Microsoft Movie Analysis

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Overview

This EDA gives insight on what successful movie studios are doing well and what specific actions Microsoft can do to achieve similar aims.

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.

Question 1: How many films have the top studios made from 2010-2019, and which studio brings in the most earnings? In other words, what are the studios that will be Microsoft's biggest competition?

Question 2: Is there a positive correlation between film length and domestic gross?

Question 3: What are the most popular movie genres?

Data Understanding

Three sets of data were collected to answer these questions - box office mojo movie gross data, imdb title basics data, and imdb title ratings data.

In [1]:

```
# Import standard packages
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
```

```
/Users/marissabush/opt/anaconda3/envs/learn-env/lib/python3.6/site-packages/statsmodels/t
ools/_testing.py:19: FutureWarning: pandas.util.testing is deprecated. Use the functions
in the public API at pandas.testing instead.
  import pandas.util.testing as tm
```

In [2]:

```
# Load csv files
bom_mg_df = pd.read_csv('data/zippedData/bom.movie_gross.csv.gz')
imdb_tr_df = pd.read_csv('data/zippedData/imdb.title.ratings.csv.gz')
imdb_tb_df = pd.read_csv('data/zippedData/imdb.title.basics.csv.gz')
```

BOM Movie Gross Data

In [3]:

```
# Function to get data frame info
```

```python
def df_scope(bom_mg_df):
    #print name,.shape, .info, .describe
    for name, df in bom_mg_df.items():
        print('=' * 100)
        print(name)
        print(bom_mg_df.shape, '\n')
        print(bom_mg_df.info(), '\n')
        print(bom_mg_df.describe(include='all'))
df_scope(bom_mg_df)
```

```
==========================================================================================
==========
title
(3387, 5)

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 3387 entries, 0 to 3386
Data columns (total 5 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   title           3387 non-null   object 
 1   studio          3382 non-null   object 
 2   domestic_gross  3359 non-null   float64
 3   foreign_gross   2037 non-null   object 
 4   year            3387 non-null   int64  
dtypes: float64(1), int64(1), object(3)
memory usage: 132.4+ KB
None

            title studio  domestic_gross foreign_gross         year
count        3387   3382    3.359000e+03          2037  3387.000000
unique       3386    257             NaN          1204          NaN
top     Bluebeard    IFC             NaN       1200000          NaN
freq            2    166             NaN            23          NaN
mean          NaN    NaN    2.874585e+07           NaN  2013.958075
std           NaN    NaN    6.698250e+07           NaN     2.478141
min           NaN    NaN    1.000000e+02           NaN  2010.000000
25%           NaN    NaN    1.200000e+05           NaN  2012.000000
50%           NaN    NaN    1.400000e+06           NaN  2014.000000
75%           NaN    NaN    2.790000e+07           NaN  2016.000000
max           NaN    NaN    9.367000e+08           NaN  2018.000000
==========================================================================================
==========
studio
(3387, 5)

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 3387 entries, 0 to 3386
Data columns (total 5 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   title           3387 non-null   object 
 1   studio          3382 non-null   object 
 2   domestic_gross  3359 non-null   float64
 3   foreign_gross   2037 non-null   object 
 4   year            3387 non-null   int64  
dtypes: float64(1), int64(1), object(3)
memory usage: 132.4+ KB
None

            title studio  domestic_gross foreign_gross         year
count        3387   3382    3.359000e+03          2037  3387.000000
unique       3386    257             NaN          1204          NaN
top     Bluebeard    IFC             NaN       1200000          NaN
freq            2    166             NaN            23          NaN
mean          NaN    NaN    2.874585e+07           NaN  2013.958075
std           NaN    NaN    6.698250e+07           NaN     2.478141
min           NaN    NaN    1.000000e+02           NaN  2010.000000
25%           NaN    NaN    1.200000e+05           NaN  2012.000000
50%           NaN    NaN    1.400000e+06           NaN  2014.000000
75%           NaN    NaN    2.790000e+07           NaN  2016.000000
max           NaN    NaN    9.367000e+08           NaN  2018.000000
```

```
==========================================================================================
===========
domestic_gross
(3387, 5)

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 3387 entries, 0 to 3386
Data columns (total 5 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   title           3387 non-null   object 
 1   studio          3382 non-null   object 
 2   domestic_gross  3359 non-null   float64
 3   foreign_gross   2037 non-null   object 
 4   year            3387 non-null   int64  
dtypes: float64(1), int64(1), object(3)
memory usage: 132.4+ KB
None

            title studio  domestic_gross foreign_gross         year
count        3387   3382    3.359000e+03          2037  3387.000000
unique       3386    257             NaN          1204          NaN
top     Bluebeard    IFC             NaN       1200000          NaN
freq            2    166             NaN            23          NaN
mean          NaN    NaN    2.874585e+07           NaN  2013.958075
std           NaN    NaN    6.698250e+07           NaN     2.478141
min           NaN    NaN    1.000000e+02           NaN  2010.000000
25%           NaN    NaN    1.200000e+05           NaN  2012.000000
50%           NaN    NaN    1.400000e+06           NaN  2014.000000
75%           NaN    NaN    2.790000e+07           NaN  2016.000000
max           NaN    NaN    9.367000e+08           NaN  2018.000000
==========================================================================================
===========
foreign_gross
(3387, 5)

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 3387 entries, 0 to 3386
Data columns (total 5 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   title           3387 non-null   object 
 1   studio          3382 non-null   object 
 2   domestic_gross  3359 non-null   float64
 3   foreign_gross   2037 non-null   object 
 4   year            3387 non-null   int64  
dtypes: float64(1), int64(1), object(3)
memory usage: 132.4+ KB
None

            title studio  domestic_gross foreign_gross         year
count        3387   3382    3.359000e+03          2037  3387.000000
unique       3386    257             NaN          1204          NaN
top     Bluebeard    IFC             NaN       1200000          NaN
freq            2    166             NaN            23          NaN
mean          NaN    NaN    2.874585e+07           NaN  2013.958075
std           NaN    NaN    6.698250e+07           NaN     2.478141
min           NaN    NaN    1.000000e+02           NaN  2010.000000
25%           NaN    NaN    1.200000e+05           NaN  2012.000000
50%           NaN    NaN    1.400000e+06           NaN  2014.000000
75%           NaN    NaN    2.790000e+07           NaN  2016.000000
max           NaN    NaN    9.367000e+08           NaN  2018.000000
==========================================================================================
===========
year
(3387, 5)

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 3387 entries, 0 to 3386
Data columns (total 5 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
```

```
 0   title           3387 non-null   object 
 1   studio          3382 non-null   object 
 2   domestic_gross  3359 non-null   float64
 3   foreign_gross   2037 non-null   object 
 4   year            3387 non-null   int64  
dtypes: float64(1), int64(1), object(3)
memory usage: 132.4+ KB
None

             title studio  domestic_gross foreign_gross         year
count         3387   3382    3.359000e+03          2037  3387.000000
unique        3386    257             NaN          1204          NaN
top     Bluebeard    IFC             NaN       1200000          NaN
freq             2    166             NaN            23          NaN
mean           NaN    NaN    2.874585e+07           NaN  2013.958075
std            NaN    NaN    6.698250e+07           NaN     2.478141
min            NaN    NaN    1.000000e+02           NaN  2010.000000
25%            NaN    NaN    1.200000e+05           NaN  2012.000000
50%            NaN    NaN    1.400000e+06           NaN  2014.000000
75%            NaN    NaN    2.790000e+07           NaN  2016.000000
max            NaN    NaN    9.367000e+08           NaN  2018.000000
```

