> **Tip**: Welcome to the Investigate a Dataset project! You will find tips in quoted sections like this to help organize your approach to your investigation. Before submitting your project, it will be a good idea to go back through your report and remove these sections to make the presentation of your work as tidy as possible. First things first, you might want to double-click this Markdown cell and change the title so that it reflects your dataset and investigation.

Project: Investigate a Dataset (TMDb Movie Data)

Table of Contents

Introduction

> **Tip**: In this section of the report, provide a brief introduction to the dataset you've selected for analysis. At the end of this section, describe the questions that you plan on exploring over the course of the report. Try to build your report around the analysis of at least one dependent variable and three independent variables.
>
> If you haven't yet selected and downloaded your data, make sure you do that first before coming back here. If you're not sure what questions to ask right now, then make sure you familiarize yourself with the variables and the dataset context for ideas of what to explore.

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

Analysis Question :

1- Who are the top twenty actors participating in the market?

2- Who are the top twenty market directors currently active in the industry?

3- Which ten production companies make up the top of the list?

4- What are the top five genres of movies that people watch the most?

5- What about the statistics regarding the profits?

6- Where do we stand with the runtime statistics?

7- What about the average values for (revenue, budget, profit, and runtime)?

8- What about the maximum and minimum values for (runtime), (budget), (profit), and (revenue), respectively?

In [8]:
```
# Use this cell to set up import statements for all of the packages that you
#   plan to use.

# Remember to include a 'magic word' so that your visualizations are plotted
#   inline with the notebook. See this page for more:
#   http://ipython.readthedocs.io/en/stable/interactive/magics.html
import pandas as pd
import numpy as np
import seaborn as sns
import plotly.express as px
import csv
from datetime import datetime
import matplotlib.pyplot as plt
%matplotlib inline
```

1- Data Wrangling

> **Tip**: In this section of the report, you will load in the data, check for cleanliness, and then trim and clean your dataset for analysis. Make sure that you document your steps carefully and justify your cleaning decisions.

General Properties

In [9]:
```
# Load your data and print out a few lines. Perform operations to inspect data
#   types and look for instances of missing or possibly errant data.
```

1.1 Load Data

In [10]:
```
movies_data = pd.read_csv("tmdb-movies.csv")
movies_data.head()
```

Out[10]:

	id	imdb_id	popularity	budget	revenue	original_title	cast	homepage	director	tagline	...	overview	runtime	
0	135397	tt0369610	32.985763	150000000	1513528810	Jurassic World	Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...	http://www.jurassicworld.com/	Colin Trevorrow	The park is open.	...	Twenty-two years after the events of Jurassic ...	124	A
1	76341	tt1392190	28.419936	150000000	378436354	Mad Max: Fury Road	Tom Hardy|Charlize Theron|Hugh Keays-Byrne|Nic...	http://www.madmaxmovie.com/	George Miller	What a Lovely Day.	...	An apocalyptic story set in the furthest reach...	120	A
2	262500	tt2908446	13.112507	110000000	295238201	Insurgent	Shailene Woodley|Theo James|Kate Winslet|Ansel...	http://www.thedivergentseries.movie/#insurgent	Robert Schwentke	One Choice Can Destroy You	...	Beatrice Prior must confront her inner demons ...	119	
3	140607	tt2488496	11.173104	200000000	2068178225	Star Wars: The Force Awakens	Harrison Ford|Mark Hamill|Carrie Fisher|Adam D...	http://www.starwars.com/films/star-wars-episod...	J.J. Abrams	Every generation has a story.	...	Thirty years after defeating the Galactic Empi...	136	A
4	168259	tt2820852	9.335014	190000000	1506249360	Furious 7	Vin Diesel|Paul Walker|Jason Statham|Michelle ...	http://www.furious7.com/	James Wan	Vengeance Hits Home	...	Deckard Shaw seeks revenge against Dominic Tor...	137	

5 rows × 21 columns

In [11]:
```
movies_data.tail()
```

Out[11]:

	id	imdb_id	popularity	budget	revenue	original_title	cast	homepage	director	tagline	...	overview	runtime	genres	produ
10861	21	tt0060371	0.080598	0	0	The Endless Summer	Michael Hynson|Robert August|Lord 'Tally Ho' B...	NaN	Bruce Brown	NaN	...	The Endless Summer, by Bruce Brown, is one of ...	95	Documentary	
10862	20379	tt0060472	0.065543	0	0	Grand Prix	James Garner|Eva Marie Saint|Yves Montand|Tosh...	NaN	John Frankenheimer	Cinerama sweeps YOU into a drama of speed and ...	...	Grand Prix driver Pete Aron is fired by his te...	176	Action|Adventure|Drama	Pro
10863	39768	tt0060161	0.065141	0	0	Beregis Avtomobilya	Innokentiy Smoktunovskiy|Oleg Efremov|Georgi Z...	NaN	Eldar Ryazanov	NaN	...	An insurance agent who moonlights as a carthie...	94	Mystery|Comedy	
10864	21449	tt0061177	0.064317	0	0	What's Up, Tiger Lily?	Tatsuya Mihashi|Akiko Wakabayashi|Mie Hama|Joh...	NaN	Woody Allen	WOODY ALLEN STRIKES BACK!	...	In comic Woody Allen's film debut, he took the...	80	Action|Comedy	Ben
10865	22293	tt0060666	0.035919	19000	0	Manos: The Hands of Fate	Harold P. Warren|Tom Neyman|John Reynolds|Dian...	NaN	Harold P. Warren	It's Shocking! It's Beyond Your Imagination!	...	A family gets lost on the road and stumbles up...	74	Horror	

5 rows × 21 columns

1.2 Carrying out a few processes in order to investigate the data

In [12]:
```
movies_data.shape
```

Out[12]:
```
(10866, 21)
```

The number of rows in the file is 10866, and there are 21 columns.

