In [46]:

```
# Importing Pandas
import pandas as pd
import csv # read and write csv files
from datetime import datetime # operations to parse dates
import matplotlib.pyplot as plt
% matplotlib inline
import numpy as np
import seaborn as sns
```

In [34]:

```
#reading tmdb csv file and storing that to a variable
tmdb = pd.read_csv('tmdb-movies.csv')

#calling out first 100 rows (excluding headers) of tmdb database
tmdb.head(101)


#lets give a list of movies that needs to be deleted
del_col = [ 'id', 'imdb_id', 'popularity', 'budget_adj', 'revenue_adj',
'homepage', 'keywords', 'overview', 'production_companies', 'vote_count'
, 'vote_average']


#deleting the columns from the database
movie_data = tmdb.drop(del_col, 1)
#now take a look at this new dataset
movie_data.head()
```

Out[34]:

	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
1	150000000	378436354	Mad Max: Fury Road	Tom Hardy|Charlize Theron|Hugh Keays-Byrne|Nic...	George Miller	What a Lovely Day.	120
2	110000000	295238201	Insurgent	Shailene Woodley|Theo James|Kate Winslet|Ansel...	Robert Schwentke	One Choice Can Destroy You	119
3	200000000	2068178225	Star Wars: The Force Awakens	Harrison Ford|Mark Hamill|Carrie Fisher|Adam D...	J.J. Abrams	Every generation has a story.	136
4	190000000	1506249360	Furious 7	Vin Diesel|Paul Walker|Jason Statham|Michelle ...	James Wan	Vengeance Hits Home	137

```
In [36]: # Describing TMDB Data
         movie_data.describe()
```

Out[36]:

	budget	revenue	runtime	release_year
count	1.086600e+04	1.086600e+04	10866.000000	10866.000000
mean	1.462570e+07	3.982332e+07	102.070863	2001.322658
std	3.091321e+07	1.170035e+08	31.381405	12.812941
min	0.000000e+00	0.000000e+00	0.000000	1960.000000
25%	0.000000e+00	0.000000e+00	90.000000	1995.000000
50%	0.000000e+00	0.000000e+00	99.000000	2006.000000
75%	1.500000e+07	2.400000e+07	111.000000	2011.000000
max	4.250000e+08	2.781506e+09	900.000000	2015.000000

```
In [37]: # Perform operations to inspect data
         # types and look for instances of missing or possibly errant data.
         movie_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10866 entries, 0 to 10865
Data columns (total 10 columns):
budget            10866 non-null int64
revenue           10866 non-null int64
original_title    10866 non-null object
cast              10790 non-null object
director          10822 non-null object
tagline           8042 non-null object
runtime           10866 non-null int64
genres            10843 non-null object
release_date      10866 non-null object
release_year      10866 non-null int64
dtypes: int64(4), object(6)
memory usage: 849.0+ KB
```

```
In [38]: sum(movie_data.duplicated())
```

```
Out[38]: 1
```

```
In [39]: movie_data.drop_duplicates(inplace=True)
```

In [40]:
```
movie_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 10865 entries, 0 to 10865
Data columns (total 10 columns):
budget            10865 non-null int64
revenue           10865 non-null int64
original_title    10865 non-null object
cast              10789 non-null object
director          10821 non-null object
tagline           8041 non-null object
runtime           10865 non-null int64
genres            10842 non-null object
release_date      10865 non-null object
release_year      10865 non-null int64
dtypes: int64(4), object(6)
memory usage: 933.7+ KB
```

In [41]:
```
movie_data.isnull().sum()
```

Out[41]:
```
budget               0
revenue              0
original_title       0
cast                76
director            44
tagline           2824
runtime              0
genres              23
release_date         0
release_year         0
dtype: int64
```

In [42]:
```
movie_data.describe()
```

Out[42]:

	budget	revenue	runtime	release_year
count	1.086500e+04	1.086500e+04	10865.000000	10865.000000
mean	1.462429e+07	3.982690e+07	102.071790	2001.321859
std	3.091428e+07	1.170083e+08	31.382701	12.813260
min	0.000000e+00	0.000000e+00	0.000000	1960.000000
25%	0.000000e+00	0.000000e+00	90.000000	1995.000000
50%	0.000000e+00	0.000000e+00	99.000000	2006.000000
75%	1.500000e+07	2.400000e+07	111.000000	2011.000000
max	4.250000e+08	2.781506e+09	900.000000	2015.000000

In [43]:
```
movie_data.head()
```

Out[43]:

	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
1	150000000	378436354	Mad Max: Fury Road	Tom Hardy|Charlize Theron|Hugh Keays-Byrne|Nic...	George Miller	What a Lovely Day.	120
2	110000000	295238201	Insurgent	Shailene Woodley|Theo James|Kate Winslet|Ansel...	Robert Schwentke	One Choice Can Destroy You	119
3	200000000	2068178225	Star Wars: The Force Awakens	Harrison Ford|Mark Hamill|Carrie Fisher|Adam D...	J.J. Abrams	Every generation has a story.	136
4	190000000	1506249360	Furious 7	Vin Diesel|Paul Walker|Jason Statham|Michelle ...	James Wan	Vengeance Hits Home	137

In [44]:
```
movie_data.drop_duplicates(keep = 'first', inplace = True)
```

In [47]:
```
#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 t
he list (check_row)
movie_data.dropna(subset = check_row, inplace = True)
```

