In [131]:

```
#importing all the nescessory libraries we need for our analysis
import numpy as np
from matplotlib import pyplot as plt
import seaborn as sns
import pandas as pd
#this variable will store the database of tmdb movies into a dataframe
movie_data = pd.read_csv('tmdb-movies.csv')
```

In [132]:

```
movie_data.head()
```

Out[132]:

	id	imdb_id	popularity	budget	revenue	original_title	cast	
0	135397	tt0369610	32.985763	150000000	1513528810	Jurassic World	Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...	
1	76341	tt1392190	28.419936	150000000	378436354	Mad Max: Fury Road	Tom Hardy|Charlize Theron|Hugh Keays-Byrne|Nic...	
2	262500	tt2908446	13.112507	110000000	295238201	Insurgent	Shailene Woodley|Theo James|Kate Winslet|Ansel...	http:/
3	140607	tt2488496	11.173104	200000000	2068178225	Star Wars: The Force Awakens	Harrison Ford|Mark Hamill|Carrie Fisher|Adam D...	
4	168259	tt2820852	9.335014	190000000	1506249360	Furious 7	Vin Diesel|Paul Walker|Jason Statham|Michelle ...	

5 rows × 21 columns

In [133]:

```
movie_data.shape
```

Out[133]:

```
(10866, 21)
```

In [134]:

```
movie_data.columns
```

Out[134]:

```
Index(['id', 'imdb_id', 'popularity', 'budget', 'revenue', 'original_titl
e',
       'cast', 'homepage', 'director', 'tagline', 'keywords', 'overview',
       'runtime', 'genres', 'production_companies', 'release_date',
       'vote_count', 'vote_average', 'release_year', 'budget_adj',
       'revenue_adj'],
      dtype='object')
```

DATA CLEANING

First, lets clean up the columns. We will only keep the columns we need and remove the rest of them.

Columns to delete - `id, imdb_id, popularity, budget_adj, revenue_adj, homepage, keywords, overview, production_companies, vote_count and vote_average.`

In [135]:

```
del_cols= [ 'id', 'imdb_id', 'popularity', 'budget_adj', 'revenue_adj', 'homepage', 'ke
ywords', 'overview', 'production_companies', 'vote_count', 'vote_average']

movie_data.drop(del_cols, axis=1, inplace=True)

movie_data.head(3)
```

Out[135]:

	budget	revenue	original_title	cast	director	tagline	runtime	
0	150000000	1513528810	Jurassic World	Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...	Colin Trevorrow	The park is open.	124	Action|A
1	150000000	378436354	Mad Max: Fury Road	Tom Hardy|Charlize Theron|Hugh Keays-Byrne|Nic...	George Miller	What a Lovely Day.	120	Action|A
2	110000000	295238201	Insurgent	Shailene Woodley|Theo James|Kate Winslet|Ansel...	Robert Schwentke	One Choice Can Destroy You	119	A

Cleaning any duplicate data row

In [136]:

```
movie_data.drop_duplicates(keep = 'first', inplace = True)
```

In [137]:

```
movie_data.shape
```

Out[137]:

```
(10865, 10)
```

Replacing the '0' values in budget and revenue column with NaN and deleting all the rows with NaN budget or revenue

In [138]:

```
#giving list of column names that needs to be checked
check_row = ['budget', 'revenue']

#this will replace the value of '0' to NaN of columns given in the list
movie_data[check_row] = movie_data[check_row].replace(0, np.NaN)

#now we will drop any row which has NaN values in any of the column of the list (check_
row)
movie_data.dropna(subset = check_row, inplace = True)
```

In [139]:

```
movie_data.shape
```

Out[139]:

```
(3854, 10)
```

DATA WRANGLING

Replacing 0 with NaN of runtime column of the dataframe

In [140]:

```
movie_data['runtime'] = movie_data['runtime'].replace(0, np.NaN)
movie_data[movie_data['runtime'].isnull()]['runtime'].sum()
```

Out[140]:

```
0
```

Now we need to convert the 'release_date' column to date format

In [141]:

```
movie_data.release_date = pd.to_datetime(movie_data['release_date'])
```

In [142]:

```
movie_data.dtypes
```

Out[142]:

```
budget                    float64
revenue                   float64
original_title             object
cast                       object
director                   object
tagline                    object
runtime                     int64
genres                     object
release_date       datetime64[ns]
release_year                int64
dtype: object
```

Changing the dataTypes of the columns to the appropriate ones

In [143]:

```
change_coltype = ['budget', 'revenue']
movie_data[change_coltype] = movie_data[change_coltype].astype('int64')
```

Renaming the columns of budget and revenue

In [144]:

```
movie_data.rename(columns = {'budget' : 'budget_(in_US-Dollars)', 'revenue' : 'revenue_
(in_US-Dollars)'}, inplace = True)
movie_data.head()
```

Out[144]:

	budget_(in_US-Dollars)	revenue_(in_US-Dollars)	original_title	cast	director	tagline	rur
0	150000000	1513528810	Jurassic World	Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...	Colin Trevorrow	The park is open.	
1	150000000	378436354	Mad Max: Fury Road	Tom Hardy|Charlize Theron|Hugh Keays-Byrne|Nic...	George Miller	What a Lovely Day.	
2	110000000	295238201	Insurgent	Shailene Woodley|Theo James|Kate Winslet|Ansel...	Robert Schwentke	One Choice Can Destroy You	
3	200000000	2068178225	Star Wars: The Force Awakens	Harrison Ford|Mark Hamill|Carrie Fisher|Adam D...	J.J. Abrams	Every generation has a story.	
4	190000000	1506249360	Furious 7	Vin Diesel|Paul Walker|Jason Statham|Michelle ...	James Wan	Vengeance Hits Home	

