Investigating TMDB dataset

Introduction

TMDB dataset is a dataset that contains information about 10,000 movies collected from The Movie Database (TMDb), including user ratings and revenue.

The columns selected for the context of this report are: “id”, “popularity”,“budget”,“revenue”,“cast”,“genres”

Data Wrangling

General Properties

In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from matplotlib.ticker import FuncFormatter
```

In [2]:
```
df = pd.read_csv('./tmdb-movies.csv')
df.head()
```

Out[2]:

	id	imdb_id	popularity	budget	revenue	original_title	cast	
0	135397	tt0369610	32.985763	150000000	1513528810	Jurassic World	Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...	
1	76341	tt1392190	28.419936	150000000	378436354	Mad Max: Fury Road	Tom Hardy|Charlize Theron|Hugh Keays-Byrne|Nic...	
2	262500	tt2908446	13.112507	110000000	295238201	Insurgent	Shailene Woodley|Theo James|Kate Winslet|Ansel...	http://www.thed
3	140607	tt2488496	11.173104	200000000	2068178225	Star Wars: The Force Awakens	Harrison Ford|Mark Hamill|Carrie Fisher|Adam D...	http://ww

	id	imdb_id	popularity	budget	revenue	original_title	cast
4	168259	tt2820852	9.335014	190000000	1506249360	Furious 7	Vin Diesel|Paul Walker|Jason Statham|Michelle ...

5 rows × 21 columns

In [3]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10866 entries, 0 to 10865
Data columns (total 21 columns):
 #   Column                Non-Null Count  Dtype  
---  ------                --------------  -----  
 0   id                    10866 non-null  int64  
 1   imdb_id               10856 non-null  object 
 2   popularity            10866 non-null  float64
 3   budget                10866 non-null  int64  
 4   revenue               10866 non-null  int64  
 5   original_title        10866 non-null  object 
 6   cast                  10790 non-null  object 
 7   homepage              2936 non-null   object 
 8   director              10822 non-null  object 
 9   tagline               8042 non-null   object 
 10  keywords              9373 non-null   object 
 11  overview              10862 non-null  object 
 12  runtime               10866 non-null  int64  
 13  genres                10843 non-null  object 
 14  production_companies  9836 non-null   object 
 15  release_date          10866 non-null  object 
 16  vote_count            10866 non-null  int64  
 17  vote_average          10866 non-null  float64
 18  release_year          10866 non-null  int64  
 19  budget_adj            10866 non-null  float64
 20  revenue_adj           10866 non-null  float64
dtypes: float64(4), int64(6), object(11)
memory usage: 1.7+ MB
```

In [4]:
```
df.isnull().sum()
```

Out[4]:
```
id                        0
imdb_id                  10
popularity                0
budget                    0
revenue                   0
original_title            0
cast                     76
homepage               7930
director                 44
tagline                2824
keywords               1493
overview                  4
runtime                   0
genres                   23
production_companies    1030
release_date              0
vote_count                0
```

```
vote_average            0
release_year            0
budget_adj              0
revenue_adj             0
dtype: int64
```

In [5]:
```
df.dtypes
```

Out[5]:
```
id                      int64
imdb_id                object
popularity            float64
budget                  int64
revenue                 int64
original_title         object
cast                   object
homepage               object
director               object
tagline                object
keywords               object
overview               object
runtime                 int64
genres                 object
production_companies   object
release_date           object
vote_count              int64
vote_average          float64
release_year            int64
budget_adj            float64
revenue_adj           float64
dtype: object
```

In [6]:
```
df.describe()
```

Out[6]:

	id	popularity	budget	revenue	runtime	vote_count	vote_aver
count	10866.000000	10866.000000	1.086600e+04	1.086600e+04	10866.000000	10866.000000	10866.000
mean	66064.177434	0.646441	1.462570e+07	3.982332e+07	102.070863	217.389748	5.974
std	92130.136561	1.000185	3.091321e+07	1.170035e+08	31.381405	575.619058	0.935
min	5.000000	0.000065	0.000000e+00	0.000000e+00	0.000000	10.000000	1.500
25%	10596.250000	0.207583	0.000000e+00	0.000000e+00	90.000000	17.000000	5.400
50%	20669.000000	0.383856	0.000000e+00	0.000000e+00	99.000000	38.000000	6.000
75%	75610.000000	0.713817	1.500000e+07	2.400000e+07	111.000000	145.750000	6.600
max	417859.000000	32.985763	4.250000e+08	2.781506e+09	900.000000	9767.000000	9.200

Remove unnecessary columns

In [7]:
```
df.drop(['imdb_id', 'homepage','director','overview','tagline','keywords',
         'budget_adj','revenue_adj','production_companies','original_title', 'release_d
        axis=1, inplace=True)
df.head()
```

Out[7]:

	id	popularity	budget	revenue	cast	runtime	genres	vote_

	id	popularity	budget	revenue	cast	runtime	genres	vote_
0	135397	32.985763	150000000	1513528810	Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...	124	Action|Adventure|Science Fiction|Thriller	
1	76341	28.419936	150000000	378436354	Tom Hardy|Charlize Theron|Hugh Keays-Byrne|Nic...	120	Action|Adventure|Science Fiction|Thriller	
2	262500	13.112507	110000000	295238201	Shailene Woodley|Theo James|Kate Winslet|Ansel...	119	Adventure|Science Fiction|Thriller	
3	140607	11.173104	200000000	2068178225	Harrison Ford|Mark Hamill|Carrie Fisher|Adam D...	136	Action|Adventure|Science Fiction|Fantasy	
4	168259	9.335014	190000000	1506249360	Vin Diesel|Paul Walker|Jason Statham|Michelle ...	137	Action|Crime|Thriller	

Remove rows with null values

In [8]:
```
df.isna().sum()
```

Out[8]:
```
id              0
popularity      0
budget          0
revenue         0
cast           76
runtime         0
genres         23
vote_count      0
vote_average    0
release_year    0
dtype: int64
```

In [9]:
```
df.dropna(inplace=True)
df.isna().sum()
```

Out[9]:
```
id              0
popularity      0
budget          0
revenue         0
cast            0
runtime         0
genres          0
vote_count      0
vote_average    0
release_year    0
dtype: int64
```

In [10]:
```
df.shape
```

Out[10]: (10768, 10)

Remove duplicates

In [11]:
```
df.drop_duplicates(inplace=True)
df.shape
```

Out[11]: (10767, 10)

Fixing the genres column

The genres column contains the genres of each movie seperated with "|". To make it easier to work with, the genres cell in each row will be transformed to be a list with genres names then it will be spreaded over multiple rows with on genre per row for each movie in another dataframe

Change the genres field to an array:

In [12]:
```
df['genres'] = df['genres'].apply(lambda x: x.split('|'))
```

In [13]:
```
df.head(1)
```

Out[13]:

	id	popularity	budget	revenue	cast	runtime	genres	vote_count	vote_aver
0	135397	32.985763	150000000	1513528810	Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...	124	[Action, Adventure, Science Fiction, Thriller]	5562	

In [14]:
```
genres_df = pd.DataFrame(df['genres'].tolist(), index=df['id']).stack()
genres_df = genres_df.reset_index([0, 'id'])
genres_df.columns=['id','genres']
genres_df.head()
```

Out[14]:

	id	genres
0	135397	Action
1	135397	Adventure
2	135397	Science Fiction
3	135397	Thriller
4	76341	Action

In [15]:
```
df_copy = df.copy()
df_copy.drop(['genres'], axis=1, inplace=True)
genres_df = pd.merge(df_copy, genres_df, how='inner', left_on='id', right_on='id')
genres_df.head()
```

Out[15]:

	id	popularity	budget	revenue	cast	runtime	vote_count	vote_average	releas

	id	popularity	budget	revenue	cast	runtime	vote_count	vote_average	releas
0	135397	32.985763	150000000	1513528810	Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...	124	5562	6.5	
1	135397	32.985763	150000000	1513528810	Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...	124	5562	6.5	
2	135397	32.985763	150000000	1513528810	Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...	124	5562	6.5	
3	135397	32.985763	150000000	1513528810	Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...	124	5562	6.5	
4	76341	28.419936	150000000	378436354	Tom Hardy|Charlize Theron|Hugh Keays-Byrne|Nic...	120	6185	7.1	

Fixing the cast column

The same process on the genres will be applied on the cast

In [16]:
```
df['cast'] = df['cast'].apply(lambda x: x.split('|'))
df.head(1)
```

Out[16]:

	id	popularity	budget	revenue	cast	runtime	genres	vote_count	vote_average
0	135397	32.985763	150000000	1513528810	[Chris Pratt, Bryce Dallas Howard, Irrfan Khan...	124	[Action, Adventure, Science Fiction, Thriller]	5562	6.5

In [17]:
```
cast_df = pd.DataFrame(df['cast'].tolist(), index=df['id']).stack()
cast_df = cast_df.reset_index([0, 'id'])
cast_df.columns=['id','cast']
cast_df.head()
```

Out[17]:

	id	cast

	id	cast
0	135397	Chris Pratt
1	135397	Bryce Dallas Howard
2	135397	Irrfan Khan
3	135397	Vincent D'Onofrio
4	135397	Nick Robinson

In [18]:
```
df_copy = df.copy()
df_copy.drop(['cast'], axis=1, inplace=True)
cast_df = pd.merge(df_copy, cast_df, how='inner', left_on='id', right_on='id')
cast_df.head()
```

Out[18]:

	id	popularity	budget	revenue	runtime	genres	vote_count	vote_average	release_y
0	135397	32.985763	150000000	1513528810	124	[Action, Adventure, Science Fiction, Thriller]	5562	6.5	2
1	135397	32.985763	150000000	1513528810	124	[Action, Adventure, Science Fiction, Thriller]	5562	6.5	2
2	135397	32.985763	150000000	1513528810	124	[Action, Adventure, Science Fiction, Thriller]	5562	6.5	2
3	135397	32.985763	150000000	1513528810	124	[Action, Adventure, Science Fiction, Thriller]	5562	6.5	2
4	135397	32.985763	150000000	1513528810	124	[Action, Adventure, Science Fiction, Thriller]	5562	6.5	2

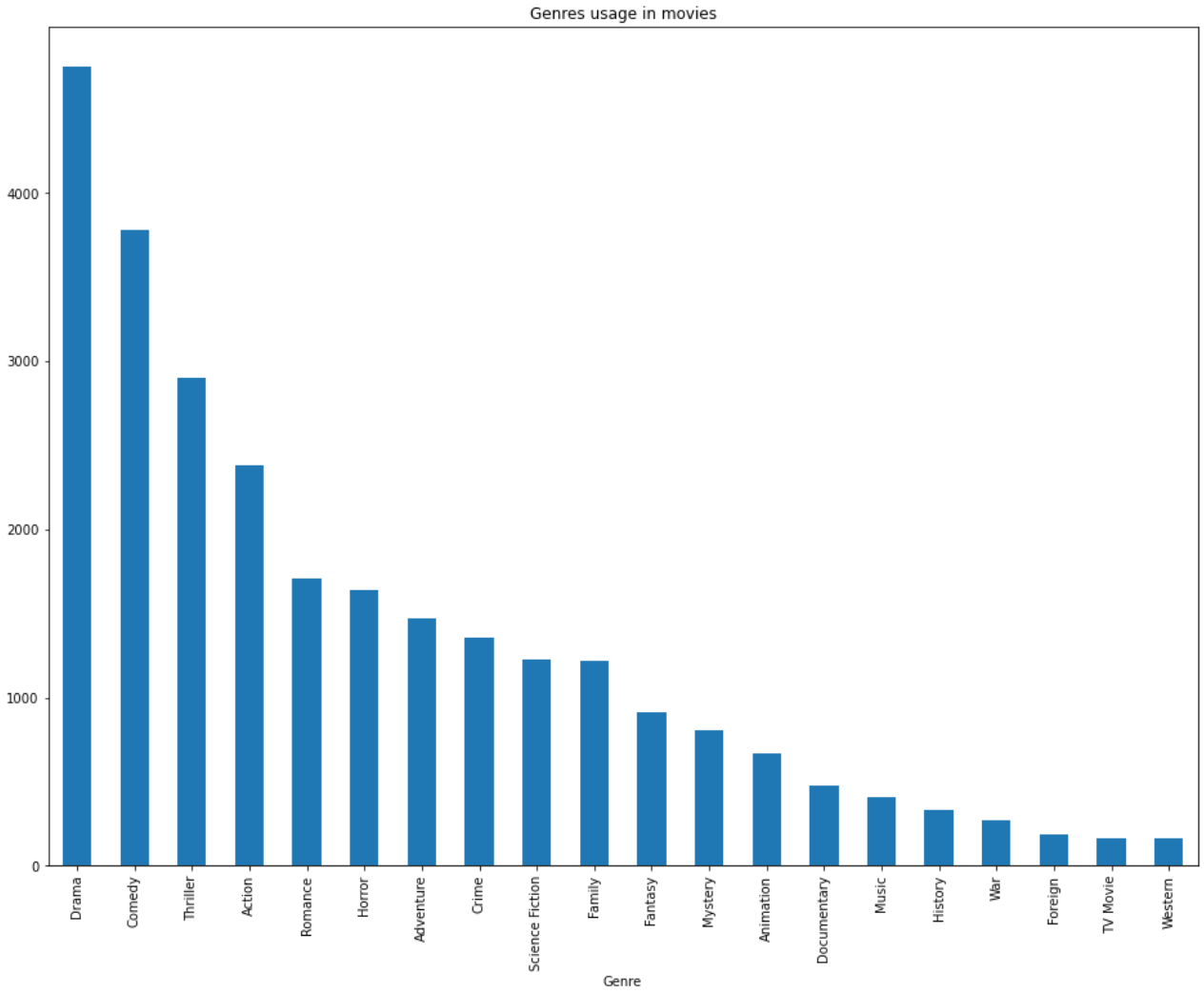
Each of the cast and genres dataframes are saved seperatly away from the main dataframe to not influence the result by the duplications in the other columns

EDA

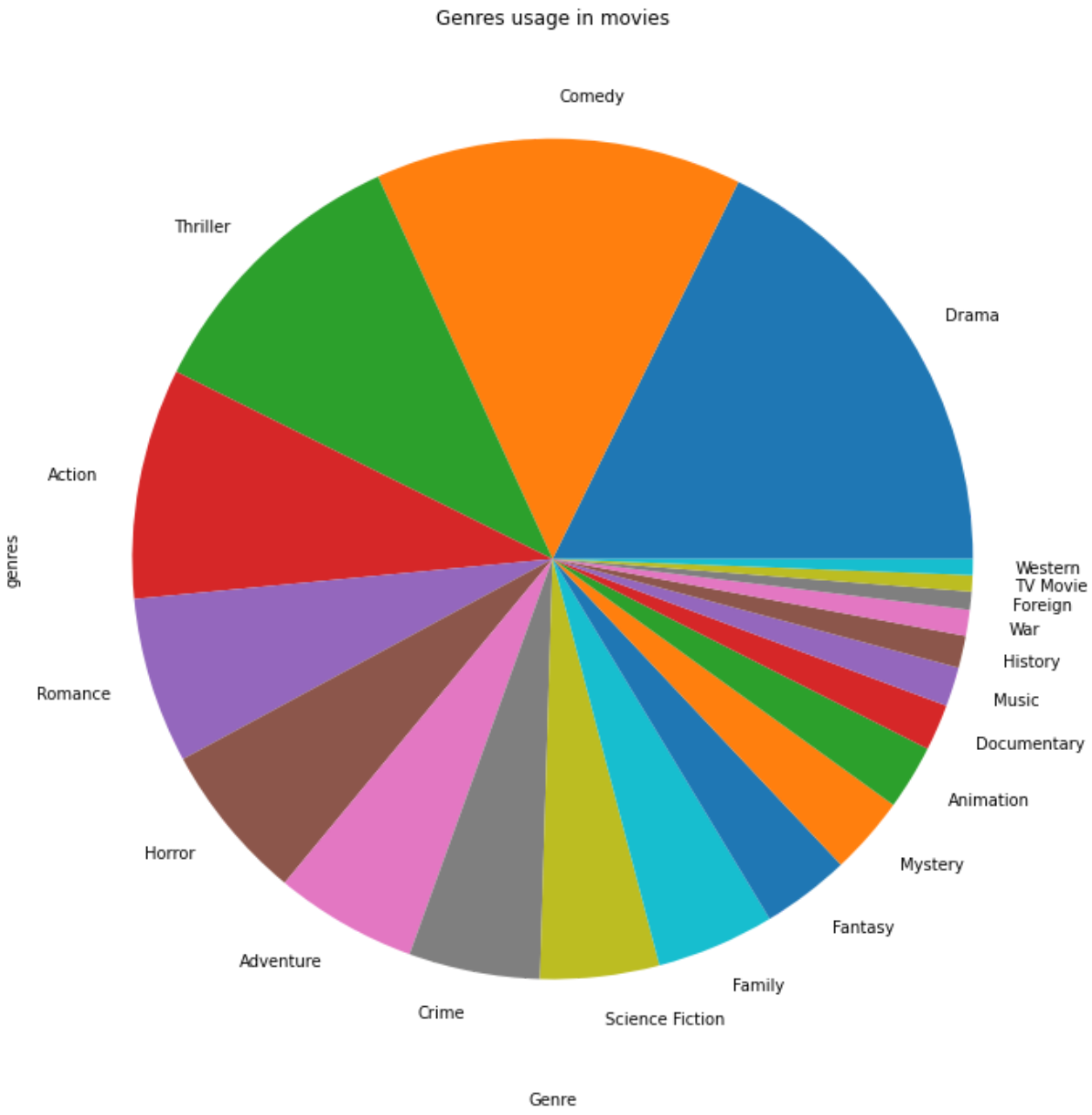
Time to ask questions, find concolusions, and have some fun!

1. What are the most used genres in movies?

In [19]:
```
genres_df['genres'].value_counts().plot(kind='bar', figsize=(16,12))
plt.title('Genres usage in movies')
plt.xlabel('Genre')
plt.show()
```



In [20]:
```
genres_df['genres'].value_counts().plot(kind='pie', figsize=(16,12))
plt.title('Genres usage in movies')
plt.xlabel('Genre')
plt.show()
```



The most used genres are Drama, Comedy, Thriller, and Action. While TV movie, War, Western, and Foreign, and other genres are lightly produced.

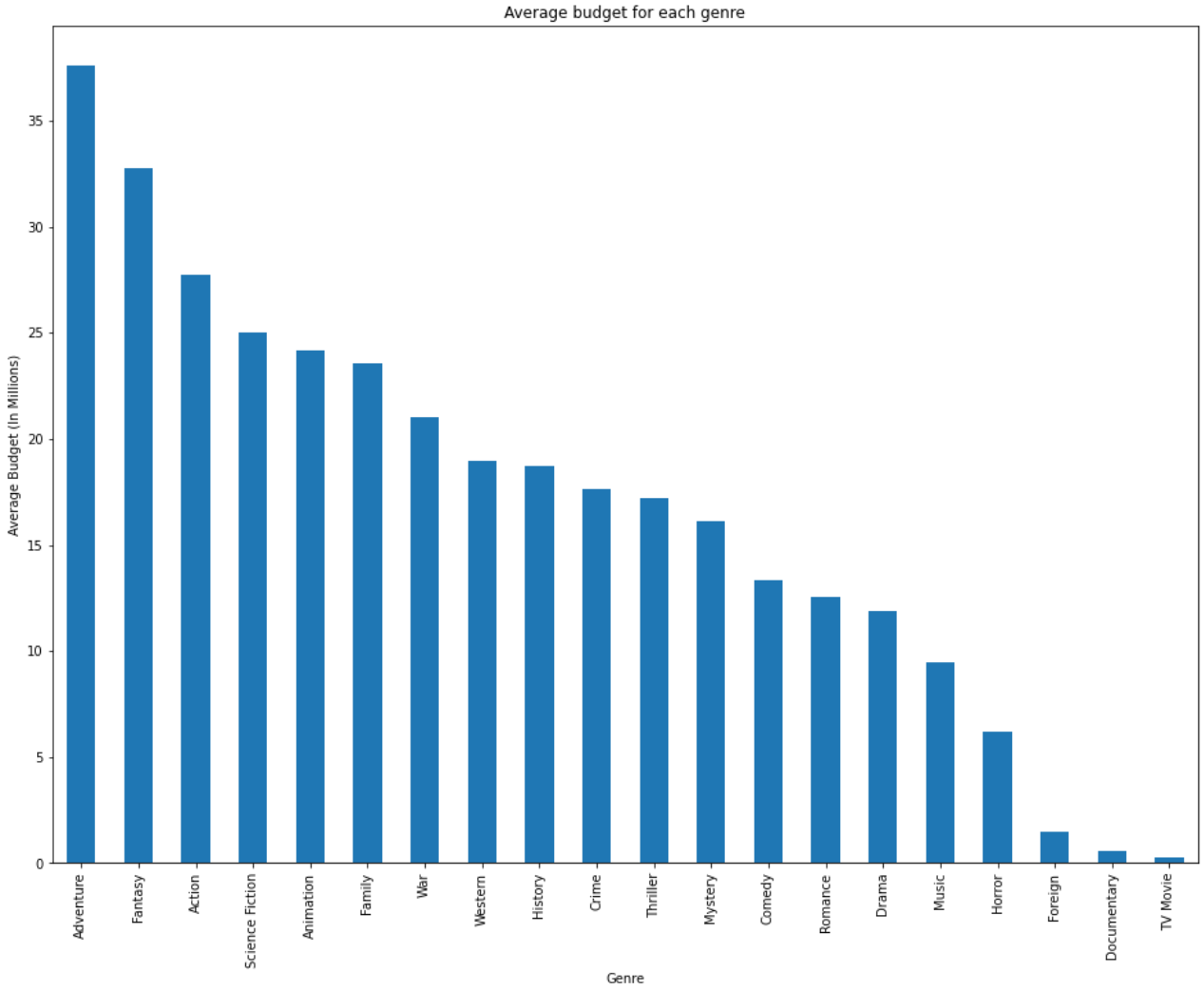
2. What is the average movie budget for each genre?

In [21]:
```
avg_budget = genres_df.groupby('genres').mean()['budget']

# round the numbers
avg_budget = avg_budget.apply(lambda x: round(x))

# sort the values
avg_budget = avg_budget.sort_values(ascending=False)
avg_budget.head()
```

Out[21]:
```
genres
Adventure          37594809
Fantasy            32791579
Action             27762757
Science Fiction    25013386
```

```
Animation          24194674
Name: budget, dtype: int64
```

In [22]:
```
avg_budget.plot(kind='bar', figsize=(16,12))
plt.title('Average budget for each genre')

ax=plt.gca()
ax.yaxis.set_major_formatter(FuncFormatter(lambda x, _: '{0:g}'.format(x/1e6)))

plt.xlabel('Genre')
plt.ylabel('Average Budget (In Millions)')
plt.show()
```



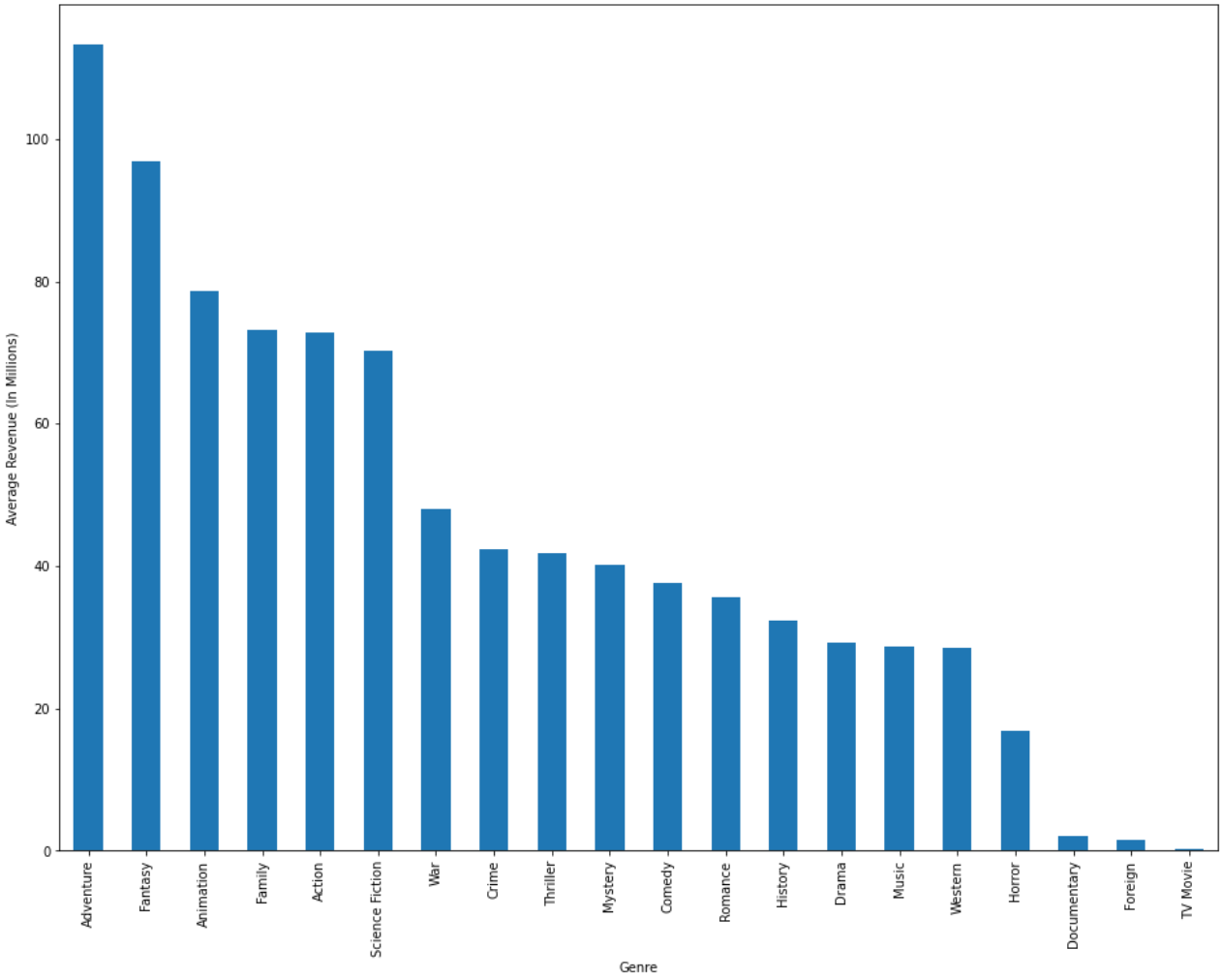
The most expensive genres are Adventure, Fantasy, Family, History, and Science Fiction. While TV Movie, Foreign, Documentary movies are the least expensive.

3. What is the average movie revenue for each genre?

In [23]:
```
avg_revenue = genres_df.groupby('genres').mean()['revenue']

# round the numbers
avg_revenue = avg_revenue.apply(lambda x: round(x))

# sort the values
avg_revenue = avg_revenue.sort_values(ascending=False)
avg_revenue.head()
```

Out[23]:
```
genres
Adventure    113291895
Fantasy       96842272
Animation     78630774
Family        73146218
Action        72886452
Name: revenue, dtype: int64
```

In [31]:
```
avg_revenue.plot(kind='bar', figsize=(16,12))

ax=plt.gca()
ax.yaxis.set_major_formatter(FuncFormatter(lambda x, _: '{0:g}'.format(x/1e6)))

plt.xlabel('Genre')
plt.ylabel('Average Revenue (In Millions)')
plt.show()
```

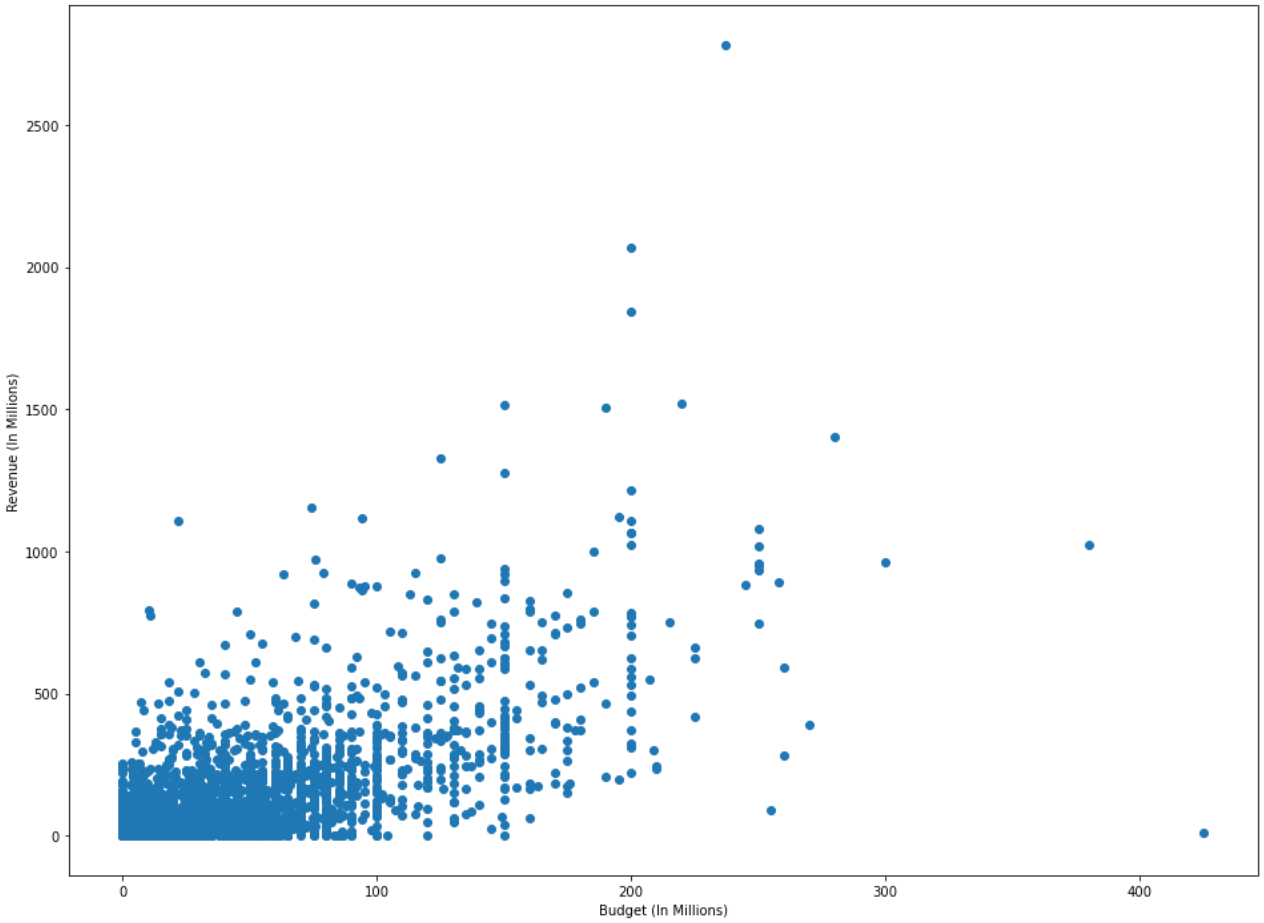


The genres that generates highest revenues are Adventure, Action, Fantasy, and Family. While Documentary movies don't generate much of a revenue.

4. Does the budget influence the revenue?

In [32]:
```
plt.figure(figsize=(16,12))
plt.scatter(df['budget'], df['revenue'])
plt.xlabel('Budget (In Millions)')
plt.ylabel('Revenue (In Millions)')

ax=plt.gca()
```

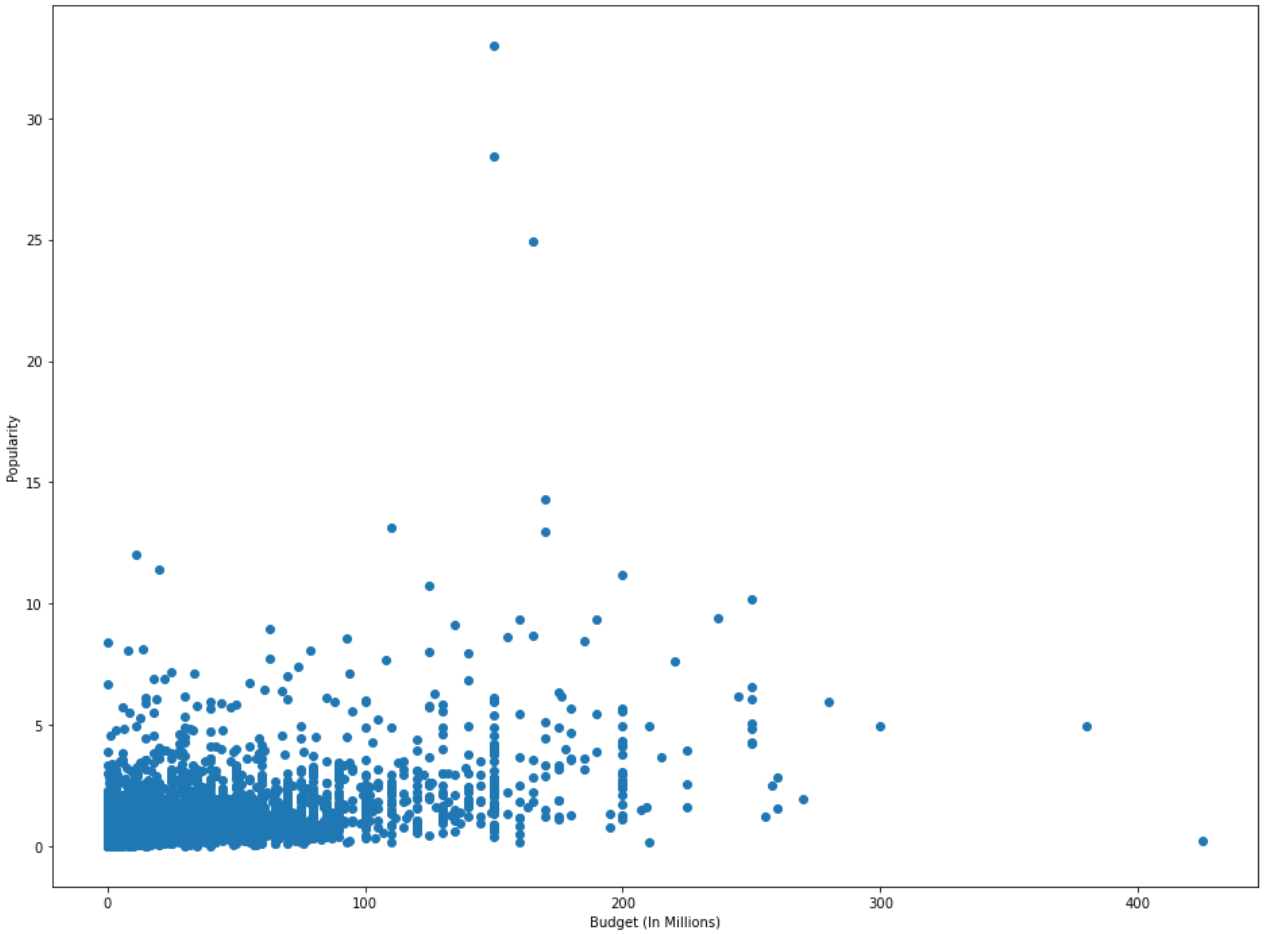
```
ax.xaxis.set_major_formatter(FuncFormatter(lambda x, _: '{0:g}'.format(x/1e6)))
ax.yaxis.set_major_formatter(FuncFormatter(lambda x, _: '{0:g}'.format(x/1e6)))

plt.show()
```



It appears that there is a very low positive correlation between the budget spent and the revenue gained. In other words, budget doesn't have that large influence on the revenue.

5. Does the budget spent influence the popularity?

In [34]:
```
plt.figure(figsize=(16,12))
plt.scatter(df['budget'], df['popularity'])

plt.xlabel('Budget (In Millions)')
plt.ylabel('Popularity')

ax=plt.gca()
ax.xaxis.set_major_formatter(FuncFormatter(lambda x, _: '{0:g}'.format(x/1e6)))

plt.show()
```



Again, although the budget spent have small influence on the popularity, it still not a large influence to consider.

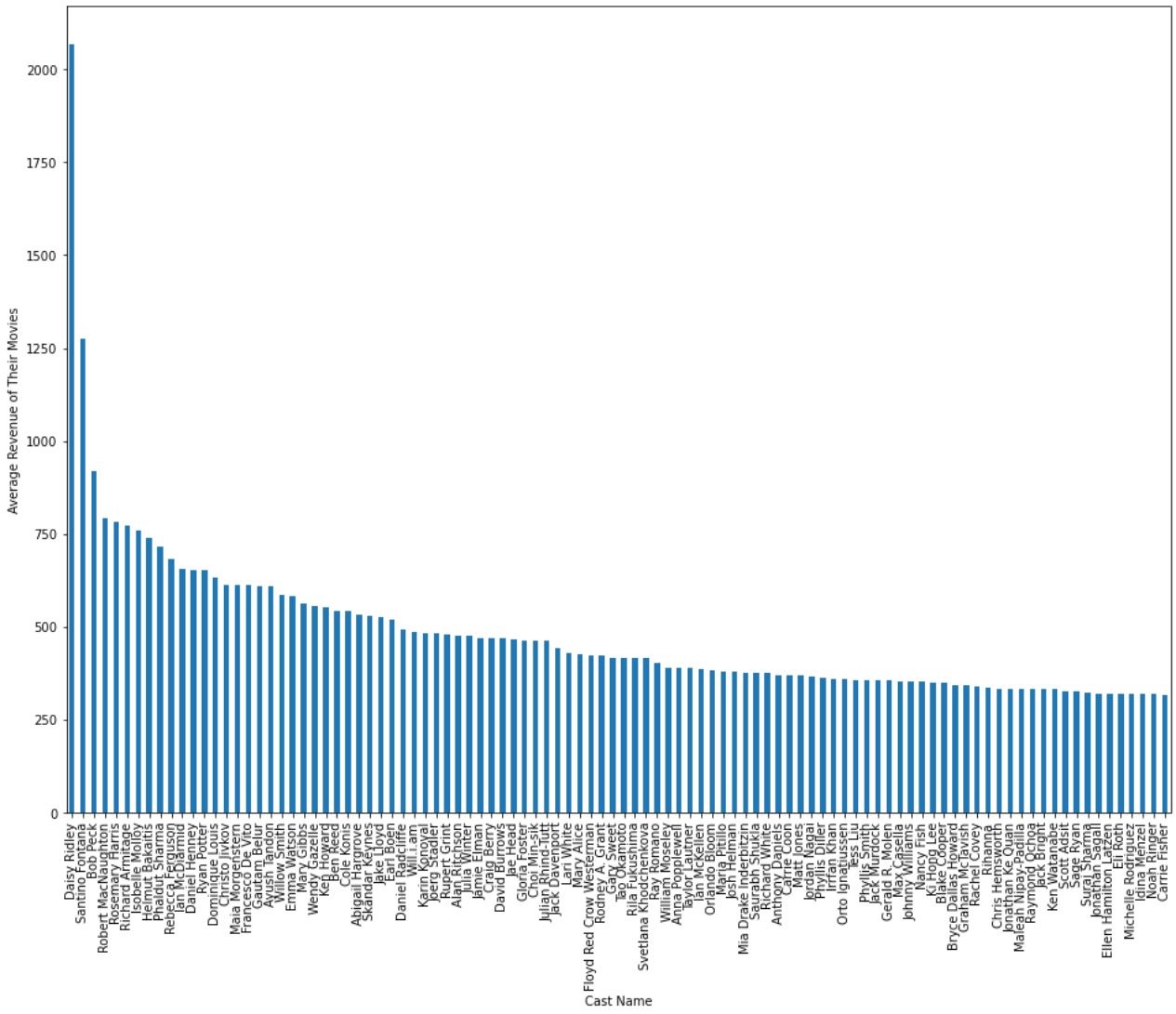
6. How the cast influence the revenue

In [27]:
```
avg_cast_revenue = cast_df.groupby('cast').mean()['revenue']

# round the numbers
avg_cast_revenue = avg_cast_revenue.apply(lambda x: round(x))

# sort the values
avg_cast_revenue = avg_cast_revenue.sort_values(ascending=False)
avg_cast_revenue.head()
```

Out[27]:
```
cast
Daisy Ridley          2068178225
Santino Fontana       1274219009
Bob Peck               920100000
Robert MacNaughton     792910554
Rosemary Harris        783766341
Name: revenue, dtype: int64
```

In [35]:
```
avg_cast_revenue[:100].plot(kind='bar', figsize=(16,12))

ax=plt.gca()
ax.yaxis.set_major_formatter(FuncFormatter(lambda x, _: '{0:g}'.format(x/1e6)))

plt.xlabel("Cast Name")
plt.ylabel('Average Revenue of Their Movies')
```

```
plt.show()
```



Cast members rarly have effect on the revenue of the movies they participate in. Daisy Ridley had the highest effect on the revenue of the movies she participated in while other cast members had similary effect on the movies they participate in.

Conclusions

- The most used genres are Drama, Comedy, Thriller, and Action with the Drama on top. People tend to be "Drama" queens
- The highest budget spent on Adventure, Fantasy, Family, and History.
- The highest reveneue making genres are are the ones most produced. That didn't need a data analyst to find out.
- Budget spent has low influence on both revenues on populariy. Money doesn't buy everything after all. At least not the popularity of the movies.
- Cast members has no influence on the revenues. It turned out to be just a myth.