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Microsoft is Joining the Streaming Race

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Overview: Microsoft feels left out of the streaming services. They want to join Apple, Netflix, and Amazon in the original content battle. I will be showing how much money should be budgeted, when the movie should be released, and what type of movie should be produced. This will be determined from the data on Box Office Mojo, IMDB, TheMovieDB, and The Numbers. After the analysis, the head of Microsoft's movie studio should be able to better determine what to start with.

Method

I am determining the PIR, profit investment return, of all movies we have data on. I will use the top 10% to answer the following questions. Then, compare to the whole to see if any value is represented more in the top than the whole.

- What should the budget be?
- When should the release date be?
- What genre should the movie be?

Cleaning Data

In [49]:

```
# standard imports
import pandas as pd
import os
import csv
import matplotlib.pyplot as plt
import seaborn as sns
```

In [2]:

```
# see what table looks like
df_budgets = pd.read_csv('zippedData/tn.movie_budgets.csv')
print(df_budgets.shape)
df_budgets.head()
```

```
(5782, 6)
```

Out[2]:

	id	release_date	movie	production_budget	domestic_gross	worldwide_gross
0	1	Dec 18, 2009	Avatar	$425,000,000	$760,507,625	$2,776,345,279
1	2	May 20, 2011	Pirates of the Caribbean: On Stranger Tides	$410,600,000	$241,063,875	$1,045,663,875
2	3	Jun 7, 2019	Dark Phoenix	$350,000,000	$42,762,350	$149,762,350
3	4	May 1, 2015	Avengers: Age of Ultron	$330,600,000	$459,005,868	$1,403,013,963
4	5	Dec 15, 2017	Star Wars Ep. VIII: The Last Jedi	$317,000,000	$620,181,382	$1,316,721,747

In [3]:

```
df_budgets.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 5782 entries, 0 to 5781
Data columns (total 6 columns):
 #   Column             Non-Null Count  Dtype 
---  ------             --------------  ----- 
 0   id                 5782 non-null   int64 
 1   release_date       5782 non-null   object
 2   movie              5782 non-null   object
 3   production_budget  5782 non-null   object
 4   domestic_gross     5782 non-null   object
 5   worldwide_gross    5782 non-null   object
dtypes: int64(1), object(5)
memory usage: 271.2+ KB
```

In [4]:

```python
# Get rid of symbols or capitalizations that could hinder matching with
# other tables. Clear out number symbols so that numbers can be integers.
def clean_title(df, column):
    data = df
    data[column] = data[column].str.replace('.', '')
    data[column] = data[column].str.replace(',', '')
    data[column] = data[column].str.replace(':', '')
    data[column] = data[column].str.replace('$', '')
    data[column] = data[column].str.replace('â', '')
    data[column] = data[column].str.lower()
```

In [5]:

```python
#removing punctuation and capitalization to better match others
clean_title(df_budgets, 'movie')
clean_title(df_budgets, 'production_budget')
clean_title(df_budgets, 'domestic_gross')
clean_title(df_budgets, 'worldwide_gross')
df_budgets.head()
```

```
<ipython-input-4-9006c6fcf56e>:5: FutureWarning: The default value of regex wi
ll change from True to False in a future version. In addition, single characte
r regular expressions will*not* be treated as literal strings when regex=True.
  data[column] = data[column].str.replace('.', '')
<ipython-input-4-9006c6fcf56e>:8: FutureWarning: The default value of regex wi
ll change from True to False in a future version. In addition, single characte
r regular expressions will*not* be treated as literal strings when regex=True.
  data[column] = data[column].str.replace('$', '')
```

Out[5]:

	id	release_date	movie	production_budget	domestic_gross	worldwide_gross
0	1	Dec 18, 2009	avatar	425000000	760507625	2776345279
1	2	May 20, 2011	pirates of the caribbean on stranger tides	410600000	241063875	1045663875
2	3	Jun 7, 2019	dark phoenix	350000000	42762350	149762350
3	4	May 1, 2015	avengers age of ultron	330600000	459005868	1403013963
4	5	Dec 15, 2017	star wars ep viii the last jedi	317000000	620181382	1316721747