In [48]:

```
movie_data
```

```
Out[48]:
```

	budget	revenue	original_title	cast	director	
0	150000000.0	1.513529e+09	Jurassic World	Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...	Colin Trevorrow	T c
1	150000000.0	3.784364e+08	Mad Max: Fury Road	Tom Hardy|Charlize Theron|Hugh Keays-Byrne|Nic...	George Miller	\ [
2	110000000.0	2.952382e+08	Insurgent	Shailene Woodley|Theo James|Kate Winslet|Ansel...	Robert Schwentke	([
3	200000000.0	2.068178e+09	Star Wars: The Force Awakens	Harrison Ford|Mark Hamill|Carrie Fisher|Adam D...	J.J. Abrams	E h
4	190000000.0	1.506249e+09	Furious 7	Vin Diesel|Paul Walker|Jason Statham|Michelle ...	James Wan	\ H
5	135000000.0	5.329505e+08	The Revenant	Leonardo DiCaprio|Tom Hardy|Will Poulter|Domhn...	Alejandro GonzÃ¡lez IÃ±Ã¡rritu	(r f
6	155000000.0	4.406035e+08	Terminator Genisys	Arnold Schwarzenegger|Jason Clarke|Emilia Clar...	Alan Taylor	F
7	108000000.0	5.953803e+08	The Martian	Matt Damon|Jessica Chastain|Kristen Wiig|Jeff ...	Ridley Scott	E
8	74000000.0	1.156731e+09	Minions	Sandra Bullock|Jon Hamm|Michael Keaton|Allison...	Kyle Balda|Pierre Coffin	E h b
9	175000000.0	8.537086e+08	Inside Out	Amy Poehler|Phyllis Smith|Richard Kind|Bill Ha...	Pete Docter	N \ y
10	245000000.0	8.806746e+08	Spectre	Daniel Craig|Christoph Waltz|LÃ©a Seydoux|Ralp...	Sam Mendes	/ E
11	176000003.0	1.839877e+08	Jupiter Ascending	Mila Kunis|Channing Tatum|Sean Bean|Eddie Redm...	Lana Wachowski|Lilly Wachowski	E u

	budget	revenue	original_title	cast	director
12	15000000.0	3.686941e+07	Ex Machina	Domhnall Gleeson|Alicia Vikander|Oscar Isaac|S...	Alex Garland
13	88000000.0	2.436371e+08	Pixels	Adam Sandler|Michelle Monaghan|Peter Dinklage|...	Chris Columbus
14	280000000.0	1.405036e+09	Avengers: Age of Ultron	Robert Downey Jr.|Chris Hemsworth|Mark Ruffalo...	Joss Whedon
15	44000000.0	1.557601e+08	The Hateful Eight	Samuel L. Jackson|Kurt Russell|Jennifer Jason ...	Quentin Tarantino
16	48000000.0	3.257714e+08	Taken 3	Liam Neeson|Forest Whitaker|Maggie Grace|Famke...	Olivier Megaton
17	130000000.0	5.186022e+08	Ant-Man	Paul Rudd|Michael Douglas|Evangeline Lilly|Cor...	Peyton Reed
18	95000000.0	5.423514e+08	Cinderella	Lily James|Cate Blanchett|Richard Madden|Helen...	Kenneth Branagh
19	160000000.0	6.505234e+08	The Hunger Games: Mockingjay - Part 2	Jennifer Lawrence|Josh Hutcherson|Liam Hemswor...	Francis Lawrence
20	190000000.0	2.090357e+08	Tomorrowland	Britt Robertson|George Clooney|Raffey Cassidy|...	Brad Bird
21	30000000.0	9.170983e+07	Southpaw	Jake Gyllenhaal|Rachel McAdams|Forest Whitaker...	Antoine Fuqua
22	110000000.0	4.704908e+08	San Andreas	Dwayne Johnson|Alexandra Daddario|Carla Gugino...	Brad Peyton
23	40000000.0	5.696515e+08	Fifty Shades of Grey	Dakota Johnson|Jamie Dornan|Jennifer Ehle|Eloi...	Sam Taylor-Johnson

	budget	revenue	original_title	cast	director
24	28000000.0	1.333465e+08	The Big Short	Christian Bale|Steve Carell|Ryan Gosling|Brad ...	Adam McKay
25	150000000.0	6.823301e+08	Mission: Impossible - Rogue Nation	Tom Cruise|Jeremy Renner|Simon Pegg|Rebecca Fe...	Christopher McQuarrie
26	68000000.0	2.158636e+08	Ted 2	Mark Wahlberg|Seth MacFarlane|Amanda Seyfried|...	Seth MacFarlane
27	81000000.0	4.038021e+08	Kingsman: The Secret Service	Taron Egerton|Colin Firth|Samuel L. Jackson|Mi...	Matthew Vaughn
28	20000000.0	8.834647e+07	Spotlight	Mark Ruffalo|Michael Keaton|Rachel McAdams|Lie...	Tom McCarthy
29	61000000.0	3.112569e+08	Maze Runner: The Scorch Trials	Dylan O'Brien|Kaya Scodelario|Thomas Brodie-Sa...	Wes Ball
...	...	...	...	...	...
10690	8200000.0	1.632143e+08	The Sound of Music	Julie Andrews|Christopher Plummer|Eleanor Park...	Robert Wise
10691	14000000.0	1.117219e+08	Doctor Zhivago	Omar Sharif|Julie Christie|Geraldine Chaplin|R...	David Lean
10692	5600000.0	2.995000e+07	Those Magnificent Men in Their Flying Machines...	Stuart Whitman|Sarah Miles|James Fox|Alberto S...	Ken Annakin
10716	20000000.0	1.200000e+07	The Greatest Story Ever Told	Max von Sydow|Michael Anderson Jr.|Carroll Bak...	George Stevens
10724	7000000.0	8.197449e+07	On Her Majesty's Secret Service	George Lazenby|Diana Rigg|Telly Savalas|Gabrie...	Peter R. Hunt

	budget	revenue	original_title	cast	director
10725	6000000.0	1.023089e+08	Butch Cassidy and the Sundance Kid	Paul Newman|Robert Redford|Katharine Ross|Stro...	George Roy Hill
10727	3600000.0	4.478505e+07	Midnight Cowboy	Dustin Hoffman|Jon Voight|Sylvia Miles|John Mc...	John Schlesinger
10728	6244087.0	6.386410e+05	The Wild Bunch	Ernest Borgnine|William Holden|Robert Ryan|Edm...	Sam Peckinpah
10755	6000000.0	1.818138e+08	Grease	John Travolta|Olivia Newton-John|Stockard Chan...	Randal Kleiser
10756	20000000.0	1.878840e+08	Jaws 2	Roy Scheider|Lorraine Gary|Murray Hamilton|Jos...	Jeannot Szwarc
10757	650000.0	5.500000e+07	Dawn of the Dead	David Emge|Ken Foree|Scott H. Reiniger|Gaylen ...	George A. Romero
10758	55000000.0	3.002180e+08	Superman	Marlon Brando|Gene Hackman|Christopher Reeve|N...	Richard Donner
10759	300000.0	7.000000e+07	Halloween	Donald Pleasence|Jamie Lee Curtis|P.J. Soles|N...	John Carpenter
10760	2700000.0	1.410000e+08	Animal House	John Belushi|Tim Matheson|John Vernon|Verna Bl...	John Landis
10762	15000000.0	5.000000e+07	The Deer Hunter	Robert De Niro|John Cazale|John Savage|Christo...	Michael Cimino
10770	2300000.0	3.500000e+07	Midnight Express	Brad Davis|Irene Miracle|Bo Hopkins|Randy Quai...	Alan Parker

