Untitled8

November 9, 2018

```
In [ ]: Project: Investigate a Dataset (TMDb movie Database)
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            Data Wrangling
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        Introduction

            In this section of the report, I'll provide a brief introduction to the dataset I'
            Introduction to dataset:

            I will be using TMDB movie dataset, This data set contains information about 10,00
```

```
In [1]: import numpy as np
        import pandas as pd
        import os
        import csv
        from datetime import datetime
        import matplotlib.pyplot as plt
        %matplotlib inline
```

```
In [ ]:     Let's load the data and check some rows from the dataset to identify the questions
```

```
In [2]: os.chdir('/home/raghusharma/Downloads')
        tmdb_data = pd.read_csv('tmdb-movies.csv')
        tmdb_data.head()
```

```
Out[2]:        id    imdb_id  popularity     budget     revenue  \
        0  135397  tt0369610   32.985763  150000000  1513528810
        1   76341  tt1392190   28.419936  150000000   378436354
        2  262500  tt2908446   13.112507  110000000   295238201
        3  140607  tt2488496   11.173104  200000000  2068178225
        4  168259  tt2820852    9.335014  190000000  1506249360

                          original_title  \
        0                 Jurassic World
```

```
1            Mad Max: Fury Road
2                     Insurgent
3  Star Wars: The Force Awakens
4                     Furious 7

                                             cast  \
0  Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...
1  Tom Hardy|Charlize Theron|Hugh Keays-Byrne|Nic...
2  Shailene Woodley|Theo James|Kate Winslet|Ansel...
3  Harrison Ford|Mark Hamill|Carrie Fisher|Adam D...
4  Vin Diesel|Paul Walker|Jason Statham|Michelle ...

                                         homepage          director  \
0                    http://www.jurassicworld.com/   Colin Trevorrow
1                      http://www.madmaxmovie.com/     George Miller
2     http://www.thedivergentseries.movie/#insurgent  Robert Schwentke
3  http://www.starwars.com/films/star-wars-episod...       J.J. Abrams
4                         http://www.furious7.com/         James Wan

                         tagline      ...       \
0              The park is open.      ...
1             What a Lovely Day.      ...
2     One Choice Can Destroy You      ...
3  Every generation has a story.      ...
4            Vengeance Hits Home      ...

                                         overview runtime  \
0  Twenty-two years after the events of Jurassic ...     124
1  An apocalyptic story set in the furthest reach...     120
2  Beatrice Prior must confront her inner demons ...     119
3  Thirty years after defeating the Galactic Empi...     136
4  Deckard Shaw seeks revenge against Dominic Tor...     137

                                      genres  \
0  Action|Adventure|Science Fiction|Thriller
1  Action|Adventure|Science Fiction|Thriller
2         Adventure|Science Fiction|Thriller
3   Action|Adventure|Science Fiction|Fantasy
4                      Action|Crime|Thriller

                               production_companies release_date vote_count  \
0  Universal Studios|Amblin Entertainment|Legenda...       6/9/15       5562
1  Village Roadshow Pictures|Kennedy Miller Produ...      5/13/15       6185
2  Summit Entertainment|Mandeville Films|Red Wago...      3/18/15       2480
3          Lucasfilm|Truenorth Productions|Bad Robot     12/15/15       5292
4  Universal Pictures|Original Film|Media Rights ...       4/1/15       2947

   vote_average  release_year    budget_adj   revenue_adj
```

```
0           6.5          2015  1.379999e+08  1.392446e+09
1           7.1          2015  1.379999e+08  3.481613e+08
2           6.3          2015  1.012000e+08  2.716190e+08
3           7.5          2015  1.839999e+08  1.902723e+09
4           7.3          2015  1.747999e+08  1.385749e+09

[5 rows x 21 columns]
```

```
In [ ]:     Questions that can be answered by looking at the datasets are:
            Some general questions that can be answered are:

                Which movie had the highest and lowest profit?
                Which movie had the greatest and least runtime?
                What is the average runtime of all movies?