In [13]:
```
movies_data.describe()
```

Out[13]:

	id	popularity	budget	revenue	runtime	vote_count	vote_average	release_year	budget_adj	revenue_adj
count	10866.000000	10866.000000	1.086600e+04	1.086600e+04	10866.000000	10866.000000	10866.000000	10866.000000	1.086600e+04	1.086600e+04
mean	66064.177434	0.646441	1.462570e+07	3.982332e+07	102.070863	217.389748	5.974922	2001.322658	1.755104e+07	5.136436e+07
std	92130.136561	1.000185	3.091321e+07	1.170035e+08	31.381405	575.619058	0.935142	12.812941	3.430616e+07	1.446325e+08
min	5.000000	0.000065	0.000000e+00	0.000000e+00	0.000000	10.000000	1.500000	1960.000000	0.000000e+00	0.000000e+00
25%	10596.250000	0.207583	0.000000e+00	0.000000e+00	90.000000	17.000000	5.400000	1995.000000	0.000000e+00	0.000000e+00
50%	20669.000000	0.383856	0.000000e+00	0.000000e+00	99.000000	38.000000	6.000000	2006.000000	0.000000e+00	0.000000e+00
75%	75610.000000	0.713817	1.500000e+07	2.400000e+07	111.000000	145.750000	6.600000	2011.000000	2.085325e+07	3.369710e+07
max	417859.000000	32.985763	4.250000e+08	2.781506e+09	900.000000	9767.000000	9.200000	2015.000000	4.250000e+08	2.827124e+09

In [14]:
```
movies_data.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
```

The revenue column, the budget column, and the runtime column all have values of zero or NAN.

In [15]:
```
movies_data.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
```

The date needs to be changed to reflect the current time in order for it not to be an object.

> **Tip**: You should *not* perform too many operations in each cell. Create cells freely to explore your data. One option that you can take with this project is to do a lot of explorations in an initial notebook. These don't have to be organized, but make sure you use enough comments to understand the purpose of each code cell. Then, after you're done with your analysis, create a duplicate notebook where you will trim the excess and organize your steps so that you have a flowing, cohesive report.

> **Tip**: Make sure that you keep your reader informed on the steps that you are taking in your investigation. Follow every code cell, or every set of related code cells, with a markdown cell to describe to the reader what was found in the preceding cell(s). Try to make it so that the reader can then understand what they will be seeing in the following cell(s).

2- Data Cleaning (Replace this with more specific notes!)

In [16]:
```
# After discussing the structure of the data and any problems that need to be
#   cleaned, perform those cleaning steps in the second part of this section.
```

2.1 Delete unused columns.

In [17]:
```
new_data = movies_data.copy()
```

In [18]:
```
unused_cols = ["id", "imdb_id", "popularity", "homepage","tagline", "overview","keywords","vote_count","budget_adj", "revenue_adj"]
```

In [19]:
```
new_data.drop(unused_cols,axis= 1,inplace=True)
```

In [20]:
```
new_data.head()
```
Out[20]:

	budget	revenue	original_title	cast	director	runtime	genres	production_companies	release_date	vote_average	release_year
0	150000000	1513528810	Jurassic World	Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...	Colin Trevorrow	124	Action|Adventure|Science Fiction|Thriller	Universal Studios|Amblin Entertainment|Legenda...	6/9/15	6.5	2015
1	150000000	378436354	Mad Max: Fury Road	Tom Hardy|Charlize Theron|Hugh Keays-Byrne|Nic...	George Miller	120	Action|Adventure|Science Fiction|Thriller	Village Roadshow Pictures|Kennedy Miller Produ...	5/13/15	7.1	2015
2	110000000	295238201	Insurgent	Shailene Woodley|Theo James|Kate Winslet|Ansel...	Robert Schwentke	119	Adventure|Science Fiction|Thriller	Summit Entertainment|Mandeville Films|Red Wago...	3/18/15	6.3	2015
3	200000000	2068178225	Star Wars: The Force Awakens	Harrison Ford|Mark Hamill|Carrie Fisher|Adam D...	J.J. Abrams	136	Action|Adventure|Science Fiction|Fantasy	Lucasfilm|Truenorth Productions|Bad Robot	12/15/15	7.5	2015
4	190000000	1506249360	Furious 7	Vin Diesel|Paul Walker|Jason Statham|Michelle ...	James Wan	137	Action|Crime|Thriller	Universal Pictures|Original Film|Media Rights ...	4/1/15	7.3	2015

2.2 Delete duplicated rows

In [21]:
```
new_data.duplicated().sum()
```
Out[21]:
```
1
```
In [22]:
```
new_data.drop_duplicates(inplace = True)
```
In [23]:
```
new_data.duplicated().sum()
```
Out[23]:
```
0
```

2.3 Delete null values

In [24]:
```
new_data.isnull().sum()
```
Out[24]:
```
budget                     0
revenue                    0
original_title             0
cast                      76
director                  44
runtime                    0
genres                    23
production_companies    1030
release_date               0
vote_average               0
release_year               0
dtype: int64
```
In [25]:
```
new_data.dropna(inplace = True)
```
In [26]:
```
new_data.isnull().sum()
```
Out[26]:
```
budget                  0
revenue                 0
original_title          0
cast                    0
director                0
runtime                 0
genres                  0
production_companies    0
release_date            0
vote_average            0
release_year            0
dtype: int64
```

2.4 Delete any values that are zero or less than 10 million from the revenue and budget, as well as any values that are zero for runtime.

In [27]:
```
k = new_data.query("revenue <= 10000000 or budget <= 10000000")
```
In [28]:
```
new_data.drop(k.index, inplace = True)
```
In [29]:
```
run_zero = new_data.query("runtime == 0")
```
In [30]:
```
new_data.drop(run_zero.index, inplace = True)
```
In [31]:
```
new_data.shape
```
Out[31]:
```
(2534, 11)
```

Currently, there are 2534 rows in the file, and 11 columns.

2.4 Change date column to datetime

In [32]:
```
new_data["release_date"] = pd.to_datetime(new_data["release_date"])
```

In [33]:
```
new_data["release_date"]
```

Out[33]:
```
0       2015-06-09
1       2015-05-13
2       2015-03-18
3       2015-12-15
4       2015-04-01
           ...
10758   1978-12-14
10762   1978-12-08
10779   1978-06-27
10788   1978-10-24
10835   2066-12-20
Name: release_date, Length: 2534, dtype: datetime64[ns]
```

2.5 Make the numbers representing revenue, budget, and runtime into integers, and add a new column for profit.

In [34]:
```
integer_values = ["revenue", "budget","runtime"]
```

In [35]:
```
new_data[integer_values] = new_data[integer_values].applymap(np.int64)
```

In [36]:
```
new_data.dtypes
```

Out[36]:
```
budget                           int64
revenue                          int64
original_title                  object
cast                            object
director                        object
runtime                          int64
genres                          object
production_companies            object
release_date            datetime64[ns]
vote_average                   float64
release_year                     int64
dtype: object
```

In [37]:
```
new_data.insert(2, "profit" , (new_data["revenue"] - new_data["budget"]) )
```

In [38]:
```
new_data.head()
```

Out[38]:

	budget	revenue	profit	original_title	cast	director	runtime	genres	production_companies	release_date	vote_average	release_year
0	150000000	1513528810	1363528810	Jurassic World	Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...	Colin Trevorrow	124	Action|Adventure|Science Fiction|Thriller	Universal Studios|Amblin Entertainment|Legenda...	2015-06-09	6.5	2015
1	150000000	378436354	228436354	Mad Max: Fury Road	Tom Hardy|Charlize Theron|Hugh Keays-Byrne|Nic...	George Miller	120	Action|Adventure|Science Fiction|Thriller	Village Roadshow Pictures|Kennedy Miller Produ...	2015-05-13	7.1	2015
2	110000000	295238201	185238201	Insurgent	Shailene Woodley|Theo James|Kate Winslet|Ansel...	Robert Schwentke	119	Adventure|Science Fiction|Thriller	Summit Entertainment|Mandeville Films|Red Wago...	2015-03-18	6.3	2015
3	200000000	2068178225	1868178225	Star Wars: The Force Awakens	Harrison Ford|Mark Hamill|Carrie Fisher|Adam D...	J.J. Abrams	136	Action|Adventure|Science Fiction|Fantasy	Lucasfilm|Truenorth Productions|Bad Robot	2015-12-15	7.5	2015
4	190000000	1506249360	1316249360	Furious 7	Vin Diesel|Paul Walker|Jason Statham|Michelle ...	James Wan	137	Action|Crime|Thriller	Universal Pictures|Original Film|Media Rights ...	2015-04-01	7.3	2015

In conclusion, there are 2534 rows and 12 columns in the file.

3 - Exploratory Data Analysis

Tip: Now that you've trimmed and cleaned your data, you're ready to move on to exploration. Compute statistics and create visualizations with the goal of addressing the research questions that you posed in the Introduction section. It is recommended that you be systematic with your approach. Look at one variable at a time, and then follow it up by looking at relationships between variables.

Research Question 1 (Who are the top twenty actors participating in the market!)

In [39]:
```
# Use this, and more code cells, to explore your data. Don't forget to add
#   Markdown cells to document your observations and findings.
```

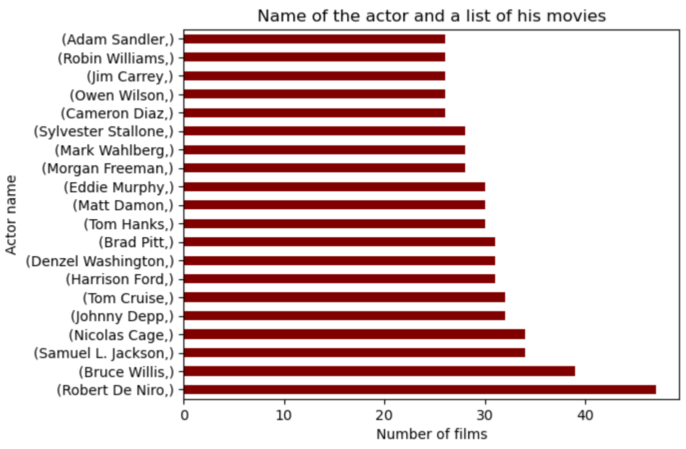
I will create a function to separate between the actors in the actors column.

In [40]:
```
def sep_data(column):
    sep_data = new_data[column].str.cat(sep = "|")
    sep_data = pd.DataFrame(list(sep_data.split("|")), columns = [column])
    sep_data.columns = sep_data.columns.str.upper()
    return sep_data
```

```
In [41]: sep_data("cast").value_counts().head(20)
```

```
Out[41]: CAST
         Robert De Niro        47
         Bruce Willis          39
         Samuel L. Jackson     34
         Nicolas Cage          34
         Johnny Depp           32
         Tom Cruise            32
         Harrison Ford         31
         Denzel Washington     31
         Brad Pitt             31
         Tom Hanks             30
         Matt Damon            30
         Eddie Murphy          30
         Morgan Freeman        28
         Mark Wahlberg         28
         Sylvester Stallone    28
         Cameron Diaz          26
         Owen Wilson           26
         Jim Carrey            26
         Robin Williams        26
         Adam Sandler          26
         dtype: int64
```

```
In [42]: sep_data("cast").value_counts().head(20).plot(kind = "barh" , color = "maroon");
         plt.xlabel("Number of films")
         plt.ylabel("Actor name")
         plt.title("Name of the actor and a list of his movies")
         plt.show()
```



In order to create the scatter plot, I will need to edit the DataFrame with the actor's name and the number of films they have appeared in.

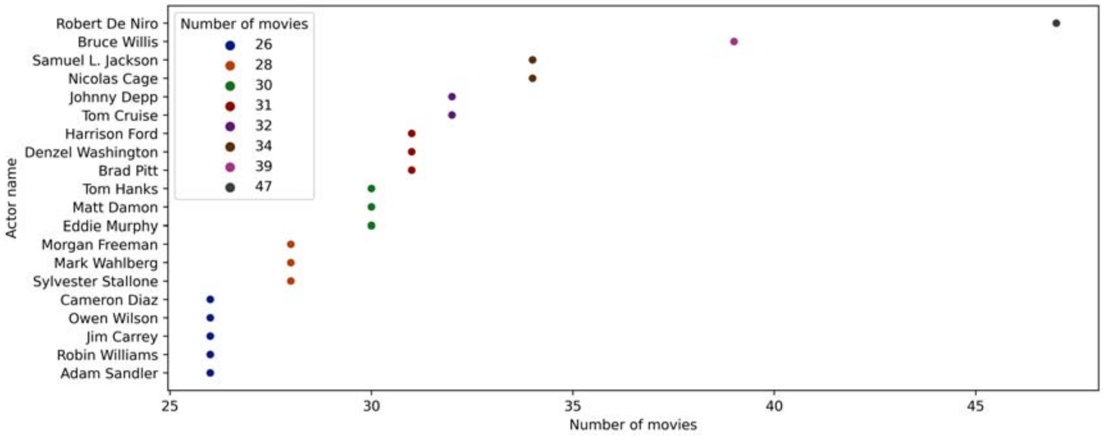
```
In [43]: actors = sep_data("cast").value_counts().head(20)
         actor_v1 = pd.DataFrame(actors)
         actor_v1.reset_index(inplace=True)
         actor_v1.rename( columns = { actor_v1.columns[0] : "Actor name", actor_v1.columns[1] : "Number of movies"},inplace = True)
         actor_v1
```