	budget	revenue	original_title	cast	director
10771	4000000.0	3.047142e+07	The Lord of the Rings	Christopher Guard|William Squire|Michael Schol...	Ralph Bakshi
10775	7920000.0	1.456008e+07	Death on the Nile	Peter Ustinov|Mia Farrow|Simon MacCorkindale|L...	John Guillermin
10777	11.0	1.100000e+01	F.I.S.T.	Sylvester Stallone|Rod Steiger|Peter Boyle|Mel...	Norman Jewison
10778	5000000.0	7.230000e+06	Force 10 from Navarone	Harrison Ford|Robert Shaw|Barbara Bach|Edward ...	Guy Hamilton
10779	12000000.0	2.276508e+07	Convoy	Kris Kristofferson|Ali MacGraw|Ernest Borgnine...	Sam Peckinpah
10780	3500000.0	2.404653e+07	Invasion of the Body Snatchers	Donald Sutherland|Brooke Adams|Leonard Nimoy|V...	Philip Kaufman
10788	24000000.0	2.104905e+07	The Wiz	Diana Ross|Michael Jackson|Nipsey Russell|Ted ...	Sidney Lumet
10791	6800000.0	2.651836e+07	Damien: Omen II	William Holden|Lee Grant|Jonathan Scott-Taylor...	Don Taylor|Mike Hodges
10793	1000000.0	3.713768e+06	Watership Down	John Hurt|Richard Briers|Michael Graham Cox|Jo...	Martin Rosen
10822	7500000.0	3.373669e+07	Who's Afraid of Virginia Woolf?	Elizabeth Taylor|Richard Burton|George Segal|S...	Mike Nichols
10828	3000000.0	1.300000e+07	Torn Curtain	Paul Newman|Julie Andrews|Lila Kedrova|HansjÃ¶...	Alfred Hitchcock
10829	4653000.0	6.000000e+06	El Dorado	John Wayne|Robert Mitchum|James Caan|Charlene ...	Howard Hawks

	budget	revenue	original_title	cast	director
10835	12000000.0	2.000000e+07	The Sand Pebbles	Steve McQueen|Richard Attenborough|Richard Cre...	Robert Wise
10848	5115000.0	1.200000e+07	Fantastic Voyage	Stephen Boyd|Raquel Welch|Edmond O'Brien|Donal...	Richard Fleischer

3854 rows × 10 columns

In [49]:

```
#replacing 0 with NaN of runtime column of the dataframe
movie_data['runtime'] = movie_data['runtime'].replace(0, np.NaN)

#calling the column which need to be formatted in datetime and storing t
hose values in them
movie_data.release_date = pd.to_datetime(movie_data['release_date'])

#showing the dataset
movie_data.head()
```

Out[49]:

	budget	revenue	original_title	cast	director	tagline	runti
0	150000000.0	1.513529e+09	Jurassic World	Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...	Colin Trevorrow	The park is open.	124
1	150000000.0	3.784364e+08	Mad Max: Fury Road	Tom Hardy|Charlize Theron|Hugh Keays-Byrne|Nic...	George Miller	What a Lovely Day.	120
2	110000000.0	2.952382e+08	Insurgent	Shailene Woodley|Theo James|Kate Winslet|Ansel...	Robert Schwentke	One Choice Can Destroy You	119
3	200000000.0	2.068178e+09	Star Wars: The Force Awakens	Harrison Ford|Mark Hamill|Carrie Fisher|Adam D...	J.J. Abrams	Every generation has a story.	136
4	190000000.0	1.506249e+09	Furious 7	Vin Diesel|Paul Walker|Jason Statham|Michelle ...	James Wan	Vengeance Hits Home	137

```
In [50]: movie_data.dtypes
```

```
Out[50]: 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
```

```
In [51]: #applymap function changes the columns data type to the type 'argument'
          we pass
         change_coltype = ['budget', 'revenue']

         movie_data[change_coltype] = movie_data[change_coltype].applymap(np.int6
         4)
         #shwoing the datatypes of all columns
         movie_data.dtypes
```

```
Out[51]: budget                      int64
         revenue                     int64
         original_title             object
         cast                       object
         director                   object
         tagline                    object
         runtime                     int64
         genres                     object
         release_date       datetime64[ns]
         release_year                int64
         dtype: object
```

```
In [52]: movie_data.rename(columns = {'budget' : 'budget_(in_US$)', 'revenue' :
         'revenue_(in_US$)'}, inplace = True)
```

```
In [53]: movie_data
```

Out[53]:

	budget_(in_US$)	revenue_(in_US$)	original_title	cast	di
0	150000000	1513528810	Jurassic World	Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...	Colin Trev
1	150000000	378436354	Mad Max: Fury Road	Tom Hardy|Charlize Theron|Hugh Keays-Byrne|Nic...	George M
2	110000000	295238201	Insurgent	Shailene Woodley|Theo James|Kate Winslet|Ansel...	Robert Schwentk
3	200000000	2068178225	Star Wars: The Force Awakens	Harrison Ford|Mark Hamill|Carrie Fisher|Adam D...	J.J. Abrar
4	190000000	1506249360	Furious 7	Vin Diesel|Paul Walker|Jason Statham|Michelle ...	James Wa
5	135000000	532950503	The Revenant	Leonardo DiCaprio|Tom Hardy|Will Poulter|Domhn...	Alejandro GonzÃ¡le IÃ±Ã¡rritu
6	155000000	440603537	Terminator Genisys	Arnold Schwarzenegger|Jason Clarke|Emilia Clar...	Alan Taylo
7	108000000	595380321	The Martian	Matt Damon|Jessica Chastain|Kristen Wiig|Jeff ...	Ridley Sc
8	74000000	1156730962	Minions	Sandra Bullock|Jon Hamm|Michael Keaton|Allison...	Kyle Balda|Pie Coffin
9	175000000	853708609	Inside Out	Amy Poehler|Phyllis Smith|Richard Kind|Bill Ha...	Pete Doct
10	245000000	880674609	Spectre	Daniel Craig|Christoph Waltz|LÃ©a Seydoux|Ralp...	Sam Men
11	176000003	183987723	Jupiter Ascending	Mila Kunis|Channing Tatum|Sean Bean|Eddie Redm...	Lana Wachows Wachows