                Which movie had the highest and lowest budget?
                Which movie had the highest and lowest revenue?

            Some questions that can be answered based on the Profit of movies making more then

                What is the average budget of the movie?
                What is the average revenue of the movie?
                What is the average runtime of the movie?
                Which are the successfull genres?
                Which are the most frequent cast involved?

        Data Wrangling

            In this section of the report, I will check for cleanliness, and then trim and clea
            Observations from above dataset are:

                The dataset has not provided the currency for columns we will be dealing with
                Even the vote count is not same for all the movies and hence this affects the

        General Properties

            Let's check the dataset and see what cleaning does it requires.
```

```
In [3]: tmdb_data.head()
```

```
Out[3]:       id    imdb_id  popularity     budget     revenue  \
        0  135397  tt0369610   32.985763  150000000  1513528810
        1   76341  tt1392190   28.419936  150000000   378436354
        2  262500  tt2908446   13.112507  110000000   295238201
        3  140607  tt2488496   11.173104  200000000  2068178225
        4  168259  tt2820852    9.335014  190000000  1506249360

                          original_title  \
        0                 Jurassic World
```

```
1            Mad Max: Fury Road
2                     Insurgent
3  Star Wars: The Force Awakens
4                     Furious 7

                                                cast  \
0  Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...
1  Tom Hardy|Charlize Theron|Hugh Keays-Byrne|Nic...
2  Shailene Woodley|Theo James|Kate Winslet|Ansel...
3  Harrison Ford|Mark Hamill|Carrie Fisher|Adam D...
4  Vin Diesel|Paul Walker|Jason Statham|Michelle ...

                                            homepage          director  \
0                    http://www.jurassicworld.com/   Colin Trevorrow
1                      http://www.madmaxmovie.com/     George Miller
2   http://www.thedivergentseries.movie/#insurgent  Robert Schwentke
3  http://www.starwars.com/films/star-wars-episod...       J.J. Abrams
4                         http://www.furious7.com/         James Wan

                         tagline      ...       \
0              The park is open.      ...
1             What a Lovely Day.      ...
2     One Choice Can Destroy You      ...
3  Every generation has a story.      ...
4            Vengeance Hits Home      ...

                                            overview runtime  \
0  Twenty-two years after the events of Jurassic ...     124
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                                      genres  \
0  Action|Adventure|Science Fiction|Thriller
1  Action|Adventure|Science Fiction|Thriller
2         Adventure|Science Fiction|Thriller
3   Action|Adventure|Science Fiction|Fantasy
4                      Action|Crime|Thriller

                                production_companies release_date vote_count  \
0  Universal Studios|Amblin Entertainment|Legenda...       6/9/15       5562
1  Village Roadshow Pictures|Kennedy Miller Produ...      5/13/15       6185
2  Summit Entertainment|Mandeville Films|Red Wago...      3/18/15       2480
3          Lucasfilm|Truenorth Productions|Bad Robot     12/15/15       5292
4  Universal Pictures|Original Film|Media Rights ...       4/1/15       2947

   vote_average  release_year    budget_adj   revenue_adj
   0            6.5          2015  1.379999e+08  1.392446e+09
   1            7.1          2015  1.379999e+08  3.481613e+08
   2            6.3          2015  1.012000e+08  2.716190e+08
   3            7.5          2015  1.839999e+08  1.902723e+09
   4            7.3          2015  1.747999e+08  1.385749e+09

   [5 rows x 21 columns]
```

```
In [4]: # lets us check some statistics of the data
        tmdb_data.describe()
```

```
Out[4]:                    id    popularity        budget       revenue       runtime  \
        count   10866.000000  10866.000000  1.086600e+04  1.086600e+04  10866.000000
        mean    66064.177434      0.646441  1.462570e+07  3.982332e+07    102.070863
        std     92130.136561      1.000185  3.091321e+07  1.170035e+08     31.381405
        min         5.000000      0.000065  0.000000e+00  0.000000e+00      0.000000