In [6]:

```
# converting money to be integers for future calculations
convert_dict = {'production_budget': int,
                'domestic_gross': int,
                'worldwide_gross': int}
df_budgets = df_budgets.astype(convert_dict)
df_budgets.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 5782 entries, 0 to 5781
Data columns (total 6 columns):
 #   Column             Non-Null Count  Dtype 
---  ------             --------------  ----- 
 0   id                 5782 non-null   int64 
 1   release_date       5782 non-null   object
 2   movie              5782 non-null   object
 3   production_budget  5782 non-null   int64 
 4   domestic_gross     5782 non-null   int64 
 5   worldwide_gross    5782 non-null   int64 
dtypes: int64(4), object(2)
memory usage: 271.2+ KB
```

In [7]:

```
#creating domestic PIR
df_budgets['domestic_pir'] = df_budgets['domestic_gross']/df_budgets['product
```

In [8]:

```
#creating worldwide PIR
df_budgets['worldwide_pir'] = df_budgets['worldwide_gross']/df_budgets['produ
```

In [9]:

```
#fixing dates to be organized by year-month-date in numbers
df_budgets['release_date'] = pd.to_datetime(df_budgets['release_date'])
df_budgets.head()
```

Out[9]:

	id	release_date	movie	production_budget	domestic_gross	worldwide_gross	domestic
0	1	2009-12-18	avatar	425000000	760507625	2776345279	1.789
1	2	2011-05-20	pirates of the caribbean on stranger tides	410600000	241063875	1045663875	0.58
2	3	2019-06-07	dark phoenix	350000000	42762350	149762350	0.12
3	4	2015-05-01	avengers age of ultron	330600000	459005868	1403013963	1.388
4	5	2017-12-15	star wars ep viii the last jedi	317000000	620181382	1316721747	1.956

In [10]:

```
#create new modified table from transformed data
df_budgets.to_csv('zippedData/tn.movie_budgets_pir.csv')
```

In [11]:

```
#clean basic's table
df_basics = pd.read_csv('zippedData/imdb.title.basics.csv')

print(df_basics.shape)
df_basics.head()
```

```
(146144, 6)
```

Out[11]:

	tconst	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 [12]:

```python
#removing punctuation and capitalization to better match others
clean_title(df_basics, 'primary_title')
clean_title(df_basics, 'original_title')
```

```
<ipython-input-4-9006c6fcf56e>:5: FutureWarning: The default value of regex wi
ll change from True to False in a future version. In addition, single characte
r regular expressions will*not* be treated as literal strings when regex=True.
  data[column] = data[column].str.replace('.', '')
<ipython-input-4-9006c6fcf56e>:8: FutureWarning: The default value of regex wi
ll change from True to False in a future version. In addition, single characte
r regular expressions will*not* be treated as literal strings when regex=True.
  data[column] = data[column].str.replace('$', '')
```

In [13]:

```python
# split genres until all are in their own
new_basics = df_basics['genres'].str.split(",", n = 1, expand = True)
df_basics['genre_1']= new_basics[0]
df_basics['genre_2']= new_basics[1]
df_basics.drop(columns =['genres'], inplace = True)
df_basics.head()
```

Out[13]:

	tconst	primary_title	original_title	start_year	runtime_minutes	genre_1	genre_
0	tt0063540	sunghursh	sunghursh	2013	175.0	Action	Crime,Dram
1	tt0066787	one day before the rainy season	ashad ka ek din	2019	114.0	Biography	Dram
2	tt0069049	the other side of the wind	the other side of the wind	2018	122.0	Drama	Non
3	tt0069204	sabse bada sukh	sabse bada sukh	2018	NaN	Comedy	Dram
4	tt0100275	the wandering soap opera	la telenovela errante	2017	80.0	Comedy	Drama,Fantas

In [14]:

```
new_basics = df_basics['genre_2'].str.split(",", n = 1, expand = True)
df_basics['genre_2']= new_basics[0]
df_basics['genre_3']= new_basics[1]
df_basics.head()
```

Out[14]:

	tconst	primary_title	original_title	start_year	runtime_minutes	genre_1	genre_2	ge
0	tt0063540	sunghursh	sunghursh	2013	175.0	Action	Crime	I
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	None	
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	Fa

