Final Project Submission

Please fill out:

- Student name :Samuel Gathogo
- Student pace : full time HYBRID
- Scheduled project review date/time:
- Instructor name : ANTONNY MUIKO
- Blog post URL :

1.0 BUSINESS UNDERSTANDING

Our company is looking to enter the growing market of original video content, following the success of major industry players. To guide the establishment of our new movie studio, we need to analyze current box office trends. Specifically, we will identify which types of films are performing best and derive actionable insights from this analysis. These insights will inform strategic decisions on the kinds of films to produce, helping ensure that our new studio makes well-informed, data-driven choices that align with market demands.

1.1 Objectives

1. identify the highest grossing films
2. Determine the most common genres among top-grossing movies
3. Analyze the correlation between the office performance and movie ratings
4. Identify the most successful film studios

2.0 DATA UNDERSTANDING

In [ ]:
```
# Importing necessary libraries
import pandas as pd
import sqlite3
```

```
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error
```

In [ ]:
```
# connecting to sqlite database
db_path = r'C:\Users\SAMMY\Documents\FLATIRON\FINAL-PHASE-PROJECT\Project-phase-2\zippedData\im.db'
conn = sqlite3.connect(db_path)
```

In [ ]:
```
# Listing the tables in the database
pd.read_sql(
"""
SELECT *
FROM sqlite_master
WHERE type="table"
""", conn)
```

Out[ ]:

	type	name	tbl_name	rootpage	sql
0	table	movie_basics	movie_basics	2	CREATE TABLE "movie_basics" (\n"movie_id" TEXT...
1	table	directors	directors	3	CREATE TABLE "directors" (\n"movie_id" TEXT,\n...
2	table	known_for	known_for	4	CREATE TABLE "known_for" (\n"person_id" TEXT,\...
3	table	movie_akas	movie_akas	5	CREATE TABLE "movie_akas" (\n"movie_id" TEXT,\...
4	table	movie_ratings	movie_ratings	6	CREATE TABLE "movie_ratings" (\n"movie_id" TEX...
5	table	persons	persons	7	CREATE TABLE "persons" (\n"person_id" TEXT,\n ...
6	table	principals	principals	8	CREATE TABLE "principals" (\n"movie_id" TEXT,\...
7	table	writers	writers	9	CREATE TABLE "writers" (\n"movie_id" TEXT,\n ...

Read the csv file

In [ ]:
```
# loading movie_gross file into a dataframe
movie_gross_path = r'C:\Users\SAMMY\Documents\FLATIRON\FINAL-PHASE-PROJECT\Project-phase-2\zippedData\bom.movie_gross.c
```

```
movie_gross_df = pd.read_csv(movie_gross_path)
movie_gross_df
```

Out[ ]:

	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
4	Shrek Forever After	P/DW	238700000.0	513900000	2010
...	...	...	...	...	...
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

3387 rows × 5 columns

2.1 DATA EXPLORATION

2.1.0 Exploring the SQLite database

In [ ]:
```
# calling movie_basic column
movie_basics_df = pd.read_sql("""
SELECT *
FROM movie_basics
""", conn)
movie_basics_df.head()
```

Out[ ]:

	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 [ ]:
```
# calling movie_ratings column
movie_ratings_df = pd.read_sql("""
SELECT *
FROM movie_ratings
""", conn)
movie_ratings_df.head()
```

Out[ ]:

	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 [ ]:
```

```

2.1.1 Eploring CSV file

In [ ]:
```
# summary information
movie_gross_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
```

In [ ]:
```
# summary statistics
movie_gross_df.describe()
```

Out[ ]:

	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 [ ]:
```
# display the column names
movie_gross_df.columns
```

Out[ ]:
```
Index(['title', 'studio', 'domestic_gross', 'foreign_gross', 'year'], dtype='object')
```

In [ ]:
```
movie_gross_df.shape
```

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

In [ ]:
```
# display the first few rows
movie_gross_df.head()
```

Out[ ]:

	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
4	Shrek Forever After	P/DW	238700000.0	513900000	2010

