In [150]:
```
# data preview
imdb.head()
```

Out[150]:

	movie_id	original_title	runtime_minutes	genres	averagerating	numvotes
0	tt0063540	Sunghursh	175.0	Action,Crime,Drama	7.0	77
1	tt0066787	Ashad Ka Ek Din	114.0	Biography,Drama	7.2	43
2	tt0069049	The Other Side of the Wind	122.0	Drama	6.9	4517
3	tt0069204	Sabse Bada Sukh	NaN	Comedy,Drama	6.1	13
4	tt0100275	La Telenovela Errante	80.0	Comedy,Drama,Fantasy	6.5	119

In [151]:
```
# identifying the movies genres with the highest ratings.
highest_rate = imdb.averagerating.groupby(imdb['genres']).max()
highest_ratings = highest_rate.sort_values(ascending = False).head(12
highest_ratings
```

Out[151]:
```
genres
Comedy,Drama                   10.0
Adventure,Comedy               10.0
Documentary,History            10.0
Documentary                    10.0
Crime,Documentary              10.0
Drama                          10.0
Comedy,Documentary              9.8
Documentary,Music               9.8
Action                          9.8
Biography,Documentary,Music     9.8
Biography,Documentary,Drama     9.8
Comedy,Documentary,Sport        9.7
Name: averagerating, dtype: float64
```

In [152]:
```
# identifying the movies genres with the highest votes.
highest_vote = imdb.numvotes.groupby(imdb['genres']).max()
highest_votes = highest_vote.sort_values(ascending = False).head(12)
highest_votes
```

Out[152]:
```
genres
Action,Adventure,Sci-Fi     1841066
Action,Thriller             1387769
Adventure,Drama,Sci-Fi      1299334
Drama,Western               1211405
Biography,Crime,Drama       1035358
Mystery,Thriller            1005960
Action,Adventure,Comedy      948394
Action,Adventure,Fantasy     784780
Drama,Mystery,Thriller       761592
Adventure,Family,Fantasy     719629
Drama,Sci-Fi,Thriller        710018
Adventure,Drama,Fantasy      691835
Name: numvotes, dtype: int64
```

In [153]:
```
#Movies with awesome ratings
best_movie = imdb.averagerating.groupby(imdb['original_title']).max()
best_movies = best_movie.sort_values(ascending = False).head(20)
best_movies
```

Out[153]:
```
original_title
Renegade
10.0
Fly High: Story of the Disc Dog
10.0
Calamity Kevin
10.0
Atlas Mountain: Barbary Macaques - Childcaring Is the Man's Job
10.0
Ellis Island: The Making of a Master Race in America
10.0
Hercule contre Hermès
10.0
All Around Us
10.0
Pick It Up! - Ska in the '90s
10.0
I Was Born Yesterday!
10.0
Requiem voor een Boom
10.0
Freeing Bernie Baran
10.0
Revolution Food
10.0
Exteriores: Mulheres Brasileiras na Diplomacia
10.0
The Dark Knight: The Ballad of the N Word
10.0
A Dedicated Life: Phoebe Brand Beyond the Group
10.0
Dog Days in the Heartland
10.0
The Wedding Present: Something Left Behind
9.9
Moscow we will lose
9.9
LA Foodways
9.9
Gini Helida Kathe
9.9
Name: averagerating, dtype: float64
```

In [154]:
```
# identifying the movies runtime minutes with the highest ratings.
run_time = imdb.averagerating.groupby(imdb['runtime_minutes']).max()
run_times = run_time.sort_values(ascending = False).head(15)
run_times
```

Out[154]:
```
runtime_minutes
93.0     10.0
129.0    10.0
48.0     10.0
99.0     10.0
31.0     10.0
100.0    10.0
52.0     10.0
65.0     10.0
77.0     10.0
59.0     10.0
70.0     10.0
72.0     10.0
87.0      9.9
51.0      9.9
138.0     9.9
Name: averagerating, dtype: float64
```

