Using Python to Analyze Netflix Data

In [117]:
```
import pandas as pd
import numpy as np
import matplotlib as mpl
import matplotlib.pyplot as plt
import plotly as pl
import plotly.express as px
import scipy as sp
import scipy.stats
from sklearn.linear_model import LinearRegression

plt.style.use("classic")
%matplotlib inline
```

Loading in Data

In [9]:
```
netflix_raw = pd.read_csv('Netflix Dataset Latest 2021.csv')
```

Filtering Data to Relevant Columns

In [71]:
```
netflix_1 = netflix_raw[['Title',
 'Genre',
 'Tags',
 'Languages',
 'Series or Movie',
 'Country Availability',
 'Runtime',
 'IMDb Score',
 'Rotten Tomatoes Score',
 'Metacritic Score',
 'Awards Received',
 'Awards Nominated For',
 'Boxoffice',
 'Release Date',
 'Netflix Release Date']].copy()

netflix_1 = netflix_1.astype("int64", errors="ignore")
netflix_1 = netflix_1.astype({"Title": "string",
 'Genre': "string",
 'Tags': "string",
 'Languages': "string",
 'Series or Movie': "string",
 'Country Availability': "string",
 'Boxoffice': "float"}, errors='ignore')
netflix_1["Release Date"] = pd.to_datetime(netflix_1["Release Date"])
netflix_1["Netflix Release Date"] = pd.to_datetime(netflix_1["Netflix Release Date"])
netflix_1["Same Day Rel"] = (netflix_1["Release Date"] == netflix_1["Netflix Release Date"])
netflix_1["USA Availability"] = netflix_1["Country Availability"].str.contains(pat = "United States")
```

Creating New DataTables for analysis

In [72]:
```
netflix_rel = netflix_1.loc[netflix_1["Same Day Rel"] == True]
netflix_nonrel = netflix_1.loc[netflix_1["Same Day Rel"] == False]

netflix_series = netflix_1.loc[netflix_1["Series or Movie"] == "Series"]
netflix_movie = netflix_1.loc[netflix_1["Series or Movie"] == "Movie"]

netflix_usa = netflix_1.loc[netflix_1["USA Availability"] == True]
netflix_int = netflix_1.loc[netflix_1["USA Availability"] == False]
```

We will be trying to research the following questions:

1. Are same day Netflix releases better or worse than non-same day release titles?
2. Are Netflix Movies or Series better?

3. Are Netflix offerings in the US better than international offerings?

Are same day Netflix releases better or worse than non-same day release titles?

Using the netflix_rel and netflix_nonrel tables, we will try to answer if there is any difference on the quality of same day releases vs. non-same day releases. We can assume same day release title are Netflix exclusives or titles that worked closely with Netflix to produce, as Netflix has not historically partnered with studios to release new titles the same day as theaters.

I will use numpy functionality to find values and matplotlib to plot histograms.

