Project: Investigate a TMDb movie data

> This project provide by **Udacity** for Data Analyst Nanoodegree Programe

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Introduction

> This data set contains information about 10,000 movies collected from The Movie Database (TMDb), including user ratings and revenue.

To start Analysis we need to Answer these questions:

1. Question 1: What is The most type of movies produced?
2. What are the highest-grossing movies?
3. What are the movies that got the most votes average?
4. Is there any relationship between vote average and runtime of movies?
5. Is there any relation between popularity and runtime?
6. Is there any relation between popularity and vote_avg?
7. Question7: Is there any relation between budget and revenue?

In [1]:
```
# import statements for all of the packages
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt

# using'magic word' so that your visualizations are plotted inline
%matplotlib inline
```

Data Wrangling

General Properties

In [2]:
```
# Load data
df = pd.read_csv('movies.csv')
print(df.shape)
df.head(2)
```

```
(10866, 21)
```

Out[2]:

	id	imdb_id	popularity	budget	revenue	original_title	cast	hom
0	135397	tt0369610	32.985763	150000000	1513528810	Jurassic World	Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...	http://www.jurassicwor
1	76341	tt1392190	28.419936	150000000	378436354	Mad Max: Fury Road	Tom Hardy|Charlize Theron|Hugh Keays-Byrne|Nic...	http://www.madmaxmov

2 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
```

Data Cleaning

In [4]:
```
#check duplicated
df.duplicated().sum()
```

Out[4]:
```
1
```

> Since the number of duplicates is one, it is okay to drop it

In [5]:
```
#drop duplicated
df.drop_duplicates(inplace=True)
```

In [6]:
```
# check if duplicate was droped
df.duplicated().sum()
```

Out[6]:
```
0
```

In [7]:
```
#check null values
df.isnull().sum()
```

Out[7]:
```
id                         0
imdb_id                   10
popularity                 0
budget                     0
revenue                    0
original_title             0
cast                      76
homepage                7929
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 the column genre I notice that the values was separated by '|', so i will split them and take 1st value then drop the other using: Split column by delimiter into multiple columns

In [8]:
```
#split genre content
df[['genre','genres2','genres3','genres4','genres5']] = df['genres'].str.split('|', expanc
df.head()
```

Out[8]:

	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...	ht
1	76341	tt1392190	28.419936	150000000	378436354	Mad Max: Fury Road	Tom Hardy|Charlize Theron|Hugh Keays-Byrne|Nic...	htt
2	262500	tt2908446	13.112507	110000000	295238201	Insurgent	Shailene Woodley|Theo James|Kate Winslet|Ansel...	http://www.thediver
3	140607	tt2488496	11.173104	200000000	2068178225	Star Wars: The Force Awakens	Harrison Ford|Mark Hamill|Carrie Fisher|Adam D...	http://www.st

	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 × 26 columns

In [9]:
```
#Drop coulmns that i don't need in my analysis
data = [
    'id',
    'release_date',
    'release_year',
    'director',
    'production_companies',
    'homepage',
    'tagline',
    'keywords',
    'imdb_id',
    'overview',
    'vote_count',
    'cast',
    'genres',
    'genres2',
    'genres3',
    'genres4',
    'genres5',
    'budget_adj',
    'revenue_adj'
]

df.drop(columns=data, axis=1, inplace=True)
```

In [10]:
```
# drop nan value
df.dropna(inplace=True)
print(df.shape)
df.head()
```

```
(10842, 7)
```

Out[10]:

	popularity	budget	revenue	original_title	runtime	vote_average	genre
0	32.985763	150000000	1513528810	Jurassic World	124	6.5	Action
1	28.419936	150000000	378436354	Mad Max: Fury Road	120	7.1	Action
2	13.112507	110000000	295238201	Insurgent	119	6.3	Adventure
3	11.173104	200000000	2068178225	Star Wars: The Force Awakens	136	7.5	Action
4	9.335014	190000000	1506249360	Furious 7	137	7.3	Action