2.2 DATA PREPARATION

2.2.1DATA CLEANING BOM CSV

In [ ]:
```
# Checking for missing values in the dataframe
movie_gross_df.isnull().sum()
```

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

FILLING MISSING VALUES

In [ ]:
```
# filling in missing values in studio column with 'unknown'
movie_gross_df['studio'].fillna('Unknown', inplace=True);
```

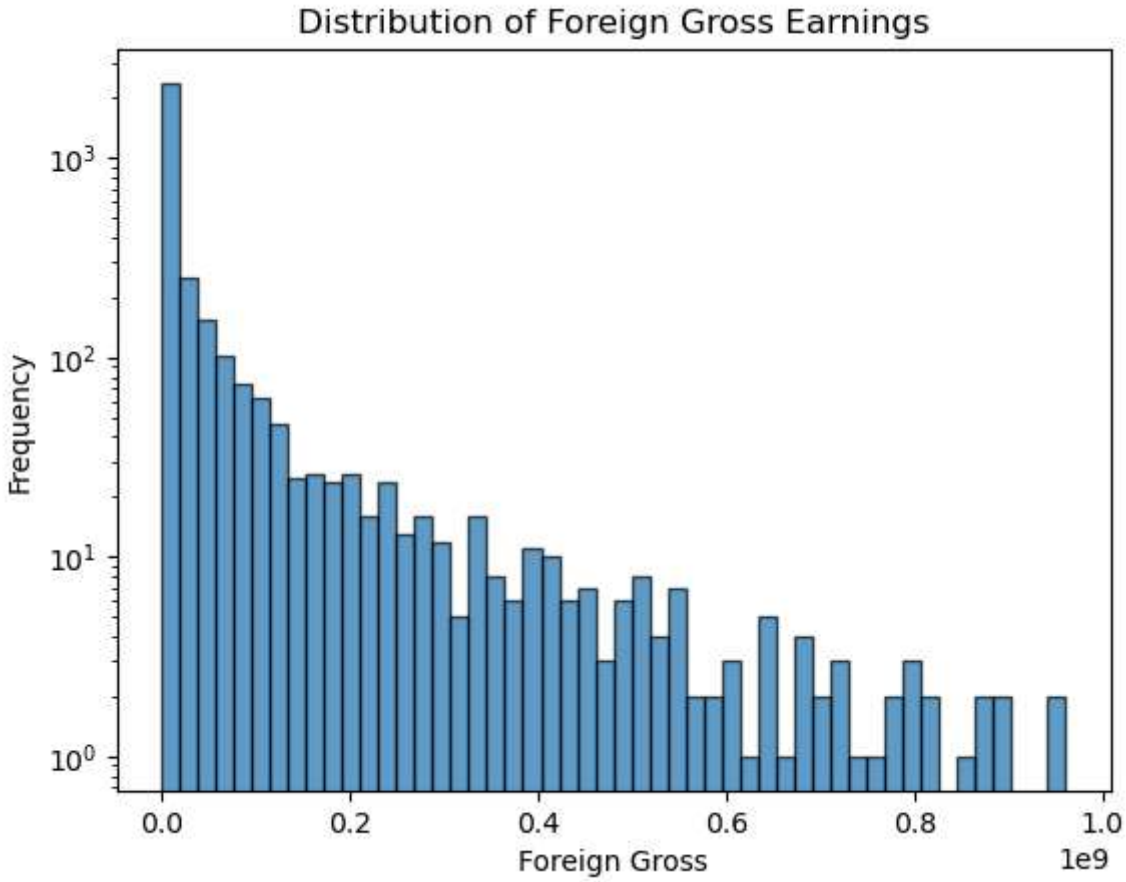
```
C:\Users\SAMMY\AppData\Local\Temp\ipykernel_19868\3348035017.py:2: FutureWarning: A value is trying to be set on a copy
of a DataFrame or Series through chained assignment using an inplace method.
The behavior will change in pandas 3.0. This inplace method will never work because the intermediate object on which we
are setting values always behaves as a copy.

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.method({col: value}, inplace=True)' or df[c
ol] = df[col].method(value) instead, to perform the operation inplace on the original object.


  movie_gross_df['studio'].fillna('Unknown', inplace=True);
```