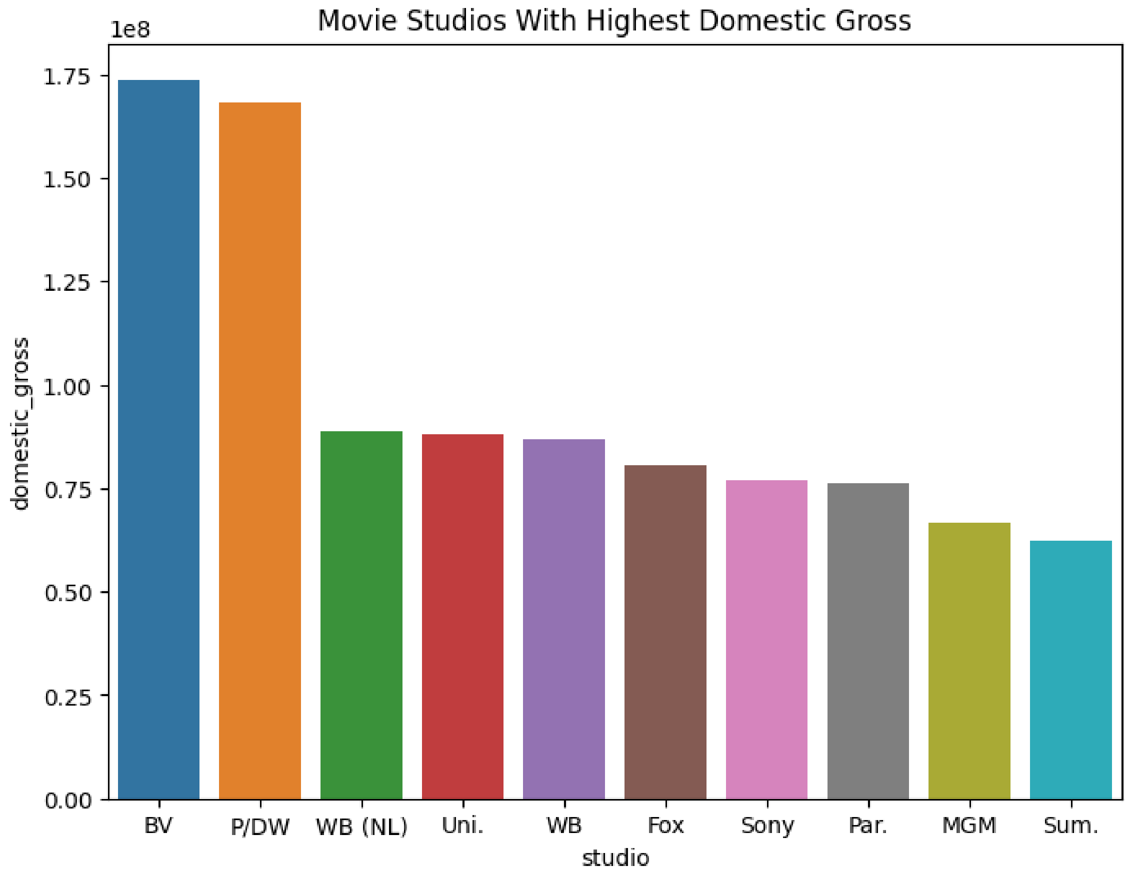
In [155]:
```
# identifying the movies runtime minutes with the highest votes.
runtimevote = imdb.numvotes.groupby(imdb['runtime_minutes']).max()
runtimevotes= runtimevote.sort_values(ascending = False).head(12)
runtimevotes
```

Out[155]:
```
runtime_minutes
148.0    1841066
164.0    1387769
169.0    1299334
165.0    1211405
143.0    1183655
180.0    1035358
138.0    1005960
121.0     948394
108.0     820847
142.0     795227
136.0     784780
120.0     780910
Name: numvotes, dtype: int64
```

iv. Data Visualization

In [156]:
```
Bom_Movie_New_df5 = Bom_Movie_New_df2.head(10)
```

In [167]:
```
#Ploting a graph for domestic gross
plt.figure(figsize=(8,6))
barplot = sns.barplot(x='studio',y='domestic_gross', data=Bom_Movie_N
barplot.set(title='Movie Studios With Highest Domestic Gross')
plt.show()
```