In [11]:
```
df.isnull().sum()
```

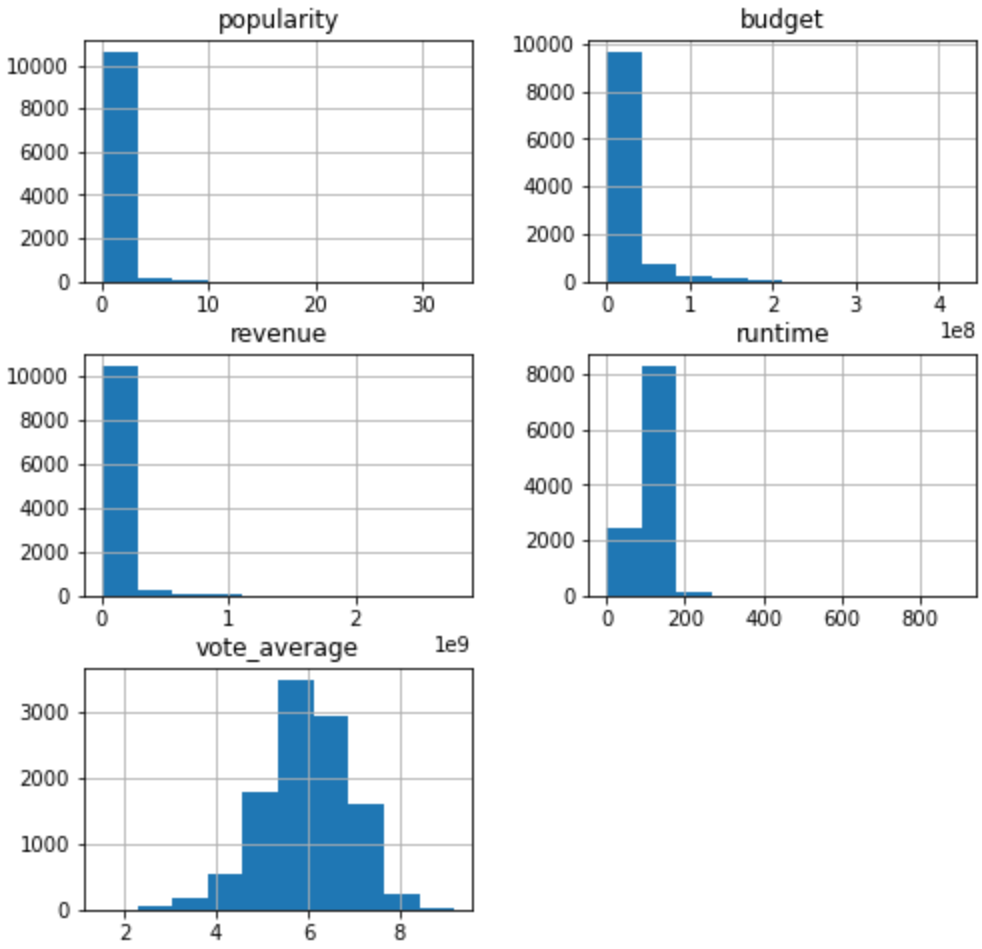
Out[11]:
```
popularity        0
budget            0
revenue           0
original_title    0
runtime           0
vote_average      0
genre             0
dtype: int64
```

In [12]:
```
df.describe()
```

Out[12]:

	popularity	budget	revenue	runtime	vote_average
count	10842.000000	1.084200e+04	1.084200e+04	10842.000000	10842.000000
mean	0.647461	1.465531e+07	3.991138e+07	102.138443	5.974064
std	1.001032	3.093971e+07	1.171179e+08	31.294612	0.934257
min	0.000065	0.000000e+00	0.000000e+00	0.000000	1.500000
25%	0.208210	0.000000e+00	0.000000e+00	90.000000	5.400000
50%	0.384532	0.000000e+00	0.000000e+00	99.000000	6.000000
75%	0.715393	1.500000e+07	2.414118e+07	111.000000	6.600000
max	32.985763	4.250000e+08	2.781506e+09	900.000000	9.200000

In [13]:
```
#plot all data values
df.hist(
    figsize=(8,8)
);
```



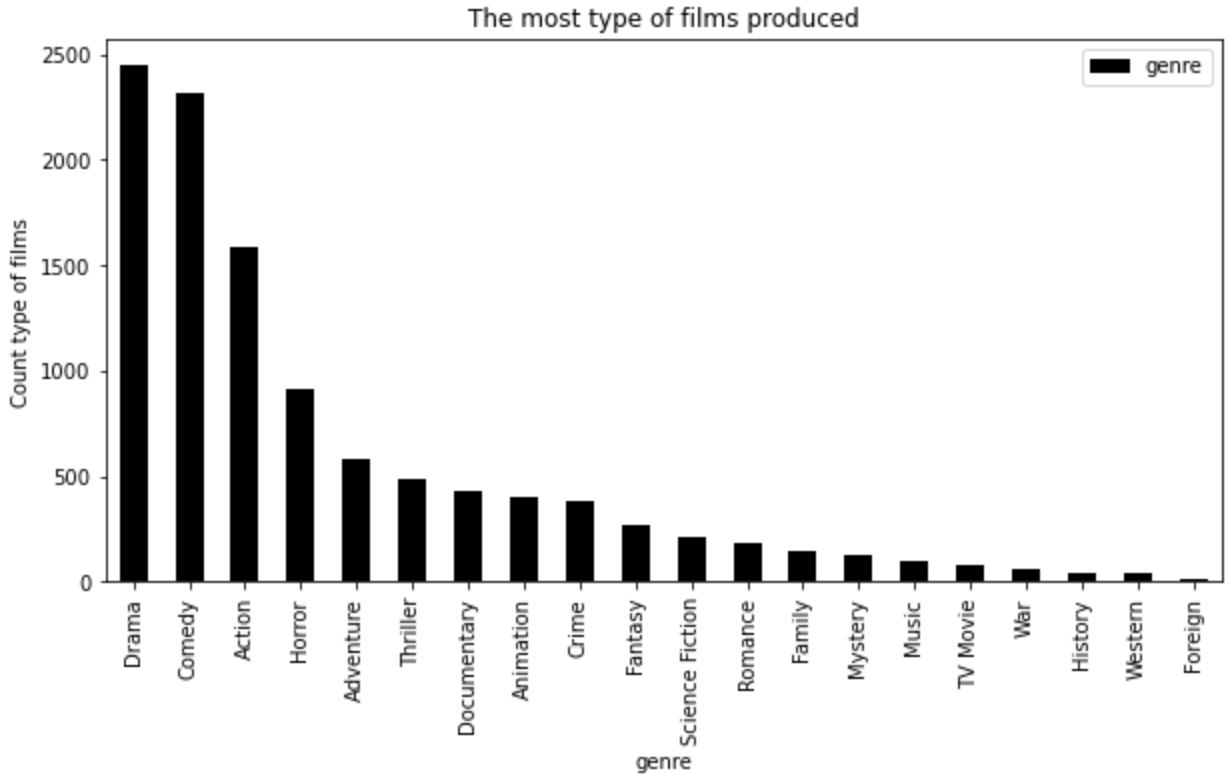
Exploratory Data Analysis

> Here we Answer the questions posed in introduction

Question 1: What is The most type of movies produced?

> First i count genre value then plot it for better vision

In [14]:
```
# count genre value
genre = df['genre'].value_counts()
# plot genre value to check the most type produced
genre.plot(
    title='The most type of films produced',
    kind='bar',
    color='#000',
    xlabel='genre',
    ylabel='Count type of films',
    legend = 'genre',
    figsize = (10,5)
);
```



Answer question1: The 10 most type of movies produced

FRom the plot we realase that:

- Drama 876
- Comedy 775
- Action 684
- Adventure 312
- Horror 272
- Crime 171
- Thriller 160

```
- Fantasy            109
- Animation          101
```

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Question 2: What are the highest-grossing movies?

> First I check if there are 0 value in: budget, revenue, runtime

In [15]:
```
#check for 0 value in budget col
df[df['budget']== 0].shape
```

Out[15]:
```
(5674, 7)
```

In [16]:
```
#check for 0 value in revenue col
df[df['revenue']==0].shape
```

Out[16]:
```
(5993, 7)
```

In [17]:
```
#check for 0 value in runtime col
df[df['runtime']==0].shape
```

Out[17]:
```
(30, 7)
```

> There are some movies that have not recorded their budget, revenue, or even their runtime In order for the comparison to be fair, we must drop the NaN values so I Replace 0 with NaN to drop it

In [18]:
```
#Replace 0 with NaN
df.replace(0, np.nan, inplace=True)
```

In [19]:
```
# check if they replaced by NaN
df.isnull().sum()
```

Out[19]:
```
popularity          0
budget           5674
revenue          5993
original_title      0
runtime            30
vote_average        0
genre               0
dtype: int64
```

In [20]:
```
#drop all NaN value
df_dropna = df.dropna()
```

To Avoid this error

> SettingWithCopyWarning: A value is trying to be set on a copy of a slice from a DataFrame.
> Try using .loc[row_indexer,col_indexer] = value instead

i saved a copy of droped in new csv file

In [21]:
```
# save new dataframe
df_dropna.to_csv('df_movies_droped.csv',index = False)
df_drp = pd.read_csv('df_movies_droped.csv')
```

In [22]:
```
# check new dataframe df_drp
print(df_drp.shape)
df_drp.head()
```

```
(3854, 7)
```

Out[22]:

	popularity	budget	revenue	original_title	runtime	vote_average	genre
0	32.985763	150000000.0	1.513529e+09	Jurassic World	124.0	6.5	Action
1	28.419936	150000000.0	3.784364e+08	Mad Max: Fury Road	120.0	7.1	Action
2	13.112507	110000000.0	2.952382e+08	Insurgent	119.0	6.3	Adventure
3	11.173104	200000000.0	2.068178e+09	Star Wars: The Force Awakens	136.0	7.5	Action
4	9.335014	190000000.0	1.506249e+09	Furious 7	137.0	7.3	Action

In [23]:
```
df_drp.describe()
```

Out[23]:

	popularity	budget	revenue	runtime	vote_average
count	3854.000000	3.854000e+03	3.854000e+03	3854.000000	3854.000000
mean	1.191554	3.720370e+07	1.076866e+08	109.220291	6.168163
std	1.475162	4.220822e+07	1.765393e+08	19.922820	0.794920
min	0.001117	1.000000e+00	2.000000e+00	15.000000	2.200000
25%	0.462367	1.000000e+07	1.360003e+07	95.000000	5.700000
50%	0.797511	2.400000e+07	4.480000e+07	106.000000	6.200000
75%	1.368324	5.000000e+07	1.242125e+08	119.000000	6.700000
max	32.985763	4.250000e+08	2.781506e+09	338.000000	8.400000

> I want to calculate the profit of each movie so I add a column to hold the results

In [24]:
```
# Add column that calculate the profit of each movie
df_drp['profit'] = df_drp['revenue'] - df_drp['budget']
df_drp.head()
```

Out[24]:

	popularity	budget	revenue	original_title	runtime	vote_average	genre	profit
0	32.985763	150000000.0	1.513529e+09	Jurassic World	124.0	6.5	Action	1.363529e+09
1	28.419936	150000000.0	3.784364e+08	Mad Max: Fury Road	120.0	7.1	Action	2.284364e+08
2	13.112507	110000000.0	2.952382e+08	Insurgent	119.0	6.3	Adventure	1.852382e+08
3	11.173104	200000000.0	2.068178e+09	Star Wars: The Force Awakens	136.0	7.5	Action	1.868178e+09
4	9.335014	190000000.0	1.506249e+09	Furious 7	137.0	7.3	Action	1.316249e+09

> Sort the profit ascending to know the top 10 movies who have highest profit

In [25]:
```
# Sort ascending profits
top_profit=df_drp.sort_values(['profit'], ascending=False)
top_profit
```

Out[25]:

	popularity	budget	revenue	original_title	runtime	vote_average	genre	profit
344	9.432768	237000000.0	2.781506e+09	Avatar	162.0	7.1	Action	2.544506e+09
3	11.173104	200000000.0	2.068178e+09	Star Wars: The Force Awakens	136.0	7.5	Action	1.868178e+09
1767	4.355219	200000000.0	1.845034e+09	Titanic	194.0	7.3	Drama	1.645034e+09
0	32.985763	150000000.0	1.513529e+09	Jurassic World	124.0	6.5	Action	1.363529e+09
4	9.335014	190000000.0	1.506249e+09	Furious 7	137.0	7.3	Action	1.316249e+09
...	...	...	...	...	...	...	...	..
1667	1.653031	100000000.0	2.500000e+02	Brother Bear	85.0	6.8	Animation	-9.999975e+07
1196	0.921653	150000000.0	3.899276e+07	Mars Needs Moms	88.0	5.5	Adventure	-1.110072e+08
2472	0.948560	145000000.0	2.581996e+07	The Alamo	137.0	5.9	Western	-1.191800e+08
1931	1.214510	255000000.0	8.928991e+07	The Lone Ranger	149.0	6.0	Action	-1.657101e+08
682	0.250540	425000000.0	1.108757e+07	The Warrior's Way	100.0	6.4	Adventure	-4.139124e+08

3854 rows × 8 columns

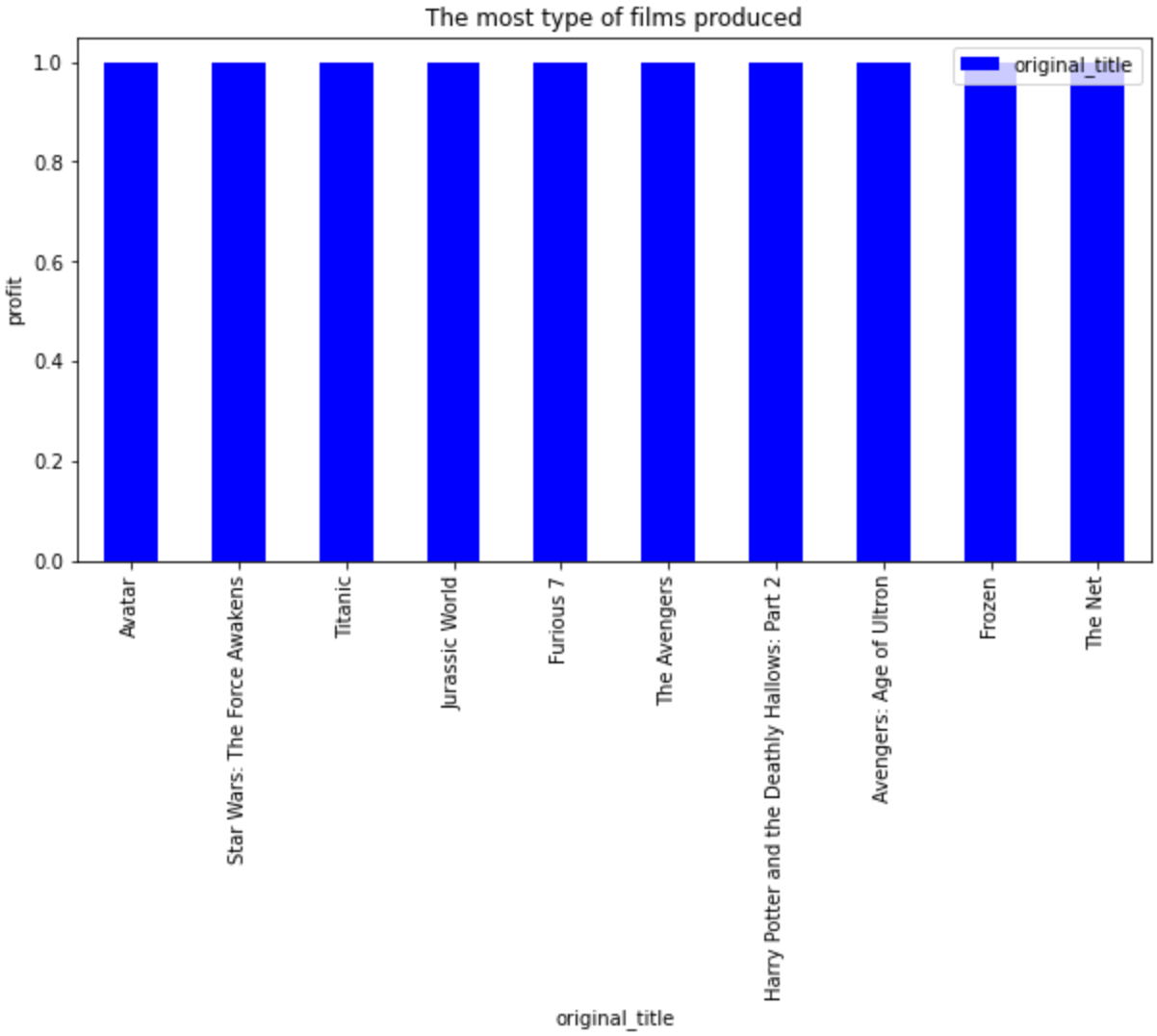
In [26]:
```
#check top 10
top_profit[['original_title', 'profit']].head(10)
```

Out[26]:

	original_title	profit
344	Avatar	2.544506e+09
3	Star Wars: The Force Awakens	1.868178e+09
1767	Titanic	1.645034e+09
0	Jurassic World	1.363529e+09
4	Furious 7	1.316249e+09
1488	The Avengers	1.299558e+09
1102	Harry Potter and the Deathly Hallows: Part 2	1.202818e+09
14	Avengers: Age of Ultron	1.125036e+09
1857	Frozen	1.124219e+09
2866	The Net	1.084280e+09

In [27]:
```
#plot top 10 profit
prof = top_profit['original_title'].iloc[:10].value_counts()
```

```
prof.plot(
   title='The most type of films produced',
    kind='bar',
    color='blue',
    xlabel='original_title',
    ylabel='profit',
    legend='original_title',
    figsize = (10,5)
);
```



Answer Question2:

The top 10 highest profit movies are:

1. Avatar: **2.544506e+09**
2. Star Wars: The Force Awakens: **1.868178e+09**
3. Titanic: **1.645034e+09**
4. Jurassic World **1.363529e+09**
5. Furious 7 **1.316249e+09**
6. The Avengers **1.299558e+09**
7. Harry Potter and the Deathly Hallows: Part 2 **1.202818e+09**
8. Avengers: Age of Ultron **1.125036e+09**
9. Frozen **1.124219e+09**

10. The Net **1.084280e+09**

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Question3: What are the movies that got the most votes average?

> sort data with ascending 'vote_average'

In [28]:
```
#top vote
top_vote=df.sort_values(['vote_average'], ascending=False)
```

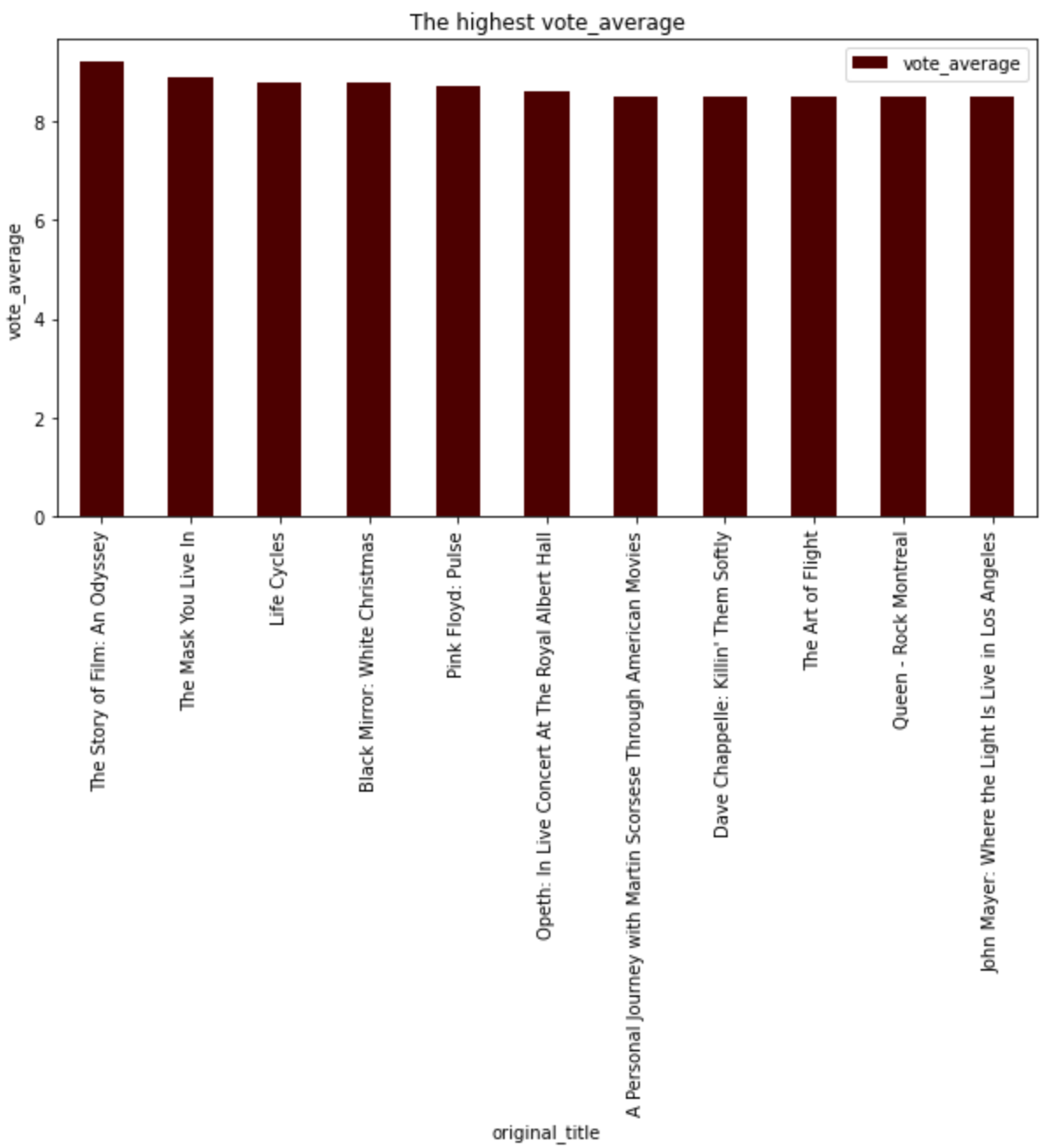
In [29]:
```
#explore top vote data
top_vote[['original_title','vote_average', 'runtime', 'popularity']].head(10)
```

Out[29]:

	original_title	vote_average	runtime	popularity
3894	The Story of Film: An Odyssey	9.2	900.0	0.006925
538	The Mask You Live In	8.9	88.0	0.114264
2269	Life Cycles	8.8	47.0	0.222293
1200	Black Mirror: White Christmas	8.8	74.0	0.129531
6911	Pink Floyd: Pulse	8.7	145.0	0.212010
2401	Opeth: In Live Concert At The Royal Albert Hall	8.6	163.0	0.067753
8221	A Personal Journey with Martin Scorsese Throug...	8.5	225.0	0.194889
8839	Dave Chappelle: Killin' Them Softly	8.5	57.0	0.157001
3690	The Art of Flight	8.5	80.0	0.321341
8411	Queen - Rock Montreal	8.5	138.0	0.302908