In [4]:

```
bom_mg_df.head(2)
```

Out[4]:

	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

IMDB Title Basics Data

In [5]:

```
# Repeat function
def df_scope(imdb_tb_df):
    #print name,.shape, .info, .describe
    for name, df in imdb_tb_df.items():
        print('=' * 100)
        print(name)
        print(imdb_tb_df.shape, '\n')
        print(imdb_tb_df.info(), '\n')
        print(imdb_tb_df.describe(include='all'))
df_scope(imdb_tb_df)
```

```
==========================================================================================
==========
tconst
(146144, 6) 

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 146144 entries, 0 to 146143
Data columns (total 6 columns):
 #   Column           Non-Null Count   Dtype  
---  ------           --------------   -----  
 0   tconst           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
None 

           tconst primary_title original_title     start_year  \
count      146144        146144         146123  146144.000000   
unique     146144        136071         137773            NaN   
```

```
unique      146144         136071          137773               NaN
top      tt5348172           Home          Broken               NaN
freq             1             24              19               NaN
mean           NaN            NaN             NaN       2014.621798
std            NaN            NaN             NaN          2.733583
min            NaN            NaN             NaN       2010.000000
25%            NaN            NaN             NaN       2012.000000
50%            NaN            NaN             NaN       2015.000000
75%            NaN            NaN             NaN       2017.000000
max            NaN            NaN             NaN       2115.000000

        runtime_minutes       genres
count     114405.000000       140736
unique              NaN         1085
top                 NaN  Documentary
freq                NaN        32185
mean          86.187247          NaN
std          166.360590          NaN
min            1.000000          NaN
25%           70.000000          NaN
50%           87.000000          NaN
75%           99.000000          NaN
max        51420.000000          NaN
==========================================================================================
===========
primary_title
(146144, 6)

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 146144 entries, 0 to 146143
Data columns (total 6 columns):
 #   Column           Non-Null Count   Dtype  
---  ------           --------------   -----  
 0   tconst           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
None

           tconst primary_title original_title     start_year  \
count      146144        146144         146123  146144.000000   
unique     146144        136071         137773            NaN   
top     tt5348172          Home         Broken            NaN   
freq            1            24             19            NaN   
mean          NaN           NaN            NaN    2014.621798   
std           NaN           NaN            NaN       2.733583   
min           NaN           NaN            NaN    2010.000000   
25%           NaN           NaN            NaN    2012.000000   
50%           NaN           NaN            NaN    2015.000000   
75%           NaN           NaN            NaN    2017.000000   
max           NaN           NaN            NaN    2115.000000   

        runtime_minutes       genres
count     114405.000000       140736
unique              NaN         1085
top                 NaN  Documentary
freq                NaN        32185
mean          86.187247          NaN
std          166.360590          NaN
min            1.000000          NaN
25%           70.000000          NaN
50%           87.000000          NaN
75%           99.000000          NaN
max        51420.000000          NaN
==========================================================================================
===========
original_title
(146144, 6)
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 146144 entries, 0 to 146143
Data columns (total 6 columns):
 #   Column           Non-Null Count   Dtype  
---  ------           --------------   -----  
 0   tconst           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
None

           tconst primary_title original_title     start_year  \
count      146144        146144         146123  146144.000000   
unique     146144        136071         137773            NaN   
top     tt5348172          Home         Broken            NaN   
freq            1            24             19            NaN   
mean          NaN           NaN            NaN    2014.621798   
std           NaN           NaN            NaN       2.733583   
min           NaN           NaN            NaN    2010.000000   
25%           NaN           NaN            NaN    2012.000000   
50%           NaN           NaN            NaN    2015.000000   
75%           NaN           NaN            NaN    2017.000000   
max           NaN           NaN            NaN    2115.000000   

        runtime_minutes       genres  
count     114405.000000       140736  
unique              NaN         1085  
top                 NaN  Documentary  
freq                NaN        32185  
mean          86.187247          NaN  
std          166.360590          NaN  
min            1.000000          NaN  
25%           70.000000          NaN  
50%           87.000000          NaN  
75%           99.000000          NaN  
max        51420.000000          NaN  
==========================================================================================
===========
start_year
(146144, 6)
```


```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 146144 entries, 0 to 146143
Data columns (total 6 columns):
 #   Column           Non-Null Count   Dtype  
---  ------           --------------   -----  
 0   tconst           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
None

           tconst primary_title original_title     start_year  \
count      146144        146144         146123  146144.000000   
unique     146144        136071         137773            NaN   
top     tt5348172          Home         Broken            NaN   
freq            1            24             19            NaN   
mean          NaN           NaN            NaN    2014.621798   
std           NaN           NaN            NaN       2.733583   
min           NaN           NaN            NaN    2010.000000   
25%           NaN           NaN            NaN    2012.000000   
50%           NaN           NaN            NaN    2015.000000   
75%           NaN           NaN            NaN    2017.000000   
max           NaN           NaN            NaN    2115.000000   
```

```
max            NaN            NaN            NaN    2115.000000

        runtime_minutes       genres
count     114405.000000       140736
unique              NaN         1085
top                 NaN  Documentary
freq                NaN        32185
mean          86.187247          NaN
std          166.360590          NaN
min            1.000000          NaN
25%           70.000000          NaN
50%           87.000000          NaN
75%           99.000000          NaN
max        51420.000000          NaN
===========================================================================================
runtime_minutes
(146144, 6)

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 146144 entries, 0 to 146143
Data columns (total 6 columns):
 #   Column           Non-Null Count   Dtype  
---  ------           --------------   -----  
 0   tconst           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
None

           tconst primary_title original_title     start_year  \
count      146144        146144         146123  146144.000000   
unique     146144        136071         137773            NaN   
top     tt5348172          Home         Broken            NaN   
freq            1            24             19            NaN   
mean          NaN           NaN            NaN    2014.621798   
std           NaN           NaN            NaN       2.733583   
min           NaN           NaN            NaN    2010.000000   
25%           NaN           NaN            NaN    2012.000000   
50%           NaN           NaN            NaN    2015.000000   
75%           NaN           NaN            NaN    2017.000000   
max           NaN           NaN            NaN    2115.000000   

        runtime_minutes       genres
count     114405.000000       140736
unique              NaN         1085
top                 NaN  Documentary
freq                NaN        32185
mean          86.187247          NaN
std          166.360590          NaN
min            1.000000          NaN
25%           70.000000          NaN
50%           87.000000          NaN
75%           99.000000          NaN
max        51420.000000          NaN
===========================================================================================
genres
(146144, 6)

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 146144 entries, 0 to 146143
Data columns (total 6 columns):
 #   Column           Non-Null Count   Dtype  
---  ------           --------------   -----  
 0   tconst           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  
```

```
 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
None

           tconst primary_title original_title     start_year  \
count      146144        146144         146123  146144.000000
unique     146144        136071         137773            NaN
top     tt5348172          Home         Broken            NaN
freq            1            24             19            NaN
mean          NaN           NaN            NaN    2014.621798
std           NaN           NaN            NaN       2.733583
min           NaN           NaN            NaN    2010.000000
25%           NaN           NaN            NaN    2012.000000
50%           NaN           NaN            NaN    2015.000000
75%           NaN           NaN            NaN    2017.000000
max           NaN           NaN            NaN    2115.000000

        runtime_minutes       genres
count     114405.000000       140736
unique              NaN         1085
top                 NaN  Documentary
freq                NaN        32185
mean          86.187247          NaN
std          166.360590          NaN
min            1.000000          NaN
25%           70.000000          NaN
50%           87.000000          NaN
75%           99.000000          NaN
max        51420.000000          NaN
```