Inserting new column profit_(in_US_Dollars) at position 2 with respect to columns which contains the value of the profit = revenue-budget

In [145]:

```
movie_data.insert(2, 'profit_(in_US_Dollars)', movie_data['revenue_(in_US-Dollars)'] -
movie_data['budget_(in_US-Dollars)'])
movie_data['profit_(in_US_Dollars)'] = movie_data['profit_(in_US_Dollars)'].astype('int
64')
```

In [146]:

```
movie_data.head()
```

Out[146]:

	budget_(in_US-Dollars)	revenue_(in_US-Dollars)	profit_(in_US_Dollars)	original_title	cast	d
0	150000000	1513528810	1363528810	Jurassic World	Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...	Tre
1	150000000	378436354	228436354	Mad Max: Fury Road	Tom Hardy|Charlize Theron|Hugh Keays-Byrne|Nic...	(
2	110000000	295238201	185238201	Insurgent	Shailene Woodley|Theo James|Kate Winslet|Ansel...	Sch
3	200000000	2068178225	1868178225	Star Wars: The Force Awakens	Harrison Ford|Mark Hamill|Carrie Fisher|Adam D...	A
4	190000000	1506249360	1316249360	Furious 7	Vin Diesel|Paul Walker|Jason Statham|Michelle ...	

QUESTIONS

Definig the fuction to get the highest and the lowest values in the respective columsn of the data

In [147]:

```
def highest_lowest(column_name):

    highest_id = movie_data[column_name].idxmax()
    highest_details = pd.DataFrame(movie_data.loc[highest_id])

    lowest_id = movie_data[column_name].idxmin()
    lowest_details = pd.DataFrame(movie_data.loc[lowest_id])

    two_in_one_data = pd.concat([highest_details, lowest_details], axis = 1, names=["De
tails", "Highest", 'Lowest'])

    return two_in_one_data
```

Q1. Which movie earns the most and least profit?

In [148]:

```
highest_lowest('profit_(in_US_Dollars)')
```

Out[148]:

	1386	2244
budget_(in_US-Dollars)	237000000	425000000
revenue_(in_US-Dollars)	2781505847	11087569
profit_(in_US_Dollars)	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
tagline	Enter the World of Pandora.	Assassin. Hero. Legend.
runtime	162	100
genres	Action|Adventure|Fantasy|Science Fiction	Adventure|Fantasy|Action|Western|Thriller
release_date	2009-12-10 00:00:00	2010-12-02 00:00:00
release_year	2009	2010

Q2. Which movie has the longest and shortest runtime?

In [149]:

```
highest_lowest('runtime')
```

Out[149]:

	2107	5162
budget_(in_US-Dollars)	18000000	10
revenue_(in_US-Dollars)	871279	5
profit_(in_US_Dollars)	-17128721	-5
original_title	Carlos	Kid's Story
cast	Edgar RamÃrez|Alexander Scheer|Fadi Abi Samra...	Clayton Watson|Keanu Reeves|Carrie-Anne Moss|K...
director	Olivier Assayas	Shinichiro Watanabe
tagline	The man who hijacked the world	NaN
runtime	338	15
genres	Crime|Drama|Thriller|History	Science Fiction|Animation
release_date	2010-05-19 00:00:00	2003-06-02 00:00:00
release_year	2010	2003

Q3. Which movie has the highest and the lowest budget?

In [150]:

```
highest_lowest('budget_(in_US-Dollars)')
```

Out[150]:

	2244	2618
budget_(in_US-Dollars)	425000000	1
revenue_(in_US-Dollars)	11087569	100
profit_(in_US_Dollars)	-413912431	99
original_title	The Warrior's Way	Lost & Found
cast	Kate Bosworth|Jang Dong-gun|Geoffrey Rush|Dann...	David Spade|Sophie Marceau|Ever Carradine|Step...
director	Sngmoo Lee	Jeff Pollack
tagline	Assassin. Hero. Legend.	A comedy about a guy who would do anything to ...
runtime	100	95
genres	Adventure|Fantasy|Action|Western|Thriller	Comedy|Romance
release_date	2010-12-02 00:00:00	1999-04-23 00:00:00
release_year	2010	1999

Q4. Which movie has the highest and the lowest Revenue?

In [151]:

```
highest_lowest('revenue_(in_US-Dollars)')
```

Out[151]:

	1386	5067
budget_(in_US-Dollars)	237000000	6000000
revenue_(in_US-Dollars)	2781505847	2
profit_(in_US_Dollars)	2544505847	-5999998
original_title	Avatar	Shattered Glass
cast	Sam Worthington|Zoe Saldana|Sigourney Weaver|S...	Hayden Christensen|Peter Sarsgaard|ChloÃ« Sevi...
director	James Cameron	Billy Ray
tagline	Enter the World of Pandora.	NaN
runtime	162	94
genres	Action|Adventure|Fantasy|Science Fiction	Drama|History
release_date	2009-12-10 00:00:00	2003-11-14 00:00:00
release_year	2009	2003

Creating the function to calculate the mean of a specific of column

In [152]:

```
def average_func(column_name):

    return movie_data[column_name].mean()
```

In [153]:

```
average_func('runtime')
```

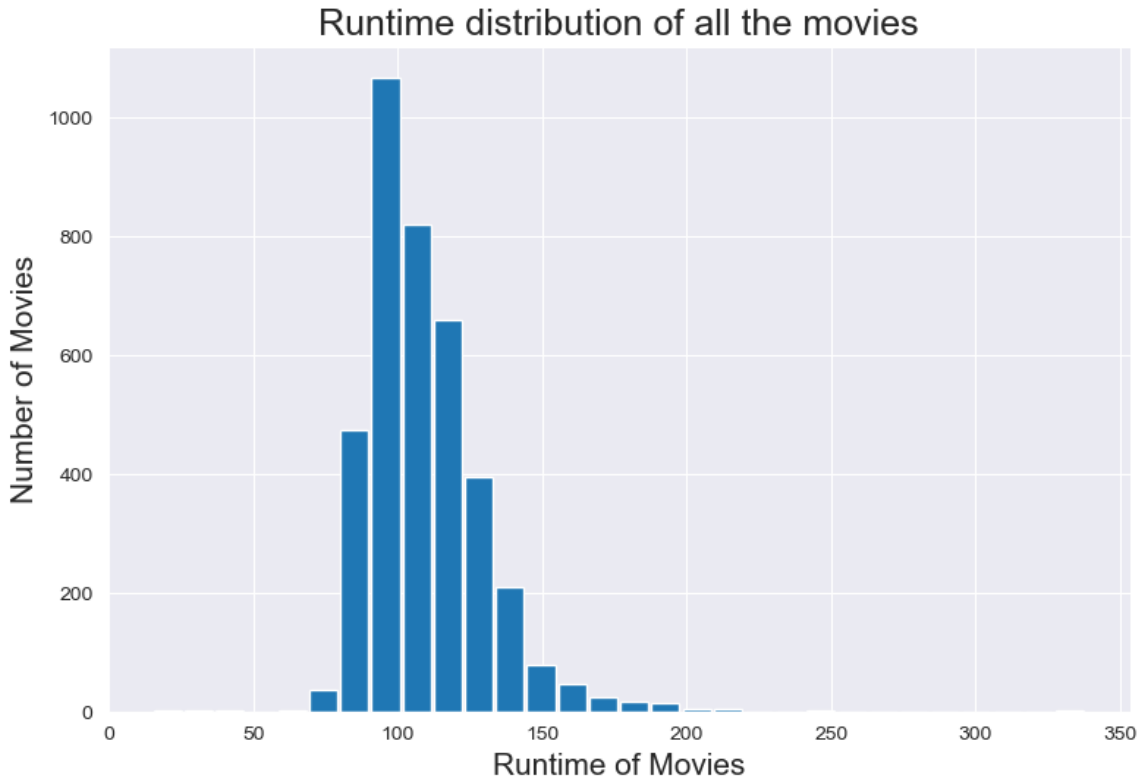
Out[153]:

```
109.22029060716139
```

Creating a histogram plot for runtime of the movies

In [154]:

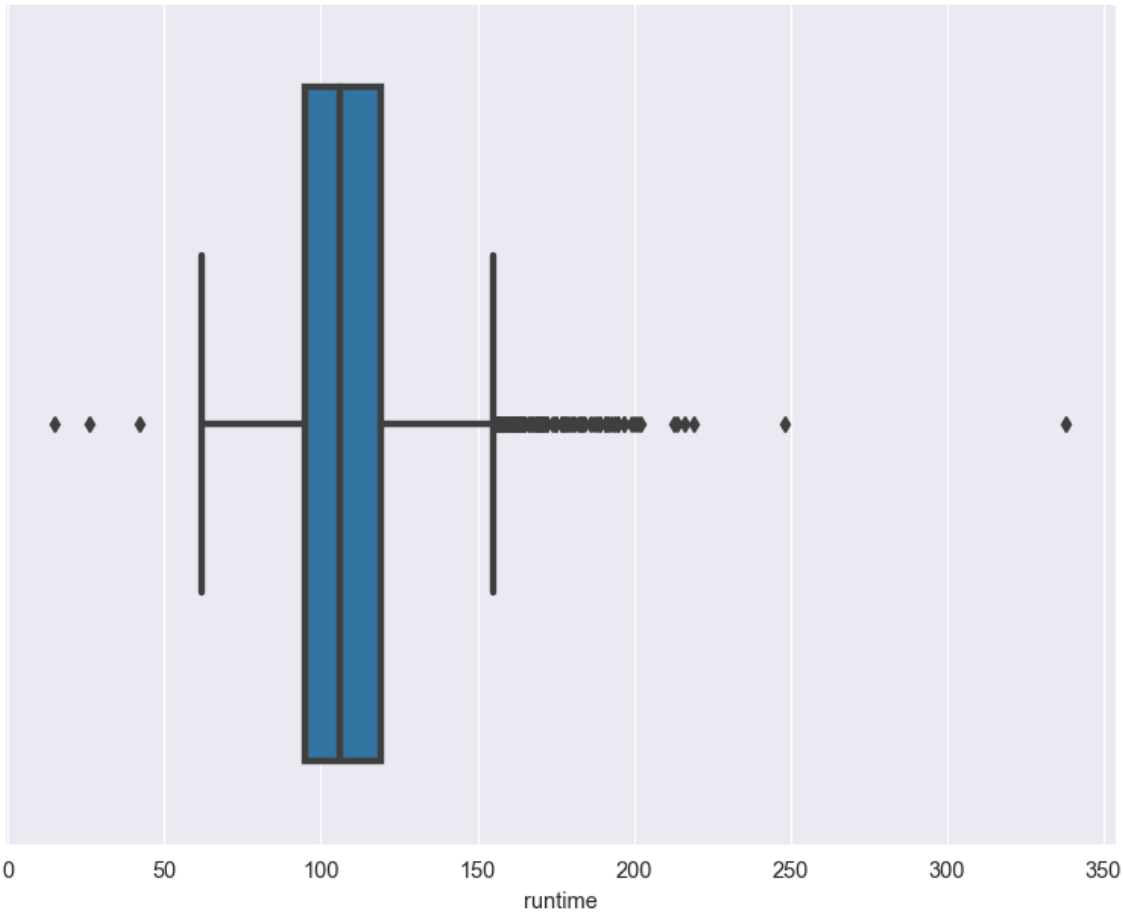
```
sns.set_style('darkgrid')
#giving the figure size(width, height)
plt.figure(figsize=(9,6), dpi = 100)
#x-axis label name
plt.xlabel('Runtime of Movies', fontsize = 15)
#y-axis label name
plt.ylabel('Number of Movies', fontsize=15)
#title of the graph
plt.title('Runtime distribution of all the movies', fontsize=18)

#giving a histogram plot
plt.hist(movie_data['runtime'], rwidth =0.9, bins =30)
#displays the plot
plt.show()
```



Creating a Box Plot for further analysis

In [155]:

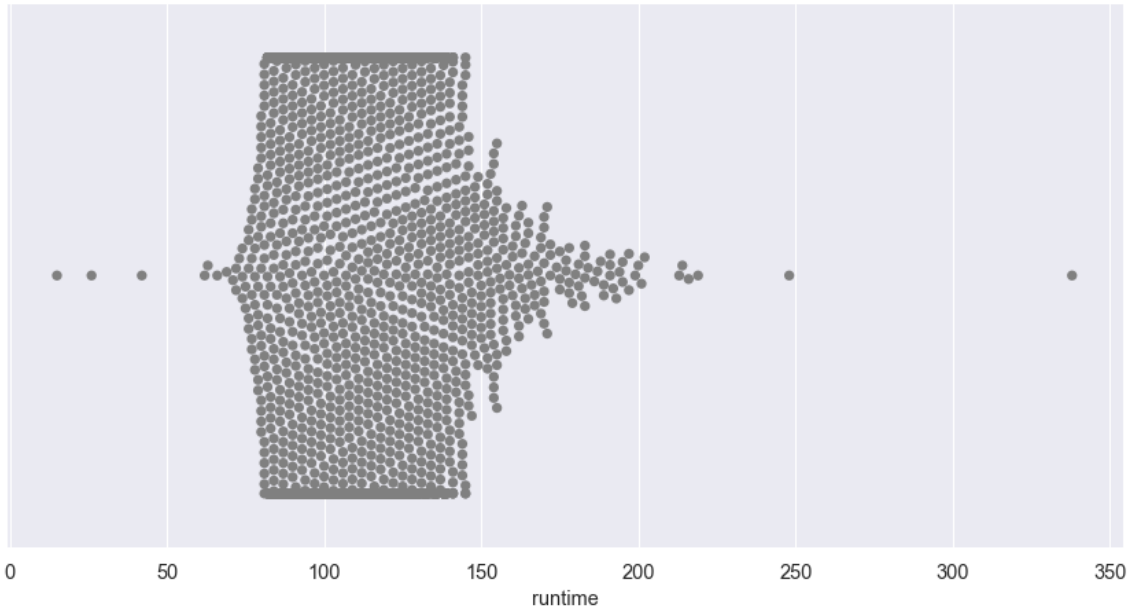
```
plt.figure(figsize=(9,7), dpi = 105)
sns.boxplot(movie_data['runtime'], linewidth = 3)
plt.show()
```



Plotting the data points on the graph

In [156]:

```
plt.figure(figsize=(10,5), dpi = 105)

sns.swarmplot(movie_data['runtime'], color = 'grey')
plt.show()
```



In [157]:

```
movie_data['runtime'].describe()
```

Out[157]:

```
count    3854.000000
mean      109.220291
std        19.922820
min        15.000000
25%        95.000000
50%       106.000000
75%       119.000000
max       338.000000
Name: runtime, dtype: float64
```

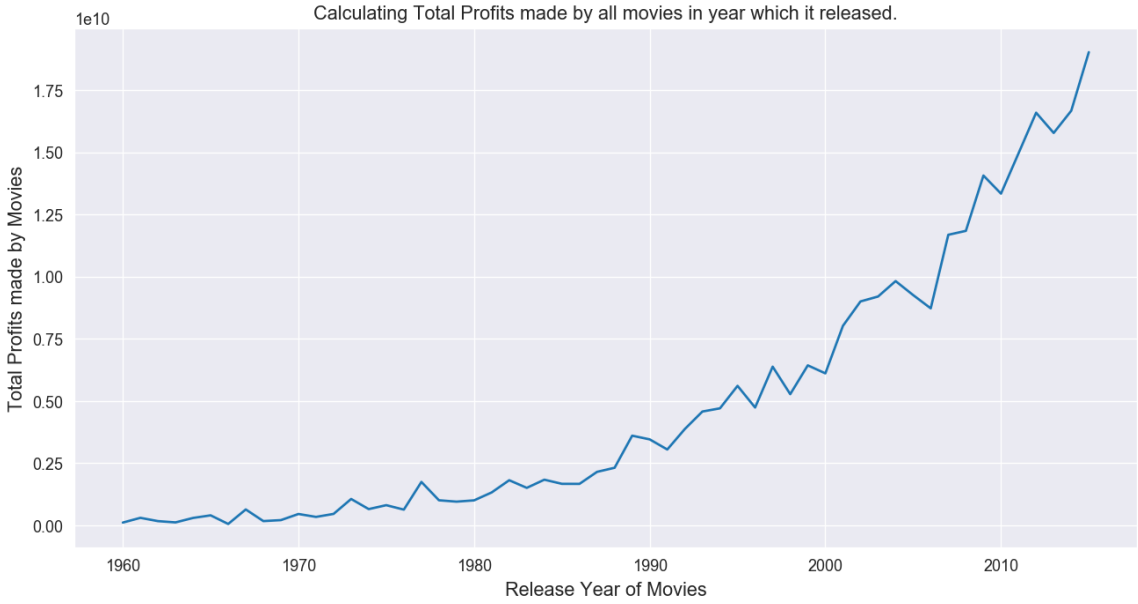
Creating a plot showing the profit made by the movies w.r.t. to release years of the movies

In [158]:

```
#the groupby function below collects all the movies for that year and then the profits
 of all those movies for that years is been added
#and storing all this in variable
profits_each_year = movie_data.groupby('release_year')['profit_(in_US_Dollars)'].sum()
```

In [159]:

```
fig=plt.figure(figsize=(12,6), dpi = 130)
plt.xlabel('Release Year of Movies', fontsize = 12)
plt.ylabel('Total Profits made by Movies', fontsize = 12)
plt.title('Calculating Total Profits made by all movies in year which it released.')
plt.plot(profits_each_year)
plt.show()
```



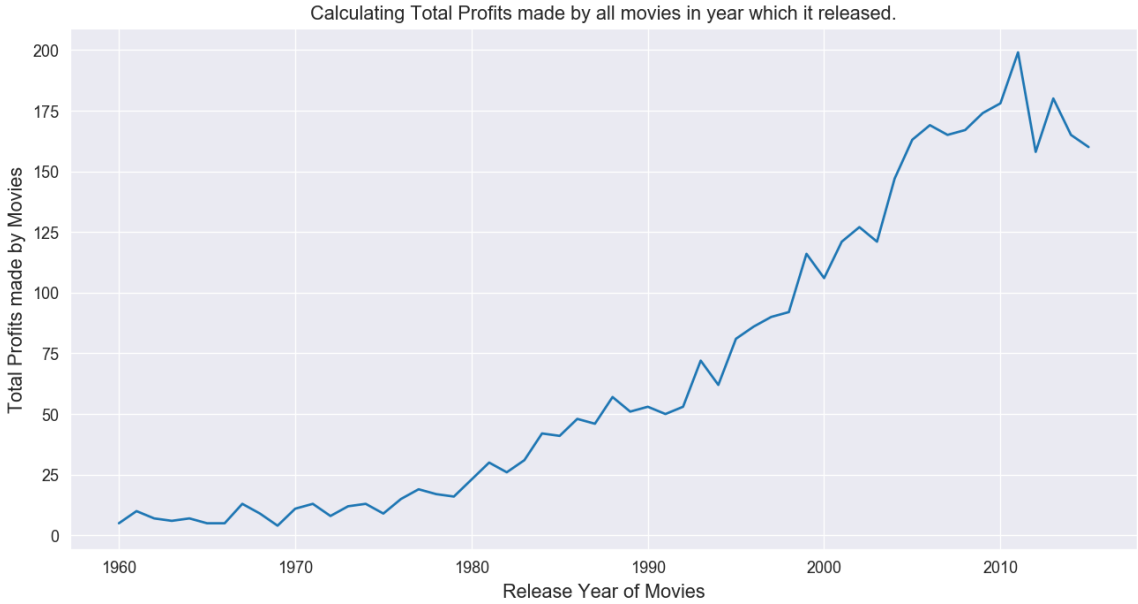
Creating a plot showing the Number of movies released w.r.t. to release years of the movies

In [160]:

```
#the groupby function below collects all the movies for that year and then the profits
 of all those movies for that years is been added
#and storing all this in variable
movies_released_peryear = movie_data.groupby('release_year')['original_title'].count()
```

In [161]:

```
fig=plt.figure(figsize=(12,6), dpi = 130)
plt.xlabel('Release Year of Movies', fontsize = 12)
plt.ylabel('Total Profits made by Movies', fontsize = 12)
plt.title('Calculating Total Profits made by all movies in year which it released.')
plt.plot(movies_released_peryear)
plt.show()
```



In [162]:

```
profits_each_year=pd.DataFrame(profits_each_year)
```

In [163]:

```
profits_each_year.tail(10)
```

Out[163]:

release_year	profit_(in_US_Dollars)
2006	8726299999
2007	11686103667
2008	11843373159
2009	14069305071
2010	13341222037
2011	14966694704
2012	16596845507
2013	15782743325
2014	16676201357
2015	19032145273

In [164]:

```
movies_released_peryear=pd.DataFrame(movies_released_peryear)
```

In [165]:

```
movies_released_peryear.tail(10)
```

Out[165]:

release_year	original_title
2006	169
2007	165
2008	167
2009	174
2010	178
2011	199
2012	158
2013	180
2014	165
2015	160

In [166]:

```
id=profits_each_year.idxmax()
id
```

Out[166]:

```
profit_(in_US_Dollars)    2015
dtype: int64
```

Only those movies which made profits more than 50 million

In [167]:

```
profit_movie_data = movie_data[movie_data['profit_(in_US_Dollars)'] >= 50000000]

profit_movie_data.index = range(len(profit_movie_data))
profit_movie_data.index = profit_movie_data.index + 1

profit_movie_data.head()
```

Out[167]:

	budget_(in_US-Dollars)	revenue_(in_US-Dollars)	profit_(in_US_Dollars)	original_title	cast	d
1	150000000	1513528810	1363528810	Jurassic World	Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...	Tre
2	150000000	378436354	228436354	Mad Max: Fury Road	Tom Hardy|Charlize Theron|Hugh Keays-Byrne|Nic...	(
3	110000000	295238201	185238201	Insurgent	Shailene Woodley|Theo James|Kate Winslet|Ansel...	Sch
4	200000000	2068178225	1868178225	Star Wars: The Force Awakens	Harrison Ford|Mark Hamill|Carrie Fisher|Adam D...	A
5	190000000	1506249360	1316249360	Furious 7	Vin Diesel|Paul Walker|Jason Statham|Michelle ...	

In [168]:

```
def profit_avg_fun(column):
    return profit_movie_data[column].mean()
```

In [169]:

```
profit_avg_fun('runtime')
```

Out[169]:

```
113.66741405082212
```

In [170]:

```
profit_avg_fun('budget_(in_US-Dollars)')
```

Out[170]:

```
60444957.76083707
```

In [171]:

```
profit_movie_data['director'].value_counts().head(10)
```

Out[171]:

```
Steven Spielberg    23
Robert Zemeckis     13
Clint Eastwood      12
Tim Burton          10
Tony Scott          10
Ron Howard          10
Ridley Scott        10
Michael Bay          9
David Fincher        8
Roland Emmerich      8
Name: director, dtype: int64
```

In [172]:

```
def extract_data(column_name):

    all_data = profit_movie_data[column_name].str.cat(sep = '|')

    all_data = pd.Series(all_data.split('|'))

    return all_data.value_counts(ascending = False)
```

In [173]:

```
extract_data('director').head(10)
```

Out[173]:

```
Steven Spielberg    23
Robert Zemeckis     13
Clint Eastwood      12
Tim Burton          11
Ron Howard          10
Tony Scott          10
Ridley Scott        10
Michael Bay          9
Roland Emmerich      8
David Fincher        8
dtype: int64
```

In [174]:

```
extract_data('cast').head(50)
```

Out[174]:

```
Tom Cruise              27
Brad Pitt               25
Tom Hanks               22
Sylvester Stallone      21
Cameron Diaz            20
Denzel Washington       19
Adam Sandler            19
Harrison Ford           19
Robert De Niro          19
Bruce Willis            19
Jim Carrey              19
Eddie Murphy            18
Matt Damon              18
Ben Stiller             18
Johnny Depp             17
Will Smith              17
Arnold Schwarzenegger   17
Samuel L. Jackson       17
Nicolas Cage            16
Robin Williams          16
Ralph Fiennes           16
Mel Gibson              15
Gary Oldman             15
Sandra Bullock          15
Liam Neeson             15
Julia Roberts           15
Dwayne Johnson          14
Morgan Freeman          14
Mark Wahlberg           14
Anne Hathaway           14
Steve Carell            14
Sean Connery            14
Owen Wilson             14
Angelina Jolie          14
Antonio Banderas        13
Leonardo DiCaprio       13
John Goodman            13
George Clooney          13
Michael Douglas         13
Tommy Lee Jones         13
Jack Black              12
Patrick Stewart         12
Gene Hackman            12
Anthony Hopkins         12
Helena Bonham Carter    12
Nicole Kidman           12
Meryl Streep            12
John Travolta           12
Keanu Reeves            12
Scarlett Johansson      11
dtype: int64
```

In [175]:

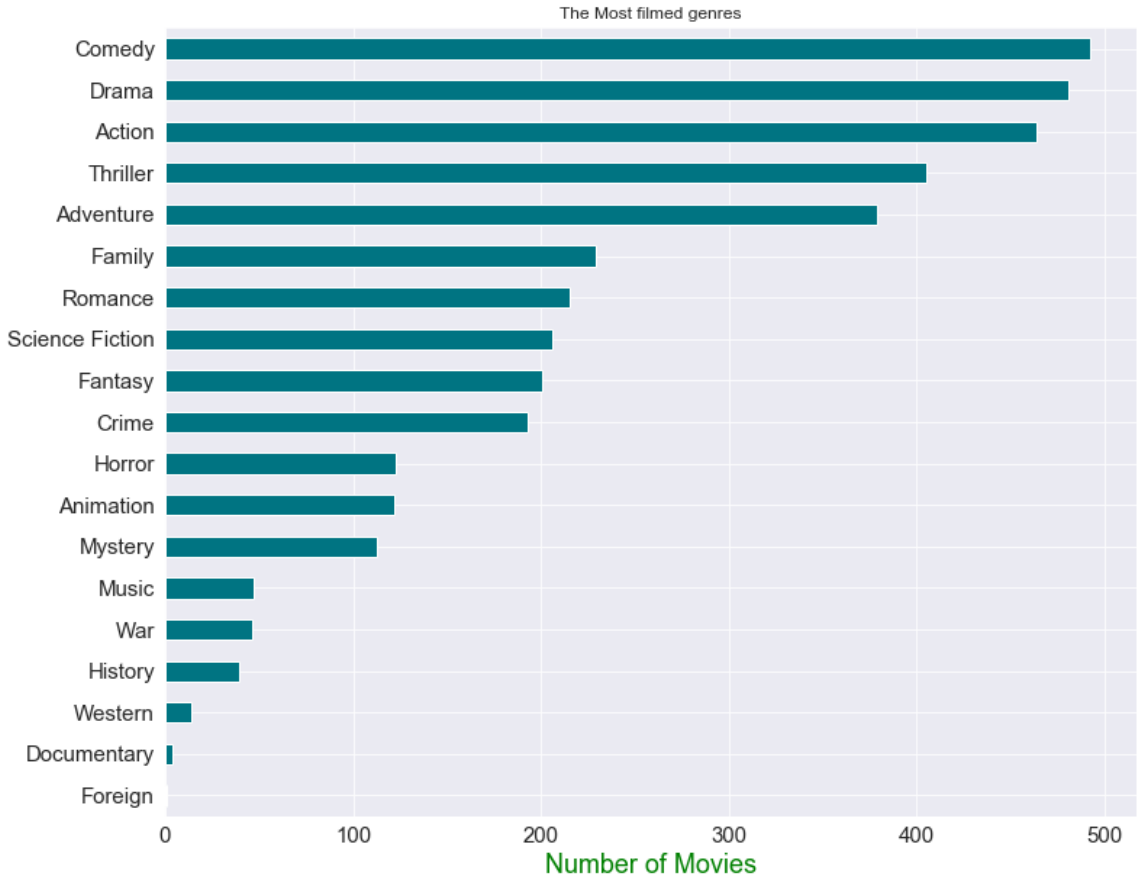
```
extract_data('genres').head(10)
```

Out[175]:

```
Comedy             492
Drama              481
Action             464
Thriller           405
Adventure          379
Family             229
Romance            215
Science Fiction    206
Fantasy            201
Crime              193
dtype: int64
```

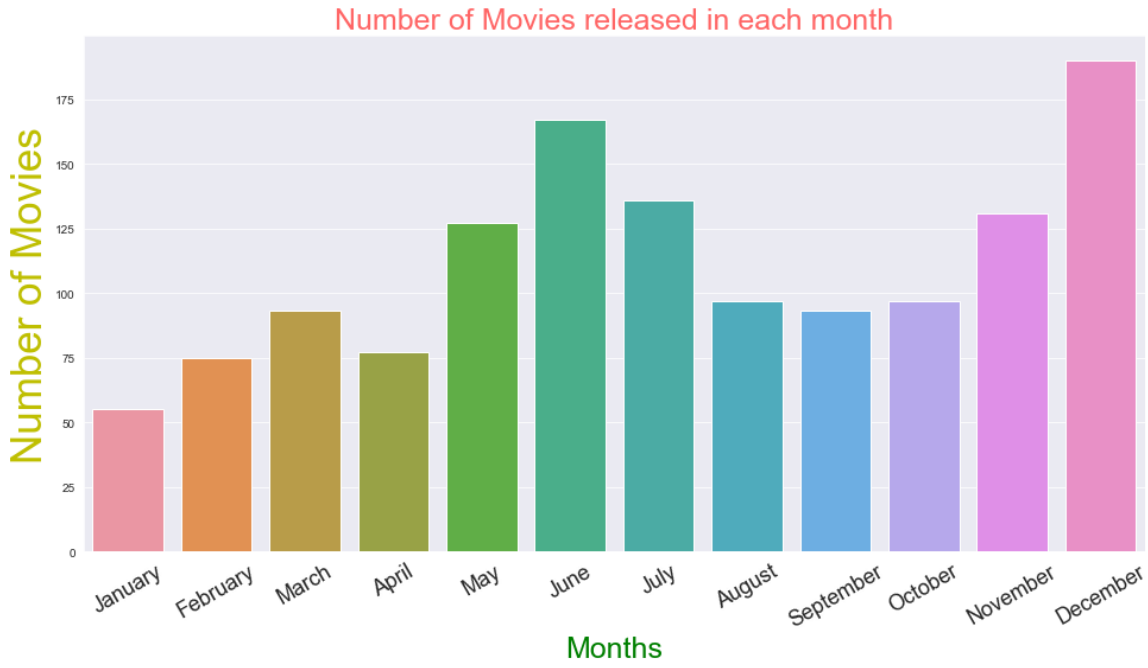
In [176]:

```
genre_count=extract_data('genres')

#we want plot to plot points in descending order top to bottom
#since our count is in descending order and graph plot points from bottom to top, our g
raph will be in ascending order form top to bottom
#hence lets give the series in ascending order
genre_count.sort_values(ascending = True, inplace = True)

#initializing plot
ax = genre_count.plot.barh(color = '#007482', fontsize = 15)

#giving a title
ax.set(title = 'The Most filmed genres')

#x-label
ax.set_xlabel('Number of Movies', color = 'g', fontsize = '18')

#giving the figure size(width, height)
ax.figure.set_size_inches(12, 10)

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


The Most filmed genres
Comedy
Drama
Action
Thriller
Adventure
Family
Romance
Science Fiction
Fantasy
Crime
Horror
Animation
Mystery
Music
War
History
Western
Documentary
Foreign
0
100
200
300
400
500
Number of Movies

In [177]:

```
#for answering this question we need to group all of the months of years and then calcu
late the profits of those months
#giving a new dataframe which gives 'release-date' as index
index_release_date = profit_movie_data.set_index('release_date')

#now we need to group all the data by month, since release date is in form of index, we
extract month from it
groupby_index = index_release_date.groupby([(index_release_date.index.month)])

#this will give us how many movies are released in each month
monthly_movie_count = groupby_index['profit_(in_US_Dollars)'].count()

#converting table to a dataframe
monthly_movie_count= pd.DataFrame(monthly_movie_count)

#giving a list of months
month_list = ['January', 'February', 'March', 'April', 'May', 'June', 'July', 'August',
'September', 'October', 'November', 'December']

monthly_movie_count_bar = sns.barplot(x = monthly_movie_count.index, y = monthly_movie_
count['profit_(in_US_Dollars)'], data = monthly_movie_count)

#setting size of the graph
monthly_movie_count_bar.figure.set_size_inches(16,8)

#setting the title and customizing
monthly_movie_count_bar.axes.set_title('Number of Movies released in each month', color
="r", fontsize = 25, alpha = 0.6)

#setting x-label
monthly_movie_count_bar.set_xlabel("Months", color="g", fontsize = 25)
#setting y-label
monthly_movie_count_bar.set_ylabel("Number of Movies", color="y", fontsize = 35)

#customizing axes values
# monthly_movie_count_bar.tick_params(labelsize = 15, labelcolor="black")

#rotating the x-axis values to make it readable
monthly_movie_count_bar.set_xticklabels(month_list, rotation = 30, size = 18)

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



In [178]:

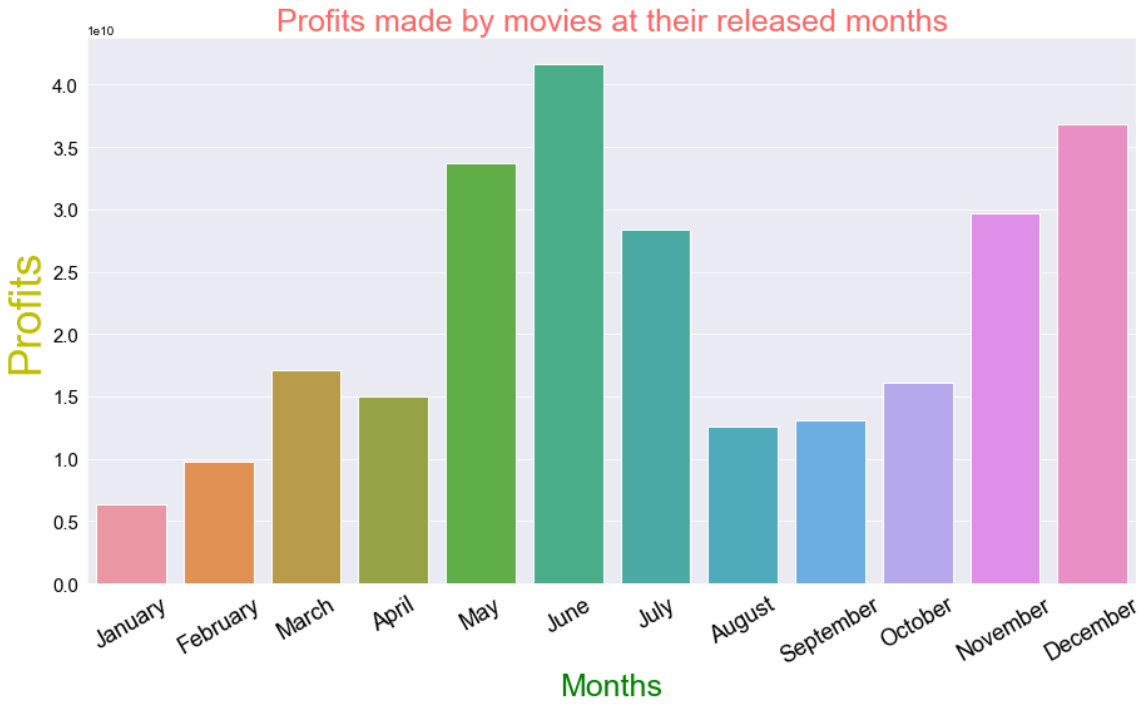
```
monthly_movie_count
```

Out[178]:

release_date	profit_(in_US_Dollars)
1	55
2	75
3	93
4	77
5	127
6	167
7	136
8	97
9	93
10	97
11	131
12	190

In [179]:

```
#finding the second part of this question

#now since the data is grouped by month, we add 'profit_(in_US_Dollars)' values to resp
ective months, saving all this to a new var
monthly_profit = groupby_index['profit_(in_US_Dollars)'].sum()

#converting table to a dataframe
monthly_profit = pd.DataFrame(monthly_profit)

#giving seaborn bar plot to visualize the data
#giving values to our graph
monthly_profit_bar = sns.barplot(x = monthly_profit.index, y = monthly_profit['profit_
(in_US_Dollars)'], data = monthly_profit)

#setting size of the graph
monthly_profit_bar.figure.set_size_inches(15,8)

#setting the title and customizing
monthly_profit_bar.axes.set_title('Profits made by movies at their released months', co
lor="r", fontsize = 25, alpha = 0.6)

#setting x-label
monthly_profit_bar.set_xlabel("Months", color="g", fontsize = 25)
#setting y-label
monthly_profit_bar.set_ylabel("Profits", color="y", fontsize = 35)

#customizing axes values
monthly_profit_bar.tick_params(labelsize = 15, labelcolor="black")

#rotating the x-axis values to make it readable
monthly_profit_bar.set_xticklabels(month_list, rotation = 30, size = 18)

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



CONCLUSION

From the analysis we have done we can deduce many kind of inferences from it such as the best genre of the movie which is most famous among the audience, the best actors and actresses to be cast to make a movie a blockbuster hit, the best directors with the best direction skills and the most suitable months to release a movie.