In [30]:
```
#plot the top 10 highest vote_average
top_vote.iloc[0:11].plot(
    x='original_title',
    y='vote_average',
    kind = 'bar',
    title='The highest vote_average',
    color= '#4d0000',
    xlabel='original_title',
    ylabel='vote_average',
    figsize = (10,5)

);
```



Answer Question3: Top 10 vote average movies:

1- Pink Floyd: Pulse

```
release_year: 2006
vote_average: 8.7
```

2- Queen - Rock Montreal

```
release_year: 1981
vote_average: 8.5
```

3- A Personal Journey with Martin Scorsese Throug...

```
release_year: 1995
vote_average: 8.5
```

4- The Art of Flight

```
release_year: 2011
vote_average: 8.5
```

5- The Shawshank Redemption

```
release_year: 1994
vote_average: 8.4
```

6- The Jinx: The Life and Deaths of Robert Durst

```
release_year: 2015
vote_average: 8.4
```

7- Guten Tag, RamÃ³n

```
release_year: 2013
vote_average: 8.4
```

8- Stop Making Sense

```
release_year: 1984
vote_average: 8.4
```

9- The Century of the Self

```
release_year: 2002
vote_average: 8.3
```

10- Shoah

```
release_year: 1985
vote_average: 8.3
```

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Relationships

> In this section I will searche about relationships between some data

> Here i defined two functions To avoid repetition

In [31]:

```
#define function to plot histogram
def histplot(col,color,title):
    plt.hist(
    df_drp[col],
    rwidth = 0.9,
    bins =31,
    color=color,
    );
    ax = plt.gca()
```

```
    ax.set_title(title)
```

scatter plot

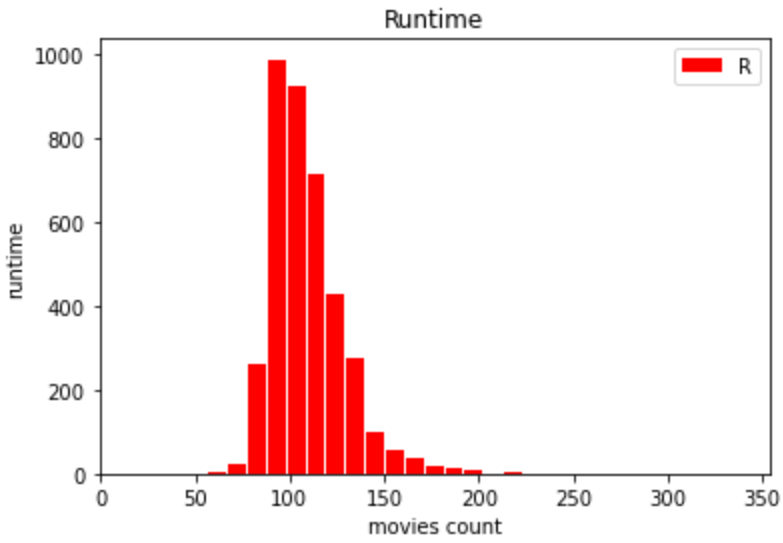
In [32]:
```
# define function to plot scatter
def scatterVote(X,Y,Data,title):
    sns.lmplot(
    x=X,
    y=Y,
    data=Data,
    #scatter_kws={'color': 'darkgreen'},
    line_kws={'color': 'black'},
    );
    ax = plt.gca()

    ax.set_title(title)

    plt.show()
```

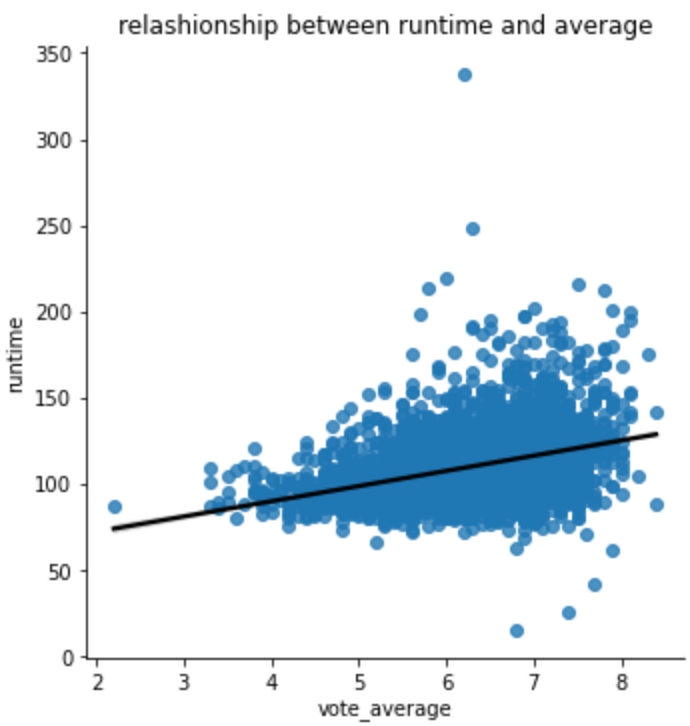
Question 4: Is there any relationship between vote average and runtime of movies?