IMDB Title Ratings Data

In [6]:

```python
# Repeat function
def df_scope(imdb_tr_df):
    #print name,.shape, .info, .describe
    for name, df in imdb_tr_df.items():
        print('=' * 100)
        print(name)
        print(imdb_tr_df.shape, '\n')
        print(imdb_tr_df.info(), '\n')
        print(imdb_tr_df.describe(include='all'))
df_scope(imdb_tr_df)
```

```
==========================================================================================
==========
tconst
(73856, 3)

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 73856 entries, 0 to 73855
Data columns (total 3 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   tconst         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
None

           tconst  averagerating      numvotes
count       73856   73856.000000  7.385600e+04
unique      73856            NaN           NaN
top     tt7938092            NaN           NaN
freq            1            NaN           NaN
mean          NaN       6.332729  3.523662e+03
std           NaN       1.474978  3.029402e+04
```

```
min           NaN       1.000000  5.000000e+00
25%           NaN       5.500000  1.400000e+01
50%           NaN       6.500000  4.900000e+01
75%           NaN       7.400000  2.820000e+02
max           NaN      10.000000  1.841066e+06
==========================================================================================
===========
averagerating
(73856, 3)

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 73856 entries, 0 to 73855
Data columns (total 3 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   tconst         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
None

           tconst  averagerating      numvotes
count       73856   73856.000000  7.385600e+04
unique      73856            NaN           NaN
top     tt7938092            NaN           NaN
freq            1            NaN           NaN
mean          NaN       6.332729  3.523662e+03
std           NaN       1.474978  3.029402e+04
min           NaN       1.000000  5.000000e+00
25%           NaN       5.500000  1.400000e+01
50%           NaN       6.500000  4.900000e+01
75%           NaN       7.400000  2.820000e+02
max           NaN      10.000000  1.841066e+06
==========================================================================================
===========
numvotes
(73856, 3)

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 73856 entries, 0 to 73855
Data columns (total 3 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   tconst         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
None

           tconst  averagerating      numvotes
count       73856   73856.000000  7.385600e+04
unique      73856            NaN           NaN
top     tt7938092            NaN           NaN
freq            1            NaN           NaN
mean          NaN       6.332729  3.523662e+03
std           NaN       1.474978  3.029402e+04
min           NaN       1.000000  5.000000e+00
25%           NaN       5.500000  1.400000e+01
50%           NaN       6.500000  4.900000e+01
75%           NaN       7.400000  2.820000e+02
max           NaN      10.000000  1.841066e+06
```

In [7]:

```python
# Combine both IMDB data frames on common column
imdb_df = pd.merge(imdb_tr_df, imdb_tb_df, on='tconst', how='inner')
imdb_df.shape
```

Out[7]:

(73856, 8)

