Making Movies

Introduction

Microsoft would like to understand how various factors affect the process of making movies. The following datasets have been used to provide insights on the making movies module: movie_budgets.csv.gz: a csv file containing data on movie budgets bom.movie_gross.csv.gz: a csv file containing data on various film grosses. im.db: an sql data base with tables on various movie aspects. movie basics and movie ratings are used in this analysis

#Importing Relevant Libraries

In [1]:
```
import numpy as np
import pandas as pd
import sqlite3
#importing the relevant data visualization libraries
import matplotlib.pyplot as plt
import seaborn as sns
from glob import glob
```

#Loading Data

In [2]:
```
#shows the csv files
csv_files = glob("./zippedData/*.csv.gz")
csv_files
```

Out[2]:
```
['./zippedData\\bom.movie_gross.csv.gz',
 './zippedData\\tmdb.movies.csv.gz',
 './zippedData\\tn.movie_budgets.csv.gz']
```

In [3]:
```
#reads the box office data
bom_df=pd.read_csv('./zippedData\\bom.movie_gross.csv.gz')
```

In [4]:
```
#reads the budgets data
budgets_df=pd.read_csv('./zippedData\\tn.movie_budgets.csv.gz')
```

#Data Understanding(budgets)

In [5]:
```
budgets_df.head()
```

Out[5]:

	id	release_date	movie	production_budget	domestic_gross	worldwide_gross
0	1	Dec 18, 2009	Avatar	$425,000,000	$760,507,625	$2,776,345,279
1	2	May 20, 2011	Pirates of the Caribbean: On Stranger Tides	$410,600,000	$241,063,875	$1,045,663,875
2	3	Jun 7, 2019	Dark Phoenix	$350,000,000	$42,762,350	$149,762,350
3	4	May 1, 2015	Avengers: Age of Ultron	$330,600,000	$459,005,868	$1,403,013,963

	id	release_date	movie	production_budget	domestic_gross	worldwide_gross
4	5	Dec 15, 2017	Star Wars Ep. VIII: The Last Jedi	$317,000,000	$620,181,382	$1,316,721,747

In [6]:
```
budgets_df.tail()
```

Out[6]:

	id	release_date	movie	production_budget	domestic_gross	worldwide_gross
5777	78	Dec 31, 2018	Red 11	$7,000	$0	$0
5778	79	Apr 2, 1999	Following	$6,000	$48,482	$240,495
5779	80	Jul 13, 2005	Return to the Land of Wonders	$5,000	$1,338	$1,338
5780	81	Sep 29, 2015	A Plague So Pleasant	$1,400	$0	$0
5781	82	Aug 5, 2005	My Date With Drew	$1,100	$181,041	$181,041

In [7]:
```
budgets_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 5782 entries, 0 to 5781
Data columns (total 6 columns):
 #   Column             Non-Null Count  Dtype 
---  ------             --------------  ----- 
 0   id                 5782 non-null   int64 
 1   release_date       5782 non-null   object
 2   movie              5782 non-null   object
 3   production_budget  5782 non-null   object
 4   domestic_gross     5782 non-null   object
 5   worldwide_gross    5782 non-null   object
dtypes: int64(1), object(5)
memory usage: 271.2+ KB
```

In [8]:
```
budgets_df.describe()
```

Out[8]:

	id
count	5782.000000
mean	50.372363
std	28.821076
min	1.000000
25%	25.000000
50%	50.000000
75%	75.000000
max	100.000000

There are no null values.

#Cleaning(budgets)

In [9]:
```
#checking for duplicates
budgets_df.duplicated().any()
```

Out[9]:
```
False
```

In [10]:
```
budgets_df['production_budget'][1]
```

Out[10]:
```
'$410,600,000'
```

In [11]:
```
#converting to a numeric data type
def numclean(df,col):
    df[col]=df[col].str.replace("$","").str.replace(",","").astype(float)
    return df
numclean(budgets_df,'production_budget')
numclean(budgets_df,'domestic_gross')
numclean(budgets_df,'worldwide_gross')
```

Out[11]:

	id	release_date	movie	production_budget	domestic_gross	worldwide_gross
0	1	Dec 18, 2009	Avatar	425000000.0	760507625.0	2.776345e+09
1	2	May 20, 2011	Pirates of the Caribbean: On Stranger Tides	410600000.0	241063875.0	1.045664e+09
2	3	Jun 7, 2019	Dark Phoenix	350000000.0	42762350.0	1.497624e+08
3	4	May 1, 2015	Avengers: Age of Ultron	330600000.0	459005868.0	1.403014e+09
4	5	Dec 15, 2017	Star Wars Ep. VIII: The Last Jedi	317000000.0	620181382.0	1.316722e+09
...	...	...	...	...	...	...
5777	78	Dec 31, 2018	Red 11	7000.0	0.0	0.000000e+00
5778	79	Apr 2, 1999	Following	6000.0	48482.0	2.404950e+05
5779	80	Jul 13, 2005	Return to the Land of Wonders	5000.0	1338.0	1.338000e+03
5780	81	Sep 29, 2015	A Plague So Pleasant	1400.0	0.0	0.000000e+00
5781	82	Aug 5, 2005	My Date With Drew	1100.0	181041.0	1.810410e+05