        25%     10596.250000      0.207583  0.000000e+00  0.000000e+00     90.000000
        50%     20669.000000      0.383856  0.000000e+00  0.000000e+00     99.000000
        75%     75610.000000      0.713817  1.500000e+07  2.400000e+07    111.000000
        max    417859.000000     32.985763  4.250000e+08  2.781506e+09    900.000000

                  vote_count  vote_average  release_year    budget_adj   revenue_adj
        count  10866.000000  10866.000000  10866.000000  1.086600e+04  1.086600e+04
        mean     217.389748      5.974922   2001.322658  1.755104e+07  5.136436e+07
        std      575.619058      0.935142     12.812941  3.430616e+07  1.446325e+08
        min       10.000000      1.500000   1960.000000  0.000000e+00  0.000000e+00
        25%       17.000000      5.400000   1995.000000  0.000000e+00  0.000000e+00
        50%       38.000000      6.000000   2006.000000  0.000000e+00  0.000000e+00
        75%      145.750000      6.600000   2011.000000  2.085325e+07  3.369710e+07
        max     9767.000000      9.200000   2015.000000  4.250000e+08  2.827124e+09
```

```
In [5]: tmdb_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10866 entries, 0 to 10865
Data columns (total 21 columns):
id                      10866 non-null int64
imdb_id                 10856 non-null object
popularity              10866 non-null float64
budget                  10866 non-null int64
revenue                 10866 non-null int64
original_title          10866 non-null object
cast                    10790 non-null object
homepage                2936 non-null object
director                10822 non-null object
tagline                 8042 non-null object
keywords                9373 non-null object
overview                10862 non-null object
runtime                 10866 non-null int64
```

```
genres                  10843 non-null object
production_companies    9836 non-null object
release_date            10866 non-null object
vote_count              10866 non-null int64
vote_average            10866 non-null float64
release_year            10866 non-null int64
budget_adj              10866 non-null float64
revenue_adj             10866 non-null float64
dtypes: float64(4), int64(6), object(11)
memory usage: 1.7+ MB
```

```
In [ ]: Data Cleaning (Replace this with more specific notes!)
```

```
In [6]: # Columns that needs to be deleted
        deleted_columns = [ 'id', 'imdb_id', 'popularity', 'budget_adj', 'revenue_adj', 'homepa
        # Drop the columns from the database
        tmdb_data.drop(deleted_columns, axis=1, inplace=True)
        # Lets look at the new dataset
        tmdb_data.head()
```

```
Out[6]:       budget     revenue                original_title  \
        0  150000000  1513528810                Jurassic World
        1  150000000   378436354            Mad Max: Fury Road
        2  110000000   295238201                     Insurgent
        3  200000000  2068178225  Star Wars: The Force Awakens
        4  190000000  1506249360                     Furious 7

                                                        cast  runtime  \
        0  Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...      124
        1  Tom Hardy|Charlize Theron|Hugh Keays-Byrne|Nic...      120
        2  Shailene Woodley|Theo James|Kate Winslet|Ansel...      119
        3  Harrison Ford|Mark Hamill|Carrie Fisher|Adam D...      136
        4  Vin Diesel|Paul Walker|Jason Statham|Michelle ...      137

                                              genres release_date  release_year
        0  Action|Adventure|Science Fiction|Thriller       6/9/15          2015
        1  Action|Adventure|Science Fiction|Thriller      5/13/15          2015
        2         Adventure|Science Fiction|Thriller      3/18/15          2015
        3   Action|Adventure|Science Fiction|Fantasy     12/15/15          2015
        4                      Action|Crime|Thriller       4/1/15          2015
```

```
In [7]: rows, col = tmdb_data.shape
        #since rows includes count of a header, we need to remove its count.
        print('We have {} total rows and {} columns.'.format(rows-1, col))
```

```
We have 10865 total rows and 8 columns.
```

```
In [8]: # Drop duplicate rows but keep the first one
        tmdb_data.drop_duplicates(keep = 'first', inplace = True)
        # Store rows and columns using shape function.
        rows, col = tmdb_data.shape
        print('Now we have {} total rows and {} columns.'.format(rows-1, col))
```

```
Now we have 10864 total rows and 8 columns.