In [8]:

```
imdb_df.head(2)
```

Out[8]:

	tconst	averagerating	numvotes	primary_title	original_title	start_year	runtime_minutes	genres
0	tt10356526	8.3	31	Laiye Je Yaarian	Laiye Je Yaarian	2019	117.0	Romance
1	tt10384606	8.9	559	Borderless	Borderless	2019	87.0	Documentary

In [9]:

```
imdb_df.head(2)
```

Out[9]:

	tconst	averagerating	numvotes	primary_title	original_title	start_year	runtime_minutes	genres
0	tt10356526	8.3	31	Laiye Je Yaarian	Laiye Je Yaarian	2019	117.0	Romance
1	tt10384606	8.9	559	Borderless	Borderless	2019	87.0	Documentary

Combined Dateframe

In [10]:

```
imdb_df.rename(columns = {'primary_title':'title'}, inplace = True)
```

In [11]:

```
bom_mg_df.head(2)
```

Out[11]:

	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

In [12]:

```
imdb_df.tail(2)
```

Out[12]:

	tconst	averagerating	numvotes	title	original_title	start_year	runtime_minutes	genres
73854	tt9886934	7.0	5	The Projectionist	The Projectionist	2019	81.0	Documentary
73855	tt9894098	6.3	128	Sathru	Sathru	2019	129.0	Thriller

In [13]:

```
# Merge both data frames on common column, 'title'
df = imdb_df.merge(bom_mg_df, on = ['title'], how = 'inner')
df.head(2)
```

Out[13]:

	tconst	averagerating	numvotes	title	original_title	start_year	runtime_minutes	genres	studio
0	tt1043726	4.2	50352	The Legend of Hercules	The Legend of Hercules	2014	99.0	Action,Adventure,Fantasy	LG/S

	tconst	averagerating	numvotes	title	original_title	start_year	runtime_minutes	genres	studio
1	tt1171222	5.1	8296	Baggage Claim	Baggage Claim	2013	96.0	Comedy	FoxS

In [14]:

```
df.shape
```

Out[14]:

```
(3027, 12)
```

In [15]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 3027 entries, 0 to 3026
Data columns (total 12 columns):
 #   Column           Non-Null Count  Dtype  
---  ------           --------------  -----  
 0   tconst           3027 non-null   object 
 1   averagerating    3027 non-null   float64
 2   numvotes         3027 non-null   int64  
 3   title            3027 non-null   object 
 4   original_title   3027 non-null   object 
 5   start_year       3027 non-null   int64  
 6   runtime_minutes  2980 non-null   float64
 7   genres           3020 non-null   object 
 8   studio           3024 non-null   object 
 9   domestic_gross   3005 non-null   float64
 10  foreign_gross    1832 non-null   object 
 11  year             3027 non-null   int64  
dtypes: float64(3), int64(3), object(6)
memory usage: 307.4+ KB
```

Data Preparation

To begin the data cleaning process I chose to examine and drop any duplicates in the two columns, 'tconst' and 'original_title'. Then find all missing values, check the percentages and drop those, as well.

In [16]:

```
# Check for duplicates and missing values for combined df
```

In [17]:

```
df.head(2)
```

Out[17]:

	tconst	averagerating	numvotes	title	original_title	start_year	runtime_minutes	genres	studio
0	tt1043726	4.2	50352	The Legend of Hercules	The Legend of Hercules	2014	99.0	Action,Adventure,Fantasy	LG/S
1	tt1171222	5.1	8296	Baggage Claim	Baggage Claim	2013	96.0	Comedy	FoxS

In [18]:

```
df['tconst'].duplicated().sum()
```

Out[18]:

```
2
```

In [19]:

In [19]:

```
df.drop_duplicates(subset=['tconst'], inplace = True)
df.shape
```

Out[19]:

```
(3025, 12)
```

In [20]:

```
df['original_title'].duplicated().sum()
```

Out[20]:

```
298
```

In [21]:

```
df.drop_duplicates(subset = ['original_title'], inplace = True)
df.shape
```

Out[21]:

```
(2727, 12)
```

In [22]:

```
# Find missing values
df.isnull().sum().sort_values(ascending=False)
```

Out[22]:

```
foreign_gross      1091
runtime_minutes      22
domestic_gross       17
genres                5
studio                3
year                  0
start_year            0
original_title        0
title                 0
numvotes              0
averagerating         0
tconst                0
dtype: int64
```

In [23]:

```
len(df)
df.isnull().sum().sort_values(ascending = False)/len(df)
```

Out[23]:

```
foreign_gross      0.400073
runtime_minutes    0.008067
domestic_gross     0.006234
genres             0.001834
studio             0.001100
year               0.000000
start_year         0.000000
original_title     0.000000
title              0.000000
numvotes           0.000000
averagerating      0.000000
tconst             0.000000
dtype: float64
```

In [24]:

```
# Drop unnecessary columns
df.drop('foreign_gross', axis = 1, inplace = True)
df.drop('tconst', axis = 1, inplace = True)
df.drop('year', axis = 1, inplace = True)
```

```
df.drop('original_title', axis = 1, inplace = True)
```

In [25]:

```
# Drop missing values from the other columns
df.dropna(subset=['genres', 'runtime_minutes', 'domestic_gross', 'studio'], inplace=True
)
df.shape
```

Out[25]:

```
(2683, 8)
```

In [26]:

```
# Double check for missing values
df.isnull().sum().sort_values(ascending=False)
```

Out[26]:

```
domestic_gross     0
studio             0
genres             0
runtime_minutes    0
start_year         0
title              0
numvotes           0
averagerating      0
dtype: int64
```

In [27]:

```
# rename column
df.rename(columns = {'start_year':'release_date'}, inplace = True)
```

In [28]:

```
df.head(2)
```

Out[28]:

	averagerating	numvotes	title	release_date	runtime_minutes	genres	studio	domestic_gross
0	4.2	50352	The Legend of Hercules	2014	99.0	Action,Adventure,Fantasy	LG/S	18800000.0
1	5.1	8296	Baggage Claim	2013	96.0	Comedy	FoxS	21600000.0

In [29]:

```
df.describe()
```

Out[29]:

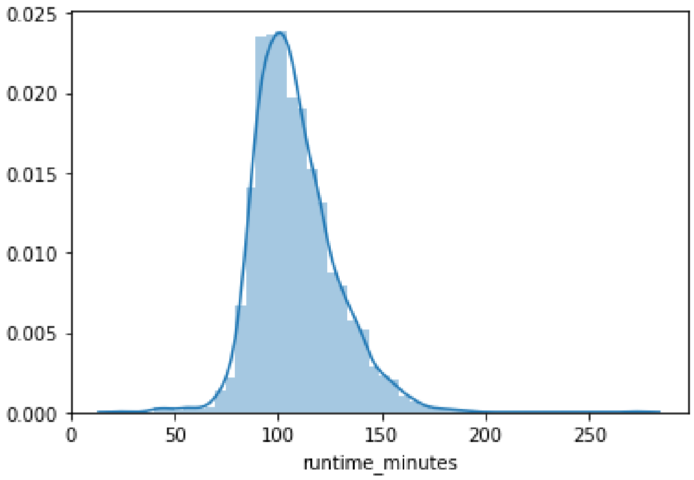
	averagerating	numvotes	release_date	runtime_minutes	domestic_gross
count	2683.000000	2.683000e+03	2683.000000	2683.000000	2.683000e+03
mean	6.486545	6.653972e+04	2013.751025	108.044726	3.027196e+07
std	0.962640	1.302484e+05	2.441232	19.484201	6.709432e+07
min	1.600000	5.000000e+00	2010.000000	25.000000	1.000000e+02
25%	6.000000	3.345500e+03	2012.000000	95.000000	1.260000e+05
50%	6.600000	1.561200e+04	2014.000000	105.000000	1.800000e+06
75%	7.200000	7.119100e+04	2016.000000	119.000000	3.120000e+07
max	8.900000	1.841066e+06	2019.000000	272.000000	7.001000e+08

In [30]:

```
# Check for outliers
sns.distplot(df['runtime_minutes'])
```

Out[30]:

```
<AxesSubplot:xlabel='runtime_minutes'>
```



In [31]:

```
# Remove outliers
df = df[df.runtime_minutes != 272]
df = df[df.runtime_minutes != 25]
```

Data Modeling

Question 1: How many films have the top studios made from 2010-2019, and which studio brings in the most earnings? In other words, what are the studios that will be Microsoft's biggest competition?

In [32]:

```
df.head(2)
```

Out[32]:

	averagerating	numvotes	title	release_date	runtime_minutes	genres	studio	domestic_gross
0	4.2	50352	The Legend of Hercules	2014	99.0	Action,Adventure,Fantasy	LG/S	18800000.0
1	5.1	8296	Baggage Claim	2013	96.0	Comedy	FoxS	21600000.0

In [33]:

```
# How many films per studio
top_studios = df['studio'].value_counts().head(10)
top_studios
```

Out[33]:

```
IFC      133
Uni.     131
Fox      121
Magn.    108
WB       107
SPC       99
BV        86
Sony      82
Par.      80
LGF       80
Name: studio, dtype: int64
```

In [34]:

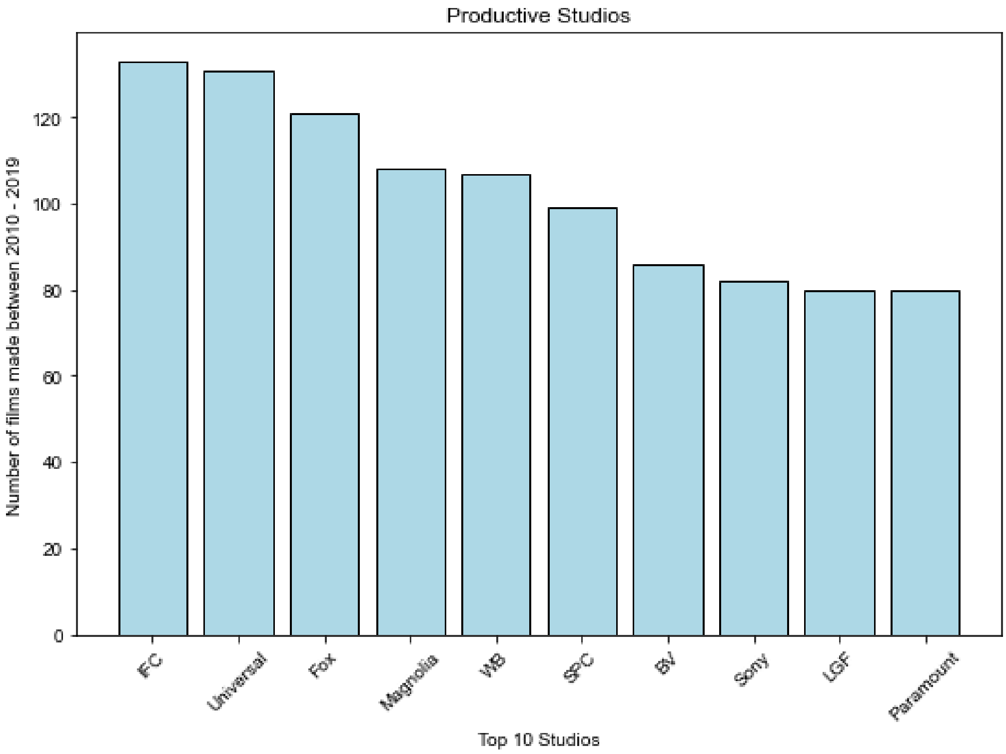
```
top_studios.describe()
```

Out[34]:

```
count     10.000000
mean     102.700000
std       20.688429
min       80.000000
25%       83.000000
50%      103.000000
75%      117.750000
max      133.000000
Name: studio, dtype: float64
```

In [35]:

```
# Bar graph of top 10 studios and number of movies made
studio = ['IFC', 'Universal', 'Fox', 'Magnolia', 'WB', 'SPC', 'BV', 'Sony', 'LGF', 'Para
mount']
num_film = [133, 131, 121, 108, 107, 99, 86, 82, 80, 80]

plt.figure(figsize=(9,6))

plt.bar(x= studio,

        height= num_film,

       color = 'lightblue', edgecolor = 'black')

plt.xlabel('Top 10 Studios')
plt.ylabel('Number of films made between 2010 - 2019')
plt.xticks(rotation=45)
plt.title('Productive Studios')

sns.set();
```



In [36]:

```
# Group top studios and their domestic gross sum
studio_gross = df.groupby('studio').domestic_gross.sum().sort_values(ascending = False).
head(10)
studio_gross
```

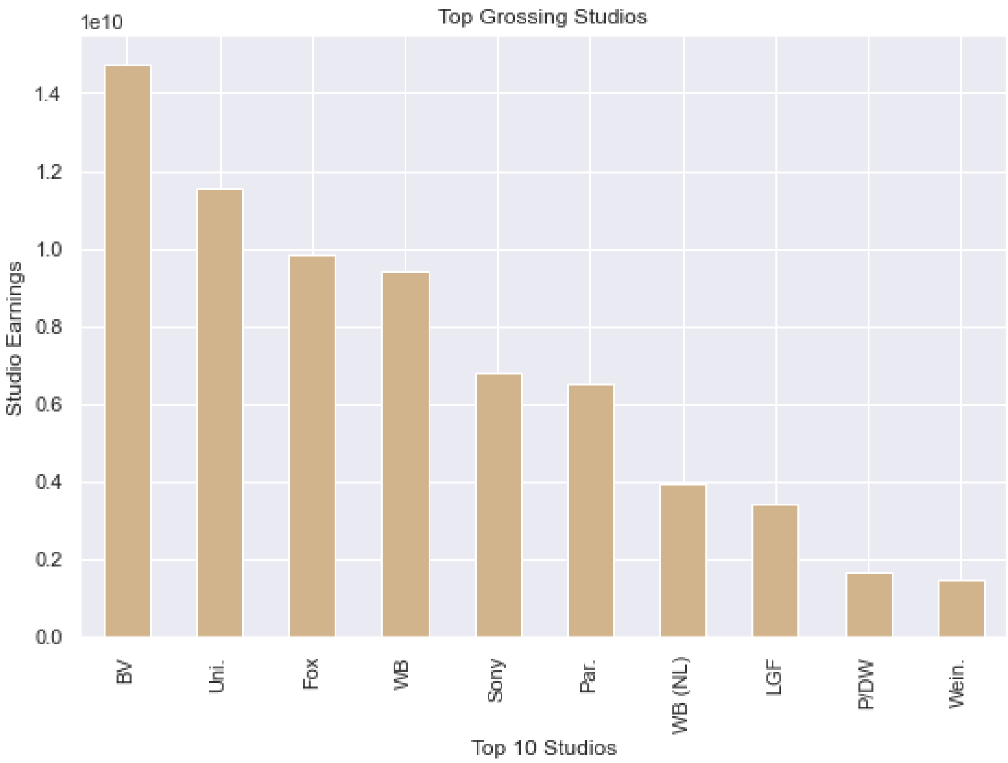
Out[36]:

```
studio
BV            1.474870e+10
```

```
BV         1.474070e+10
Uni.       1.152670e+10
Fox        9.853700e+09
WB         9.415000e+09
Sony       6.809846e+09
Par.       6.517213e+09
WB (NL)    3.962400e+09
LGF        3.440950e+09
P/DW       1.682900e+09
Wein.      1.485199e+09
Name: domestic_gross, dtype: float64
```

In [37]:

```
# Bar graph of studios and domestic gross sum
studio_gross.plot.bar(figsize=(9,6), color = 'tan',
                      edgecolor = 'white'
                     )
plt.xlabel('Top 10 Studios')
plt.ylabel('Studio Earnings')
plt.title('Top Grossing Studios')
sns.set();
```



The most productive studios from 2010-2019 made over 80 films in that time with Buena Vista studios bringing in the highest earnings.

Question 2: Is there a correlation between film length and domestic gross?

In [38]:

```
df['domestic_gross'].describe()
```

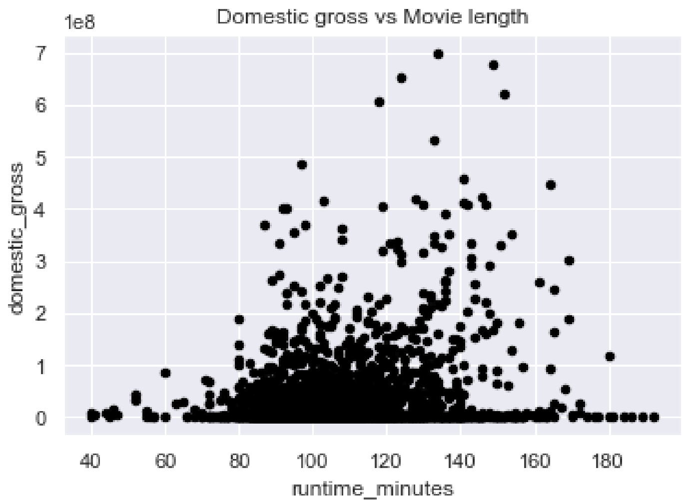
Out[38]:

```
count    2.681000e+03
mean     3.027515e+07
std      6.711552e+07
min      1.000000e+02
25%      1.260000e+05
50%      1.800000e+06
75%      3.120000e+07
max      7.001000e+08
Name: domestic_gross, dtype: float64
```

In [39]:

```python
# Scatter plot of domestic gross vs movie length
plt.figure(figsize = (9, 6))
df.plot.scatter(x = 'runtime_minutes', y = 'domestic_gross', color = 'black')
plt.title("Domestic gross vs Movie length")

plt.show()

sns.set();
```

```
<Figure size 648x432 with 0 Axes>
```



It looks there is a slight positive correlation between the two with the higher grossing films being in the 2 - 2.5 hour range. Perhaps making a film that length would be a good move.

Question 3: What are the most popular movie genres?

In [40]:

```python
df.head(1)
```

Out[40]:

	averagerating	numvotes	title	release_date	runtime_minutes	genres	studio	domestic_gross
0	4.2	50352	The Legend of Hercules	2014	99.0	Action,Adventure,Fantasy	LG/S	18800000.0

In [41]:

```python
# Organize genres by first genre in string - for simplification
df['new_genres'] = df['genres'].str.split(pat=",").str[0]
df['new_genres'].value_counts()
```

Out[41]:

```
Drama          677
Action         592
Comedy         569
Biography      227
Adventure      203
Documentary    128
Crime          116
Horror          84
Animation       35
Thriller        18
Fantasy         11
Mystery          8
Romance          8
Family           2
Sci-Fi           1
Sport            1
Music            1
Name: new_genres, dtype: int64
```

Name: new_genres, dtype: int64

In [42]:

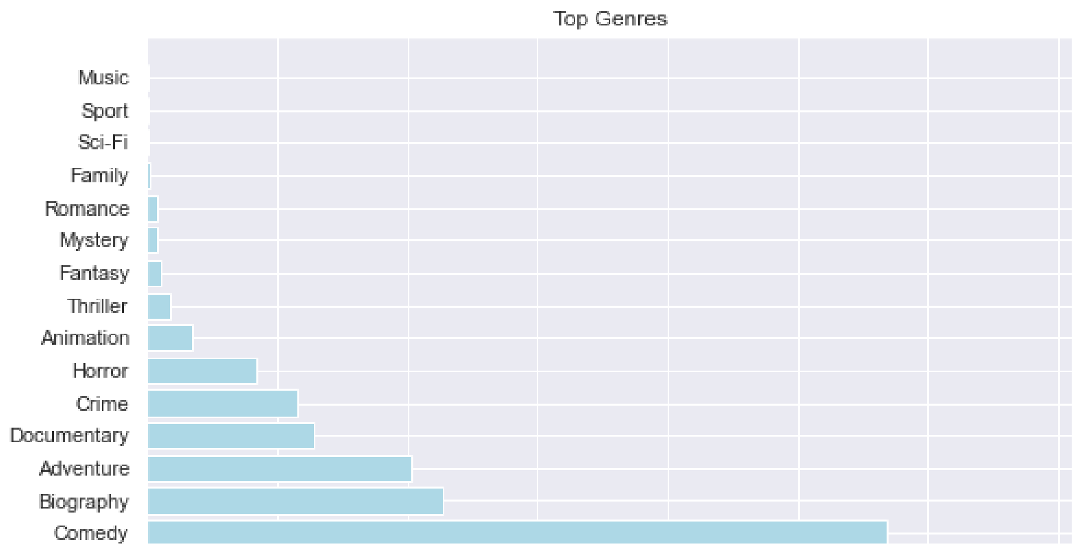
```
# Group the data by genres
df.groupby('new_genres').sum()
```

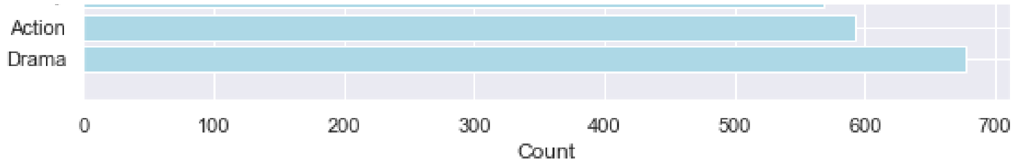
Out[42]:

new_genres	averagerating	numvotes	release_date	runtime_minutes	domestic_gross
Action	3751.5	76494734	1192261	68654.0	3.653866e+10
Adventure	1319.1	20258369	408849	21020.0	1.475267e+10
Animation	238.7	1524793	70493	3339.0	9.411647e+08
Biography	1589.0	14129553	457249	25461.0	4.291921e+09
Comedy	3547.9	25024900	1145600	59980.0	1.132005e+10
Crime	776.9	7325512	233595	13067.0	1.469601e+09
Documentary	929.0	646155	257718	11595.0	1.092938e+09
Drama	4470.5	25172473	1363243	73239.0	7.027175e+09
Family	12.7	145	4033	182.0	1.398400e+07
Fantasy	70.4	200047	22151	1215.0	4.656020e+08
Horror	453.0	5400191	169172	7960.0	2.562128e+09
Music	7.2	15592	2013	93.0	3.400000e+06
Mystery	56.2	2011759	16108	902.0	3.426180e+08
Romance	46.9	263754	16113	885.0	6.489330e+07
Sci-Fi	5.9	3501	2018	89.0	7.800000e+04
Sport	7.9	77	2014	114.0	5.300000e+06
Thriller	105.2	51572	36241	1792.0	2.754883e+08

In [43]:

```
# Horizontal Bar chart
fig, ax = plt.subplots(figsize = (9,6))

genre_types = df['new_genres'].value_counts()