5782 rows × 6 columns

In [12]:
```
budgets_df.head()
```

Out[12]:

	id	release_date	movie	production_budget	domestic_gross	worldwide_gross
0	1	Dec 18, 2009	Avatar	425000000.0	760507625.0	2.776345e+09
1	2	May 20, 2011	Pirates of the Caribbean: On Stranger Tides	410600000.0	241063875.0	1.045664e+09
2	3	Jun 7, 2019	Dark Phoenix	350000000.0	42762350.0	1.497624e+08
3	4	May 1, 2015	Avengers: Age of Ultron	330600000.0	459005868.0	1.403014e+09
4	5	Dec 15, 2017	Star Wars Ep. VIII: The Last Jedi	317000000.0	620181382.0	1.316722e+09

In [13]:
```
budgets_df.tail()
```

Out[13]:

	id	release_date	movie	production_budget	domestic_gross	worldwide_gross
5777	78	Dec 31, 2018	Red 11	7000.0	0.0	0.0
5778	79	Apr 2, 1999	Following	6000.0	48482.0	240495.0
5779	80	Jul 13, 2005	Return to the Land of Wonders	5000.0	1338.0	1338.0
5780	81	Sep 29, 2015	A Plague So Pleasant	1400.0	0.0	0.0
5781	82	Aug 5, 2005	My Date With Drew	1100.0	181041.0	181041.0

In [14]:
```
#dropping the id column as it served no function
budgets_cleaned=budgets_df.drop('id',axis=1)
budgets_cleaned.head()
```

Out[14]:

	release_date	movie	production_budget	domestic_gross	worldwide_gross
0	Dec 18, 2009	Avatar	425000000.0	760507625.0	2.776345e+09
1	May 20, 2011	Pirates of the Caribbean: On Stranger Tides	410600000.0	241063875.0	1.045664e+09
2	Jun 7, 2019	Dark Phoenix	350000000.0	42762350.0	1.497624e+08
3	May 1, 2015	Avengers: Age of Ultron	330600000.0	459005868.0	1.403014e+09
4	Dec 15, 2017	Star Wars Ep. VIII: The Last Jedi	317000000.0	620181382.0	1.316722e+09

In [15]:
```
#convert release date to date_time format
budgets_cleaned['release_date'] = pd.to_datetime(budgets_cleaned['release_date'])
budgets_cleaned.head()
```

Out[15]:

	release_date	movie	production_budget	domestic_gross	worldwide_gross
0	2009-12-18	Avatar	425000000.0	760507625.0	2.776345e+09
1	2011-05-20	Pirates of the Caribbean: On Stranger Tides	410600000.0	241063875.0	1.045664e+09
2	2019-06-07	Dark Phoenix	350000000.0	42762350.0	1.497624e+08
3	2015-05-01	Avengers: Age of Ultron	330600000.0	459005868.0	1.403014e+09
4	2017-12-15	Star Wars Ep. VIII: The Last Jedi	317000000.0	620181382.0	1.316722e+09

#Data Understanding(Box office)

In [16]:
```
bom_df.head()
```

Out[16]:

	title	studio	domestic_gross	foreign_gross	year
0	Toy Story 3	BV	415000000.0	652000000	2010
1	Alice in Wonderland (2010)	BV	334200000.0	691300000	2010
2	Harry Potter and the Deathly Hallows Part 1	WB	296000000.0	664300000	2010
3	Inception	WB	292600000.0	535700000	2010

	title	studio	domestic_gross	foreign_gross	year
4	Shrek Forever After	P/DW	238700000.0	513900000	2010

In [17]:
```
bom_df.tail()
```

Out[17]:

	title	studio	domestic_gross	foreign_gross	year
3382	The Quake	Magn.	6200.0	NaN	2018
3383	Edward II (2018 re-release)	FM	4800.0	NaN	2018
3384	El Pacto	Sony	2500.0	NaN	2018
3385	The Swan	Synergetic	2400.0	NaN	2018
3386	An Actor Prepares	Grav.	1700.0	NaN	2018

In [18]:
```
bom_df.shape
```

Out[18]:
```
(3387, 5)
```

In [19]:
```
bom_df.describe()
```

Out[19]:

	domestic_gross	year
count	3.359000e+03	3387.000000
mean	2.874585e+07	2013.958075
std	6.698250e+07	2.478141
min	1.000000e+02	2010.000000
25%	1.200000e+05	2012.000000
50%	1.400000e+06	2014.000000
75%	2.790000e+07	2016.000000
max	9.367000e+08	2018.000000

In [20]:
```
bom_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 3387 entries, 0 to 3386
Data columns (total 5 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   title           3387 non-null   object 
 1   studio          3382 non-null   object 
 2   domestic_gross  3359 non-null   float64
 3   foreign_gross   2037 non-null   object 
 4   year            3387 non-null   int64  
dtypes: float64(1), int64(1), object(3)
memory usage: 132.4+ KB
```

There are null values in the following columns: studio
domestic_gross foreign_gross

#Data Cleaning(Box Office)

In [21]:
```
# number of rows with null values
```

```
bom_df.isnull().sum()
```

Out[21]:
```
title               0
studio              5
domestic_gross     28
foreign_gross    1350
year                0
dtype: int64
```