	budget_(in_US$)	revenue_(in_US$)	original_title	cast	di
12	15000000	36869414	Ex Machina	Domhnall Gleeson|Alicia Vikander|Oscar Isaac|S...	Alex Garla
13	88000000	243637091	Pixels	Adam Sandler|Michelle Monaghan|Peter Dinklage|...	Chris Columbus
14	280000000	1405035767	Avengers: Age of Ultron	Robert Downey Jr.|Chris Hemsworth|Mark Ruffalo...	Joss Whe
15	44000000	155760117	The Hateful Eight	Samuel L. Jackson|Kurt Russell|Jennifer Jason ...	Quentin Tarantino
16	48000000	325771424	Taken 3	Liam Neeson|Forest Whitaker|Maggie Grace|Famke...	Olivier Me
17	130000000	518602163	Ant-Man	Paul Rudd|Michael Douglas|Evangeline Lilly|Cor...	Peyton Re
18	95000000	542351353	Cinderella	Lily James|Cate Blanchett|Richard Madden|Helen...	Kenneth Branagh
19	160000000	650523427	The Hunger Games: Mockingjay - Part 2	Jennifer Lawrence|Josh Hutcherson|Liam Hemswor...	Francis Lawrence
20	190000000	209035668	Tomorrowland	Britt Robertson|George Clooney|Raffey Cassidy|...	Brad Bird
21	30000000	91709827	Southpaw	Jake Gyllenhaal|Rachel McAdams|Forest Whitaker...	Antoine F
22	110000000	470490832	San Andreas	Dwayne Johnson|Alexandra Daddario|Carla Gugino...	Brad Peyt
23	40000000	569651467	Fifty Shades of Grey	Dakota Johnson|Jamie Dornan|Jennifer Ehle|Eloi...	Sam Taylo Johnson

	budget_(in_US$)	revenue_(in_US$)	original_title	cast	di
24	28000000	133346506	The Big Short	Christian Bale|Steve Carell|Ryan Gosling|Brad ...	Adam Mc
25	150000000	682330139	Mission: Impossible - Rogue Nation	Tom Cruise|Jeremy Renner|Simon Pegg|Rebecca Fe...	Christoph McQuarri
26	68000000	215863606	Ted 2	Mark Wahlberg|Seth MacFarlane|Amanda Seyfried|...	Seth MacFarlai
27	81000000	403802136	Kingsman: The Secret Service	Taron Egerton|Colin Firth|Samuel L. Jackson|Mi...	Matthew Vaughn
28	20000000	88346473	Spotlight	Mark Ruffalo|Michael Keaton|Rachel McAdams|Lie...	Tom McC
29	61000000	311256926	Maze Runner: The Scorch Trials	Dylan O'Brien|Kaya Scodelario|Thomas Brodie-Sa...	Wes Ball
...	...	...	...	...	...
10690	8200000	163214286	The Sound of Music	Julie Andrews|Christopher Plummer|Eleanor Park...	Robert W
10691	14000000	111721910	Doctor Zhivago	Omar Sharif|Julie Christie|Geraldine Chaplin|R...	David Lea
10692	5600000	29950000	Those Magnificent Men in Their Flying Machines...	Stuart Whitman|Sarah Miles|James Fox|Alberto S...	Ken Anna
10716	20000000	12000000	The Greatest Story Ever Told	Max von Sydow|Michael Anderson Jr.|Carroll Bak...	George Stevens
10724	7000000	81974493	On Her Majesty's Secret Service	George Lazenby|Diana Rigg|Telly Savalas|Gabrie...	Peter R. H

	budget_(in_US$)	revenue_(in_US$)	original_title	cast	di
10725	6000000	102308889	Butch Cassidy and the Sundance Kid	Paul Newman|Robert Redford|Katharine Ross|Stro...	George R
10727	3600000	44785053	Midnight Cowboy	Dustin Hoffman|Jon Voight|Sylvia Miles|John Mc...	John Schlesing
10728	6244087	638641	The Wild Bunch	Ernest Borgnine|William Holden|Robert Ryan|Edm...	Sam Pec
10755	6000000	181813770	Grease	John Travolta|Olivia Newton-John|Stockard Chan...	Randal Kl
10756	20000000	187884007	Jaws 2	Roy Scheider|Lorraine Gary|Murray Hamilton|Jos...	Jeannot Szwarc
10757	650000	55000000	Dawn of the Dead	David Emge|Ken Foree|Scott H. Reiniger|Gaylen ...	George A Romero
10758	55000000	300218018	Superman	Marlon Brando|Gene Hackman|Christopher Reeve|N...	Richard D
10759	300000	70000000	Halloween	Donald Pleasence|Jamie Lee Curtis|P.J. Soles|N...	John Car
10760	2700000	141000000	Animal House	John Belushi|Tim Matheson|John Vernon|Verna Bl...	John Lan
10762	15000000	50000000	The Deer Hunter	Robert De Niro|John Cazale|John Savage|Christo...	Michael C
10770	2300000	35000000	Midnight Express	Brad Davis|Irene Miracle|Bo Hopkins|Randy Quai...	Alan Park