In [15]:

```
# shows no more "doubled" genres columns
print(df_basics['genre_3'].unique())
print(df_basics['genre_2'].unique())
print(df_basics['genre_1'].unique())
```

```
['Drama' None 'Fantasy' 'Comedy' 'History' nan 'Sci-Fi' 'Thriller'
 'Romance' 'War' 'Crime' 'Family' 'Music' 'Horror' 'Animation' 'Sport'
 'Western' 'Mystery' 'Documentary' 'Musical' 'Biography' 'News'
 'Reality-TV' 'Short']
['Crime' 'Drama' None 'Thriller' 'Animation' 'History' nan 'Mystery'
 'Comedy' 'Adventure' 'Romance' 'Horror' 'Family' 'Sci-Fi' 'Fantasy'
 'Sport' 'Documentary' 'Music' 'War' 'Biography' 'Musical' 'Western'
 'News' 'Reality-TV' 'Talk-Show' 'Game-Show' 'Adult' 'Short']
['Action' 'Biography' 'Drama' 'Comedy' 'Horror' 'Adventure' 'Documentary'
 'History' 'Animation' nan 'Crime' 'Sci-Fi' 'Thriller' 'Fantasy' 'Mystery'
 'Musical' 'Family' 'Western' 'Romance' 'Sport' 'Adult' 'Music' 'News'
 'Talk-Show' 'Reality-TV' 'War' 'Game-Show' 'Short']
```

In [16]:

```
print('budgets table length is',len(df_budgets['movie']))
print('genres table length is',len(df_basics['primary_title']))
```

```
budgets table length is 5782
genres table length is 146144
```

In [17]:

```
#create new modified table from transformed data
df_basics.to_csv('zippedData/genres.cleaned.csv')
```

In [18]:

```
# use sql to analyze further
import sqlite3

conn = sqlite3.connect('movies.db')

# Create a cursor object
cur = conn.cursor()

# Create table in sqlite3
cur.execute('''CREATE TABLE IF NOT EXISTS basics (
    id integer,
    release_date date,
    movie_title text PRIMARY KEY,
    domestic_gross integer,
    worldwide_gross integer,
    domestic_PIR integer,
    worldwide_PIR integer)
;''')

cur.execute('''CREATE TABLE IF NOT EXISTS genres (
    tconst text,
    movie_title text PRIMARY KEY,
    start_year date,
    runtime_min integer,
    genre_1 text,
    genre_2 text
    genre_3 text)
;''')

# Load CSV data into Pandas DataFrame
basics = pd.read_csv('zippedData/tn.movie_budgets_pir.csv')
genres = pd.read_csv('zippedData/genres.cleaned.csv')

# Write the data to a sqlite db table
basics.to_sql('basics', conn, if_exists='replace', index=False)
genres.to_sql('genres', conn, if_exists='replace', index=False)
```

```
/opt/anaconda3/lib/python3.8/site-packages/pandas/core/generic.py:2779: UserWa
rning: The spaces in these column names will not be changed. In pandas version
s < 0.14, spaces were converted to underscores.
  sql.to_sql(
```

Finding Recommended Budget

Find top 10% movie budgets for movies in the last 10 years. To qualify, I am setting the requirement of having made a minimum of the budget back in domestic sales and having made money internationally. This gives a total of 739 qualifying movies. Top 10% is being rounded to be the top 74 movies.

Top 10% Budgets

In [19]:

```
top_budgets = pd.read_sql('''
    SELECT movie, production_budget, worldwide_pir
    FROM basics
    WHERE release_date >= 2011
    AND domestic_gross > 0
    AND domestic_pir > 1
    ORDER BY worldwide_pir DESC
    LIMIT 74
    ;''', conn)
len(top_budgets)
```

Out[19]:

```
74
```

All Budgets

In [20]:

```
all_budgets = pd.read_sql('''
    SELECT movie, production_budget, worldwide_pir
    FROM basics
    WHERE release_date >= 2011
    AND domestic_gross > 0
    AND domestic_pir > 1
    ORDER BY worldwide_pir DESC
    ;''', conn)
len(all_budgets)
```