```

```
In [9]: # Columns that need to be checked.
        columns = ['budget', 'revenue']
        # Replace 0 with NAN
        tmdb_data[columns] = tmdb_data[columns].replace(0, np.NaN)
        # Drop rows which contains NAN
        tmdb_data.dropna(subset = columns, inplace = True)
        rows, col = tmdb_data.shape
        print('We now have only {} rows.'.format(rows-1))
```

```
We now have only 3853 rows.
```

```
In [10]: tmdb_data.release_date = pd.to_datetime(tmdb_data['release_date'])
         # Lets look at the new dataset
         tmdb_data.head()
```

```
Out[10]:         budget       revenue                original_title  \
         0  150000000.0  1.513529e+09                Jurassic World
         1  150000000.0  3.784364e+08            Mad Max: Fury Road
         2  110000000.0  2.952382e+08                     Insurgent
         3  200000000.0  2.068178e+09  Star Wars: The Force Awakens
         4  190000000.0  1.506249e+09                     Furious 7

                                                         cast  runtime  \
         0  Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...      124
         1  Tom Hardy|Charlize Theron|Hugh Keays-Byrne|Nic...      120
         2  Shailene Woodley|Theo James|Kate Winslet|Ansel...      119
         3  Harrison Ford|Mark Hamill|Carrie Fisher|Adam D...      136
         4  Vin Diesel|Paul Walker|Jason Statham|Michelle ...      137

                                               genres release_date  release_year
         0  Action|Adventure|Science Fiction|Thriller   2015-06-09          2015
         1  Action|Adventure|Science Fiction|Thriller   2015-05-13          2015
         2         Adventure|Science Fiction|Thriller   2015-03-18          2015
         3   Action|Adventure|Science Fiction|Fantasy   2015-12-15          2015
         4                      Action|Crime|Thriller   2015-04-01          2015
```

```
In [11]: # Columns to convert datatype of
         columns = ['budget', 'revenue']
         # Convert budget and revenue column to int datatype
```

```
        tmdb_data[columns] = tmdb_data[columns].applymap(np.int64)
        # Lets look at the new datatype
        tmdb_data.dtypes

Out[11]: budget                    int64
        revenue                   int64
        original_title           object
        cast                     object
        runtime                   int64
        genres                   object
        release_date     datetime64[ns]
        release_year              int64
        dtype: object

In [12]: # Replace runtime value of 0 to NAN, Since it will affect the result.
        tmdb_data['runtime'] = tmdb_data['runtime'].replace(0, np.NaN)
        # Check the stats of dataset
        tmdb_data.describe()

Out[12]:             budget       revenue      runtime  release_year
        count  3.854000e+03  3.854000e+03  3854.000000   3854.000000
        mean   3.720370e+07  1.076866e+08   109.220291   2001.261028
        std    4.220822e+07  1.765393e+08    19.922820     11.282575
        min    1.000000e+00  2.000000e+00    15.000000   1960.000000
        25%    1.000000e+07  1.360003e+07    95.000000   1995.000000
        50%    2.400000e+07  4.480000e+07   106.000000   2004.000000
        75%    5.000000e+07  1.242125e+08   119.000000   2010.000000
        max    4.250000e+08  2.781506e+09   338.000000   2015.000000

In [ ]: Exploratory Data Analysis

           Tip: Now that you've trimmed and cleaned your data, you're ready to move on to expl

       Research Question 1 (Which movie had the highest and lowest profit?)