In [22]:
```
# sample rows where foreign_gross has no missing values
bom_df[bom_df["studio"].notna()].sample(5, random_state = 1)
```

Out[22]:

	title	studio	domestic_gross	foreign_gross	year
571	Poetry	Kino	356000.0	1900000	2011
3343	The Third Murder	FM	89300.0	NaN	2018
1850	Camp X-Ray	IFC	13300.0	NaN	2014
3257	Don't Worry He Won't Get Far on Foot	Amazon	1400000.0	2500000	2018
1512	Non-Stop	Uni.	92200000.0	130600000	2014

In [23]:
```
# sample rows where foreign_gross has missing values
bom_df[bom_df["studio"].isna()]
```

Out[23]:

	title	studio	domestic_gross	foreign_gross	year
210	Outside the Law (Hors-la-loi)	NaN	96900.0	3300000	2010
555	Fireflies in the Garden	NaN	70600.0	3300000	2011
933	Keith Lemon: The Film	NaN	NaN	4000000	2012
1862	Plot for Peace	NaN	7100.0	NaN	2014
2825	Secret Superstar	NaN	NaN	122000000	2017

In [24]:
```
#dropping null values in the studio column
bom_df.dropna(subset = ["studio"], inplace = True)
```

In [25]:
```
bom_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 3382 entries, 0 to 3386
Data columns (total 5 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   title           3382 non-null   object 
 1   studio          3382 non-null   object 
 2   domestic_gross  3356 non-null   float64
 3   foreign_gross   2033 non-null   object 
 4   year            3382 non-null   int64  
dtypes: float64(1), int64(1), object(3)
memory usage: 158.5+ KB
```

In [26]:
```
# percentage of missing values in domestic_gross
bom_df["domestic_gross"].isnull().sum()/len(bom_df)*100
```

Out[26]:
```
0.768775872264932
```

Since the percentage is quite small, we can drop the rows.

In [27]:
```
bom_df.dropna(subset = ["domestic_gross"], inplace = True)
```

```
bom_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 3356 entries, 0 to 3386
Data columns (total 5 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   title           3356 non-null   object 
 1   studio          3356 non-null   object 
 2   domestic_gross  3356 non-null   float64
 3   foreign_gross   2007 non-null   object 
 4   year            3356 non-null   int64  
dtypes: float64(1), int64(1), object(3)
memory usage: 157.3+ KB
```

In [28]:
```
# percentage of missing values in foreign gross
bom_df["foreign_gross"].isnull().sum()/len(bom_df)*100
```

Out[28]:
```
40.19666269368295
```

Not droppable as it is too large. We shall replace the values with either the mean or median depending on our investigation.

In [29]:
```
# preview of foreign gross column
bom_df["foreign_gross"].head()
```

Out[29]:
```
0    652000000
1    691300000
2    664300000
3    535700000
4    513900000
Name: foreign_gross, dtype: object
```

In [30]:
```
#converting to numerical values
bom_df["foreign_gross"] = [float(str(i).replace(",", "")) for i in bom_df["foreign_g
bom_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 3356 entries, 0 to 3386
Data columns (total 5 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   title           3356 non-null   object 
 1   studio          3356 non-null   object 
 2   domestic_gross  3356 non-null   float64
 3   foreign_gross   2007 non-null   float64
 4   year            3356 non-null   int64  
dtypes: float64(2), int64(1), object(2)
memory usage: 157.3+ KB
```

In [31]:
```
bom_df["foreign_gross"].mean()
```

Out[31]:
```
75790384.84130543
```

In [32]:
```
bom_df["foreign_gross"].median()
```

Out[32]:
```
19400000.0
```

In [33]:
```
#replacing with mean as replacing with the median affects mean
bom_df["foreign_gross"].fillna(bom_df["foreign_gross"].mean(), inplace=True)
bom_df["foreign_gross"].mean()
```

Out[33]:
```
75790384.84130543
```

In [34]:
```
bom_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 3356 entries, 0 to 3386
Data columns (total 5 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   title           3356 non-null   object 
 1   studio          3356 non-null   object 
 2   domestic_gross  3356 non-null   float64
 3   foreign_gross   3356 non-null   float64
 4   year            3356 non-null   int64  
dtypes: float64(2), int64(1), object(2)
memory usage: 157.3+ KB
```

In [35]:
```
bom_df.duplicated().any()
```

Out[35]:
```
False
```

In [36]:
```
bom_df.describe()
```

Out[36]:

	domestic_gross	foreign_gross	year
count	3.356000e+03	3.356000e+03	3356.000000
mean	2.877149e+07	7.579038e+07	2013.970203
std	6.700694e+07	1.068472e+08	2.479064
min	1.000000e+02	6.000000e+02	2010.000000
25%	1.200000e+05	1.220000e+07	2012.000000
50%	1.400000e+06	7.579038e+07	2014.000000
75%	2.795000e+07	7.579038e+07	2016.000000
max	9.367000e+08	9.605000e+08	2018.000000

#Data Understanding(imdb)

In [37]:
```
conn= sqlite3.connect("./zippedData/im.db_1/im.db")
```

In [38]:
```
#introducing cursor
cur=conn.cursor()
```

In [39]:
```
#selecting table names
cur.execute("""SELECT name FROM sqlite_master WHERE type = 'table';""")
table_names = cur.fetchall()
table_names
```