In [ ]:
```python
# filling in missing values in domestic gross using median
movie_gross_df['domestic_gross'] = movie_gross_df['domestic_gross'].fillna(movie_gross_df['domestic_gross'].median())
```

Given the right-skewed distribution of the data, using the median to fill missing values preserves the original distribution. We avoid using the mean because it is influenced by outliers

In [ ]:
```python
# Remove commas and convert to numeric for foreign_gross
movie_gross_df['foreign_gross'] = movie_gross_df['foreign_gross'].str.replace(',', '')
# Change the data type to float
movie_gross_df['foreign_gross'] = movie_gross_df['foreign_gross'].astype(float)
# Fill missing foreign_gross values with the median
movie_gross_df['foreign_gross'] = movie_gross_df['foreign_gross'].fillna(movie_gross_df['foreign_gross'].median())
```

In [ ]:
```python
# Plot the distribution of foreign_gross
plt.hist(movie_gross_df['foreign_gross'].dropna(), bins=50, edgecolor='k', alpha=0.7)
plt.title('Distribution of Foreign Gross Earnings')
plt.xlabel('Foreign Gross')
plt.ylabel('Frequency')
plt.yscale('log')
plt.show()

# Print summary statistics
print(movie_gross_df['foreign_gross'].describe())
```




```
count    3.387000e+03
mean     5.248329e+07
std      1.100461e+08
min      6.000000e+02
25%      1.160000e+07
50%      1.870000e+07
75%      2.915000e+07
max      9.605000e+08
Name: foreign_gross, dtype: float64
```

Replacing the missing values in the foreign_gross column with the median does not alter the overall distribution of the data, thus preserving its accuracy.

In [ ]:
```
# checking for duplicates
movie_gross_duplicates = movie_gross_df.duplicated().sum()
movie_gross_duplicates
```

Out[ ]:
```
0
```

This shows that there are no duplicates

In [ ]:
```
# rechecking for null values after cleaning
movie_gross_df.isnull().sum()
```

Out[ ]:
```
title            0
studio           0
domestic_gross   0
foreign_gross    0
year             0
dtype: int64
```

2.2.2 DATA CLEANING SQL

1) MOVIE_RATINGS DATAFRAME

In [ ]:
```
# sumary information of the dataframe
movie_ratings_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
```

In [ ]:
```
# summary statistics of the dataframe
movie_ratings_df.describe()
```

Out[ ]:

	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 [ ]:
```
# checking the size of the data
movie_ratings_df.shape
```

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

In [ ]:
```
# checking for duplicates
movie_ratings_df_duplicated = movie_ratings_df.duplicated().sum()
movie_ratings_df_duplicated
```

Out[ ]:
```
0
```

In [ ]:
```
# checking the movie ratings null values
movie_ratings_df.isnull().sum()
```

Out[ ]:
```
movie_id        0
averagerating   0
numvotes        0
dtype: int64
```

This dataframe has zero null values hence does not require cleaning, therefore essential for analysis

2) MOVIE_BASICS DATAFRAME

In [ ]:
```
# summary information
movie_basics_df.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
```

In [ ]:
```
# summary statistics
movie_basics_df.describe()
```

Out[ ]:

	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 [ ]:
```
# checking size of the dataset
movie_basics_df.shape
```

Out[ ]:
```
(146144, 6)
```

In [ ]:
```
# checking for duplicates
movie_basics_df_duplicated = movie_basics_df.duplicated().sum()
movie_basics_df_duplicated
```

Out[ ]:
```
0
```

In [ ]:
```
# checking movie basics null values
movie_basics_df.isnull().sum()
```

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

In [ ]:
```
# checking for percentage of null values
(movie_basics_df.isnull().sum()/len(movie_basics_df))*100
```

Out[ ]:
```
movie_id           0.000000
primary_title      0.000000
original_title     0.014369
start_year         0.000000
runtime_minutes   21.717621
genres             3.700460
dtype: float64
```

1. The percentage of null values in the original_title and genres columns is low, so dropping the rows with these null values will not significantly impact the dataset.
2. Therefore the column runtime_minutes requires data cleaning

In [ ]:
```
# dropping rows with null in the columns original_title and genres
movie_basics_df = movie_basics_df.dropna(subset=['original_title', 'genres'])
```

In [ ]:
```
# filling in missing values with the median
movie_basics_df['runtime_minutes'] = movie_basics_df['runtime_minutes'].fillna(movie_basics_df['runtime_minutes'].media
```

In [ ]:
```
# rechecking movie basics null values
movie_basics_df.isnull().sum()
```

Out[ ]:
```
movie_id           0
primary_title      0
original_title     0
start_year         0
runtime_minutes    0
genres             0
dtype: int64
```

In [ ]:
```
# Get the column names of the movie_basics_df DataFrame
movie_basics_df.columns
```

Out[ ]:
```
Index(['movie_id', 'primary_title', 'original_title', 'start_year',
       'runtime_minutes', 'genres'],
      dtype='object')
```

In [ ]:
```
# Get the column names of the movie_ratings_df DataFrame
movie_ratings_df.columns
```

Out[ ]:
```
Index(['movie_id', 'averagerating', 'numvotes'], dtype='object')
```

movie gross df

In [ ]:
```
# Get the column names of the movie_gross_df DataFrame
movie_gross_df.columns
```

Out[ ]:
```
Index(['title', 'studio', 'domestic_gross', 'foreign_gross', 'year'], dtype='object')
```

In [ ]:
```
# Access the 'year' column of the movie_gross_df DataFrame
movie_gross_df['year']
```

Out[ ]:
```
0       2010
1       2010
2       2010
3       2010
4       2010
       ...
3382    2018
3383    2018
3384    2018
3385    2018
3386    2018
Name: year, Length: 3387, dtype: int64
```

Merge the DataFrames

In [ ]:
```
# Merge movie_ratings_df with movie_basics_df on 'movie_id'
merged_df = pd.merge(movie_ratings_df, movie_basics_df, on='movie_id', how='inner')
merged_df
```

Out[ ]:

	movie_id	averagerating	numvotes	primary_title	original_title	start_year	runtime_minutes	genres
0	tt10356526	8.3	31	Laiye Je Yaarian	Laiye Je Yaarian	2019	117.0	Romance
1	tt10384606	8.9	559	Borderless	Borderless	2019	87.0	Documentary
2	tt1042974	6.4	20	Just Inès	Just Inès	2010	90.0	Drama
3	tt1043726	4.2	50352	The Legend of Hercules	The Legend of Hercules	2014	99.0	Action,Adventure,Fantasy
4	tt1060240	6.5	21	Até Onde?	Até Onde?	2011	73.0	Mystery,Thriller
...	...	...	...	...	...	...	...	...
73047	tt9805820	8.1	25	Caisa	Caisa	2018	84.0	Documentary
73048	tt9844256	7.5	24	Code Geass: Lelouch of the Rebellion - Glorifi...	Code Geass: Lelouch of the Rebellion Episode III	2018	120.0	Action,Animation,Sci-Fi
73049	tt9851050	4.7	14	Sisters	Sisters	2019	87.0	Action,Drama
73050	tt9886934	7.0	5	The Projectionist	The Projectionist	2019	81.0	Documentary
73051	tt9894098	6.3	128	Sathru	Sathru	2019	129.0	Thriller

73052 rows × 8 columns

In [ ]:
```
# Merge merged_df and movie_gross_df DataFrames
final_merged_df = pd.merge(merged_df, movie_gross_df, left_on='primary_title', right_on='title', how='inner')
final_merged_df
```