In [13]: # To calculate profit, we need to substract the budget from the revenue.
        tmdb_data['profit'] = tmdb_data['revenue'] - tmdb_data['budget']
        # Lets look at the new dataset
        tmdb_data.head()

Out[13]:       budget     revenue                original_title  \
        0  150000000  1513528810                Jurassic World
        1  150000000   378436354            Mad Max: Fury Road
        2  110000000   295238201                     Insurgent
        3  200000000  2068178225  Star Wars: The Force Awakens
        4  190000000  1506249360                     Furious 7

                                                      cast  runtime  \
        0  Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...      124
```

```
1  Tom Hardy|Charlize Theron|Hugh Keays-Byrne|Nic...      120
2  Shailene Woodley|Theo James|Kate Winslet|Ansel...      119
3  Harrison Ford|Mark Hamill|Carrie Fisher|Adam D...      136
4  Vin Diesel|Paul Walker|Jason Statham|Michelle ...      137

                                      genres release_date  release_year  \
0  Action|Adventure|Science Fiction|Thriller   2015-06-09          2015
1  Action|Adventure|Science Fiction|Thriller   2015-05-13          2015
2         Adventure|Science Fiction|Thriller   2015-03-18          2015
3   Action|Adventure|Science Fiction|Fantasy   2015-12-15          2015
4                      Action|Crime|Thriller   2015-04-01          2015

       profit
0  1363528810
1   228436354
2   185238201
3  1868178225
4  1316249360
```

```
In [14]: # Movie with highest profit
         tmdb_data.loc[tmdb_data['profit'].idxmax()]
```

```
Out[14]: budget                                                   237000000
         revenue                                                 2781505847
         original_title                                              Avatar
         cast              Sam Worthington|Zoe Saldana|Sigourney Weaver|S...
         runtime                                                        162
         genres                     Action|Adventure|Fantasy|Science Fiction
         release_date                                   2009-12-10 00:00:00
         release_year                                                  2009
         profit                                                  2544505847
         Name: 1386, dtype: object
```

```
In [15]: # Movie with lowest profit
         tmdb_data.loc[tmdb_data['profit'].idxmin()]
```

```
Out[15]: budget                                                   425000000
         revenue                                                   11087569
         original_title                                     The Warrior's Way
         cast              Kate Bosworth|Jang Dong-gun|Geoffrey Rush|Dann...
         runtime                                                        100
         genres                    Adventure|Fantasy|Action|Western|Thriller
         release_date                                   2010-12-02 00:00:00
         release_year                                                  2010
         profit                                                  -413912431
         Name: 2244, dtype: object
```

```
In [ ]: Research Question 1.2 (Which movie had the greatest and least runtime?)
In [16]: # Movie with greatest runtime
         tmdb_data.loc[tmdb_data['runtime'].idxmax()]
```

```
Out[16]: budget                                                   18000000
         revenue                                                    871279
         original_title                                             Carlos
         cast              Edgar RamÃŋrez|Alexander Scheer|Fadi Abi Samra...
         runtime                                                       338
         genres                               Crime|Drama|Thriller|History
         release_date                                  2010-05-19 00:00:00
         release_year                                                 2010
         profit                                                  -17128721
         Name: 2107, dtype: object
```

```
In [17]: # Movie with least runtime
         tmdb_data.loc[tmdb_data['runtime'].idxmin()]
```

```
Out[17]: budget                                                         10
         revenue                                                         5
         original_title                                        Kid's Story
         cast              Clayton Watson|Keanu Reeves|Carrie-Anne Moss|K...