Out[20]:

```
739
```

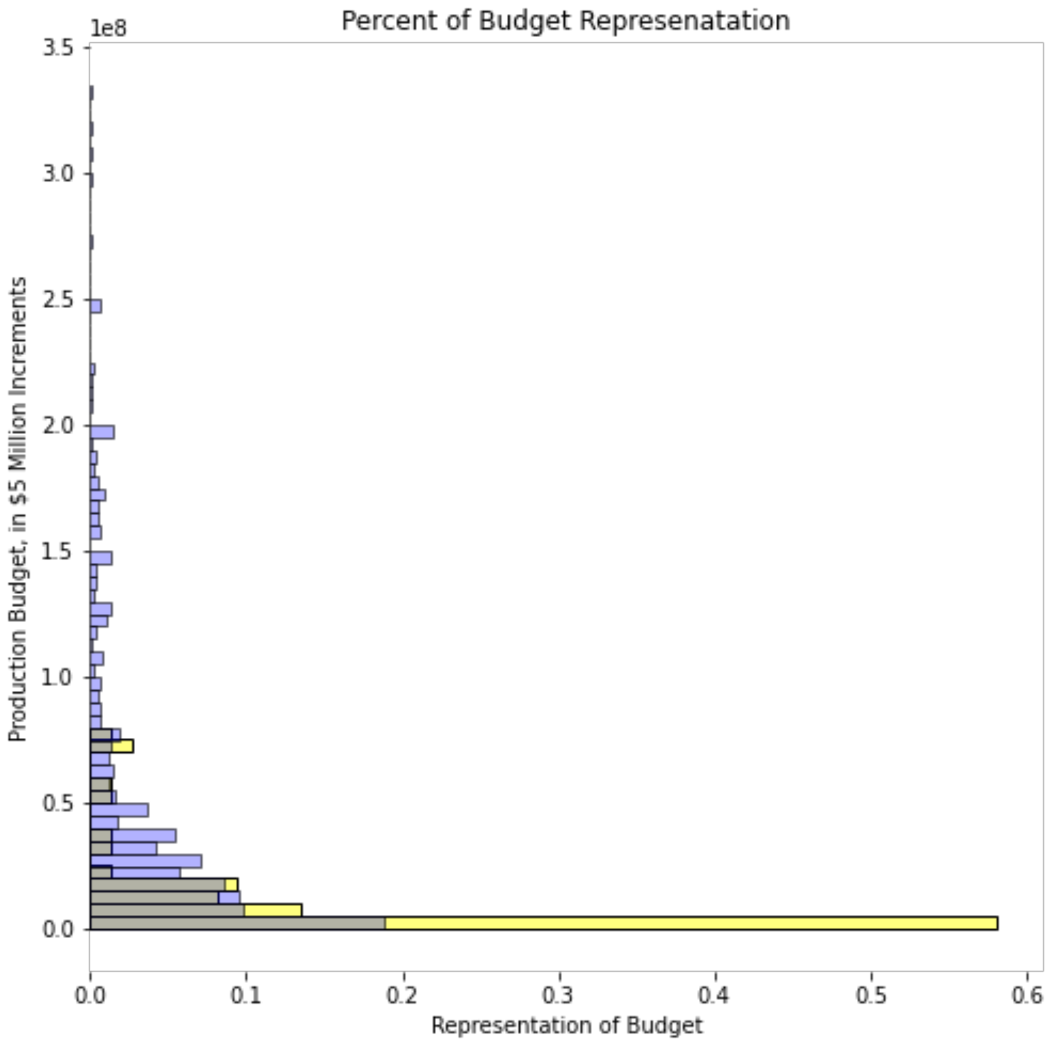
Comparison of All Budgets

In [66]:

```
# bins are $5 mil
f, ax = plt.subplots(figsize=(8, 8))

b1 = top_budgets['production_budget']
b2 = all_budgets['production_budget']
sns.histplot(y=b1, color='yellow', stat='probability', alpha=0.5,
             binwidth=5000000)
sns.histplot(y=b2, color='blue', stat='probability', alpha=0.3,
             binwidth=5000000)

ax.set(xlabel='Representation of Budget')
ax.set(ylabel='Production Budget, in $5 Million Increments')
ax.set(title='Percent of Budget Represenatation')
sns.despine(left=True, bottom=True)
```



Finding Recommended Release Month

I am determining which month to release a movie in by comparing top 10% to the overall table. I will look for an over-representation in the top 10%.