Out[ ]:

	movie_id	averagerating	numvotes	primary_title	original_title	start_year	runtime_minutes	genres
0	tt1043726	4.2	50352	The Legend of Hercules	The Legend of Hercules	2014	99.0	Action,Adventure,Fantasy
1	tt1171222	5.1	8296	Baggage Claim	Baggage Claim	2013	96.0	Comedy
2	tt1181840	7.0	5494	Jack and the Cuckoo-Clock Heart	Jack et la mécanique du coeur	2013	94.0	Adventure,Animation,Drama
3	tt1210166	7.6	326657	Moneyball	Moneyball	2011	133.0	Biography,Drama,Sport
4	tt1212419	6.5	87288	Hereafter	Hereafter	2010	129.0	Drama,Fantasy,Romance
...	...	...	...	...	...	...	...	...
3015	tt7122852	5.1	7	Let Me In	Let Me In	2017	74.0	Horror
3016	tt7315484	5.2	22399	The Silence	The Silence	2019	90.0	Horror,Thriller
3017	tt8011712	7.4	54	The Past	The Past	2018	120.0	Drama,Horror
3018	tt9042690	7.6	43	The Negotiation	The Negotiation	2018	89.0	Documentary,History,War
3019	tt9851050	4.7	14	Sisters	Sisters	2019	87.0	Action,Drama

3020 rows × 13 columns

After merging, the columns primary_title, original_title, and title contain equivalent values. Therefore, we will drop the primary_title and original_title columns

In [ ]:
```
# Drop the 'primary_title' and 'original_title' columns
final_merged_df.drop(columns=['primary_title', 'original_title'], inplace=True)
```

In [ ]:
```
# Access the final_merged_df DataFrame
final_merged_df
```

Out[ ]:

	movie_id	averagerating	numvotes	start_year	runtime_minutes	genres	title	studio	domesti
0	tt1043726	4.2	50352	2014	99.0	Action,Adventure,Fantasy	The Legend of Hercules	LG/S	188
1	tt1171222	5.1	8296	2013	96.0	Comedy	Baggage Claim	FoxS	216
2	tt1181840	7.0	5494	2013	94.0	Adventure,Animation,Drama	Jack and the Cuckoo-Clock Heart	Shout!	14
3	tt1210166	7.6	326657	2011	133.0	Biography,Drama,Sport	Moneyball	Sony	756
4	tt1212419	6.5	87288	2010	129.0	Drama,Fantasy,Romance	Hereafter	WB	327
...	...	...	...	...	...	...	...	...	...
3015	tt7122852	5.1	7	2017	74.0	Horror	Let Me In	Over.	121
3016	tt7315484	5.2	22399	2019	90.0	Horror,Thriller	The Silence	MBox	1
3017	tt8011712	7.4	54	2018	120.0	Drama,Horror	The Past	SPC	13
3018	tt9042690	7.6	43	2018	89.0	Documentary,History,War	The Negotiation	CJ	1
3019	tt9851050	4.7	14	2019	87.0	Action,Drama	Sisters	Uni.	870