         runtime                                                        15
         genres                                  Science Fiction|Animation
         release_date                                  2003-06-02 00:00:00
         release_year                                                 2003
         profit                                                         -5
         Name: 5162, dtype: object
```

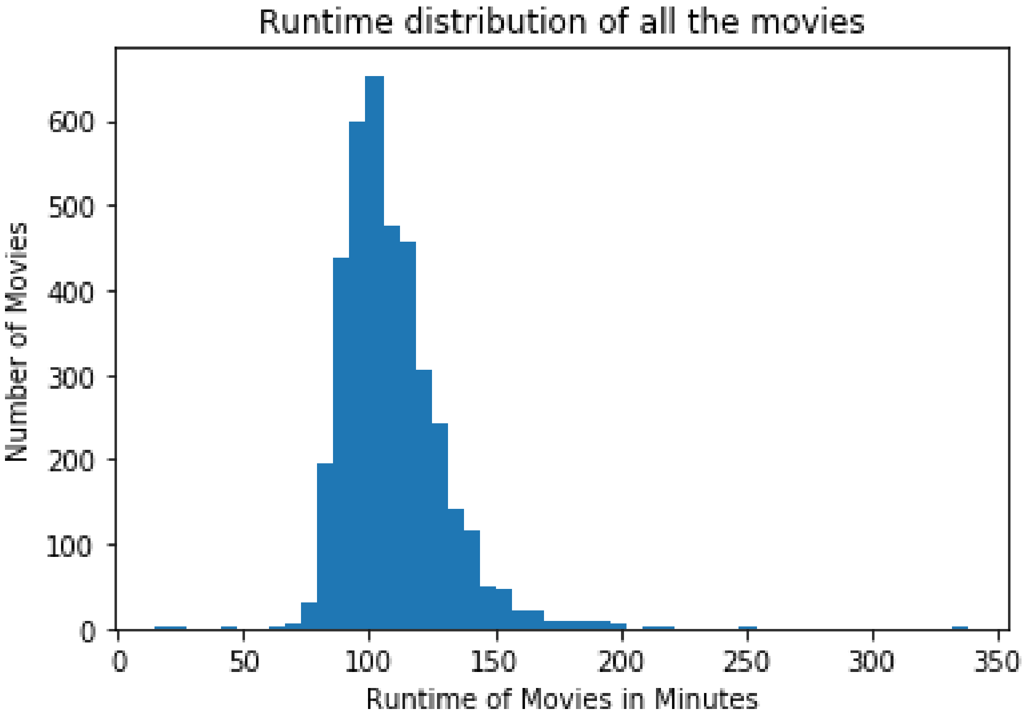
```
In [ ]: Research Question 1.3 (What is the average runtime of all movies?)
```

```
In [18]: # Average runtime of movies
         tmdb_data['runtime'].mean()
```

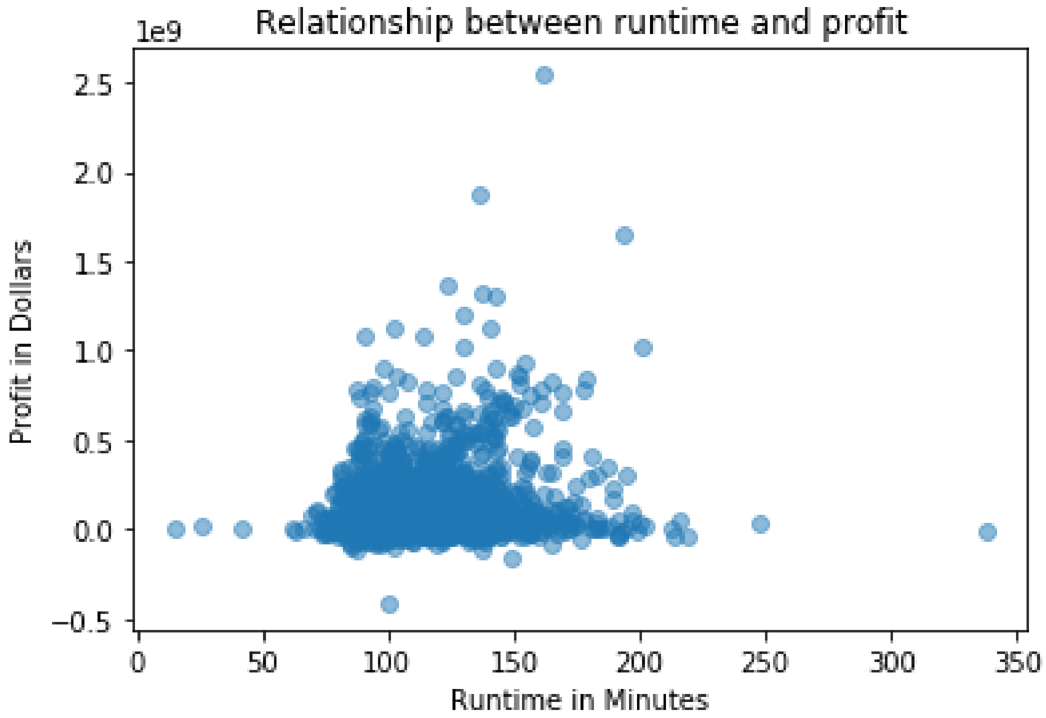
```
Out[18]: 109.22029060716139
```

```
In [19]: # x-axis
         plt.xlabel('Runtime of Movies in Minutes')
         # y-axis
         plt.ylabel('Number of Movies')
         # Title of the histogram
         plt.title('Runtime distribution of all the movies')
         # Plot a histogram
         plt.hist(tmdb_data['runtime'], bins = 50)
```

```
Out[19]: (array([  1.,   1.,   0.,   0.,   1.,   0.,   0.,   3.,   5.,  31., 196.,
                 437., 598., 653., 475., 458., 305., 243., 141., 117.,  49.,  47.,
                  21.,  23.,   9.,  10.,  10.,   8.,   6.,   0.,   2.,   2.,   0.,
                   0.,   0.,   0.,   1.,   0.,   0.,   0.,   0.,   0.,   0.,   0.,
                   0.,   0.,   0.,   0.,   0.,   1.]),
          array([ 15.  ,  21.46,  27.92,  34.38,  40.84,  47.3 ,  53.76,  60.22,
                  66.68,  73.14,  79.6 ,  86.06,  92.52,  98.98, 105.44, 111.9 ,
                 118.36, 124.82, 131.28, 137.74, 144.2 , 150.66, 157.12, 163.58,
                 170.04, 176.5 , 182.96, 189.42, 195.88, 202.34, 208.8 , 215.26,
                 221.72, 228.18, 234.64, 241.1 , 247.56, 254.02, 260.48, 266.94,
                 273.4 , 279.86, 286.32, 292.78, 299.24, 305.7 , 312.16, 318.62,
                 325.08, 331.54, 338.  ]),
          <a list of 50 Patch objects>)
```



```
In [20]: # x-axis
         plt.xlabel('Runtime in Minutes')
         # y-axis
         plt.ylabel('Profit in Dollars')
         # Title of the histogram
         plt.title('Relationship between runtime and profit')
         plt.scatter(tmdb_data['runtime'], tmdb_data['profit'], alpha=0.5)