Out[39]:
```
[('movie_basics',),
 ('directors',),
 ('known_for',),
 ('movie_akas',),
 ('movie_ratings',),
 ('persons',),
 ('principals',),
 ('writers',)]
```

In [40]:
```
#reading all columns using pandas
moviebasics_df=pd.read_sql("""
SELECT * FROM movie_basics;
""", conn)
```

In [41]:
```
movieratings_df=pd.read_sql("""
SELECT * FROM movie_ratings;
""", conn)
```

#Data Cleaning(movie_basics)

In [42]:
```
pd.read_sql("""
SELECT * FROM movie_basics;
""", conn).head().head()
```

Out[42]:

	movie_id	primary_title	original_title	start_year	runtime_minutes	genres
0	tt0063540	Sunghursh	Sunghursh	2013	175.0	Action,Crime,Drama
1	tt0066787	One Day Before the Rainy Season	Ashad Ka Ek Din	2019	114.0	Biography,Drama
2	tt0069049	The Other Side of the Wind	The Other Side of the Wind	2018	122.0	Drama
3	tt0069204	Sabse Bada Sukh	Sabse Bada Sukh	2018	NaN	Comedy,Drama
4	tt0100275	The Wandering Soap Opera	La Telenovela Errante	2017	80.0	Comedy,Drama,Fantasy

In [43]:
```
pd.read_sql("""
SELECT * FROM movie_basics;
""", conn).head().tail()
```

Out[43]:

	movie_id	primary_title	original_title	start_year	runtime_minutes	genres
0	tt0063540	Sunghursh	Sunghursh	2013	175.0	Action,Crime,Drama
1	tt0066787	One Day Before the Rainy Season	Ashad Ka Ek Din	2019	114.0	Biography,Drama
2	tt0069049	The Other Side of the Wind	The Other Side of the Wind	2018	122.0	Drama
3	tt0069204	Sabse Bada Sukh	Sabse Bada Sukh	2018	NaN	Comedy,Drama
4	tt0100275	The Wandering Soap Opera	La Telenovela Errante	2017	80.0	Comedy,Drama,Fantasy

In [44]:
```
pd.read_sql("""
SELECT * FROM movie_basics;
""", conn).info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 146144 entries, 0 to 146143
Data columns (total 6 columns):
 #   Column           Non-Null Count   Dtype  
---  ------           --------------   -----  
 0   movie_id         146144 non-null  object 
 1   primary_title    146144 non-null  object 
 2   original_title   146123 non-null  object 
 3   start_year       146144 non-null  int64  
 4   runtime_minutes  114405 non-null  float64
 5   genres           140736 non-null  object 
```

```
dtypes: float64(1), int64(1), object(4)
memory usage: 6.7+ MB
```

Discrepancies in entries indicate existence of null values.

In [45]:
```
pd.read_sql("""
SELECT * FROM movie_basics;
""", conn).describe()
```

Out[45]:

	start_year	runtime_minutes
count	146144.000000	114405.000000
mean	2014.621798	86.187247
std	2.733583	166.360590
min	2010.000000	1.000000
25%	2012.000000	70.000000
50%	2015.000000	87.000000
75%	2017.000000	99.000000
max	2115.000000	51420.000000

In [46]:
```
#finding the total of the null values
moviebasics_df.isna().sum()
```

Out[46]:
```
movie_id              0
primary_title         0
original_title       21
start_year            0
runtime_minutes    31739
genres              5408
dtype: int64
```

In [47]:
```
#finding the percentage of null values in the original_title column
((moviebasics_df["original_title"].isna().sum()/len(moviebasics_df)) * 100)
```

Out[47]:
```
0.014369389095686446
```

In [48]:
```
#Drop as percentage is insignificant
moviebasics_df.dropna(subset = ["original_title"], inplace = True)
```

In [49]:
```
moviebasics_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 146123 entries, 0 to 146143
Data columns (total 6 columns):
 #   Column           Non-Null Count   Dtype  
---  ------           --------------   -----  
 0   movie_id         146123 non-null  object 
 1   primary_title    146123 non-null  object 
 2   original_title   146123 non-null  object 
 3   start_year       146123 non-null  int64  
 4   runtime_minutes  114401 non-null  float64
 5   genres           140734 non-null  object 
dtypes: float64(1), int64(1), object(4)
memory usage: 7.8+ MB
```

In [50]:
```
#finding percentage of null values in run_time minutes column
((moviebasics_df["runtime_minutes"].isna().sum()/len(moviebasics_df)) * 100)
```

Out[50]:
```
21.709108080179025
```

replacing with either mean or median as it is a substantial percentage

In [51]:
```
moviebasics_df["runtime_minutes"].mean()
```

Out[51]:
```
86.18612599540214
```

In [52]:
```
moviebasics_df["runtime_minutes"].median()
```

Out[52]:
```
87.0
```

In [53]:
```
moviebasics_df["runtime_minutes"].fillna(moviebasics_df["runtime_minutes"].mean(),in
```

In [54]:
```
#investigating effect on mean
moviebasics_df["runtime_minutes"].mean()
```