In [33]:
```
# plot Runtime
histplot('runtime','red', 'Runtime');
plt.xlabel('movies count');
plt.ylabel('runtime');
plt.legend('Runtime');
```



> Here I use df_drp data when we droped all NaN value because I used runtime to compare

In [34]:
```
scatterVote("vote_average","runtime",df_drp, "relashionship between runtime and average")
```



Answer Question4

From the plots above there is a relationship between the hight vote average and runtime

i.e. The higher the runtime, the higher the vote average

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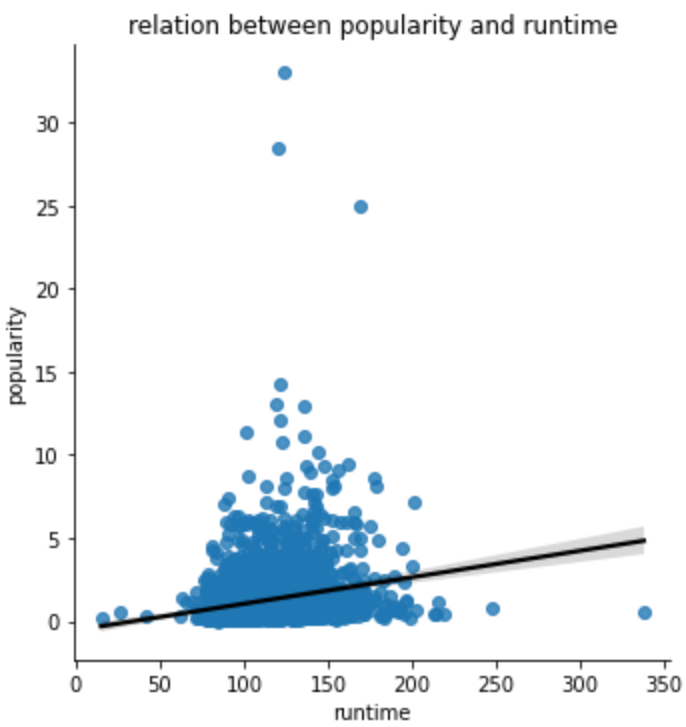
Question 5: Is there any relation between popularity and runtime?

> Here I use df_drp data when we droped all NaN value because i used runtime to compare

In [35]:
```
scatterVote("runtime","popularity",df_drp, "relation between popularity and runtime")
```



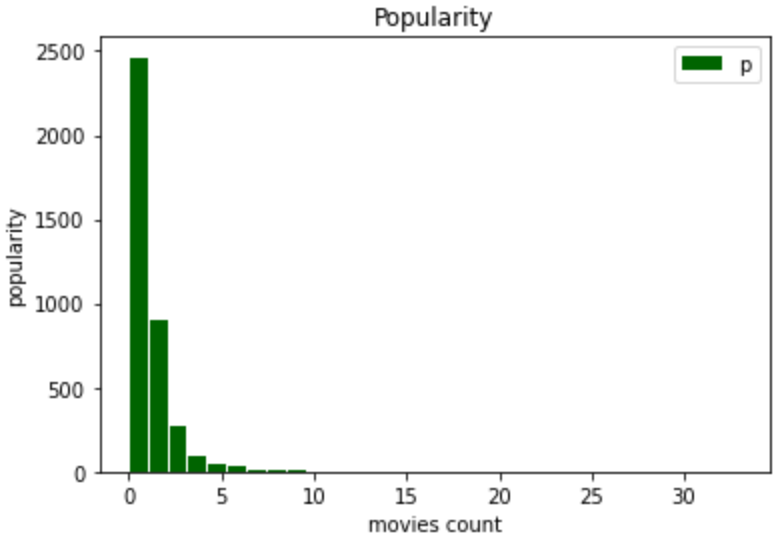
Answer Question5:

From the plots above there is a relationship between the hight vote average and runtime

i.e. The higher the runtime, the higher the popularity

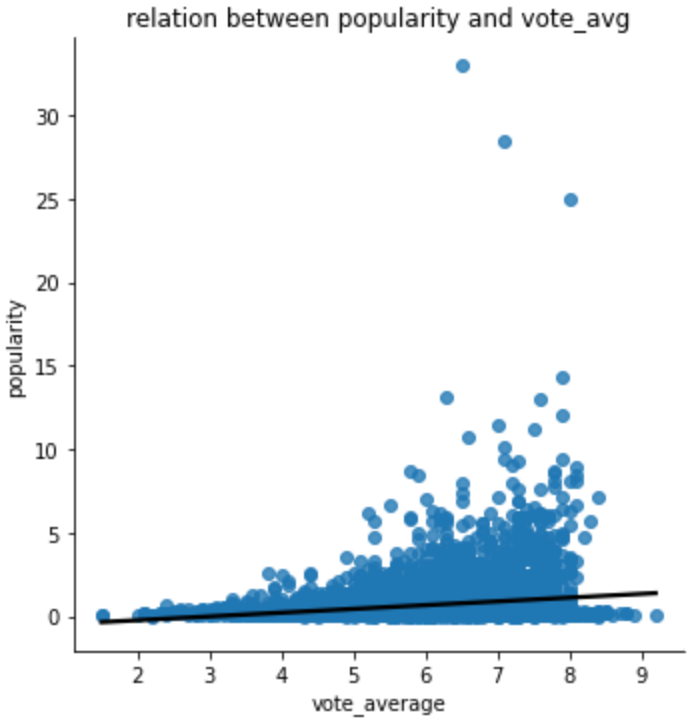
Question6 : Is there any relation between popularity and vote_avg?