Out[43]:

	Actor name	Number of movies
0	Robert De Niro	47
1	Bruce Willis	39
2	Samuel L. Jackson	34
3	Nicolas Cage	34
4	Johnny Depp	32
5	Tom Cruise	32
6	Harrison Ford	31
7	Denzel Washington	31
8	Brad Pitt	31
9	Tom Hanks	30
10	Matt Damon	30
11	Eddie Murphy	30
12	Morgan Freeman	28
13	Mark Wahlberg	28
14	Sylvester Stallone	28
15	Cameron Diaz	26
16	Owen Wilson	26
17	Jim Carrey	26
18	Robin Williams	26
19	Adam Sandler	26

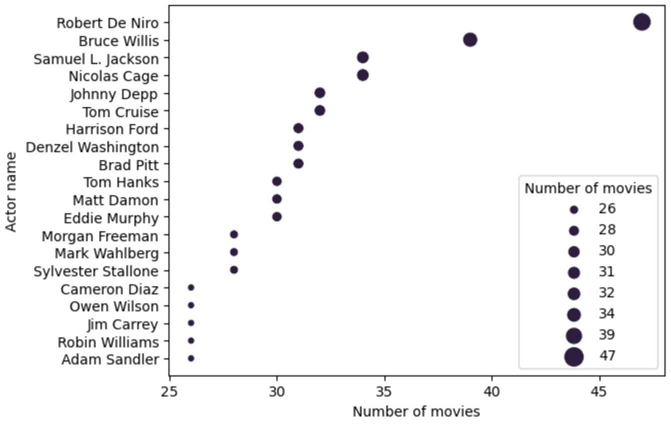
The scatter plot that follows demonstrates the relationship between the number of films and the directors who have helmed them.

In [44]:
```
plt.figure(figsize= (12,5) , dpi= 500);
sns.scatterplot( x = "Number of movies" , y = "Actor name" ,data = actor_v1 , hue = "Number of movies" , palette = "dark");
```



In [45]:
```
sns.scatterplot(
    data=actor_v1, x="Number of movies", y="Actor name", hue="Number of movies", size="Number of movies",
    sizes=(25, 170), hue_norm=(0, 7), legend="full"
)
```

Out[45]:
```
<AxesSubplot:xlabel='Number of movies', ylabel='Actor name'>
```



Robert De Niro is widely considered to be the most accomplished actor of all time (47 movies)

Research Question 2 (Who are the top twenty market directors currently active in the industry!)

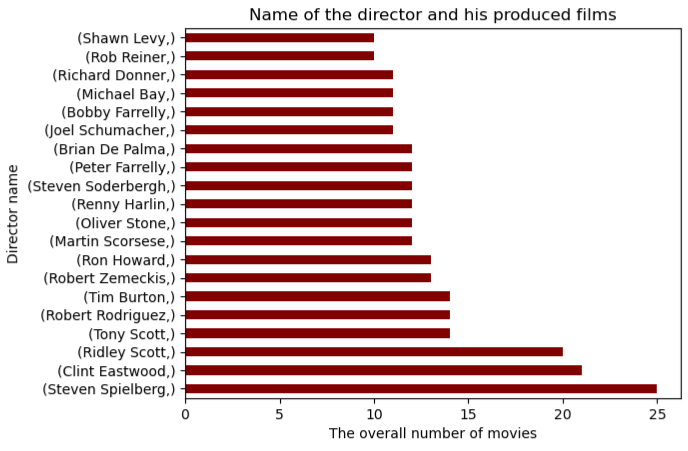
In [46]:
```
# Continue to explore the data to address your additional research
#   questions. Add more headers as needed if you have more questions
#   investigate.
```

I'll use the sep_data function for this question as well.

In [47]:
```
sep_data("director").value_counts().head(20)
```

Out[47]:
```
DIRECTOR
Steven Spielberg     25
Clint Eastwood       21
Ridley Scott         20
Tony Scott           14
Robert Rodriguez     14
Tim Burton           14
Robert Zemeckis      13
Ron Howard           13
Martin Scorsese      12
Oliver Stone         12
Renny Harlin         12
Steven Soderbergh    12
Peter Farrelly       12
Brian De Palma       12
Joel Schumacher      11
Bobby Farrelly       11
Michael Bay          11
Richard Donner       11
Rob Reiner           10
Shawn Levy           10
dtype: int64
```

In [48]:
```python
sep_data("director").value_counts().head(20).plot(kind = "barh" , color = "maroon");
plt.xlabel("The overall number of movies")
plt.ylabel("Director name")
plt.title("Name of the director and his produced films")
plt.show()
```



Steven Spielberg is the director of the vast majority of films (25 movies)

On average, each of the top twenty directors has directed a total of six different movies over the course of their careers..