Out[54]:
```
86.18612599540215
```

In [55]:
```
moviebasics_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 146123 entries, 0 to 146143
Data columns (total 6 columns):
 #   Column           Non-Null Count   Dtype  
---  ------           --------------   -----  
 0   movie_id         146123 non-null  object 
 1   primary_title    146123 non-null  object 
 2   original_title   146123 non-null  object 
 3   start_year       146123 non-null  int64  
 4   runtime_minutes  146123 non-null  float64
 5   genres           140734 non-null  object 
dtypes: float64(1), int64(1), object(4)
memory usage: 7.8+ MB
```

In [56]:
```
((moviebasics_df["genres"].isna().sum()/len(moviebasics_df)) * 100)
```

Out[56]:
```
3.6879888860754293
```

In [57]:
```
#Dropping as value is insignificant
moviebasics_df.dropna(subset = ["genres"], inplace = True)
moviebasics_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 140734 entries, 0 to 146143
Data columns (total 6 columns):
 #   Column           Non-Null Count   Dtype  
---  ------           --------------   -----  
 0   movie_id         140734 non-null  object 
 1   primary_title    140734 non-null  object 
 2   original_title   140734 non-null  object 
 3   start_year       140734 non-null  int64  
 4   runtime_minutes  140734 non-null  float64
 5   genres           140734 non-null  object 
dtypes: float64(1), int64(1), object(4)
memory usage: 7.5+ MB
```

In [58]:
```
#confirming null values have been dropped
moviebasics_df.isna().sum()
```

Out[58]:
```
movie_id           0
primary_title      0
original_title     0
start_year         0
runtime_minutes    0
```

```
genres             0
dtype: int64
```

In [59]:
```
#checking for duplicates
moviebasics_df.duplicated().any()
```

Out[59]:
```
False
```

#Data Cleaning(movie_ratings)

In [60]:
```
movieratings_df.head()
```

Out[60]:

	movie_id	averagerating	numvotes
0	tt10356526	8.3	31
1	tt10384606	8.9	559
2	tt1042974	6.4	20
3	tt1043726	4.2	50352
4	tt1060240	6.5	21

In [61]:
```
movieratings_df.tail()
```

Out[61]:

	movie_id	averagerating	numvotes
73851	tt9805820	8.1	25
73852	tt9844256	7.5	24
73853	tt9851050	4.7	14
73854	tt9886934	7.0	5
73855	tt9894098	6.3	128

In [62]:
```
movieratings_df.shape
```

Out[62]:
```
(73856, 3)
```

In [63]:
```
movieratings_df.describe()
```

Out[63]:

	averagerating	numvotes
count	73856.000000	7.385600e+04
mean	6.332729	3.523662e+03
std	1.474978	3.029402e+04
min	1.000000	5.000000e+00
25%	5.500000	1.400000e+01
50%	6.500000	4.900000e+01
75%	7.400000	2.820000e+02
max	10.000000	1.841066e+06

In [64]:
```
movieratings_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 73856 entries, 0 to 73855
Data columns (total 3 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   movie_id       73856 non-null  object
 1   averagerating  73856 non-null  float64
 2   numvotes       73856 non-null  int64
dtypes: float64(1), int64(1), object(1)
memory usage: 1.7+ MB
```

There are no null values.

In [65]:
```
movieratings_df.duplicated().any()
```

Out[65]:
```
False
```

#DATA ANALYSIS

Budgets

In [66]:
```
#preview
budgets_df.head()
```

Out[66]:

	id	release_date	movie	production_budget	domestic_gross	worldwide_gross
0	1	Dec 18, 2009	Avatar	425000000.0	760507625.0	2.776345e+09
1	2	May 20, 2011	Pirates of the Caribbean: On Stranger Tides	410600000.0	241063875.0	1.045664e+09
2	3	Jun 7, 2019	Dark Phoenix	350000000.0	42762350.0	1.497624e+08
3	4	May 1, 2015	Avengers: Age of Ultron	330600000.0	459005868.0	1.403014e+09
4	5	Dec 15, 2017	Star Wars Ep. VIII: The Last Jedi	317000000.0	620181382.0	1.316722e+09

In [67]:
```
# statistical summaries
budgets_df['production_budget'].describe()
```

Out[67]:
```
count    5.782000e+03
mean     3.158776e+07
std      4.181208e+07
min      1.100000e+03
25%      5.000000e+06
50%      1.700000e+07
75%      4.000000e+07
max      4.250000e+08
Name: production_budget, dtype: float64
```

In [68]:
```
#previewing columns
budgets_df[['movie', 'production_budget']]
```

Out[68]:

	movie	production_budget
0	Avatar	425000000.0
1	Pirates of the Caribbean: On Stranger Tides	410600000.0
2	Dark Phoenix	350000000.0

	movie	production_budget
3	Avengers: Age of Ultron	330600000.0
4	Star Wars Ep. VIII: The Last Jedi	317000000.0
...	...	...
5777	Red 11	7000.0
5778	Following	6000.0
5779	Return to the Land of Wonders	5000.0
5780	A Plague So Pleasant	1400.0
5781	My Date With Drew	1100.0