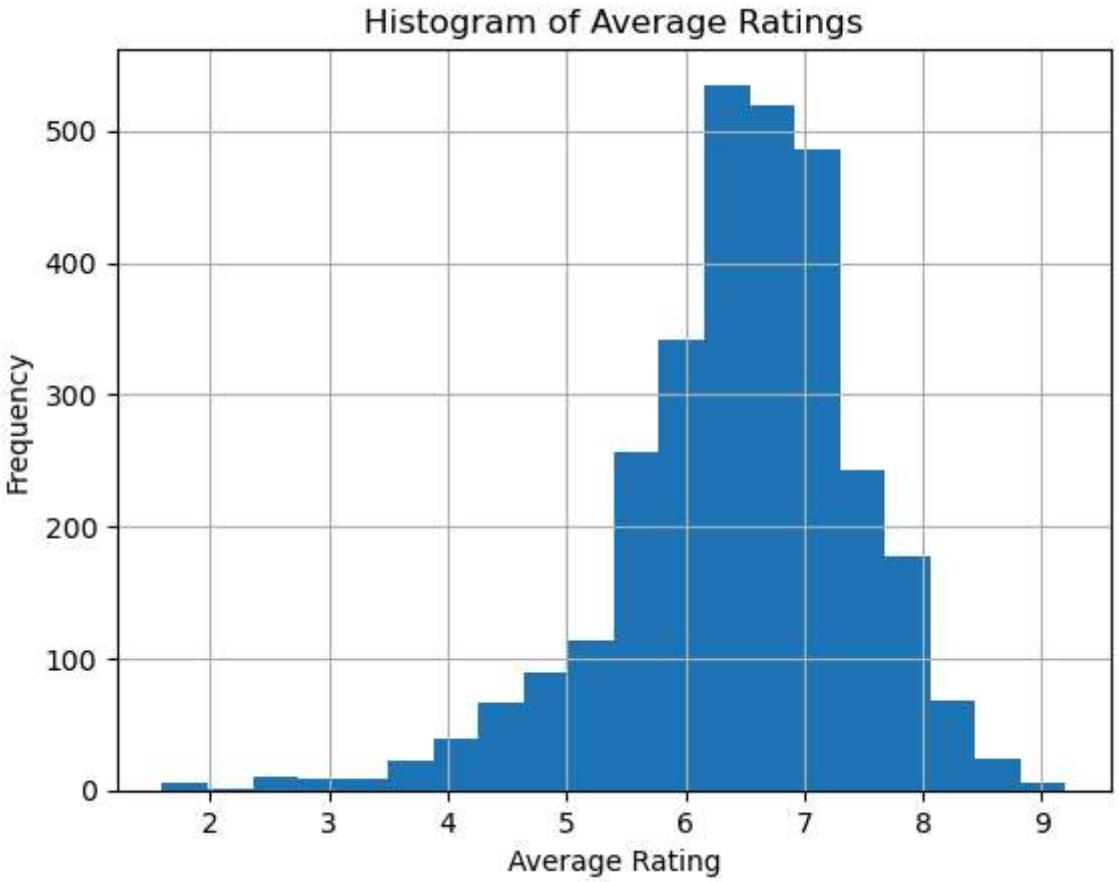
3020 rows × 11 columns

Save the cleaned data back to CSV

In [ ]:

```
# Save cleaned DataFrames
movie_gross_df.to_csv('cleaned_movie_gross_df', index=False)
movie_basics_df.to_csv('cleaned_movie_basics_df', index=False)
movie_ratings_df.to_csv('cleaned_movie_ratings_df', index=False)
final_merged_df.to_csv('cleaned_final_merged_df', index=False)
```

In [ ]:
```
final_merged_df['averagerating'].hist(bins=20)
plt.xlabel('Average Rating')
plt.ylabel('Frequency')
plt.title('Histogram of Average Ratings')
plt.show()
```

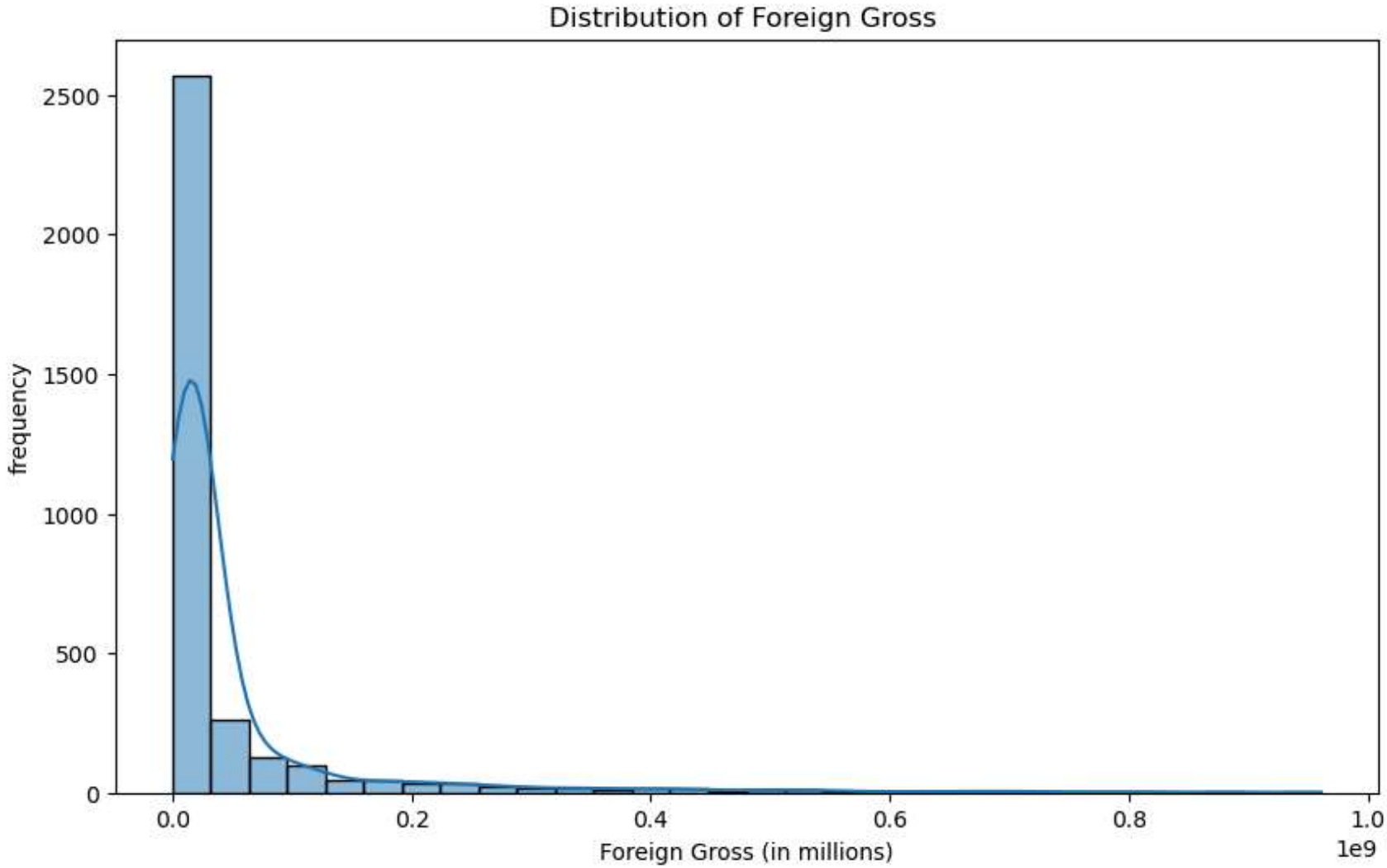


Most of the bars are concentrated around the center, indicating that most ratings fall within almost in the middle range middle range. This suggests that the data likely follows a normal distribution, meaning that the majority of ratings are average, with fewer ratings at the extreme low or high ends.

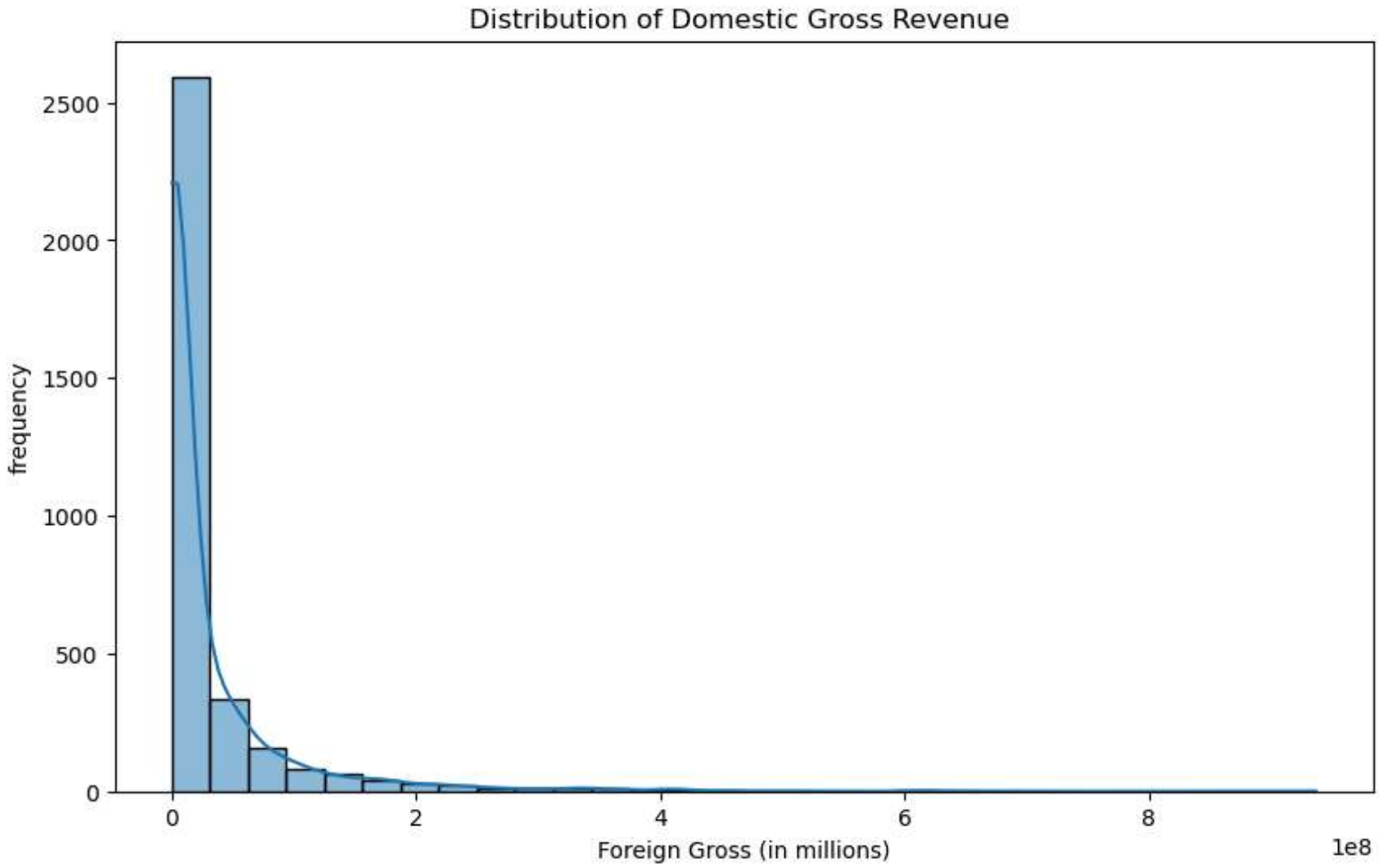
In [ ]:
```
plt.figure(figsize=(10, 6))
sns.histplot(movie_gross_df['foreign_gross'], bins=30, kde=True)
plt.title('Distribution of Foreign Gross ')
```

```
plt.xlabel('Foreign Gross (in millions)')
plt.ylabel('frequency')
plt.show()

plt.figure(figsize=(10, 6))
sns.histplot(movie_gross_df['domestic_gross'], bins=30, kde=True)
plt.title('Distribution of Domestic Gross Revenue ')
plt.xlabel('Foreign Gross (in millions)')
plt.ylabel('frequency')

plt.show()
```

```
c:\Users\SAMMY\anaconda03\envs\learn-env\Lib\site-packages\seaborn\_oldcore.py:1119: FutureWarning: use_inf_as_na option is deprecated and will be removed in a future version. Convert inf values to NaN before operating instead.
  with pd.option_context('mode.use_inf_as_na', True):
```




```
c:\Users\SAMMY\anaconda03\envs\learn-env\Lib\site-packages\seaborn\_oldcore.py:1119: FutureWarning: use_inf_as_na option
is deprecated and will be removed in a future version. Convert inf values to NaN before operating instead.
  with pd.option_context('mode.use_inf_as_na', True):
```



High Frequency at Lower Revenues: Most movies earn lower gross revenues.

Decreasing Frequency: As the gross revenue increases, the number of movies earning that amount decreases.

Right Skew: The histogram you provided seems to have a right skew, as the majority of the data (movies) are concentrated on the lower end of the gross revenue scale, with a few movies earning significantly higher amounts12.

Implications: This skewness indicates that while most movies earn lower gross revenues, there are some outliers that earn much higher amounts, pulling the mean to the right.

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