Final Project Submission

Please fill out:

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- Student pace: part time
- Scheduled project review date/time: 13/04/2023
- Instructor name: Diana Mongina and Noah Kemboi
- Blog post URL:N/A

Overview

The project analyzes what key factors one should consider during a movie production for it to be a success. The project will identify the reasonable profit margin that Microsoft should aim for and also identify the key competitors in film sector

Business Problem

Microsoft wants to get into the film creation space, however they are not sure on which type of films to speciliaze on. By analyzing the BOM data we will see

In [1]:

```
#Import  libraries
import pandas as pd
import numpy as np
from scipy.stats import pearsonr
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
```

In [2]:
```
#Import data
movie_budgets_df = pd.read_csv('zippedData/tn.movie_budgets.csv.gz', compression='gzip')
```

In [3]:
```
#View the shape of the budget_df
movie_budgets_df.shape
```

Out[3]:
```
(5782, 6)
```

In [4]:
```
#View the first five rows
movie_budgets_df.head()
```

Out[4]:

	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 [5]:
```
#Preview the structure of budget_df
movie_budgets_df.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 [6]:

```
# Convert the production_budge,domestic_gross and worldwide_gross columns to numeric type
movie_budgets_df['production_budget'] = pd.to_numeric(movie_budgets_df['production_budget'].str.replace(',', '',regex
movie_budgets_df['domestic_gross'] = pd.to_numeric(movie_budgets_df['domestic_gross'].str.replace(',', '', regex=Fals
movie_budgets_df['worldwide_gross'] = pd.to_numeric(movie_budgets_df['worldwide_gross'].str.replace(',', '', regex=Fa

#Print the results
movie_budgets_df.head()
```

Out[6]:

	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 [7]:

```
# Calculate the net profit and profit margin for each movie
movie_budgets_df['net_profit'] = movie_budgets_df['worldwide_gross'] - movie_budgets_df['production_budget']
movie_budgets_df['profit_margin'] = round(movie_budgets_df['net_profit'] / movie_budgets_df['worldwide_gross'], 4)

#Print the results
movie_budgets_df.head()
```

Out[7]:

	id	release_date	movie	production_budget	domestic_gross	worldwide_gross	net_profit	profit_margin
0	1	Dec 18, 2009	Avatar	425000000	760507625	2776345279	2351345279	0.8469
1	2	May 20, 2011	Pirates of the Caribbean: On Stranger Tides	410600000	241063875	1045663875	635063875	0.6073
2	3	Jun 7, 2019	Dark Phoenix	350000000	42762350	149762350	-200237650	-1.3370
3	4	May 1, 2015	Avengers: Age of Ultron	330600000	459005868	1403013963	1072413963	0.7644
4	5	Dec 15, 2017	Star Wars Ep. VIII: The Last Jedi	317000000	620181382	1316721747	999721747	0.7593

In [8]:

```
#Remove movies with o gross revenue
movie_budgets_df.profit_margin.replace(-np.inf, np.nan, inplace=True)
movie_budgets_df.dropna(inplace=True)
movie_budgets_df.head()
```

Out[8]:

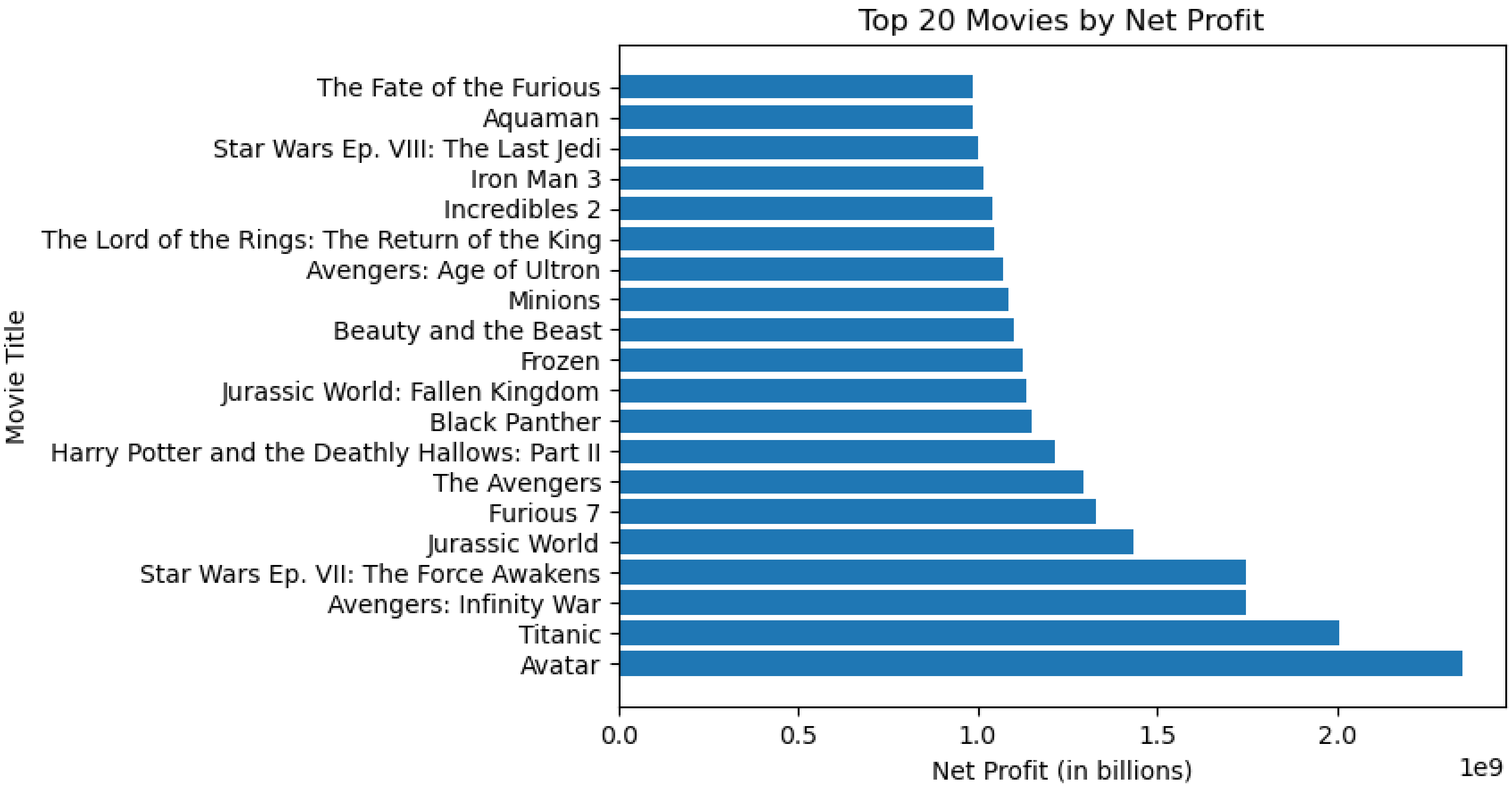
	id	release_date	movie	production_budget	domestic_gross	worldwide_gross	net_profit	profit_margin
0	1	Dec 18, 2009	Avatar	425000000	760507625	2776345279	2351345279	0.8469
1	2	May 20, 2011	Pirates of the Caribbean: On Stranger Tides	410600000	241063875	1045663875	635063875	0.6073
2	3	Jun 7, 2019	Dark Phoenix	350000000	42762350	149762350	-200237650	-1.3370
3	4	May 1, 2015	Avengers: Age of Ultron	330600000	459005868	1403013963	1072413963	0.7644
4	5	Dec 15, 2017	Star Wars Ep. VIII: The Last Jedi	317000000	620181382	1316721747	999721747	0.7593

In [9]:

```
#Create two new columns: gross_profit
movie_budgets_df['net_profit'] = movie_budgets_df['worldwide_gross'] - movie_budgets_df['production_budget']
```

In [10]:

```
#Sort by highest to lowest
sorted_movies = movie_budgets_df.sort_values(by='net_profit', ascending=False)

# Get top 20 movies by net profit
top_20 = sorted_movies[:20]

# Create bar chart of top 20 movies by net profit
plt.barh(top_20['movie'], top_20['net_profit'])
plt.title('Top 20 Movies by Net Profit')
plt.xlabel('Net Profit (in billions)')
plt.ylabel('Movie Title')
plt.show()
```

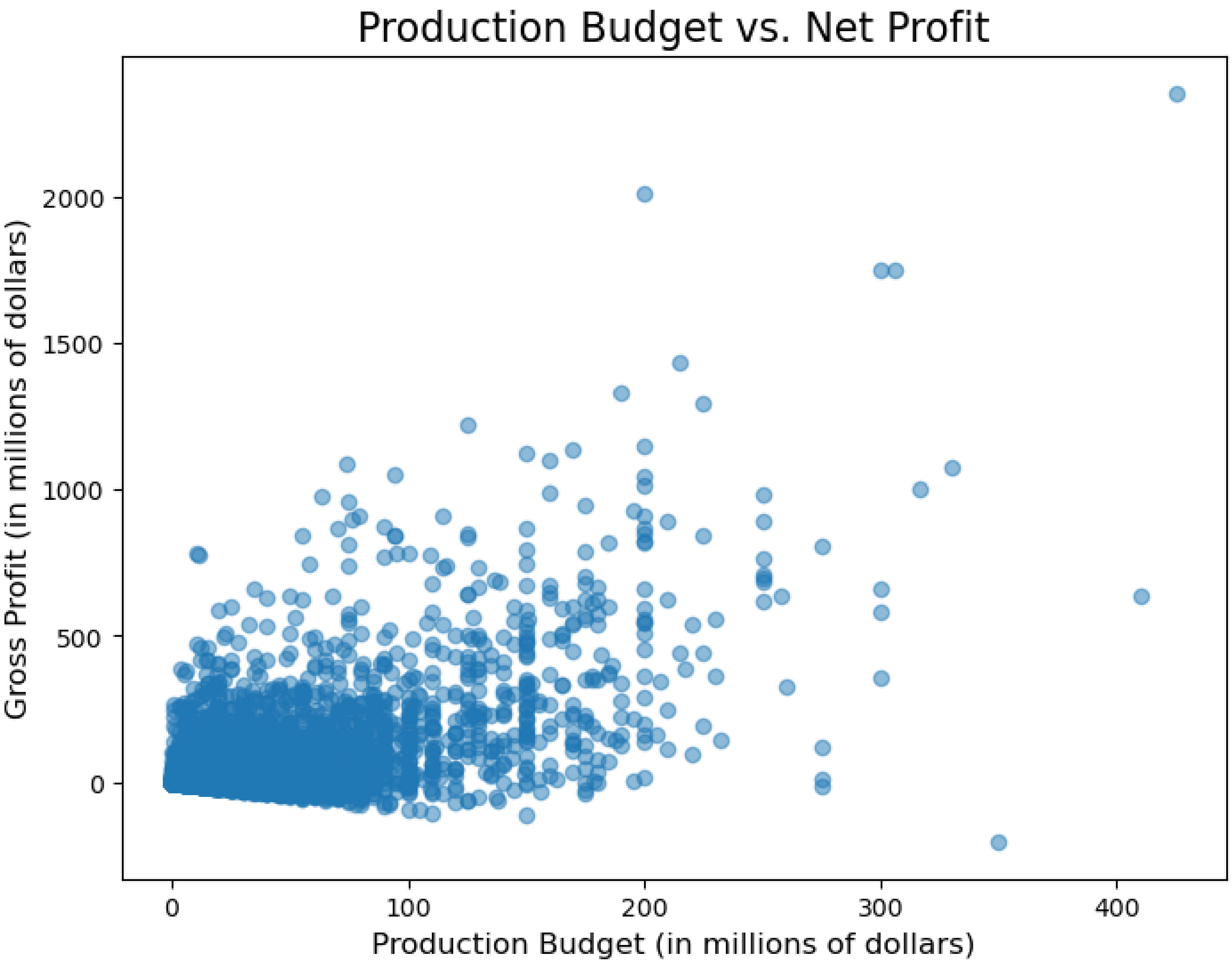


Avatar,Titanit and Avengers were the top three movies that did well. Let's investigate why they did well? Is there are correlation of the investment to the profit?

In [11]:

```
# calculate the Pearson correlation coefficient between budget and net profit
budget = movie_budgets_df['production_budget']
net_profit = movie_budgets_df['net_profit']
corr = np.corrcoef(budget, net_profit)[0, 1]

# print the correlation coefficient
print('The Pearson correlation coefficient between budget and net profit is:', corr)

# create a scatterplot of production budget and gross profit
plt.figure(figsize=(8,6))
plt.scatter(x=movie_budgets_df['production_budget']/1000000, y=movie_budgets_df['net_profit']/1000000, alpha=0.5)

# set the chart title and axes labels
plt.title('Production Budget vs. Net Profit', fontsize=16)
plt.xlabel('Production Budget (in millions of dollars)', fontsize=12)
plt.ylabel('Gross Profit (in millions of dollars)', fontsize=12)

# show the plot
plt.show()
```

```
The Pearson correlation coefficient between budget and net profit is: 0.6068652923681536
```



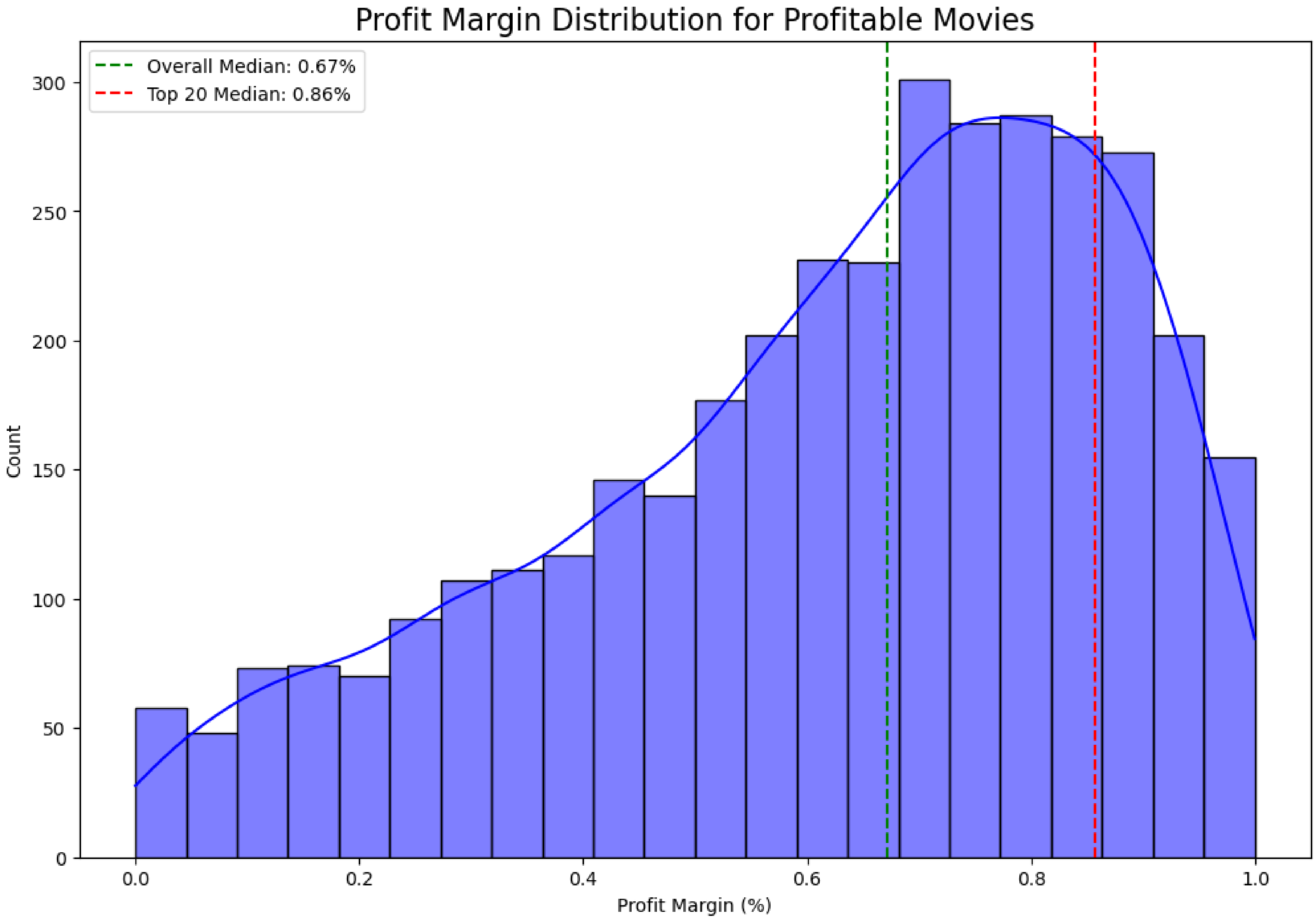
A Pearson correlation coefficient of 0.61 indicates a moderate positive correlation between production budget and net profit. This means that as production budget increases, net profit tends to increase as well. However, it's important to note that correlation does not imply causation, so we cannot say for certain that increasing production budget will always lead to higher net profit.However, based on profit margins of successful movies, we can determine the profit margin to target for. This is through analyzing the profit margin for movies that have made a profit and compare that to the overall median profit margin to the median profit margin for the top 20 movies with the highest net profit:

In [12]:

```
# Compute the profit_margin
movie_budgets_df['profit_margin'] = movie_budgets_df['net_profit'] / movie_budgets_df['worldwide_gross']
```

In [13]:

```
# Filter movies that have made a profit
profitable_movies = movie_budgets_df[movie_budgets_df['net_profit'] > 0]

# Calculate the overall median profit margin
overall_median = profitable_movies['profit_margin'].median()

# Calculate the median profit margin for the top 20 movies with highest net profit
top20_movies = profitable_movies.nlargest(20, 'net_profit')
top20_median = top20_movies['profit_margin'].median()

# Plot the profit margin distribution for profitable movies
plt.figure(figsize=(12, 8))
sns.histplot(profitable_movies['profit_margin'], kde=True, color='blue', alpha=0.5)
plt.axvline(x=overall_median, color='green', linestyle='--', label='Overall Median: {:.2f}%'.format(overall_median))
plt.axvline(x=top20_median, color='red', linestyle='--', label='Top 20 Median: {:.2f}%'.format(top20_median))
plt.xlabel('Profit Margin (%)')
plt.ylabel('Count')
plt.title('Profit Margin Distribution for Profitable Movies', fontsize=16)
plt.legend()
plt.show()
```



The median profit margin of all profitable movies stands at 67%, whereas for the top 20 movies with the highest net profit, it is 86%. By aiming for a profit margin of higher than 67% would guarantee the movie to a success.

Other factors

Who are the top studios we would potentially be competing against? To get this answer, we need to merge the movie_budgets dataframe with the movie dataframe.

In [14]:

```
#Import Movie_gross file
movie_gross_df = pd.read_csv('zippedData/bom.movie_gross.csv.gz', compression='gzip')
```

In [15]:

```
movie_gross_df.head()
```

Out[15]:

	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

In [16]:

```
# Create a merged df of both movie_budgets_df and movie_gross_df
merged_df = movie_budgets_df.merge(movie_gross_df, left_on='movie', right_on='title', how='inner')
```

In [17]:

```
merged_df.head()
```

Out[17]:

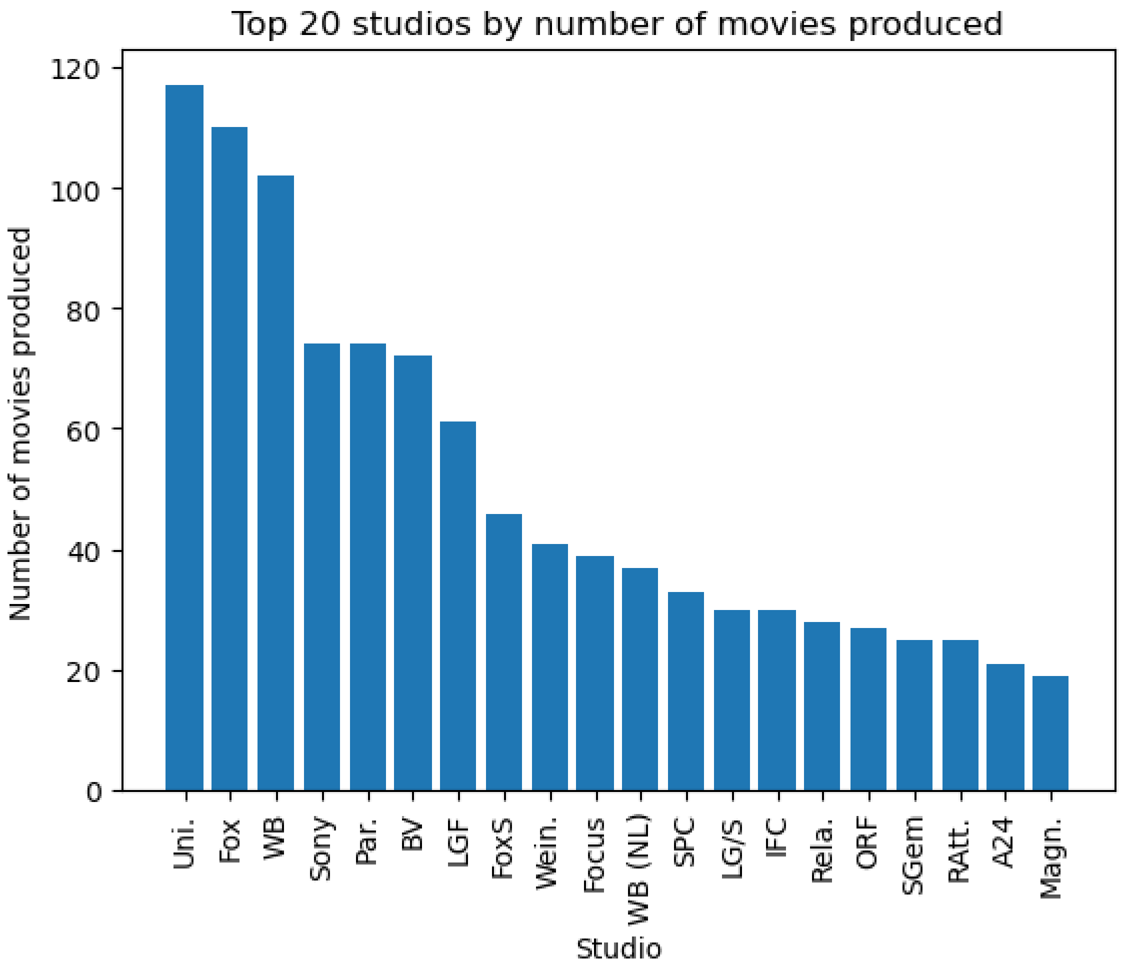
	id	release_date	movie	production_budget	domestic_gross_x	worldwide_gross	net_profit	profit_margin	title	studio	domestic_
0	2	May 20, 2011	Pirates of the Caribbean: On Stranger Tides	410600000	241063875	1045663875	635063875	0.607331	Pirates of the Caribbean: On Stranger Tides	BV	2411
1	4	May 1, 2015	Avengers: Age of Ultron	330600000	459005868	1403013963	1072413963	0.764364	Avengers: Age of Ultron	BV	4590
2	7	Apr 27, 2018	Avengers: Infinity War	300000000	678815482	2048134200	1748134200	0.853525	Avengers: Infinity War	BV	6788
3	9	Nov 17, 2017	Justice League	300000000	229024295	655945209	355945209	0.542645	Justice League	WB	2290
4	10	Nov 6, 2015	Spectre	300000000	200074175	879620923	579620923	0.658944	Spectre	Sony	2001

In [18]:

```
# drop rows where the studio information is missing
merged_df = merged_df.dropna(subset=['studio'])
```

In [19]:

```
# group the merged dataframe by studio and count the number of movies produced
studio_counts = merged_df.groupby('studio')['title'].count()

# get the top 20 studios by number of movies produced
top_studios = studio_counts.sort_values(ascending=False)[:20]

# plot the top 20 studios by number of movies produced
plt.bar(top_studios.index, top_studios.values)
plt.xticks(rotation=90)
plt.xlabel('Studio')
plt.ylabel('Number of movies produced')
plt.title('Top 20 studios by number of movies produced')
plt.show()
```



Universal, Fox, and Warner Brothers are the top three studios and this would be the main competitors to compete with