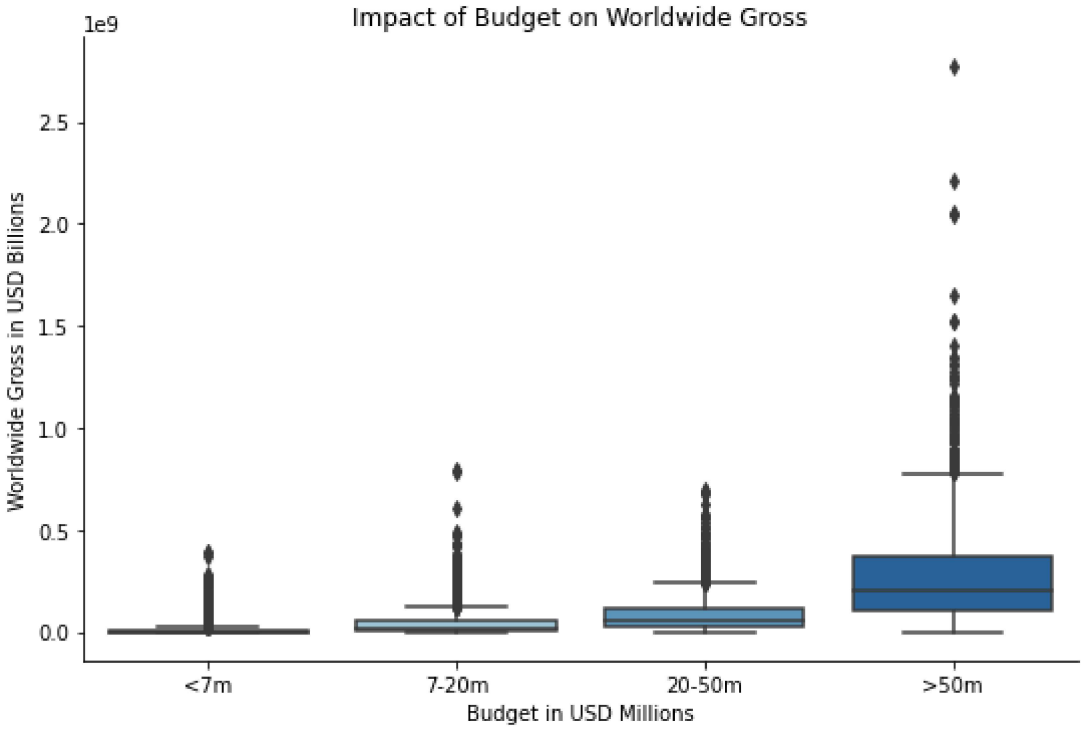
5782 rows × 2 columns

In [69]:
```
#float
budgets_df['production_budget'].describe().apply(lambda x: format(x, 'f'))
```

Out[69]:
```
count         5782.000000
mean      31587757.096506
std       41812076.826943
min           1100.000000
25%        5000000.000000
50%       17000000.000000
75%       40000000.000000
max      425000000.000000
Name: production_budget, dtype: object
```

In [70]:
```
bins = [0, 7000000, 20000000, 50000000, np.inf]
names = ['<7m', '7-20m', '20-50m', '>50m']
budgets_df['budget_range'] = pd.cut(budgets_df['production_budget'], bins, labels=na
```

In [71]:
```
#plotting to see the budget range
sns.catplot(x = 'budget_range', y = 'worldwide_gross', aspect = 1.5, kind = 'box',
            palette="Blues", data = budgets_df)
plt.title('Impact of Budget on Worldwide Gross')
plt.xlabel('Budget in USD Millions')
plt.ylabel('Worldwide Gross in USD Billions')
plt.show()
```



#Recommendation based on budgets

A budget of above $50 million leads to a greater worldwide gross thus higher profits

#Release Month

In [72]:
```
# Create month column
budgets_df['release_month'] = pd.DatetimeIndex(budgets_df['release_date']).month
```

In [73]:
```
budgets_df.head()
```

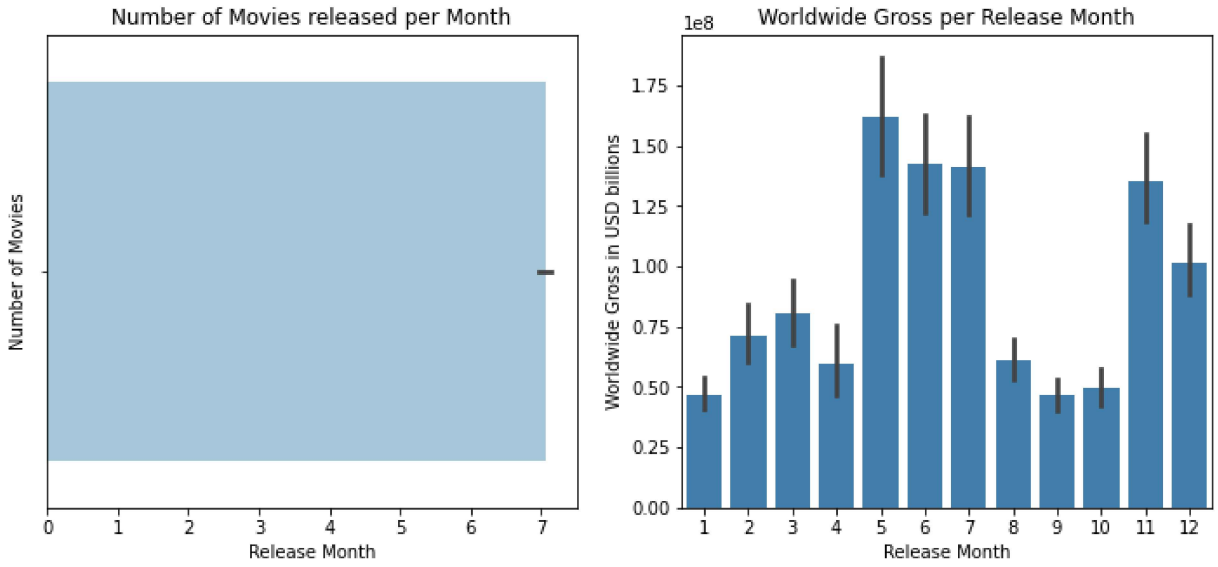
Out[73]:

	id	release_date	movie	production_budget	domestic_gross	worldwide_gross	budget_range
0	1	Dec 18, 2009	Avatar	425000000.0	760507625.0	2.776345e+09	>50m
1	2	May 20, 2011	Pirates of the Caribbean: On Stranger Tides	410600000.0	241063875.0	1.045664e+09	>50m
2	3	Jun 7, 2019	Dark Phoenix	350000000.0	42762350.0	1.497624e+08	>50m
3	4	May 1, 2015	Avengers: Age of Ultron	330600000.0	459005868.0	1.403014e+09	>50m
4	5	Dec 15, 2017	Star Wars Ep. VIII: The Last Jedi	317000000.0	620181382.0	1.316722e+09	>50m

In [74]:
```
#defining function to plot
```

```
def releasemonthplot(df):
    fig, ax = plt.subplots(ncols = 2, nrows = 1, figsize = (12,5))
    sns.barplot( x = 'release_month', color = '#9ecae1',data = df, ax = ax[0])
    ax[0].set_xlabel('Release Month')
    ax[0].set_ylabel('Number of Movies')
    ax[0].set_title('Number of Movies released per Month')
    sns.barplot( x = 'release_month', y = 'worldwide_gross', color = '#3182bd',
                data = df, ax = ax[1])
    ax[1].set_xlabel('Release Month')
    ax[1].set_ylabel('Worldwide Gross in USD billions')
    ax[1].set_title('Worldwide Gross per Release Month')
    plt.close(2)
    plt.close(3)
    return plt.show()
```

In [75]:
```
#Running function for dataframe
releasemonthplot(budgets_df)
```



#Recommendation(Release month)

There is generally a higher worldwide gross in June and July thus one should aim to release movies then

#Data Analysis(Runtime)

In [76]:
```
moviebasics_df.head()
```

Out[76]:

	movie_id	primary_title	original_title	start_year	runtime_minutes	genres
0	tt0063540	Sunghursh	Sunghursh	2013	175.000000	Action,Crime,Drama
1	tt0066787	One Day Before the Rainy Season	Ashad Ka Ek Din	2019	114.000000	Biography,Drama
2	tt0069049	The Other Side of the Wind	The Other Side of the Wind	2018	122.000000	Drama
3	tt0069204	Sabse Bada Sukh	Sabse Bada Sukh	2018	86.186126	Comedy,Drama

	movie_id	primary_title	original_title	start_year	runtime_minutes	genres
4	tt0100275	The Wandering Soap Opera	La Telenovela Errante	2017	80.000000	Comedy,Drama,Fantasy

In [77]:
```
moviebasics_df[['primary_title', 'runtime_minutes']]
```

Out[77]:

	primary_title	runtime_minutes
0	Sunghursh	175.000000
1	One Day Before the Rainy Season	114.000000
2	The Other Side of the Wind	122.000000
3	Sabse Bada Sukh	86.186126
4	The Wandering Soap Opera	80.000000
...	...	...
146138	The Secret of China	86.186126
146139	Kuambil Lagi Hatiku	123.000000
146140	Rodolpho Teóphilo - O Legado de um Pioneiro	86.186126
146141	Dankyavar Danka	86.186126
146143	Chico Albuquerque - Revelações	86.186126

140734 rows × 2 columns

In [78]:
```
moviebasics_df['runtime_minutes'].describe()
```

Out[78]:
```
count    140734.000000
mean         86.246280
std         149.934119
min           1.000000
25%          75.000000
50%          86.186126
75%          95.000000
max       51420.000000
Name: runtime_minutes, dtype: float64
```

In [79]:
```
#renaming column so as to join the two dataframes
moviebasics_df.rename(columns = {'primary_title':'movie'}, inplace = True)
```

In [80]:
```
moviebasics_df.head()
```

Out[80]:

	movie_id	movie	original_title	start_year	runtime_minutes	genres
0	tt0063540	Sunghursh	Sunghursh	2013	175.000000	Action,Crime,Drama
1	tt0066787	One Day Before the Rainy Season	Ashad Ka Ek Din	2019	114.000000	Biography,Drama
2	tt0069049	The Other Side of the Wind	The Other Side of the Wind	2018	122.000000	Drama
3	tt0069204	Sabse Bada Sukh	Sabse Bada Sukh	2018	86.186126	Comedy,Drama
4	tt0100275	The Wandering Soap Opera	La Telenovela Errante	2017	80.000000	Comedy,Drama,Fantasy