Top 10% Release Month

In [22]:

```
top_movies = pd.read_sql('''
    SELECT movie, worldwide_pir, release_date
    FROM basics
    WHERE release_date >= 2011
    AND domestic_gross > 0
    AND domestic_pir > 1
    ORDER BY worldwide_pir DESC
    LIMIT 74
    ;''', conn)
```

In [23]:

```
#sort by release month
top_movies['release_date'] = pd.to_datetime(top_movies['release_date'])
top_movies['release_month'] = top_movies['release_date'].dt.month
top_movies['release_month']
```

Out[23]:

```
0      7
1      1
2      4
3      4
4      1
      ..
69     7
70     1
71     3
72     2
73    11
Name: release_month, Length: 74, dtype: int64
```

All Release Month

In [24]:

```
all_movies = pd.read_sql('''
    SELECT movie, worldwide_pir, release_date
    FROM basics
    WHERE release_date >= 2011
    AND domestic_gross > 0
    AND domestic_pir > 1
    ORDER BY worldwide_pir DESC
    ;''', conn)
```

In [25]:

```
#sort by release month
all_movies['release_date'] = pd.to_datetime(all_movies['release_date'])
all_movies['release_month'] = all_movies['release_date'].dt.month
all_movies['release_month'].head()
```

Out[25]:

```
0    7
1    1
2    4
3    4
4    1
Name: release_month, dtype: int64
```