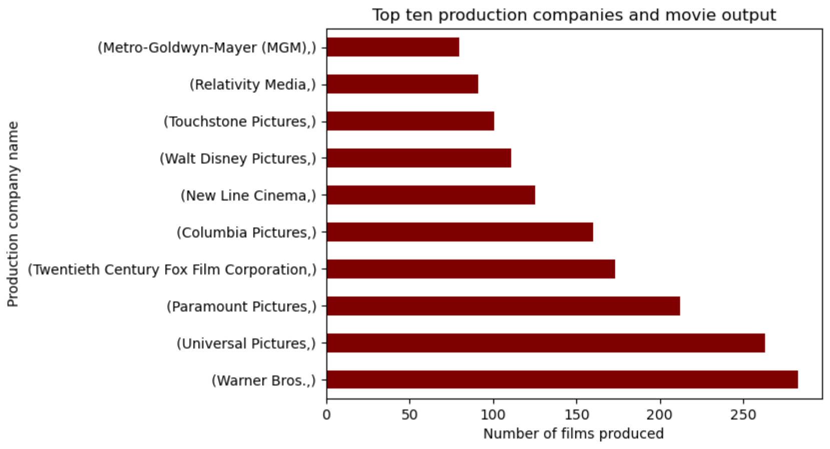
Research Question 3 (Which ten production companies make up the top of the list!)

I'll use the sep_data function for this question as well.

In [49]:
```python
sep_data("production_companies").value_counts().head(10)
```

Out[49]:
```
PRODUCTION_COMPANIES
Warner Bros.                              283
Universal Pictures                        263
Paramount Pictures                        212
Twentieth Century Fox Film Corporation    173
Columbia Pictures                         160
New Line Cinema                           125
Walt Disney Pictures                      111
Touchstone Pictures                       101
Relativity Media                           91
Metro-Goldwyn-Mayer (MGM)                  80
dtype: int64
```

In [50]:
```python
sep_data("production_companies").value_counts().head(10).plot(kind = "barh", color = "maroon");
plt.xlabel("Number of films produced")
plt.ylabel("Production company name")
plt.title("Top ten production companies and movie output")
plt.show()
```



In order to generate the scatter plot, I will need to make some edits to the DataFrame and include the name of each production company as well as the total number of movies that they have created.

```
In [51]: Co_v1 = sep_data("production_companies").value_counts().head(10)
         Co_v2 = pd.DataFrame(Co_v1)
         Co_v2.reset_index(inplace=True)
         Co_v2.rename( columns = { Co_v2.columns[0] : "Company name", Co_v2.columns[1] : "Number of movies produced"},inplace = True)
         Co_v2
```

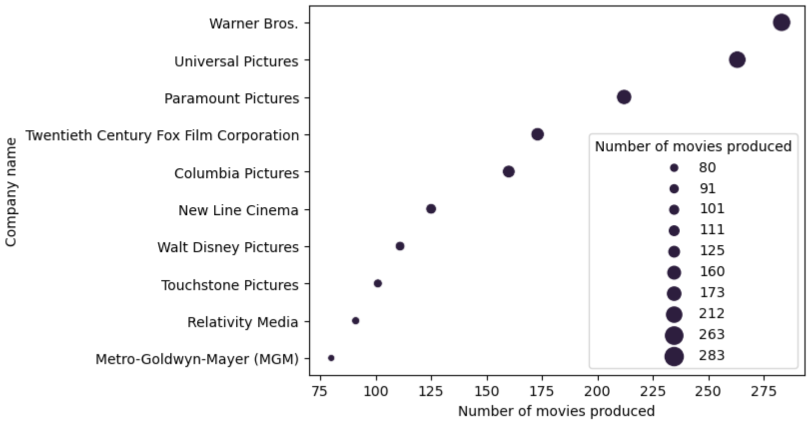
Out[51]:

	Company name	Number of movies produced
0	Warner Bros.	283
1	Universal Pictures	263
2	Paramount Pictures	212
3	Twentieth Century Fox Film Corporation	173
4	Columbia Pictures	160
5	New Line Cinema	125
6	Walt Disney Pictures	111
7	Touchstone Pictures	101
8	Relativity Media	91
9	Metro-Goldwyn-Mayer (MGM)	80

This is a scatter plot that illustrates the connection between the name of the production company and the movies that it has produced.

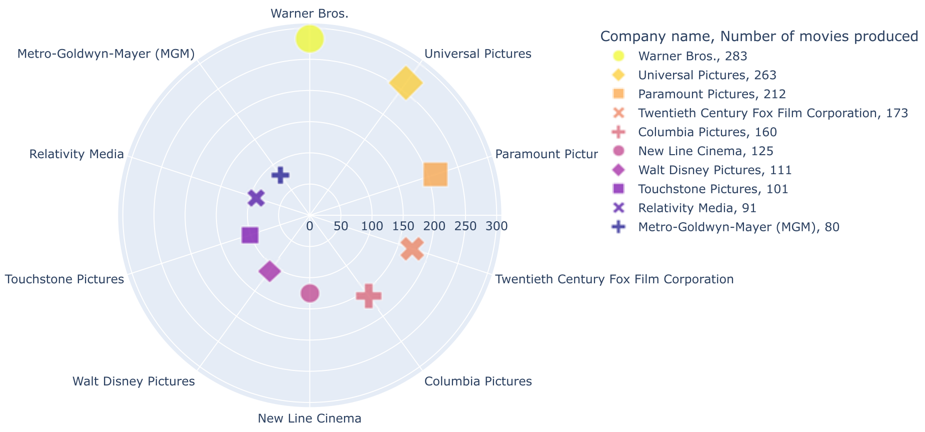
```
In [52]: sns.scatterplot(data=Co_v2, x="Number of movies produced", y="Company name", hue="Number of movies produced",
                         size="Number of movies produced",sizes=(25, 170), hue_norm=(0, 7), legend="full")
```

```
Out[52]: <AxesSubplot:xlabel='Number of movies produced', ylabel='Company name'>
```



This is a spider diagram that illustrates the connection between the name of the production company and the movies that it has produced.

```
In [53]: fig = px.scatter_polar(Co_v2, r="Number of movies produced", theta="Company name",
                                color="Company name", symbol="Number of movies produced", size="Number of movies produced",
                                color_discrete_sequence=px.colors.sequential.Plasma_r);
         fig.show()
```



Warner Bros. is the most successful film production company in terms of the number of movies it has produced (283).

Research Question 4 (What are the top five genres of movies that people watch the most!)

I'll use the sep_data function for this question as well.