	budget_(in_US$)	revenue_(in_US$)	original_title	cast	di
10771	4000000	30471420	The Lord of the Rings	Christopher Guard|William Squire|Michael Schol...	Ralph Bal
10775	7920000	14560084	Death on the Nile	Peter Ustinov|Mia Farrow|Simon MacCorkindale|L...	John Guil
10777	11	11	F.I.S.T.	Sylvester Stallone|Rod Steiger|Peter Boyle|Mel...	Norman Jewison
10778	5000000	7230000	Force 10 from Navarone	Harrison Ford|Robert Shaw|Barbara Bach|Edward ...	Guy Ham
10779	12000000	22765081	Convoy	Kris Kristofferson|Ali MacGraw|Ernest Borgnine...	Sam Pecl
10780	3500000	24046533	Invasion of the Body Snatchers	Donald Sutherland|Brooke Adams|Leonard Nimoy|V...	Philip Kau
10788	24000000	21049053	The Wiz	Diana Ross|Michael Jackson|Nipsey Russell|Ted ...	Sidney Lu
10791	6800000	26518355	Damien: Omen II	William Holden|Lee Grant|Jonathan Scott-Taylor...	Don Taylor|Mik Hodges
10793	1000000	3713768	Watership Down	John Hurt|Richard Briers|Michael Graham Cox|Jo...	Martin Ro
10822	7500000	33736689	Who's Afraid of Virginia Woolf?	Elizabeth Taylor|Richard Burton|George Segal|S...	Mike Nich
10828	3000000	13000000	Torn Curtain	Paul Newman|Julie Andrews|Lila Kedrova|HansjÃ¶...	Alfred Hitchcocl
10829	4653000	6000000	El Dorado	John Wayne|Robert Mitchum|James Caan|Charlene ...	Howard H

	budget_(in_US$)	revenue_(in_US$)	original_title	cast	di
10835	12000000	20000000	The Sand Pebbles	Steve McQueen|Richard Attenborough|Richard Cre...	Robert W
10848	5115000	12000000	Fantastic Voyage	Stephen Boyd|Raquel Welch|Edmond O'Brien|Donal...	Richard Fleischer

3854 rows × 10 columns

In [54]:

```
#To calculate profit of each movie, we need to substract the budget from the revenue of each movie
movie_data.insert(2, 'profit', movie_data['revenue_(in_US$)'] - movie_data['budget_(in_US$)'])

#for just in case situations or for convenience, we change the data type to int
movie_data['profit'] = movie_data['profit'].apply(np.int64)

#showing the dataset
movie_data.head()
```

Out[54]:

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

Q1 : Which movie had the greatest and least budget?

In [59]:

```
def highest_lowest(column_name):

    #highest
    #taking the index value of the highest number in profit column
    highest_id = movie_data[column_name].idxmax()
    #calling by index number,storing that row info to a variable
    highest_details = pd.DataFrame(movie_data.loc[highest_id])

    #lowest
    #same processing as above
    lowest_id = movie_data[column_name].idxmin()
    lowest_details = pd.DataFrame(movie_data.loc[lowest_id])

    #concatenating two dataframes
    two_in_one_data = pd.concat([highest_details, lowest_details], axis
= 1)

    return two_in_one_data
```

In [60]:

```
highest_lowest('budget_(in_US$)')
```

Out[60]:

	2244	**2618**
budget_(in_US$)	425000000	1
revenue_(in_US$)	11087569	100
profit	-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

Ans : The Warrior's Way

Q2 : Which movie earns the most and least profit?

```
In [58]: #calling the function and passing the argument
         highest_lowest('profit')
```

Out[58]:

	1386	2244
budget_(in_US$)	237000000	425000000
revenue_(in_US$)	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
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

Ans : Avatar with $2781505847

Q3 : What is the average runtime of all movies?

```
In [61]: def average_func(column_name):

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

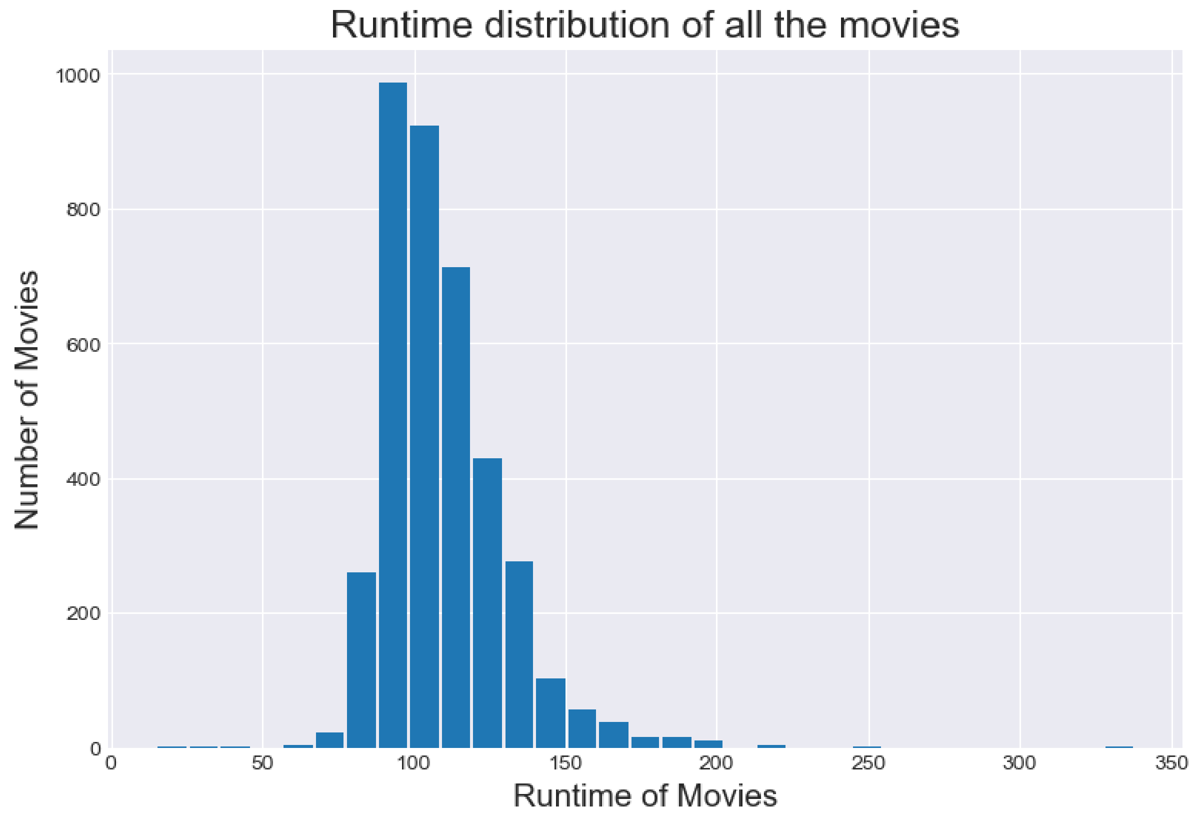
```
In [62]: average_func('runtime')
```

```
Out[62]: 109.22029060716139
```

Ans : 109.22029060716139

In [63]:

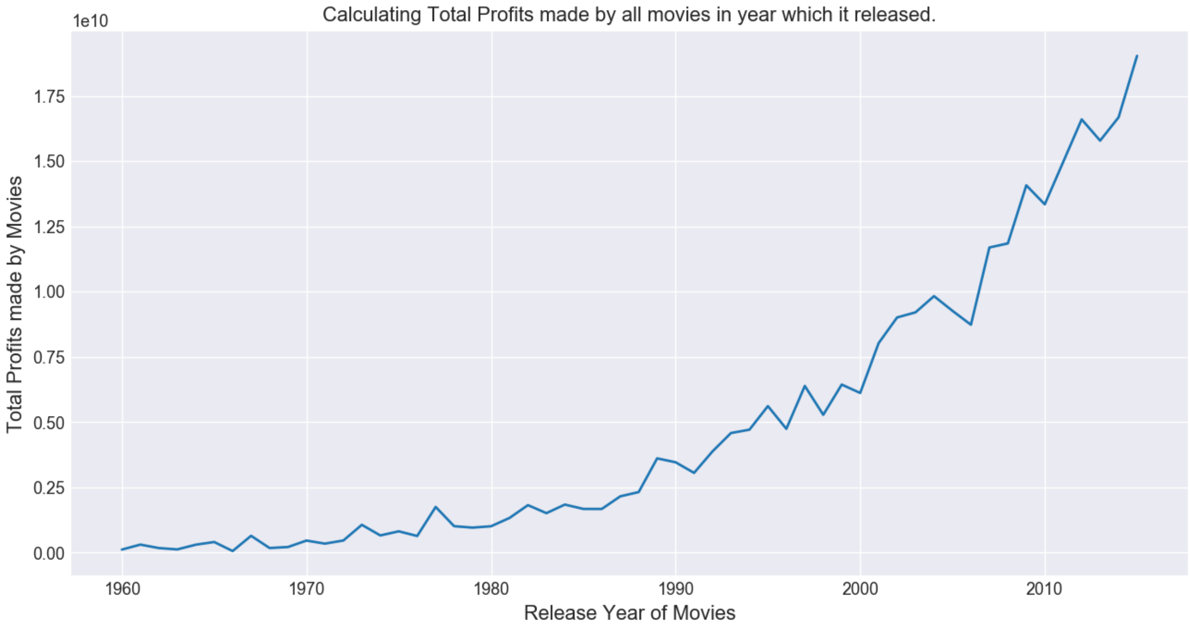
```
#plotting a histogram of runtime of movies

#gives styles to bg plot
sns.set_style('darkgrid')

#chaging the label size, this will change the size of all plots that we plot from now!
plt.rc('xtick', labelsize = 10)
plt.rc('ytick', labelsize = 10)

#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 =31)
#displays the plot
plt.show()
```



Opinion : as you can see the tallest bar here is time interval between 85-100 min(approx) and around 1000 movies out of 3855 movies have the runtime between these time intervals. So we can also say from this graph that mode time of movies is around 85-110 min, has the highest concentration of data points around this time interval. The distribution of this graph is positively skewed or right skewed!

Q4 : In which year we had the most movies making profits?

In [68]:
```
profits_each_year = movie_data.groupby('release_year')['profit'].sum()

#giving the figure size(width, height)
plt.figure(figsize=(12,6), dpi = 130)

#labeling x-axis
plt.xlabel('Release Year of Movies', fontsize = 12)
#labeling y-axis
plt.ylabel('Total Profits made by Movies', fontsize = 12)
#title of a the plot
plt.title('Calculating Total Profits made by all movies in year which it
 released.')

#plotting what needs to be plotted
plt.plot(profits_each_year)

#showing the plot
plt.show()

#shows which year made the highest profit
profits_each_year.idxmax()
```



```
Out[68]: 2015
```

Opinion : The year 2015, shows us the highest peak, having the highest profit than in any year, of more than 18 billion dollars. Not every year had same amount of movies released, the year 2015 had the most movie releases than in any other year. The more old the movies, the more less releases at that year (atleast this is what the dataset shows us).

In [69]:
```
#storing the values in the the form of DataFrame just to get a clean and
 better visual output
profits_each_year = pd.DataFrame(profits_each_year)
profits_each_year.tail()
```

Out[69]:

	profit
release_year	
2011	14966694704
2012	16596845507
2013	15782743325
2014	16676201357
2015	19032145273

Q5: Which directer directed most films?

In [70]:
```
def extract_data(column_name):
    #will take a column, and separate the string by '|'
    all_data = profit_movie_data[column_name].str.cat(sep = '|')

    #giving pandas series and storing the values separately
    all_data = pd.Series(all_data.split('|'))

    #this will us value in descending order
    count = all_data.value_counts(ascending = False)

    return count
```

In [72]:

```
#assinging new dataframe which holds values only of movies having profit
 $100k or more
profit_movie_data = movie_data.query('profit >= 50000000')

#reindexing new dataframe
profit_movie_data.index = range(len(profit_movie_data))
#will initialize dataframe from 1 instead of 0
profit_movie_data.index = profit_movie_data.index + 1

#showing the dataset
profit_movie_data.head(2)
```

Out[72]:

	budget_(in_US$)	revenue_(in_US$)	profit	original_title	cast	director
1	150000000	1513528810	1363528810	Jurassic World	Chris Pratt|Bryce Dallas Howard|Irrfan Khan|Vi...	Colin Trevorrow
2	150000000	378436354	228436354	Mad Max: Fury Road	Tom Hardy|Charlize Theron|Hugh Keays-Byrne|Nic...	George Miller

In [73]:

```
#this will variable will store the return value from a function
director_count = extract_data('director')
#shwoing top 5 values
director_count.head()
```

Out[73]:

```
Steven Spielberg    23
Robert Zemeckis     13
Clint Eastwood      12
Tim Burton          11
Ron Howard          10
dtype: int64
```

Q6 : Which genre were more successful?

In [74]:

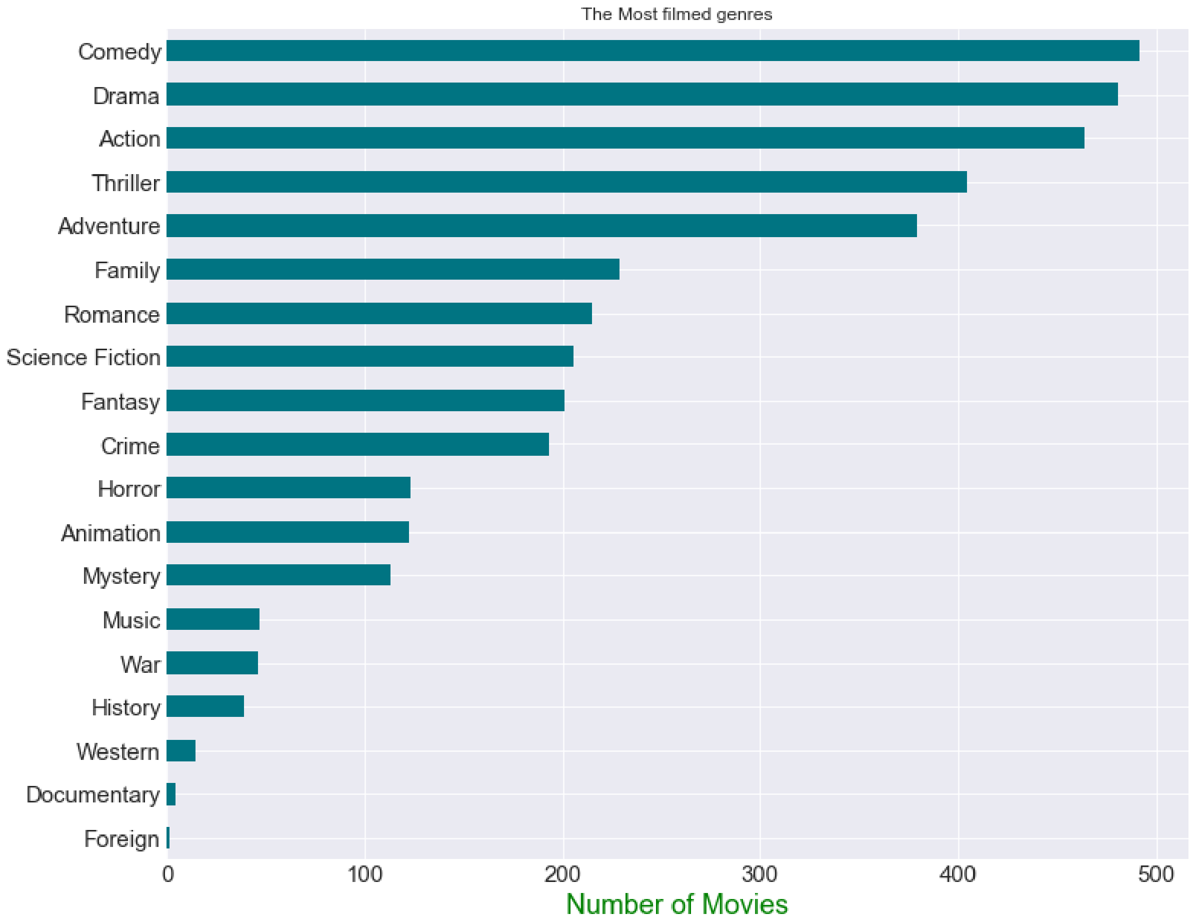
```
#this will variable will store the return value from a function
genre_count = extract_data('genres')
#shwoing top 5 values
genre_count.head()
```

Out[74]:

```
Comedy       492
Drama        481
Action       464
Thriller     405
Adventure    379
dtype: int64
```

In [75]:

```
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()
```

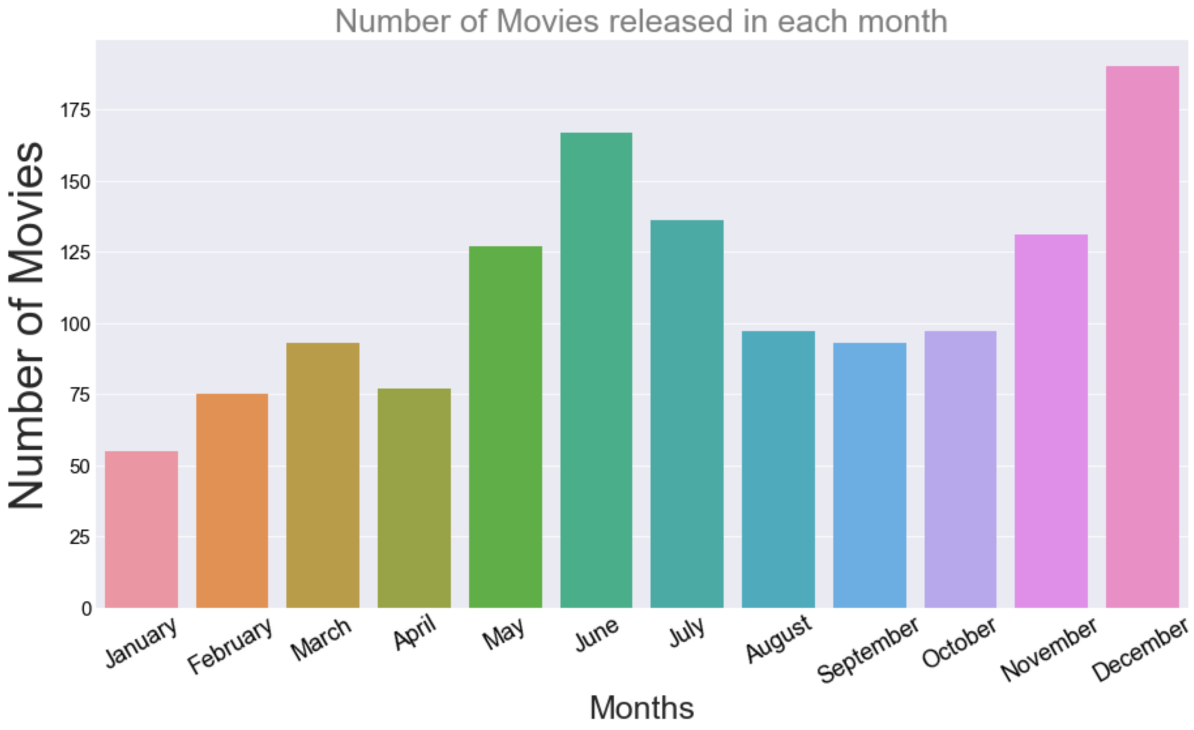


Opinion : Another amazing results. Action, Drama and Comedy genres are the most as visualized but Comedy takes the prize, about 492 movies have genres comedy which make $50M+ in profit. In comparison, even `Adventure` and `Thriller` really play the role.

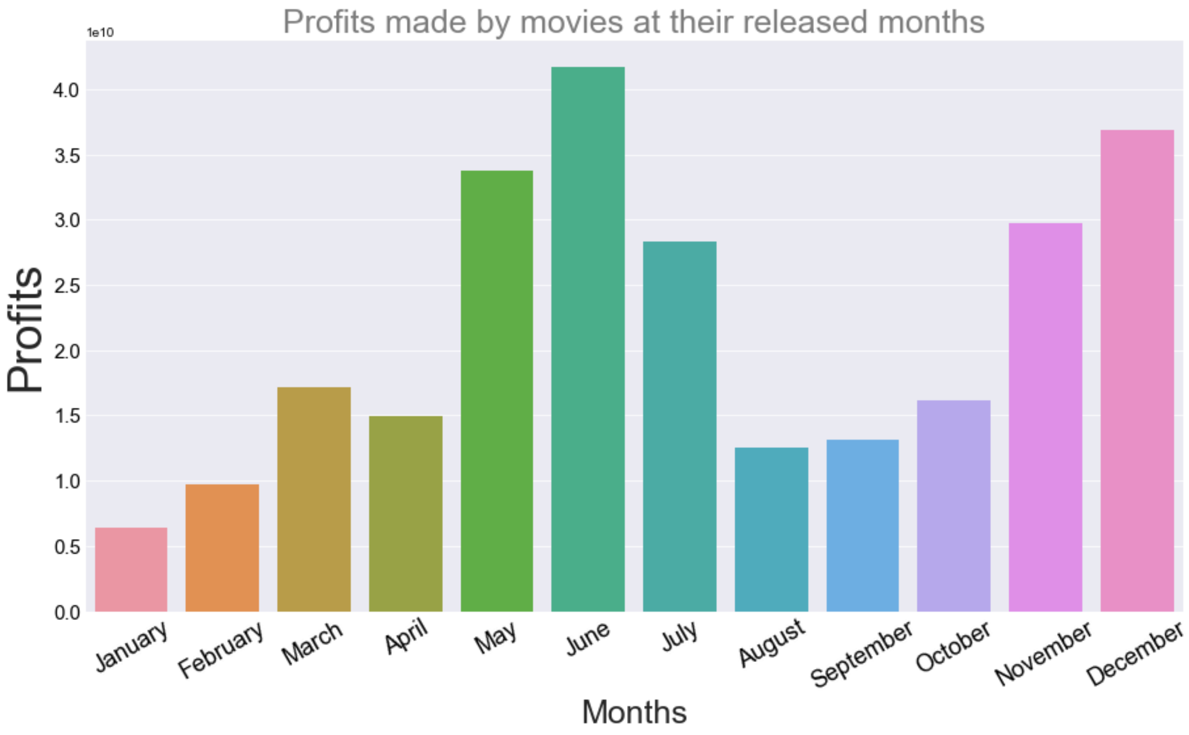
Q7 : Which month released highest number of movies in all of the years? And which month made the most profit?

In [84]:

```
####### Which month released highest number of movies in all of the year
s

#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 fo
rm of index, we extract month from it
groupby_index = index_release_date.groupby([(index_release_date.index.mo
nth)])

#this will give us how many movies are released in each month
monthly_movie_count = groupby_index.profit.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', 'J
uly', 'August', 'September', 'October', 'November', 'December']

monthly_movie_count_bar = sns.barplot(x = monthly_movie_count.index, y =
 monthly_movie_count.profit, data = monthly_movie_count)

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

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

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


Number of Movies released in each month
Number of Movies
0
25
50
75
100
125
150
175
January
February
March
April
May
June
July
August
September
October
November
December
Months

In [85]:
```
######### which month made the most profit

#now since the data is grouped by month, we add 'profit' values to respe
ctive months, saving all this to a new var
monthly_profit = groupby_index.profit.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_p
rofit.profit, 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 relea
sed months',fontsize = 25, alpha = 0.6)

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



Opinion : Seeing the both visualizations of both graphs we see similar trend. Where there are more movie released there is more profit and vice versa but just not for one month i.e December. December is the month where most movie release but when compared to profits it ranks second. This means that december month has high release rate but less profit margin. The month of June where we have around 165 movie releases, which is second highest, is the highest in terms of making profits.

Reference : https://matplotlib.org/users/pyplot_tutorial.html (https://matplotlib.org/users/pyplot_tutorial.html) https://plot.ly/matplotlib/bar-charts/ (https://plot.ly/matplotlib/bar-charts/) http://cs231n.github.io/python-numpy-tutorial/ (http://cs231n.github.io/python-numpy-tutorial/) https://seaborn.pydata.org/ (https://seaborn.pydata.org/) https://docs.python.org/2/library/datetime.html (https://docs.python.org/2/library/datetime.html) https://stackoverflow.com/questions/11346283/renaming-columns-in-pandas (https://stackoverflow.com/questions/11346283/renaming-columns-in-pandas)