         plt.show()
```



```
In [ ]: Research Question 1.4 (Which movie had the highest and lowest budget?)
```

```
In [21]: # Movie with lowest budget
         tmdb_data.loc[tmdb_data['budget'].idxmin()]
```

```
Out[21]: budget                                                            1
         revenue                                                         100
         original_title                                         Lost & Found
         cast              David Spade|Sophie Marceau|Ever Carradine|Step...
         runtime                                                          95
         genres                                               Comedy|Romance
         release_date                                    1999-04-23 00:00:00
         release_year                                                   1999
         profit                                                           99
         Name: 2618, dtype: object
```

```
In [22]: # Movie with highest budget
         tmdb_data.loc[tmdb_data['budget'].idxmax()]
```

```
Out[22]: budget                                                    425000000
         revenue                                                    11087569
         original_title                                      The Warrior's Way
         cast              Kate Bosworth|Jang Dong-gun|Geoffrey Rush|Dann...
         runtime                                                         100
         genres                      Adventure|Fantasy|Action|Western|Thriller
         release_date                                    2010-12-02 00:00:00
         release_year                                                   2010
         profit                                                    -413912431
         Name: 2244, dtype: object
```

```
In [ ]: Conclusions
```

```
In [ ]: The limitations associated with the conclusions are:
        The conclusion is not full proof that given the above requirement the movie will be a
        Also, we also lost some of the data in the data cleaning steps where we dont know the
        This conclusion is not error proof.
```

```
In [23]: from subprocess import call
         call(['python', '-m', 'nbconvert', 'Investigate_a_Dataset.ipynb'])
```

```
Out[23]: 255
```