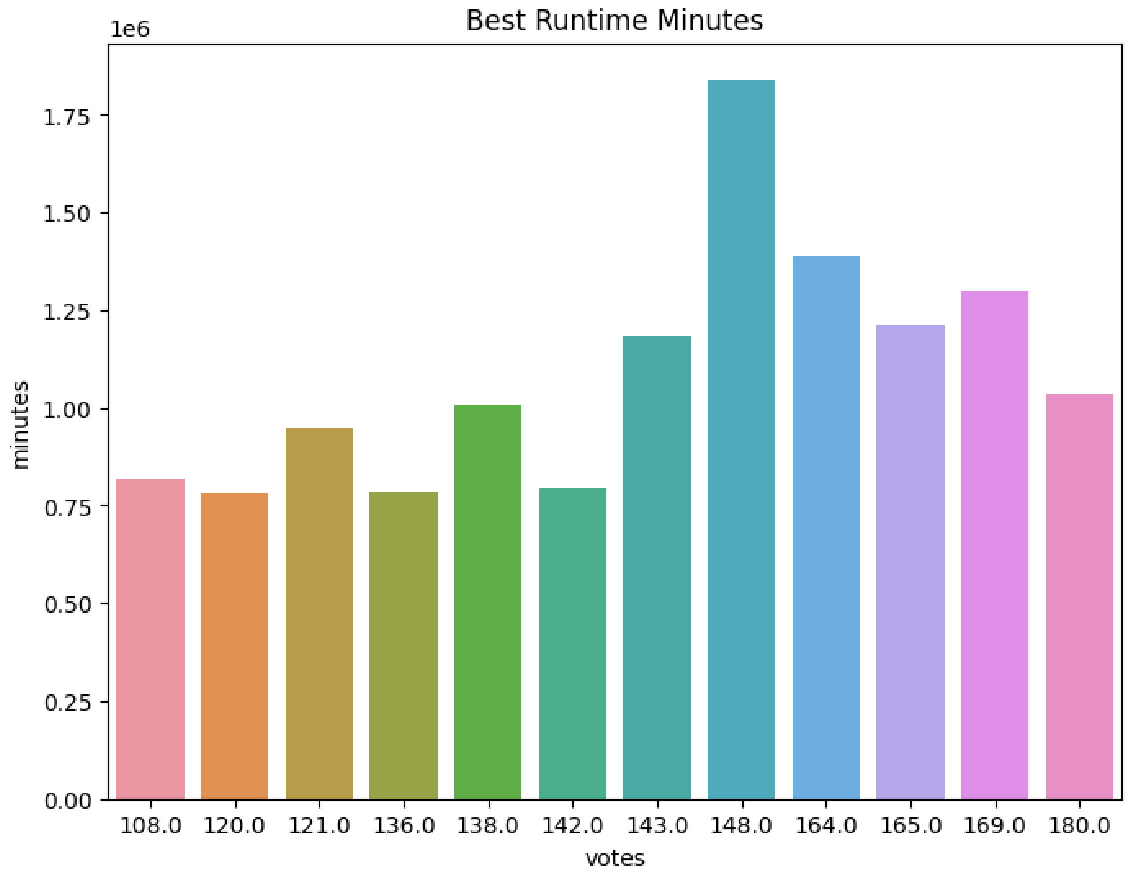


In [158]:
```
# creating a dataframe
runtimevotes= runtimevotes.rename_axis('votes')
runtimevot= runtimevotes.reset_index(name='minutes')
runtimevot
```

Out[158]:

	votes	minutes
0	148.0	1841066
1	164.0	1387769
2	169.0	1299334
3	165.0	1211405
4	143.0	1183655
5	180.0	1035358
6	138.0	1005960
7	121.0	948394
8	108.0	820847
9	142.0	795227
10	136.0	784780
11	120.0	780910

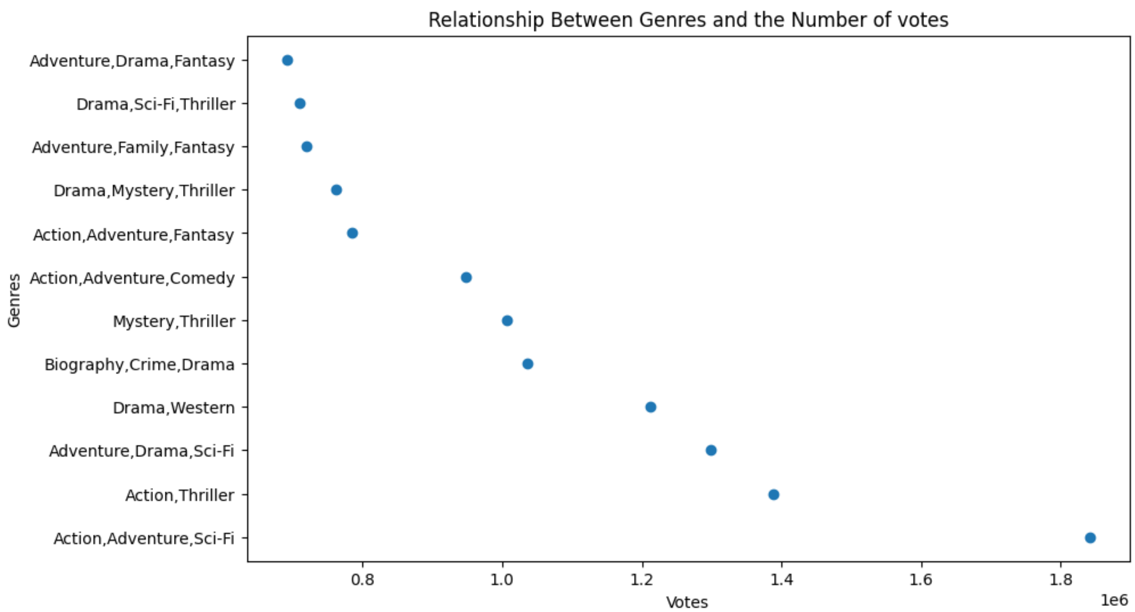
In [166]:
```
plt.figure(figsize=(8,6))
barplot = sns.barplot(x='votes',y='minutes', data=runtimevot)
barplot.set(title='Best Runtime Minutes')
plt.show()
```



The highest runtime is at the 148s. This shows that many people prefer to have or watch Videos that range at around that lenghth.