In [36]:
```
#plot the popularity
histplot('popularity','darkgreen', 'Popularity');
plt.xlabel('movies count');
plt.ylabel('popularity');
plt.legend('popularity');
```



> here I used top_vote data because vote_average and popularity did not have NaN value

In [37]:
```
scatterVote("vote_average","popularity",top_vote, "relation between popularity and vote_av
```



Answer Question 6

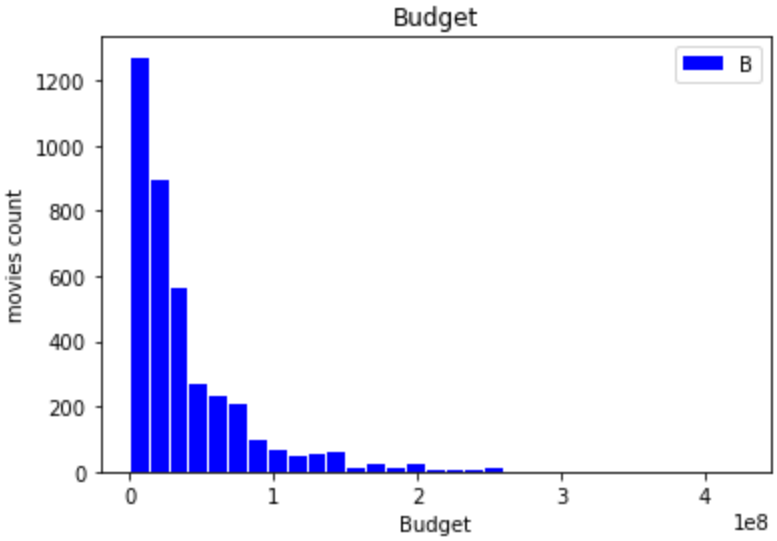
From the plots above there is a relationship between the hight vote average and popularity

i.e. The higher the popularity, the higher the vote average

Question7: Is there any relation between budget and revenue?

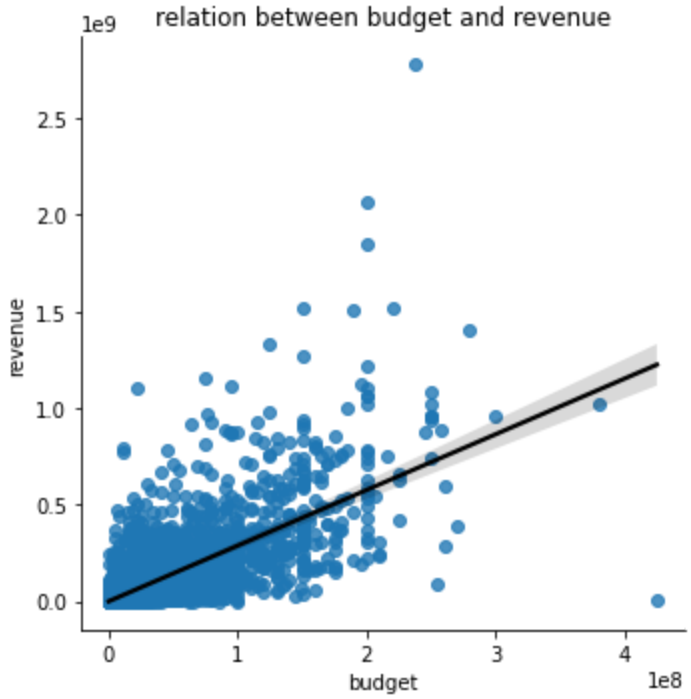
In [38]:
```
# plot Budget
histplot('budget','blue', 'Budget')
plt.xlabel('Budget'),
plt.ylabel('movies count')
plt.legend('Budget')
```

Out[38]:
```
<matplotlib.legend.Legend at 0x7f8c54741b20>
```



> Here I use df_drp data when we droped all NaN value because i used budget, revenue to compare

In [39]:
```
scatterVote("budget","revenue",df_drp, "relation between budget and revenue")
```



Answer Question 7:

This is a positive relationship. i.e. the more the budget the more revenue a movie makes

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Conclusions

As a conclusion

> **first we found the top 10 type of films produced:**

1. Drama
2. Comedy
3. Action
4. Adventure
5. Horror
6. Crime
7. Thriller
8. Fantasy
9. Animation

> **Second The top 10 budget and highest profit films are:**
>
> 1. Avatar: **2.544506e+09**
> 2. Star Wars: The Force Awakens: **1.868178e+09**
> 3. Titanic: **1.645034e+09**
> 4. Jurassic World **1.363529e+09**
> 5. Furious 7 **1.316249e+09**
> 6. The Avengers **1.299558e+09**
> 7. Harry Potter and the Deathly Hallows: Part 2 **1.202818e+09**
> 8. Avengers: Age of Ultron **1.125036e+09**
> 9. Frozen **1.124219e+09**
> 10. The Net **1.084280e+09**
>
> **Third Top 10 vote average movies:**
>
> 1. Pink Floyd: Pulse
> 2. Queen - Rock Montreal
> 3. A Personal Journey with Martin Scorsese Throug...
> 4. The Art of Flight
> 5. The Shawshank Redemption
> 6. The Jinx: The Life and Deaths of Robert Durst
> 7. Guten Tag, RamÃ³n
> 8. Stop Making Sense
> 9. The Century of the Self
> 10. Shoah
>
> **After that i searched about relationships between some data:**

- between vote average and runtime of movies
- between popularity and runtime
- between popularity and vote_avg
- relation between budget and revenue

> **In all the comparisons above, in which I searched for relationships, I found A positive relationship, the higher the value of one of them, the higher the value of the second, depending on scatterplot to highlight the results**

Limitations

> There is a large group of movies that did not record the value of their budget, revenue, or even the runtime, which made it difficult to analyze all the data together, which caused me to drop them in the stage of searching for relationships.
>
> In addition to the fact that this data is old, the last recording in it was in 2015. We suggest that there be serious updates to the data

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In [40]:

```
df.to_csv('df_movies_final.csv',index = False)
```