In [81]:
```
#joining the dataframes
movies_and_budgets = budgets_df.merge(moviebasics_df, on = "movie", how = "inner")
```

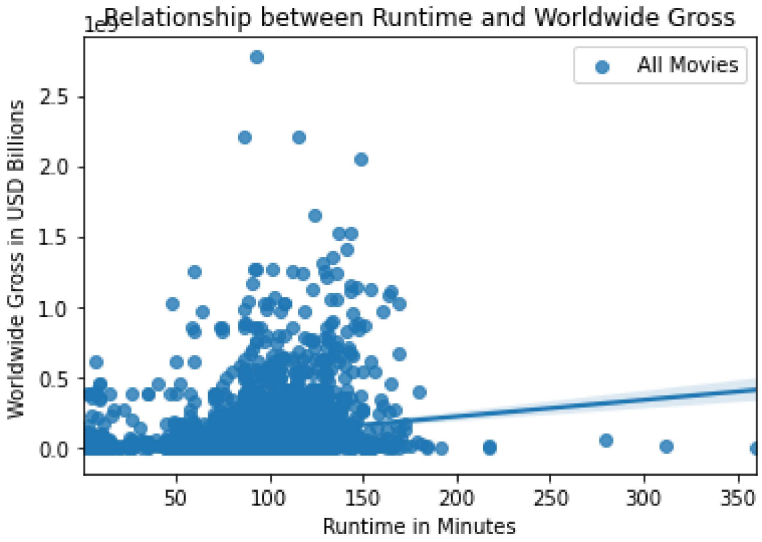
In [82]:
```
movies_and_budgets
```

Out[82]:

	id	release_date	movie	production_budget	domestic_gross	worldwide_gross	budget_ra
0	1	Dec 18, 2009	Avatar	425000000.0	760507625.0	2.776345e+09	>5
1	2	May 20, 2011	Pirates of the Caribbean: On Stranger Tides	410600000.0	241063875.0	1.045664e+09	>5
2	3	Jun 7, 2019	Dark Phoenix	350000000.0	42762350.0	1.497624e+08	>5
3	4	May 1, 2015	Avengers: Age of Ultron	330600000.0	459005868.0	1.403014e+09	>5
4	7	Apr 27, 2018	Avengers: Infinity War	300000000.0	678815482.0	2.048134e+09	>5
...	...	...	...	...	...	...	
3738	67	Apr 28, 2006	Clean	10000.0	138711.0	1.387110e+05	<
3739	68	Jul 6, 2001	Cure	10000.0	94596.0	9.459600e+04	<
3740	73	Jan 13, 2012	Newlyweds	9000.0	4584.0	4.584000e+03	<
3741	78	Dec 31, 2018	Red 11	7000.0	0.0	0.000000e+00	<
3742	81	Sep 29, 2015	A Plague So Pleasant	1400.0	0.0	0.000000e+00	<

3743 rows × 13 columns

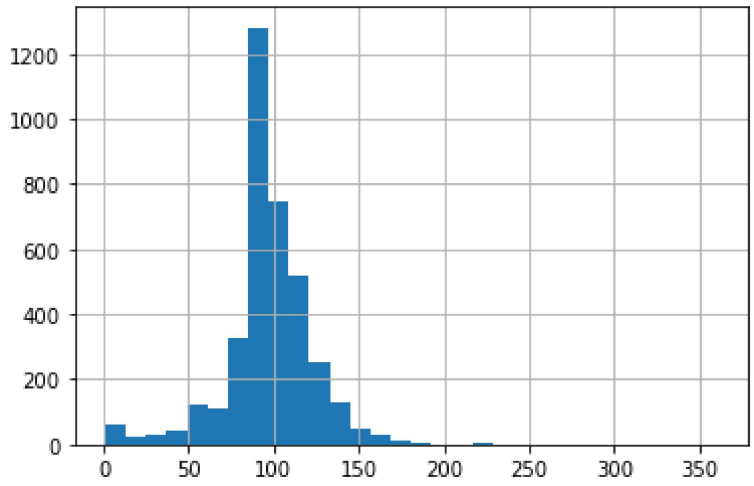
In [83]:
```
#analysing the joined dataframe
sns.regplot(x = 'runtime_minutes', y = 'worldwide_gross',
            label = 'All Movies', data = movies_and_budgets)
plt.xlabel('Runtime in Minutes')
plt.ylabel('Worldwide Gross in USD Billions')
plt.title('Relationship between Runtime and Worldwide Gross')
plt.legend()
plt.show()
```



In [84]:
```
movies_and_budgets['runtime_minutes'].mean()
```

Out[84]: 96.00528417900202

In [85]:
```
movies_and_budgets["runtime_minutes"].hist(bins = 30);
```



#Recommendation(Runtime)

There does not seem to be any correlation between runtime and worldwide gross.The safer option would be to aim for the average runtime which is 100 minutes

Conclusion

Recommendations

1.There does not seem to be any correlation between runtime and worldwide gross.The safer option would be to aim for the average runtime which is 100 minutes.

2.There is generally a higher worldwide gross in June and July thus one should aim to release movies then.

3.A budget of above $50 million leads to a greater worldwide gross thus higher profits