In [165]:
```
# investigate the relationship between genres and the number of votes
scatter_figure, ax = plt.subplots(figsize=(10, 6))
ax.scatter(highest_votes['votes'], highest_votes['genres'])
ax.set_title('Relationship Between Genres and the Number of votes')
ax.set_xlabel('Votes')
ax.set_ylabel('Genres')
```

Out[165]: Text(0, 0.5, 'Genres')



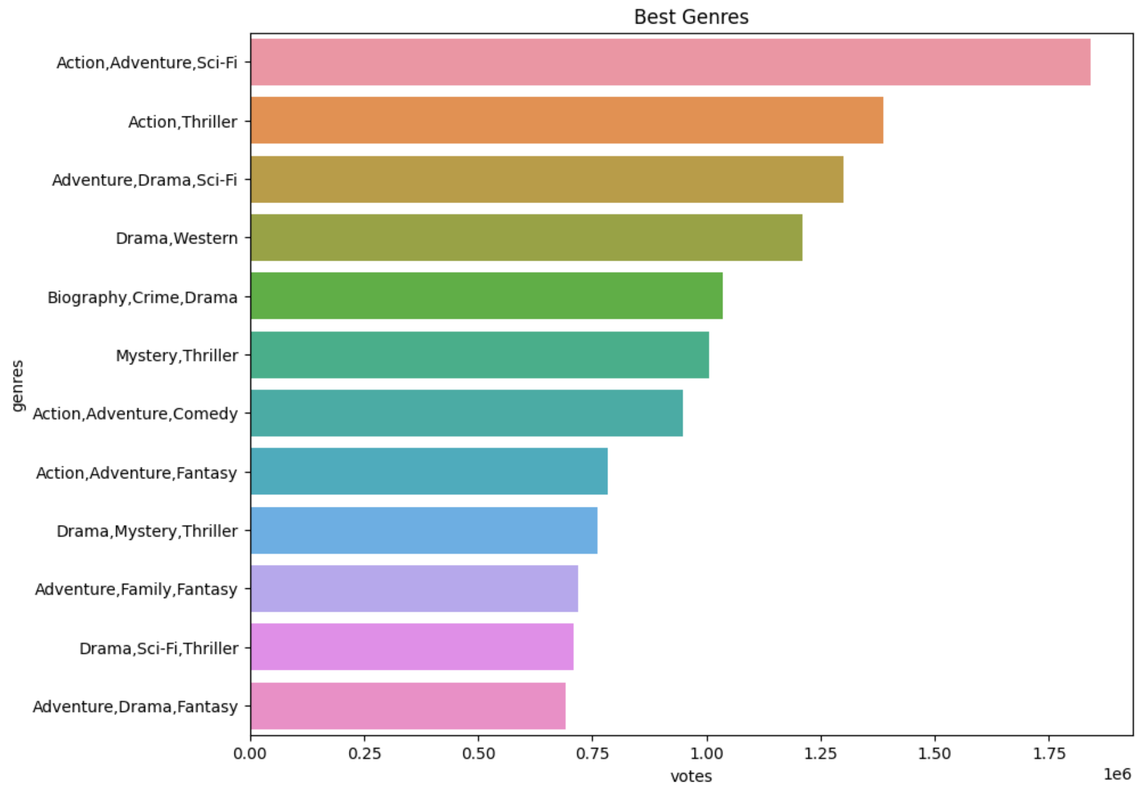
There is a negative relationship between the genre and number of votes.

In [163]:
```
# creating a dataframe
highest_votes= highest_votes.rename_axis('genre')
highest_votes1= highest_votes.reset_index(name='vote')
highest_votes1
```

Out[163]:

	genres	votes
0	Action,Adventure,Sci-Fi	1841066
1	Action,Thriller	1387769
2	Adventure,Drama,Sci-Fi	1299334
3	Drama,Western	1211405
4	Biography,Crime,Drama	1035358
5	Mystery,Thriller	1005960
6	Action,Adventure,Comedy	948394
7	Action,Adventure,Fantasy	784780
8	Drama,Mystery,Thriller	761592
9	Adventure,Family,Fantasy	719629
10	Drama,Sci-Fi,Thriller	710018
11	Adventure,Drama,Fantasy	691835

In [164]:
```
# movie genres with the highest vote.
plt.figure(figsize=(10,8))
barplot = sns.barplot(x='votes',y='genres', data=highest_votes)
barplot.set(title='Best Genres')
plt.show()
```



Action,Adventure,sci-fi have the largest popularity. This makes them the genres to go for as they wiull definitely have a higher return fetched.