In [54]:
```
sep_data("genres")
```

Out[54]:

	GENRES
0	Action
1	Adventure
2	Science Fiction
3	Thriller
4	Action
...	...
7071	Action
7072	Adventure
7073	Drama
7074	War
7075	Romance

7076 rows × 1 columns

In [55]:
```
sep_data("genres")
```

Out[55]:

	GENRES
0	Action
1	Adventure
2	Science Fiction
3	Thriller
4	Action
...	...
7071	Action
7072	Adventure
7073	Drama
7074	War
7075	Romance

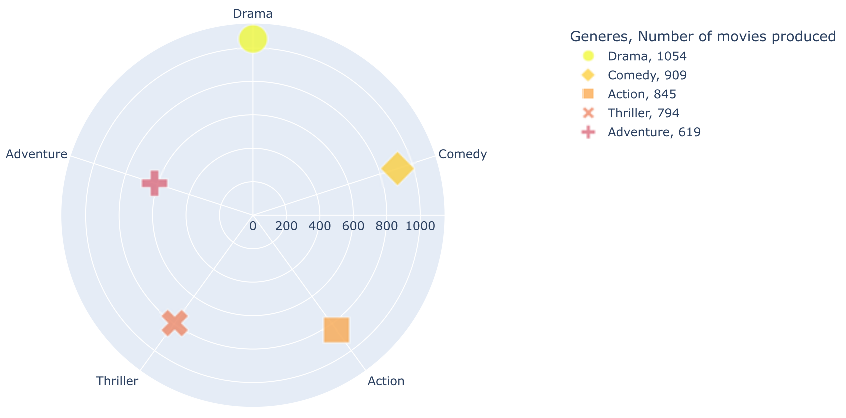
7076 rows × 1 columns

In [75]:
```
y= sep_data("genres").value_counts().head(5)
x = pd.DataFrame(y)
x.reset_index(inplace=True)
x.rename( columns = { x.columns[0] : "Generes", x.columns[1] : "Number of movies produced"},inplace = True)
x
```

Out[75]:

	Generes	Number of movies produced
0	Drama	1054
1	Comedy	909
2	Action	845
3	Thriller	794
4	Adventure	619

In [76]:
```
fig = px.scatter_polar(x, r="Number of movies produced", theta="Generes",
                       color="Generes", symbol="Number of movies produced", size="Number of movies produced",
                       color_discrete_sequence=px.colors.sequential.Plasma_r);
fig.show()
```



There are a wide variety of film genres (Drama , Comedy , Action ,Thriller, Adventure).

Research Question 5 (What about the statistics regarding the profits!)

```
In [58]: new_data["profit"].describe()
```

```
Out[58]: count    2.534000e+03
         mean     1.000954e+08
         std      1.758003e+08
         min     -4.139124e+08
         25%      5.503971e+06
         50%      4.518973e+07
         75%      1.237433e+08
         max      2.544506e+09
         Name: profit, dtype: float64
```

Notes :

1- Twenty-five percent of all films gross less than 5,503,971 dollars.

2- Fifty percent of films have earnings that are lower than 45,189,730 dollars.

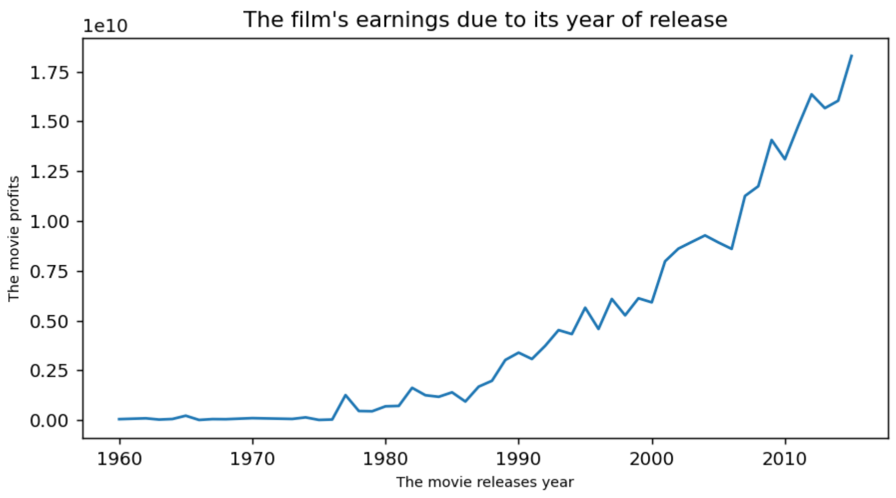
3- The majority of movies, approximately 75 percent, make less than 1,237,433,000 dollars.

4- The average amount of profit is 100,095,400 dollars.

The following code illustrates the relationship between the number of years of release and profit.

```
In [59]: year_profit = new_data.groupby("release_year")["profit"].sum()
         plt.figure(figsize=(8,4), dpi = 130)

         plt.xlabel('The movie releases year', fontsize = 8)
         plt.ylabel('The movie profits', fontsize = 8)
         plt.title("The film's earnings due to its year of release")
         plt.plot(year_profit)
         plt.show()
```

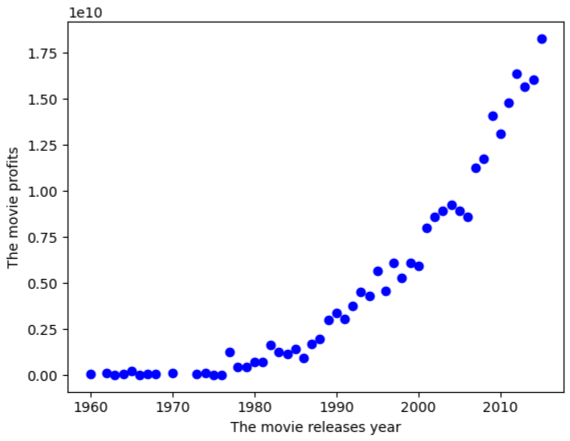


In [60]:
```
mo_v2 = pd.DataFrame(year_profit)
mo_v2.reset_index(inplace=True)
mo_v2.rename(columns = { mo_v2.columns[0] : "The movie releases year", mo_v2.columns[1] : "The movie profits"},inplace = True)
mo_v2
```

Out[60]:

	The movie releases year	The movie profits
0	1960	48000000
1	1962	90000000
2	1963	26635000
3	1964	55000000
4	1965	219917568
5	1966	8000000
6	1967	50044718
7	1968	44715371
8	1970	98422843
9	1973	58323467
10	1974	136542841
11	1975	9000000
12	1976	28937737
13	1977	1255124457
14	1978	455916159
15	1979	443754763
16	1980	692266417
17	1981	712313857
18	1982	1620789566
19	1983	1247957154
20	1984	1169429193
21	1985	1394102869
22	1986	931607630
23	1987	1679713931
24	1988	1974156529
25	1989	3018312011
26	1990	3386546310
27	1991	3066959819
28	1992	3731427370
29	1993	4518385609
30	1994	4318744702
31	1995	5642558315
32	1996	4573062949
33	1997	6081563465
34	1998	5259210145
35	1999	6116235588
36	2000	5910311345
37	2001	7973307471
38	2002	8607658389
39	2003	8942603152
40	2004	9272616596
41	2005	8919685474
42	2006	8594263966
43	2007	11252600046
44	2008	11741358849
45	2009	14064768856
46	2010	13096575414
47	2011	14770792711
48	2012	16355055453
49	2013	15661238749
50	2014	16033367620
51	2015	18281931971

In [61]:
```
plt.scatter(mo_v2["The movie releases year"] , mo_v2["The movie profits"], c ="blue")
plt.xlabel("The movie releases year")
plt.ylabel("The movie profits")
plt.show()
```

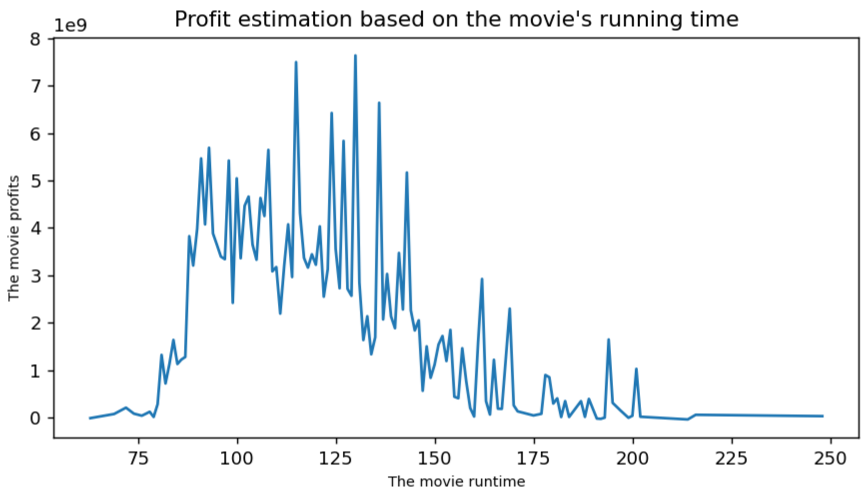


The most recent years of release have seen an increase in profits.

The following snippet of code demonstrates the correlation between the length of a movie's run and its gross earnings.

In [62]:
```
runtime_profit = new_data.groupby("runtime")["profit"].sum()
plt.figure(figsize=(8,4), dpi = 130)

plt.xlabel('The movie runtime', fontsize = 8)
plt.ylabel('The movie profits', fontsize = 8)
plt.title("Profit estimation based on the movie's running time")
plt.plot(runtime_profit)
plt.show()
```



The most profitable length for movies is between (100 and 120) minutes.

Research Question 6 (Where do we stand with the runtime statistics!)

```
In [63]: new_data["runtime"].describe()
```

```
Out[63]: count    2534.000000
         mean      112.012628
         std        20.066978
         min        63.000000
         25%        98.000000
         50%       108.000000
         75%       123.000000
         max       248.000000
         Name: runtime, dtype: float64
```

Notes :

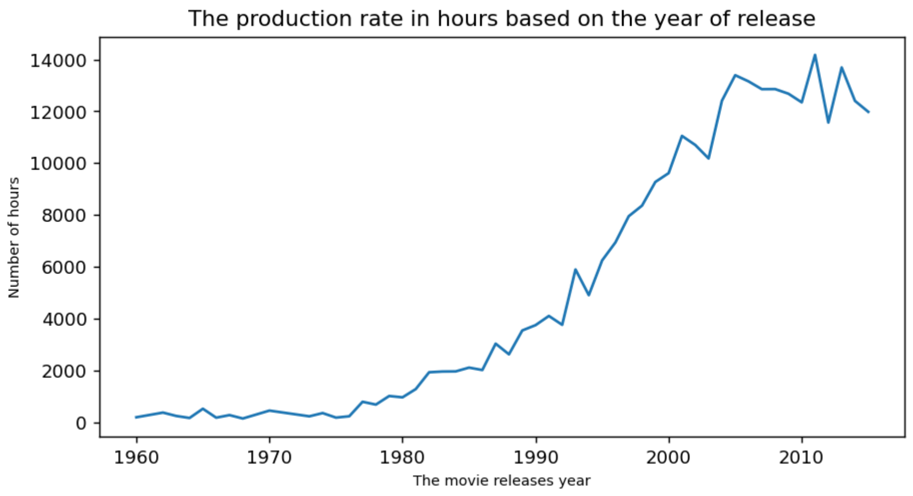
1- 25 percent of all films that are shorter than 98 minutes.

2- Fifty percent of films that are shorter than 108 minutes.

3-75 percent of all films that are shorter than 123 minutes.

4- The average length of the show is 112 minutes.

```
In [64]: year_profit = new_data.groupby("release_year")["runtime"].sum()
         plt.figure(figsize=(8,4), dpi = 130)
         plt.xlabel('The movie releases year', fontsize = 8)
         plt.ylabel('Number of hours', fontsize = 8)
         plt.title('The production rate in hours based on the year of release')
         plt.plot(year_profit)
         plt.show()
```



In recent years, the number of hours produced has led to an increase in film production.

Research Question 7 (What about the average values for (revenue, budget, profit, and runtime)!)