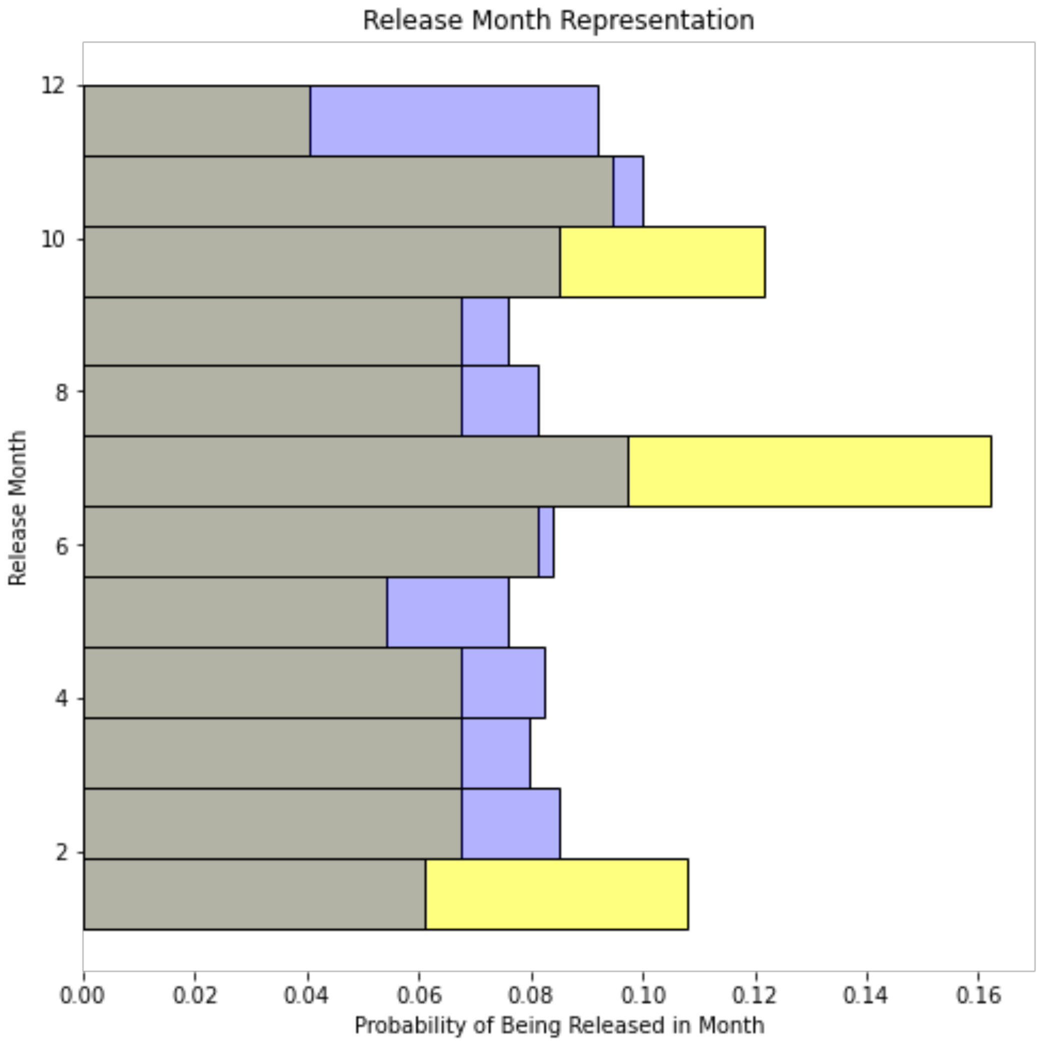
Comparison of Release Months

In [59]:

```
f, ax = plt.subplots(figsize=(8, 8))

m1 = top_movies['release_month']
m2 = all_movies['release_month']
sns.histplot(y=m1, color='yellow', stat='probability', alpha=0.5,
             bins=12)
sns.histplot(y=m2, color='blue', stat='probability', alpha=0.3,
             bins=12)

ax.set(xlabel='Probability of Being Released in Month')
ax.set(ylabel='Release Month')
ax.set(title='Release Month Representation')
sns.despine(left=True, bottom=True)
```



Finding Recommended Genre

I am pulling out the top genres to see if there is a clear genre that is over represented in the top 10%. I will only compare the movies that have at least 1 genre listed. The total is 1956, so this makes the top 10% the top 196. To make each movie have equal weight, if only 1 genre is listed then it will be copied over to genre_2 and genre_3. If there are 2 genres, then genre 1 will be copied to genre 3.

Top 10% Genre Rep

In [27]:

```
# Can't clean completely, am not including ones
# where there is no genre listed
top_genre = pd.read_sql('''SELECT movie, genre_1, genre_2, genre_3
    FROM basics
    LEFT JOIN genres
        ON genres.primary_title = basics.movie
    WHERE release_date >= 2011
    AND domestic_gross > 0
    AND genre_1 IS NOT NULL
    ORDER BY worldwide_pir DESC
    LIMIT 196
    ;''', conn)
top_genre.head()
```

Out[27]:

	movie	genre_1	genre_2	genre_3
0	the gallows	Horror	Mystery	Thriller
1	the devil inside	Horror	None	None
2	insidious	Horror	Mystery	Thriller
3	unfriended	Horror	Mystery	Thriller
4	split	Action	Drama	Sport

In [28]:

```
top_genre['genre_2'].fillna(top_genre['genre_1'], inplace=True)
top_genre['genre_3'].fillna(top_genre['genre_1'], inplace=True)
top_genre.head()
```

Out[28]:

	movie	genre_1	genre_2	genre_3
0	the gallows	Horror	Mystery	Thriller
1	the devil inside	Horror	Horror	Horror
2	insidious	Horror	Mystery	Thriller
3	unfriended	Horror	Mystery	Thriller
4	split	Action	Drama	Sport

In [29]:

```
all_top_genres = top_genre['genre_1'].tolist()
all_top_genres_2 = top_genre['genre_2'].tolist()
all_top_genres.extend(all_top_genres_2)
all_top_genres_3 = top_genre['genre_3'].tolist()
all_top_genres.extend(all_top_genres_3)
len(all_top_genres)
```

Out[29]:

```
588
```

In [30]:

```
top_10_genres = list(pd.unique(all_top_genres))
genre_count = dict.fromkeys(top_10_genres, 0)
for i in all_top_genres:
    genre_count[i] += 1
```

In [31]:

```
# find probability of each genre represented in top 10%
for genre in genre_count:
    genre_count[genre] = genre_count[genre]/588
```

In [67]:

```
# Zero count genres were added after the complete list was compliled.
# This was done to have matching dictionaries to add them into the same df
genre_count['War'] = 0
genre_count['News'] = 0
genre_count['Western'] = 0
genre_count = dict(sorted(genre_count.items()))
```