ax.barh(y=genre_types.index,
    width=genre_types.values, color = 'lightblue', edgecolor = 'white'
)
ax.set_xlabel('Count')
ax.set_title('Top Genres')
sns.set();
```

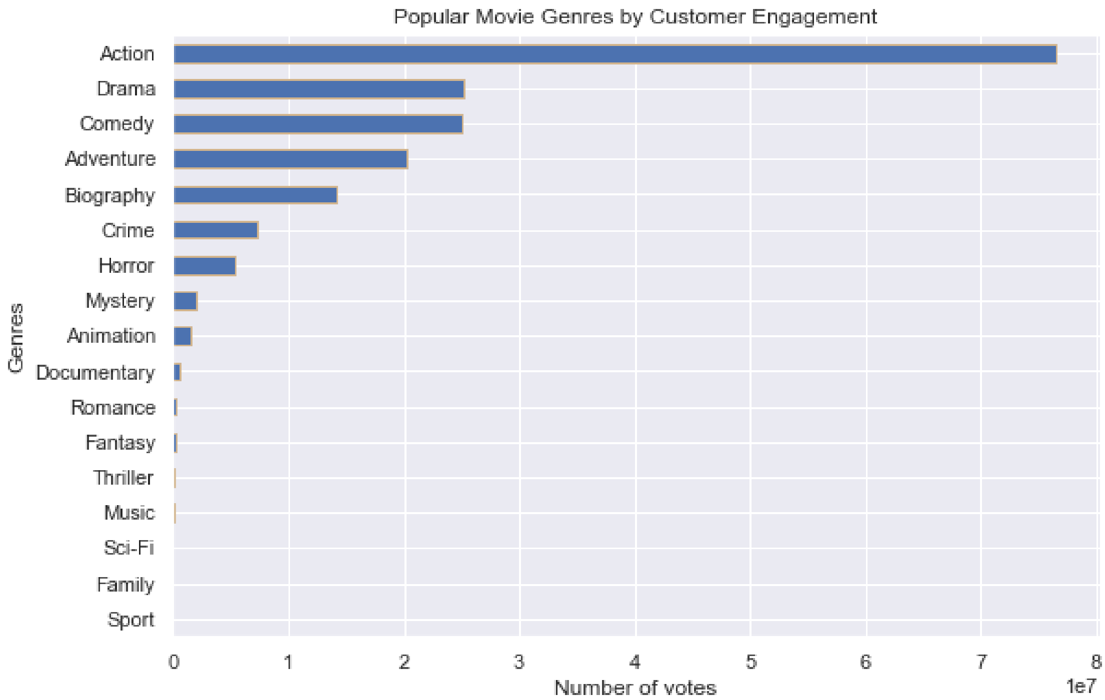




Results show drama, action, and comedy are the most frequently made movies.

In [44]:

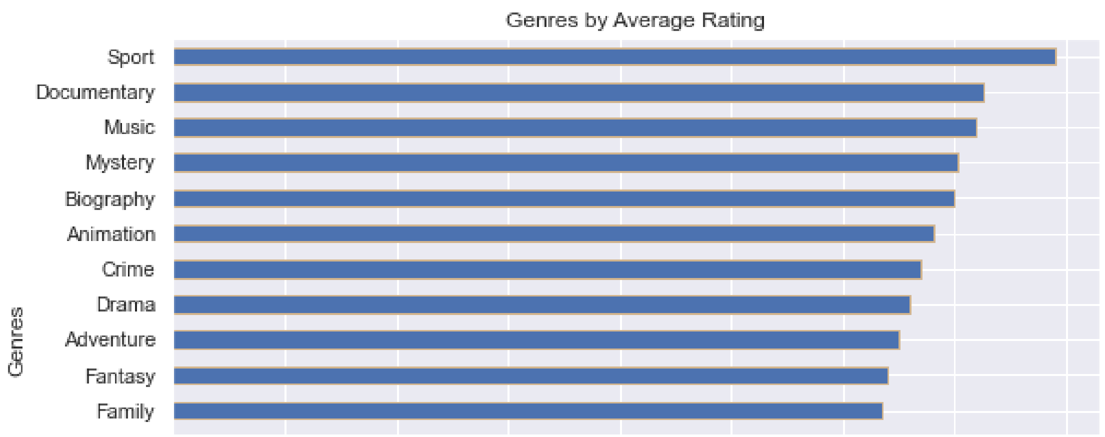
```
# Graph by genre and number of votes - or number of customer interaction
df.groupby(['new_genres'])['numvotes'].sum().sort_values().plot(kind='barh', figsize=(9,
6), edgecolor = 'tan')
plt.title('Popular Movie Genres by Customer Engagement')
plt.xlabel("Number of votes")
plt.ylabel('Genres')
sns.set();
```

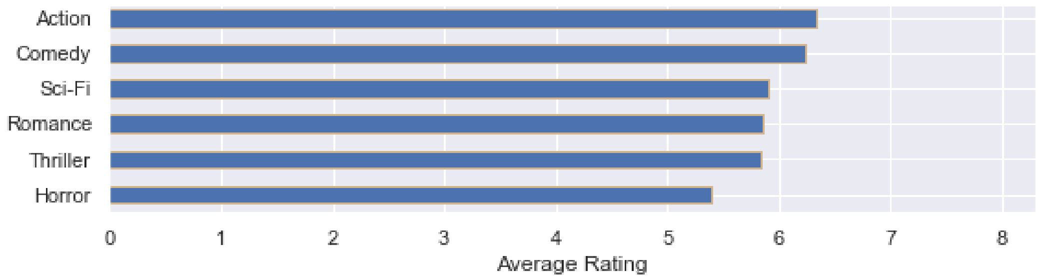


Results show that action films result in a lot more online engagement compared the other genres.

In [45]:

```
# Bar graph
df.groupby(['new_genres'])['averagerating'].mean().sort_values().plot(kind='barh',
                                                                   figsize=(9,6),
                                                                   edgecolor = 'tan'
)
plt.title("Genres by Average Rating")
plt.xlabel('Average Rating')
plt.ylabel('Genres')
sns.set();
```





Results seem to show that sport, documentary, and music come out as the top three genres with the highest ratings. However, this would be inaccurate to conclude due the low number of votes for those particular genres.

Looking at the previous three graphs, it appears action, drama, and comedy are the most successful genres with audiences.

Evaluation

The visualizations show that the top movie studios today have made an average of 102.7 films between 2010-2019 with that being about 11.4 films a year. The other visualization shows that movies that make a higher domestic gross are between 2 - 2.5 hours long. With the final visualizations, it looks like drama, action, and comedy are the most frequently made films with the action genre creating the most 'buzz'/customer engagement.

Conclusions

With all this in mind, I would recommend Microsoft to make a movie that is between 2 to 2.5 hours long and also to consider a film in the action, drama, or comedy genre. Additionally, I would recommend making about 11.4 films a year in order to compete with the top studios. This analysis has gaps due to the small data set and with only including domestic gross as a measure of earnings. To improve this project, I would like to work with foreign gross and cost of production data to understand the bigger picture of potential earnings per film.

In [ ]: