```
'''This file contains the code and results for the multiclass classification movie revenue prediction problem'''

# Pull in raw dataset to coding environment utilizing pandas to read the csv, provide a dataframe structure and add correspoding attribute la

import pandas as pd
from pandas.core.ops.array_ops import isna
import os

# Raw dataset is stored in Google Drive. Mounted google drive to access original IMDB dataset:
movies = pd.read_csv('/content/drive/MyDrive/820/21Jan2023- 820- Movie metadata.csv')
movies = pd.DataFrame(data = movies)

col_names = ["Color", "Director Name", "# Critic Reviews", "Duration", "# Director Likes", "# Actor 1 Likes", "Actor 2 Name", "# Actor 1 Like
             "Actor 1 Name", "Movie Title", "# Users Voted", "# Cast Likes", "Actor 3 Name", "# FB Poster", "Plot Keywords", "Movie Link", "#
             "Content Rating", "Budget", "Title Year", "# Actor 2 Likes", "IMDB Score", "Aspect Ratio", "# Movie Likes"]
movies.columns = col_names
```

```
movies.head()
```

	Color	Director Name	# Critic Reviews	Duration	# Director Likes	# Actor 1 Likes	Actor 2 Name	# Actor 1 Likes	Gr
0	Color	James Cameron	723.00	178.00	0.00	855.00	Joel David Moore	1000.00	76050584
1	Color	Gore Verbinski	302.00	169.00	563.00	1000.00	Orlando Bloom	40000.00	30940415
2	Color	Sam Mendes	602.00	148.00	0.00	161.00	Rory Kinnear	11000.00	20007417
3	Color	Christopher Nolan	813.00	164.00	22000.00	23000.00	Christian Bale	27000.00	44813064
5	Color	Andrew Stanton	462.00	132.00	475.00	530.00	Samantha Morton	640.00	7305867

5 rows × 28 columns

```
# Display raw data information prior to removing missing data:
movies.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 3756 entries, 0 to 5042
Data columns (total 28 columns):
 #   Column              Non-Null Count  Dtype
---  ------              --------------  -----
 0   Color               3756 non-null   object
 1   Director Name       3756 non-null   object
 2   # Critic Reviews    3756 non-null   float64
 3   Duration            3756 non-null   float64
 4   # Director Likes    3756 non-null   float64
 5   # Actor 1 Likes     3756 non-null   float64
 6   Actor 2 Name        3756 non-null   object
 7   # Actor 1 Likes     3756 non-null   float64
 8   Gross               3756 non-null   float64
 9   Genres              3756 non-null   object
 10  Actor 1 Name        3756 non-null   object
 11  Movie Title         3756 non-null   object
 12  # Users Voted       3756 non-null   int64
 13  # Cast Likes        3756 non-null   int64
 14  Actor 3 Name        3756 non-null   object
 15  # FB Poster         3756 non-null   float64
 16  Plot Keywords       3756 non-null   object
 17  Movie Link          3756 non-null   object
 18  # Users for Reviews 3756 non-null   float64
 19  Langauge            3756 non-null   object
 20  Country             3756 non-null   object
 21  Content Rating      3756 non-null   object
 22  Budget              3756 non-null   float64
 23  Title Year          3756 non-null   float64
 24  # Actor 2 Likes     3756 non-null   float64
 25  IMDB Score          3756 non-null   float64
 26  Aspect Ratio        3756 non-null   float64
 27  # Movie Likes       3756 non-null   int64
```

```
dtypes: float64(13), int64(3), object(12)
memory usage: 851.0+ KB
```

```
# Remove all movies that contain missing data and display information about new dataset:
movies = movies.dropna()
pd.set_option('float_format', '{:.2f}'.format)
movies.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 3756 entries, 0 to 5042
Data columns (total 28 columns):
 #   Column              Non-Null Count  Dtype
---  ------              --------------  -----
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 3   Duration            3756 non-null   float64
 4   # Director Likes    3756 non-null   float64
 5   # Actor 1 Likes     3756 non-null   float64
 6   Actor 2 Name        3756 non-null   object
 7   # Actor 1 Likes     3756 non-null   float64
 8   Gross               3756 non-null   float64
 9   Genres              3756 non-null   object
 10  Actor 1 Name        3756 non-null   object
 11  Movie Title         3756 non-null   object
 12  # Users Voted       3756 non-null   int64
 13  # Cast Likes        3756 non-null   int64
 14  Actor 3 Name        3756 non-null   object
 15  # FB Poster         3756 non-null   float64
 16  Plot Keywords       3756 non-null   object
 17  Movie Link          3756 non-null   object
 18  # Users for Reviews  3756 non-null  float64
 19  Langauge            3756 non-null   object
 20  Country             3756 non-null   object
 21  Content Rating      3756 non-null   object
 22  Budget              3756 non-null   float64
 23  Title Year          3756 non-null   float64
 24  # Actor 2 Likes     3756 non-null   float64
 25  IMDB Score          3756 non-null   float64
 26  Aspect Ratio        3756 non-null   float64
 27  # Movie Likes       3756 non-null   int64
dtypes: float64(13), int64(3), object(12)
memory usage: 851.0+ KB
```
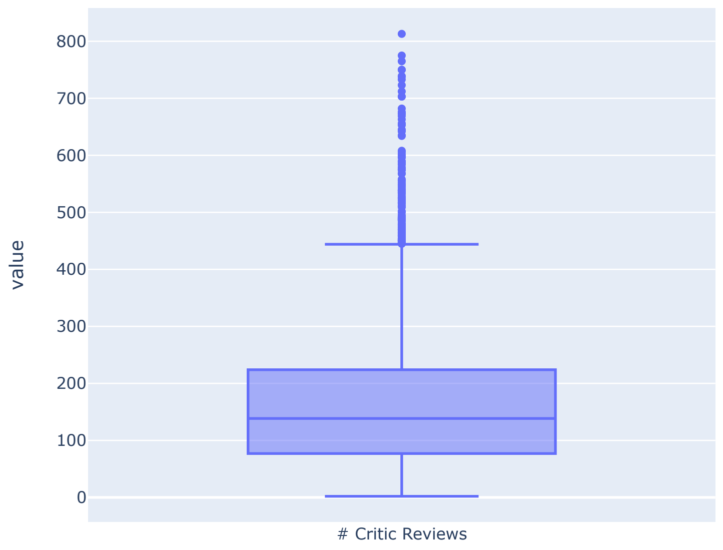
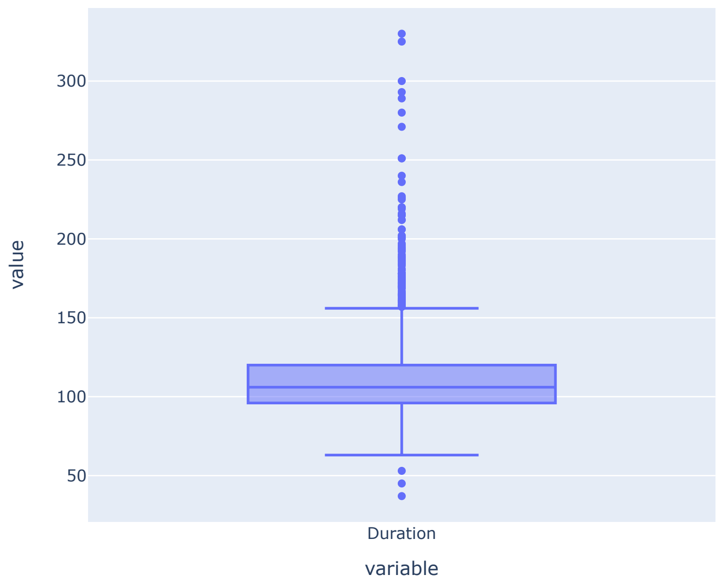

```
# Display statistical measures for each numerical attribute on the cleaned dataset:
movies.describe()
```

	# Critic Reviews	Duration	# Director Likes	# Actor 1 Likes	# Actor 1 Likes	Gross	# Users Voted	# Cast Likes	# FB Poster	# Users for Reviews	
count	3756.00	3756.00	3756.00	3756.00	3756.00	3756.00	3756.00	3756.00	3756.00	3756.00	
mean	167.38	110.26	807.34	771.28	7751.34	52612824.24	105826.73	11527.10	1.38	336.84	
std	123.45	22.65	3068.17	1894.25	15519.34	70317866.91	152035.40	19122.18	2.04	411.23	[illegible]
min	2.00	37.00	0.00	0.00	0.00	162.00	91.00	0.00	0.00	4.00	
25%	77.00	96.00	11.00	194.00	745.00	8270232.75	19667.00	1919.75	0.00	110.00	
50%	138.50	106.00	64.00	436.00	1000.00	30093107.00	53973.50	4059.50	1.00	210.00	
75%	224.00	120.00	235.00	691.00	13000.00	66881940.75	128602.00	16240.00	2.00	398.25	
max	813.00	330.00	23000.00	23000.00	640000.00	760505847.00	1689764.00	656730.00	43.00	5060.00	12

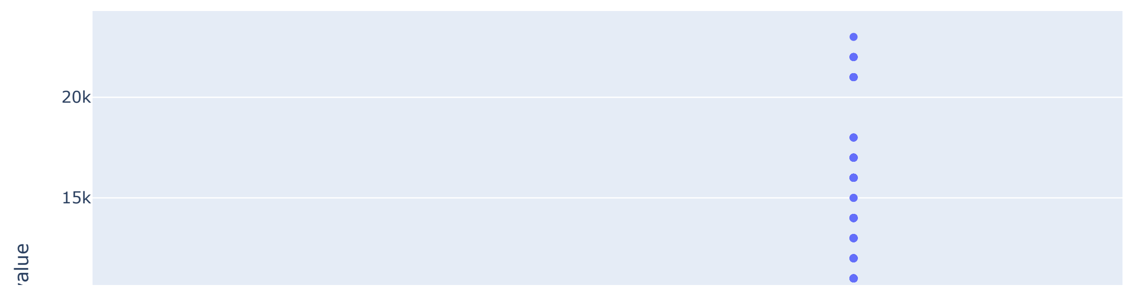
```
# Provide visualization tools to aid in understanding the features utilizing plotly packages.

import plotly.express as px

# Box & Whisker for the number of Critic Reviews registered:
bw_Critics = px.box(movies['# Critic Reviews'])
bw_Critics
```



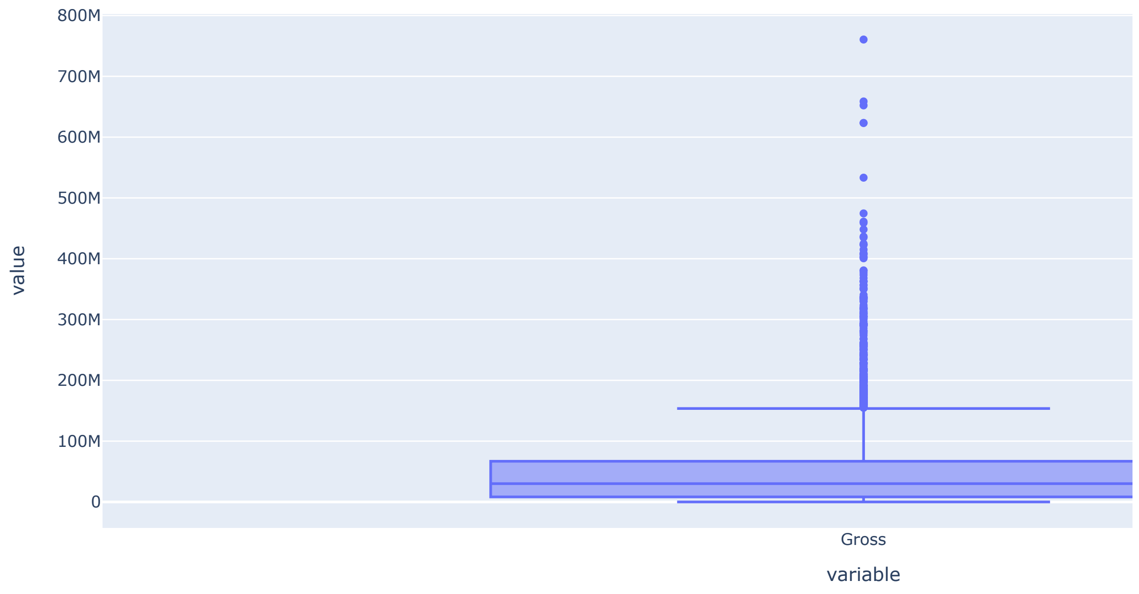
```
# Box & Whisker for the length of the movie:
bw_Duration = px.box(movies['Duration'])
bw_Duration
```



```
# Box & Whisker for the number of director likes on Facebook:
bw_Director = px.box(movies['# Director Likes'])
bw_Director
```

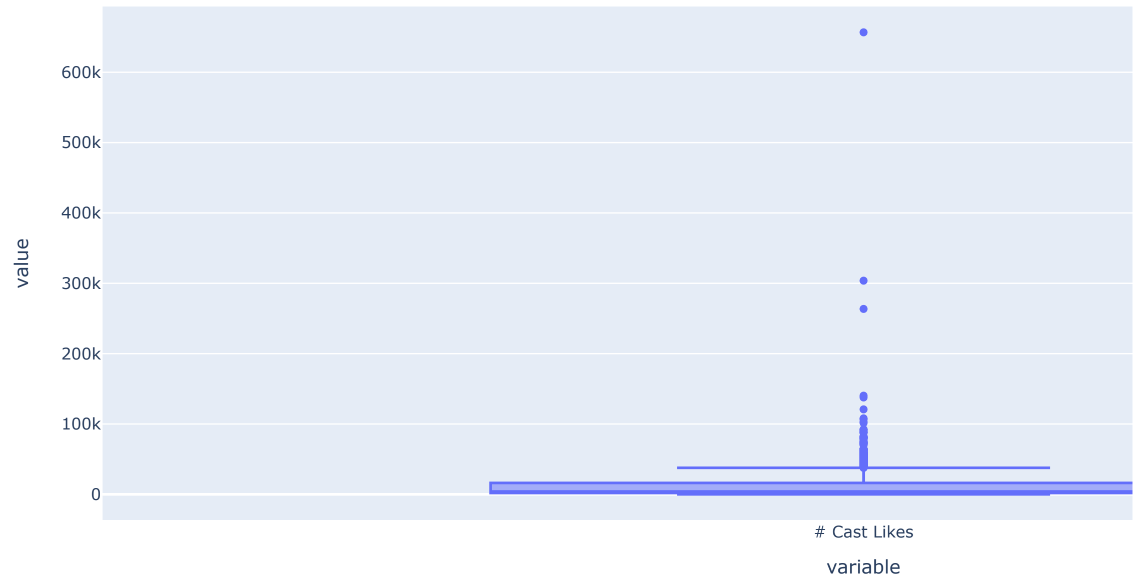


```
# Box & Whisker for the gross revenue in US dollars for each movie:
bw_Gross = px.box(movies['Gross'])
bw_Gross
```



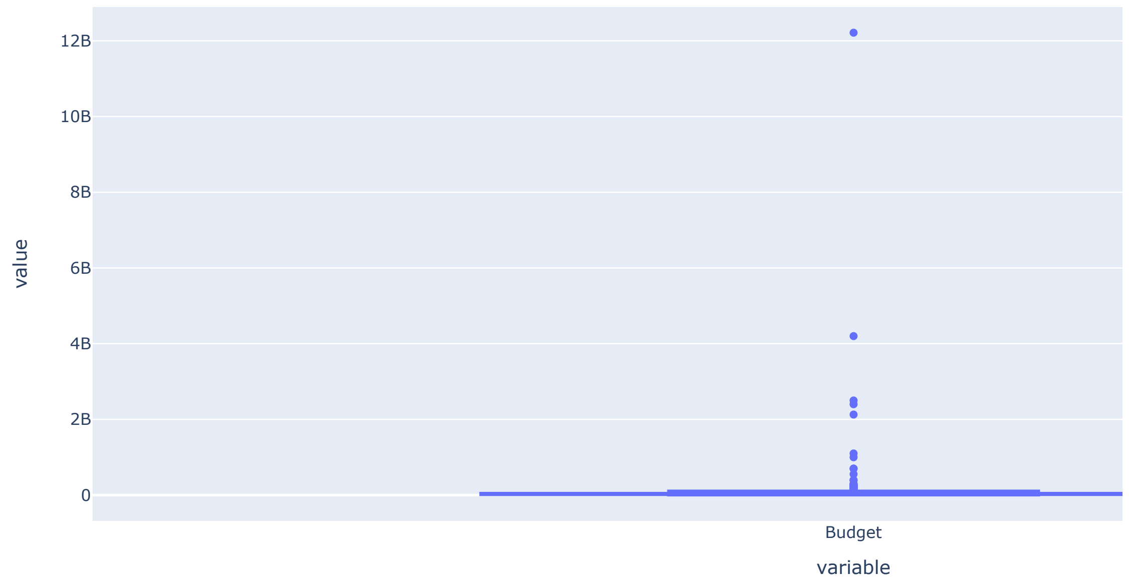
```
# Box & Whisker for the number of users who registered a vote on IMDB:
bw_Users = px.box(movies['# Users Voted'])
bw_Users
```

```
# Box & Whisker for the number of Facbeook likes the cast has earned as a collective:
bw_Cast = px.box(movies['# Cast Likes'])
bw_Cast
```



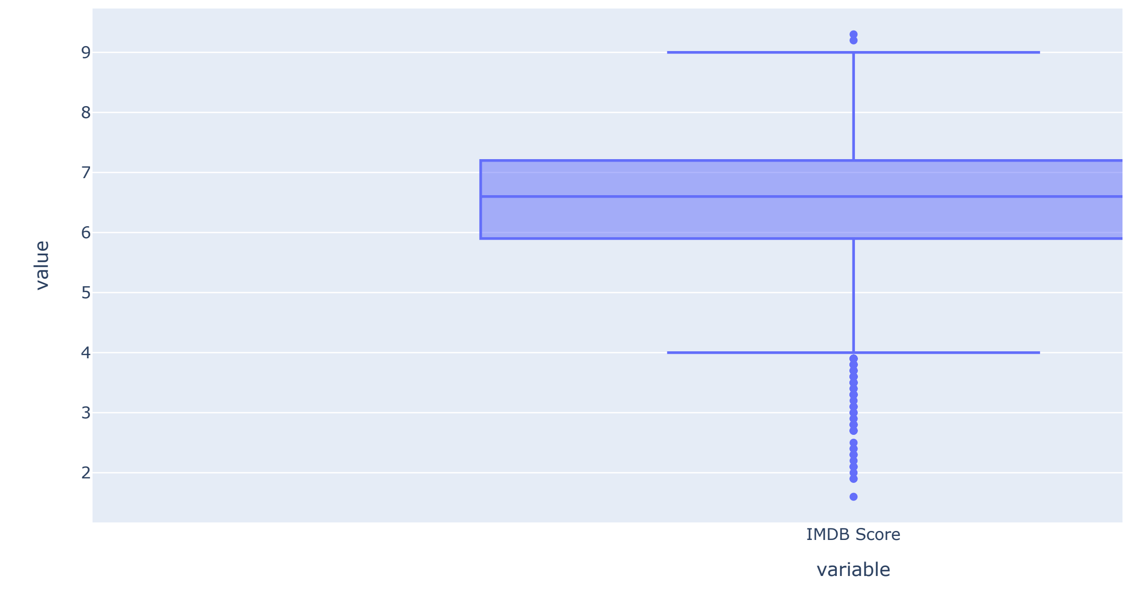
```
# Box & Whisker for the number of Facebook movie posters:
bw_Poster = px.box(movies['# FB Poster'])
bw_Poster
```

```
# Box & Whisker for the production budget (excluding marketing and promotional) in US dollars for each movie:
bw_Budget = px.box(movies['Budget'])
bw_Budget
```

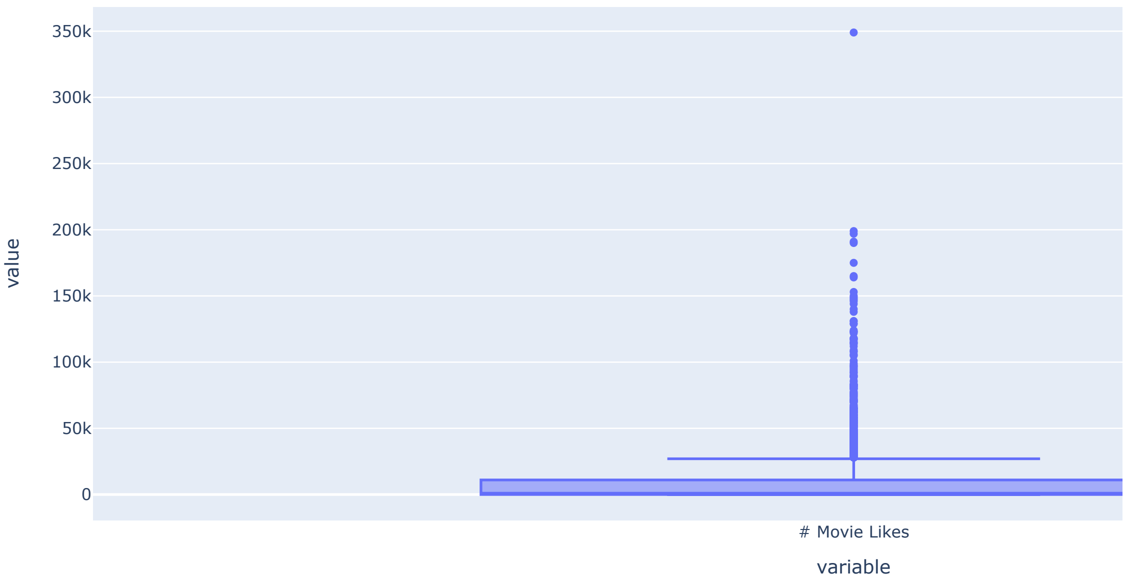


```
# Box & Whisker for theIMDB scores that were submitted by users:
bw_IMDB = px.box(movies['IMDB Score'])
```

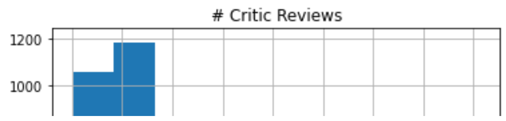
```
bw_IMDB
```



```
# Box & Whisker for the number of movie likes on Facebook:
bw_Likes = px.box(movies['# Movie Likes'])
bw_Likes
```

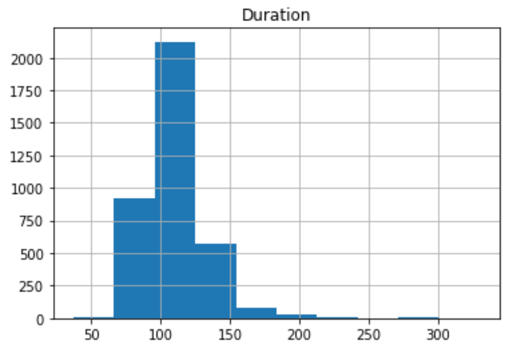


```
# Histogram displaying the distribution of the # of critic reviews registered:
hist_Critic = movies.hist('# Critic Reviews')
```



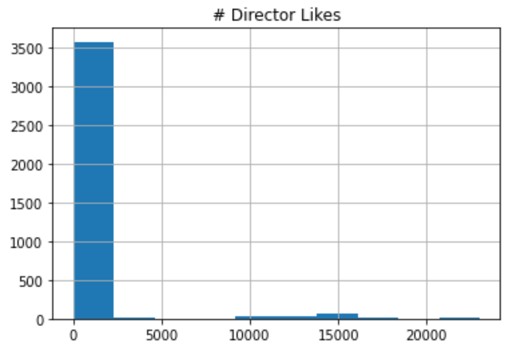
```
# Histograms displaying the distribution of the length/watch time/run time/duration of the movie:
hist_Duration = movies.hist('Duration')
hist_Duration
```

```
array([[<AxesSubplot:title={'center':'Duration'}>]], dtype=object)
```



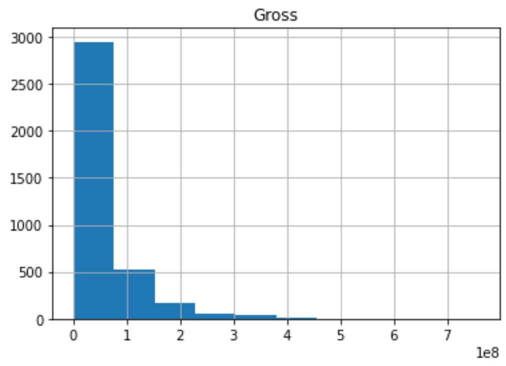
```
# Histogram showing the distrituion of the # of director likes on Facebook:
hist_Director = movies.hist('# Director Likes')
hist_Director
```

```
array([[<AxesSubplot:title={'center':'# Director Likes'}>]], dtype=object)
```



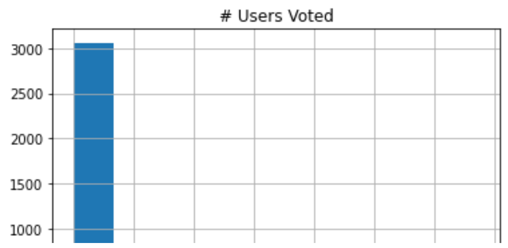
```
# Histrogram showing the distribution of the gross revenue variable:
hist_Gross = movies.hist('Gross')
hist_Gross
```

```
array([[<AxesSubplot:title={'center':'Gross'}>]], dtype=object)
```



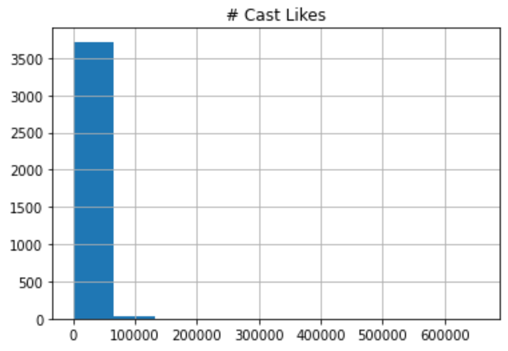
```
# Historgram showing the distribution of the number of users who registered a vote on IMDB:
hist_Users = movies.hist('# Users Voted')
hist_Users
```

```
array([[<AxesSubplot:title={'center':'# Users Voted'}>]], dtype=object)
```



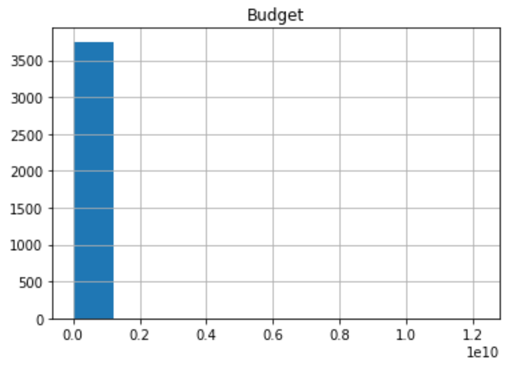
```
# Histogram showing the distribution of number of likes the cast has collectively on Facebook:
hist_Cast = movies.hist('# Cast Likes')
hist_Cast
```

```
array([[<AxesSubplot:title={'center':'# Cast Likes'}>]], dtype=object)
```



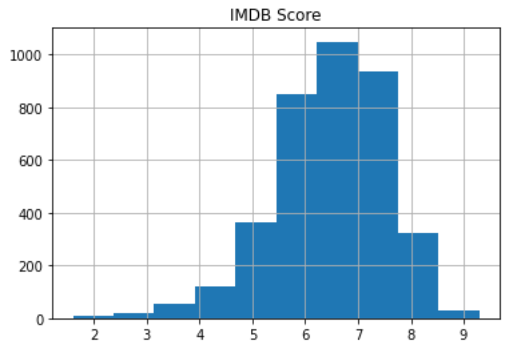
```
hist_Budget = movies.hist('Budget')
hist_Budget
```

```
array([[<AxesSubplot:title={'center':'Budget'}>]], dtype=object)
```



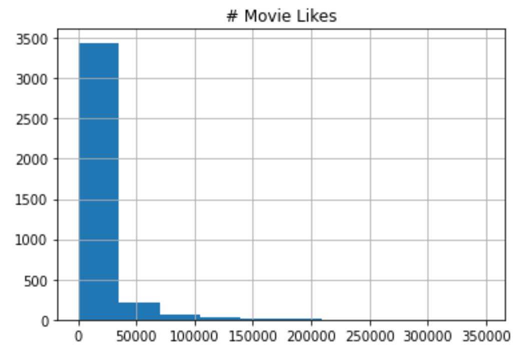
```
# Histogram showing the distribution of the IMDB Score variable:
hist_IMDB = movies.hist('IMDB Score')
hist_IMDB
```

```
array([[<AxesSubplot:title={'center':'IMDB Score'}>]], dtype=object)
```



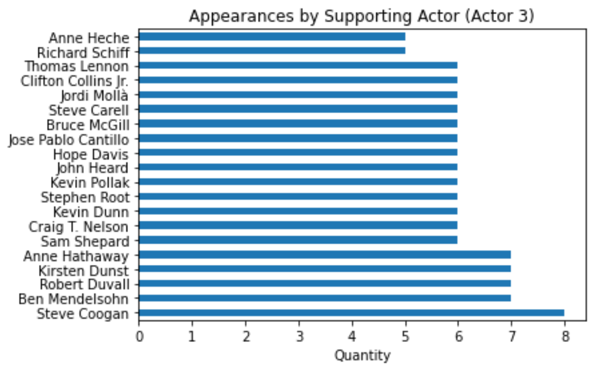
```
# Histogram showing the distribution of the number of movie likes on Facebook:
hist_Likes = movies.hist('# Movie Likes')
hist_Likes
```

```
array([[<AxesSubplot:title={'center':'# Movie Likes'}>]], dtype=object)
```



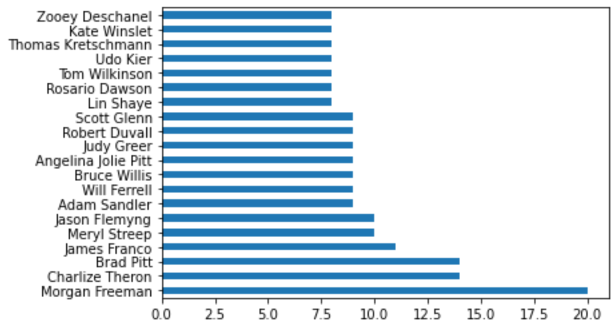
```
# Utilize Matplotlib packages to display bar plots:

import matplotlib.pyplot as plt

# Bar plot showing the number of times the third actor appeared in the dataset for the top 20:
bar_Actor3 = movies['Actor 3 Name'].value_counts()[:20].plot(kind = 'barh')
plt.title("Appearances by Supporting Actor (Actor 3)")
plt.xlabel("Quantity")
```

```
Text(0.5, 0, 'Quantity')
```



```
# Bar plot showing the number of times the second actor appeared in the dataset for the top 20:
bar_Actor2 = movies['Actor 2 Name'].value_counts()[:20].plot(kind = 'barh')
bar_Actor2
```

```
<AxesSubplot:>
```

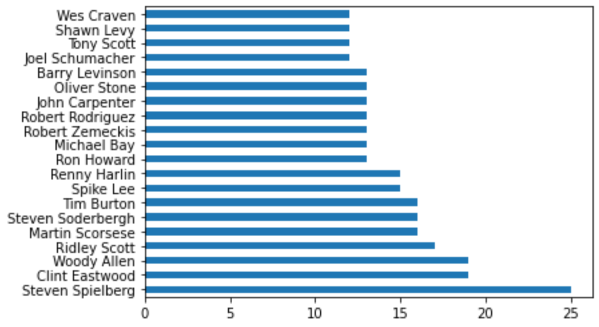


```
# Bar plot showing the number of times the first actor appeared in the dataset for the top 20:
bar_Actor1 = movies['Actor 1 Name'].value_counts()[:20].plot(kind = 'barh')
bar_Actor1
```

```
<AxesSubplot:>
```

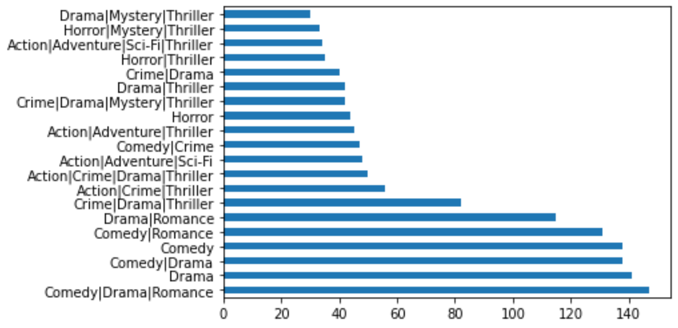
```
# Bar plot showing the number of times the director appeared in the dataset for the top 20:
bar_Director = movies['Director Name'].value_counts()[:20].plot(kind = 'barh')
bar_Director
```

```
<AxesSubplot:>
```



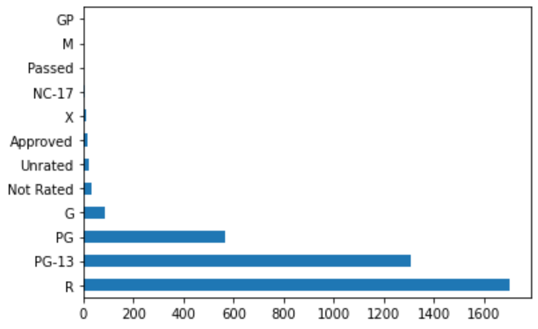
```
# Bar plot showing the number of times each genre appeared in the dataset for the top 20:
bar_Genre = movies['Genres'].value_counts()[:20].plot(kind = 'barh')
bar_Genre
```

```
<AxesSubplot:>
```



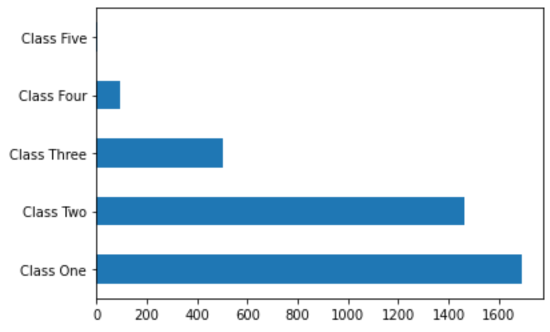
```
# Bar plot showing the number of times each content rating appeared in the dataset for the top 20:
bar_Rating = movies['Content Rating'].value_counts()[:20].plot(kind = 'barh')
bar_Rating
```

```
<AxesSubplot:>
```



```
from pandas.core.groupby.grouper import DataFrame

# Initialize gross revenue classes for our multi- class classification problem.

'''Revenue Classes:
      $0 - 24.99M
      $25 - 99.99M
      $100 - 249.99M
      $250 - 499.99M
      $500M - 1000000000'''

#Assign each movie to a REVENUE CLASS:
x = pd.cut(movies.Gross, bins = [0, 24999999, 99999999,249999999, 499999999, 1000000000],
        labels = ['Class One', 'Class Two', 'Class Three', 'Class Four', 'Class Five'])
movies['Classes'] = x

# Now that each movie has been labeled with the corresponding revenue category, count the number of each class that appears in the modified d
class_Count = movies['Classes'].value_counts()
bar_class_Count = movies['Classes'].value_counts().plot(kind = 'barh')

# Display table and chart showing the relative quantities of each movie class:
print(class_Count)
print(bar_class_Count)
```

```
Class One      1692
Class Two      1463
Class Three     502
Class Four       93
Class Five        6
Name: Classes, dtype: int64
AxesSubplot(0.125,0.125;0.775x0.755)
```


Class Five
Class Four
Class Three
Class Two
Class One