All Genre Rep

In [33]:

```
# Can't clean completely, am not including ones
# where there is no genre listed
all_genre = pd.read_sql('''SELECT movie, genre_1, genre_2, genre_3
    FROM basics
    LEFT JOIN genres
        ON genres.primary_title = basics.movie
    WHERE release_date >= 2011
    AND domestic_gross > 0
    AND genre_1 IS NOT NULL
    ORDER BY worldwide_pir DESC
    ;''', conn)
all_genre.head()
```

Out[33]:

	movie	genre_1	genre_2	genre_3
0	the gallows	Horror	Mystery	Thriller
1	the devil inside	Horror	None	None
2	insidious	Horror	Mystery	Thriller
3	unfriended	Horror	Mystery	Thriller
4	split	Action	Drama	Sport

In [34]:

```
all_genre['genre_2'].fillna(all_genre['genre_1'], inplace=True)
all_genre['genre_3'].fillna(all_genre['genre_1'], inplace=True)
all_genre.head()
```

Out[34]:

	movie	genre_1	genre_2	genre_3
0	the gallows	Horror	Mystery	Thriller
1	the devil inside	Horror	Horror	Horror
2	insidious	Horror	Mystery	Thriller
3	unfriended	Horror	Mystery	Thriller
4	split	Action	Drama	Sport

In [35]:

```
list_all_genre = all_genre['genre_1'].tolist()
list_all_genre_2 = all_genre['genre_2'].tolist()
list_all_genre.extend(list_all_genre_2)
list_all_genre_3 = all_genre['genre_3'].tolist()
list_all_genre.extend(list_all_genre_3)
len(list_all_genre)
```

Out[35]:

```
5868
```

In [36]:

```
all_uni_genres = list(pd.unique(list_all_genre))
genre_count_all = dict.fromkeys(all_uni_genres, 0)
for i in list_all_genre:
    genre_count_all[i] += 1
```

In [37]:

```
# find probability of each genre represented
for genre in genre_count_all:
    genre_count_all[genre] = genre_count_all[genre]/5868
```

In [68]:

```
genre_count_all['Music'] = 0.010736196319018405 + 0.0028970688479890935
genre_count_all = dict(sorted(genre_count_all.items()))
genre_count_all.pop('Musical')
```

```
---------------------------------------------------------------------------
KeyError                                  Traceback (most recent call last)
<ipython-input-68-3d6618310c82> in <module>
      1 genre_count_all['Music'] = 0.010736196319018405 + 0.002897068847989093
5
      2 genre_count_all = dict(sorted(genre_count_all.items()))
----> 3 genre_count_all.pop('Musical')

KeyError: 'Musical'
```

Comparison of all genres

In [39]:

```
genre_df = pd.DataFrame(list(genre_count_all.items()))
```

In [40]:

```
genre_df[2] = genre_df[0].map(genre_count)
genre_df.columns = ['Genre', 'Count_All', 'Top_10p']
genre_df
```

Out[40]:

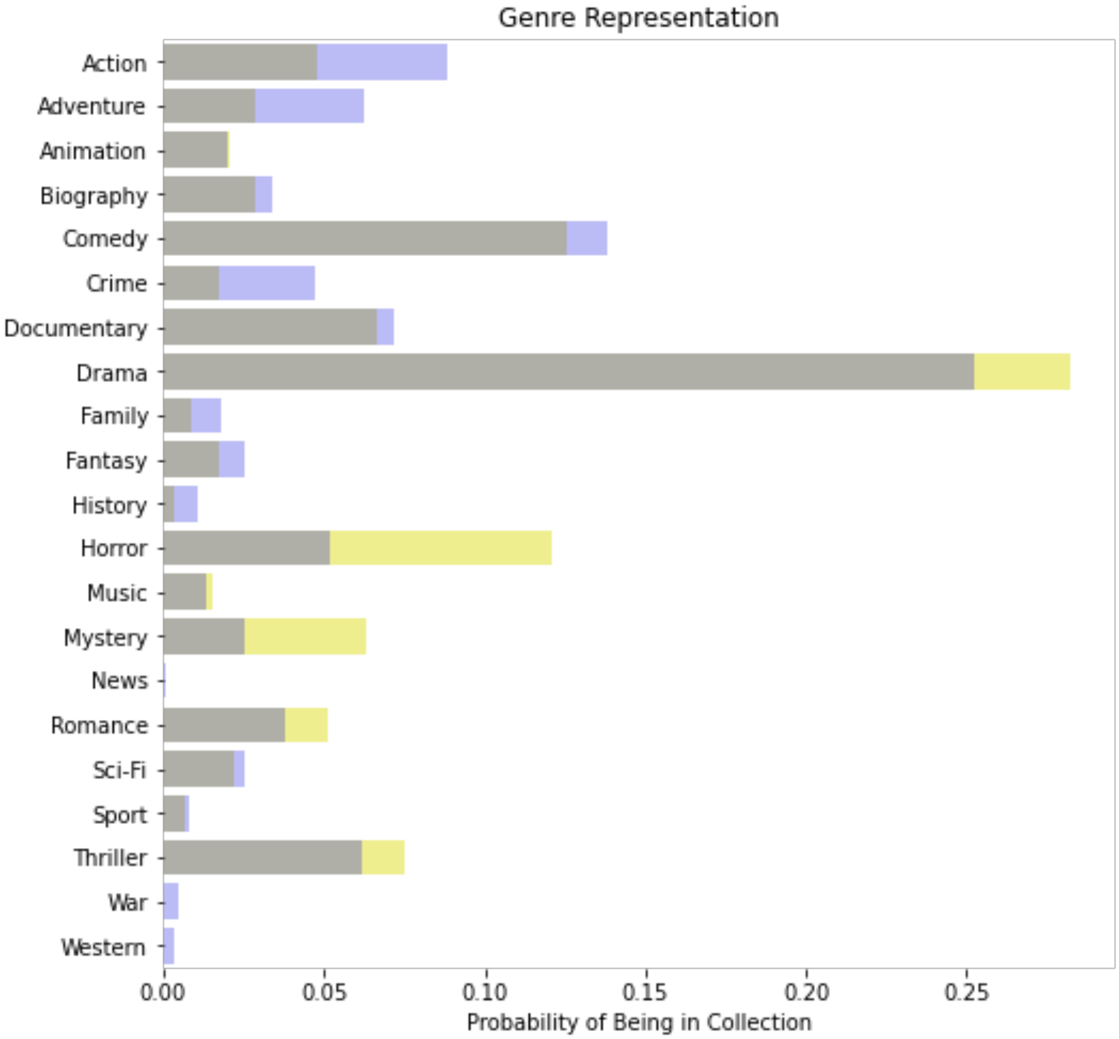
	Genre	Count_All	Top_10p
0	Action	0.088105	0.047619
1	Adventure	0.062202	0.028912
2	Animation	0.020279	0.020408
3	Biography	0.034083	0.028912
4	Comedy	0.137866	0.125850
5	Crime	0.046864	0.017007
6	Documentary	0.071915	0.066327
7	Drama	0.252386	0.282313
8	Family	0.017894	0.008503
9	Fantasy	0.025392	0.017007
10	History	0.010736	0.003401
11	Horror	0.051636	0.120748
12	Music	0.013633	0.015306
13	Mystery	0.025562	0.062925
14	News	0.000682	0.000000
15	Romance	0.037832	0.051020
16	Sci-Fi	0.025222	0.022109
17	Sport	0.008180	0.006803
18	Thriller	0.061861	0.074830
19	War	0.004431	0.000000
20	Western	0.003238	0.000000

In [58]:

```
# plot that compares both percentages
f, ax = plt.subplots(figsize=(8, 8))

g1 = genre_df['Top_10p']
g2 = genre_df['Count_All']
sns.barplot(x=g1, y='Genre', data=genre_df, color='yellow', alpha=0.5)
sns.barplot(x=g2, y='Genre', data=genre_df, color='blue', alpha=0.3)

ax.set(xlabel='Probability of Being in Collection')
ax.set(ylabel='')
ax.set(title='Genre Representation')
sns.despine(left=True, bottom=True)
```



Final Conclusions

I would recommend:

- Setting a maximum budget of $15 million
- Releasing in either January, July, or November
- Doing a genre that falls in any of the following genres:
    - Drama
    - Horror, the second most over-represented
    - Mystery, the first most over-represented
    - Romance
    - Thriller

These categories are all over-represented in the top 10% population of the data indicating that they have a higher probability of turining a larger rate of return.

In [ ]:

```
#Close connection to SQLite3 database
conn.close()
```