I'm going to write a function that finds the column average and displays it.

```
In [65]: def avg(column):
             return int(np.mean(new_data[column]))
```

```
In [66]: avg("budget")
Out[66]: 52146725
```

```
In [67]: avg("profit")
Out[67]: 100095427
```

```
In [68]: avg("revenue")
Out[68]: 152242152
```

```
In [69]: avg("runtime")
Out[69]: 112
```

Notes :

1 The average spending plan is 52,146,725 dollars.

2 The average amount of profit is 100,095,427 dollars.

3 The average length of the show is 112 minutes.

4 The average amount of revenue is 152,242,152 dollars.

Research Question 8 (What about the maximum and minimum values for (runtime), (budget), (profit), and (revenue), respectively!)

I'm going to write a function that looks up the highest and lowest possible values for a column and then displays them.

```
In [70]: def max_min(column):
             max_value = new_data[column].idxmax()
             max_value_v1 = pd.DataFrame(new_data.loc[max_value])
             min_value = new_data[column].idxmin()
             min_value_v1 = pd.DataFrame(new_data.loc[min_value])

             all_values = pd.concat([max_value_v1, min_value_v1], axis = 1)

             return all_values
```

The following are the calculations regarding profit.

```
In [71]: max_min("profit")
```

Out[71]:

	1386	2244
budget	237000000	425000000
revenue	2781505847	11087569
profit	2544505847	-413912431
original_title	Avatar	The Warrior's Way
cast	Sam Worthington|Zoe Saldana|Sigourney Weaver|S...	Kate Bosworth|Jang Dong-gun|Geoffrey Rush|Dann...
director	James Cameron	Sngmoo Lee
runtime	162	100
genres	Action|Adventure|Fantasy|Science Fiction	Adventure|Fantasy|Action|Western|Thriller
production_companies	Ingenious Film Partners|Twentieth Century Fox ...	Boram Entertainment Inc.
release_date	2009-12-10 00:00:00	2010-12-02 00:00:00
vote_average	7.1	6.4
release_year	2009	2010

1- The highest possible profit is 2,544,505,847 dollars.

2- The minimum amount of profit is $ 413,912,431.

The following are the calculations regarding runtime.

```
In [72]: max_min("runtime")
```

Out[72]:

	10443	3424
budget	31115000	30000000
revenue	57750000	14460000
profit	26635000	-15540000
original_title	Cleopatra	Winnie the Pooh
cast	Elizabeth Taylor|Richard Burton|Rex Harrison|R...	Jim Cummings|Travis Oates|Jim Cummings|Bud Luc...
director	Joseph L. Mankiewicz|Rouben Mamoulian|Darryl F...	Stephen Anderson|Don Hall
runtime	248	63
genres	Drama|History|Romance	Animation|Family
production_companies	Twentieth Century Fox Film Corporation|MCL Fil...	Walt Disney Pictures|Walt Disney Animation Stu...
release_date	2063-06-12 00:00:00	2011-04-13 00:00:00
vote_average	6.3	6.8
release_year	1963	2011

1- There are a total of 248 minutes in The Max.

2- The duration of the Min is sixty-three minutes.

The following are the calculations regarding revenue.

```
In [73]: max_min("revenue")
```

Out[73]:

	1386	4017
budget	237000000	21000000
revenue	2781505847	10011050
profit	2544505847	-10988950
original_title	Avatar	Moonlight Mile
cast	Sam Worthington|Zoe Saldana|Sigourney Weaver|S...	Jake Gyllenhaal|Dustin Hoffman|Susan Sarandon|...
director	James Cameron	Brad Silberling
runtime	162	117
genres	Action|Adventure|Fantasy|Science Fiction	Romance|Drama
production_companies	Ingenious Film Partners|Twentieth Century Fox ...	Punch Productions|Touchstone Pictures|Hyde Par...
release_date	2009-12-10 00:00:00	2002-09-09 00:00:00
vote_average	7.1	6.6
release_year	2009	2002

The total revenue for Max comes to 2,781,505,847 dollars.

The minimum revenue required is 10,011,050 dollars.

The following are the calculations regarding budget.

In [74]:
```
max_min("budget")
```

Out[74]:

	2244	7476
budget	425000000	10200000
revenue	11087569	35619521
profit	-413912431	25419521
original_title	The Warrior's Way	Hostel: Part II
cast	Kate Bosworth|Jang Dong-gun|Geoffrey Rush|Dann...	Lauren German|Bijou Phillips|Heather Matarazzo...
director	Sngmoo Lee	Eli Roth
runtime	100	93
genres	Adventure|Fantasy|Action|Western|Thriller	Horror
production_companies	Boram Entertainment Inc.	Lions Gate Films|Next Entertainment|Screen Gems
release_date	2010-12-02 00:00:00	2007-06-08 00:00:00
vote_average	6.4	5.6
release_year	2010	2007

The maximum budget allowed is 42,500,000 dollars.

The minimum budget is set at 10,200,000 dollars.

Conclusions

> **Tip**: Finally, summarize your findings and the results that have been performed. Make sure that you are clear with regards to the limitations of your exploration. If you haven't done any statistical tests, do not imply any statistical conclusions. And make sure you avoid implying causation from correlation!

> **Tip**: Once you are satisfied with your work, you should save a copy of the report in HTML or PDF form via the **File** > **Download as** submenu. Before exporting your report, check over it to make sure that the flow of the report is complete. You should probably remove all of the "Tip" quotes like this one so that the presentation is as tidy as possible. Congratulations!

Results : Our findings indicate that

1- The profit has risen with the most recent releases

2- Films between 100 and 120 minutes long make the most money.

3- 50% of films make more than $100,094,277 in profit.

4- Robert De Niro is the top actor, with 47 films to his credit.

5- Steven Spielberg is the top director with 25 movies.

6- Warner Bros. is the leading production firm (in terms of the quantity of films) with 283 films.

7- Drama has 1054 films, making it the most popular movie genre.

Limitation :

1- This data set contains information about 10000 movies collected from The Movie Database (TMDb), including user ratings and revenue for movies, but there is missing data and zero values for many rows, so in this report I take all movies that profit more than 10,000,000 $ to reduce errors in analysis due to missing values, so the results may be affected by deleted movies during the data cleaning process.

2- Because this is a descriptive study and not an inferential one, it follows that I will not be conducting any experiments based on the results of this data collection; as a result, there may be some fluctuations in the results due to the fact that some data has been omitted.

3- I do not have a lot of information regarding popularity, such as how the number is determined. For instance, it is connected to total sales or the average number of votes submitted.