In [12]:
```
rel_imdb = np.array(netflix_rel["IMDb Score"])
rel_rt = np.array(netflix_rel["Rotten Tomatoes Score"])
rel_mc = np.array(netflix_rel["Metacritic Score"])
rel_awards_n = np.array(netflix_rel["Awards Nominated For"])
rel_awards_r = np.array(netflix_rel["Awards Received"])

nonrel_imdb = np.array(netflix_nonrel["IMDb Score"])
nonrel_rt = np.array(netflix_nonrel["Rotten Tomatoes Score"])
nonrel_mc = np.array(netflix_nonrel["Metacritic Score"])
nonrel_awards_n = np.array(netflix_nonrel["Awards Nominated For"])
nonrel_awards_r = np.array(netflix_nonrel["Awards Received"])

v_rel_imdb = np.array([np.nanmean(rel_imdb), np.nanmedian(rel_imdb), np.nanmin(rel_imdb), np.nanmax(rel_imdb)])
v_rel_rt = np.array([np.nanmean(rel_rt), np.nanmedian(rel_rt), np.nanmin(rel_rt), np.nanmax(rel_rt)])
v_rel_mc = np.array([np.nanmean(rel_mc), np.nanmedian(rel_mc), np.nanmin(rel_mc), np.nanmax(rel_mc)])
v_rel_awards_n = np.array([np.nanmean(rel_awards_n), np.nanmedian(rel_awards_n), np.nanmin(rel_awards_n), np.nanmax(rel_awards
v_rel_awards_r = np.array([np.nanmean(rel_awards_r), np.nanmedian(rel_awards_r), np.nanmin(rel_awards_r), np.nanmax(rel_awards

v_nonrel_imdb = np.array([np.nanmean(nonrel_imdb), np.nanmedian(nonrel_imdb), np.nanmin(nonrel_imdb), np.nanmax(nonrel_imdb)])
v_nonrel_rt = np.array([np.nanmean(nonrel_rt), np.nanmedian(nonrel_rt), np.nanmin(nonrel_rt), np.nanmax(nonrel_rt)])
v_nonrel_mc = np.array([np.nanmean(nonrel_mc), np.nanmedian(nonrel_mc), np.nanmin(nonrel_mc), np.nanmax(nonrel_mc)])
v_nonrel_awards_n = np.array([np.nanmean(nonrel_awards_n), np.nanmedian(nonrel_awards_n), np.nanmin(nonrel_awards_n), np.nanma
v_nonrel_awards_r = np.array([np.nanmean(nonrel_awards_r), np.nanmedian(nonrel_awards_r), np.nanmin(nonrel_awards_r), np.nanma

print(np.vstack([v_rel_imdb,v_nonrel_imdb,(v_rel_imdb - v_nonrel_imdb)]))

print(np.vstack([v_rel_rt,v_nonrel_rt,(v_rel_rt - v_nonrel_rt)]))

print(np.vstack([v_rel_mc,v_nonrel_mc,(v_rel_mc - v_nonrel_mc)]))

print(np.vstack([v_rel_awards_n,v_nonrel_awards_n,(v_rel_awards_n - v_nonrel_awards_n)]))

print(np.vstack([v_rel_awards_r,v_nonrel_awards_r,(v_rel_awards_r - v_nonrel_awards_r)]))
```

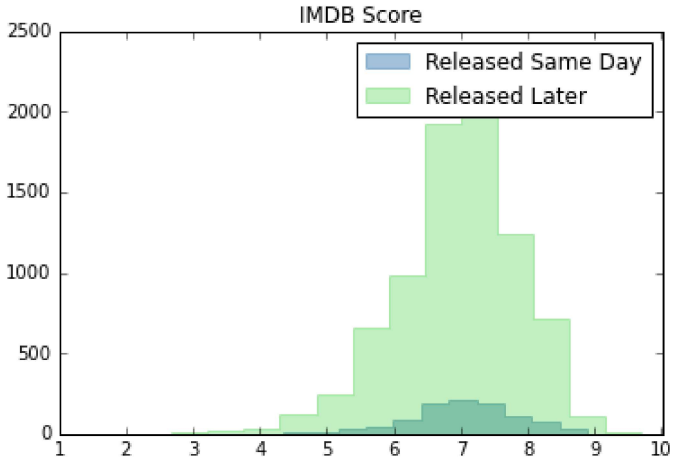
```
[[ 7.08104313  7.1         3.1         9.3       ]
 [ 6.94065321  7.          1.6         9.7       ]
 [ 0.14038992  0.1         1.5        -0.4       ]]
[[ 74.69407895  81.          0.        100.        ]
 [ 64.09978603  69.          0.        100.        ]
 [ 10.59429291  12.          0.          0.        ]]
[[ 62.64609053  65.         18.         94.        ]
 [ 57.82651732  58.          6.        100.        ]
 [  4.81957321   7.         12.         -6.        ]]
[[ 10.58964143   4.          1.        334.        ]
 [ 16.50102145   6.          1.        386.        ]
 [ -5.91138002  -2.          0.        -52.        ]]
```

```
[[   5.95166163    3.           1.          127.        ]
 [   9.9918284     4.           1.          300.        ]
 [  -4.04016676   -1.           0.         -173.        ]]
```

Matplotlib Histogram Plots

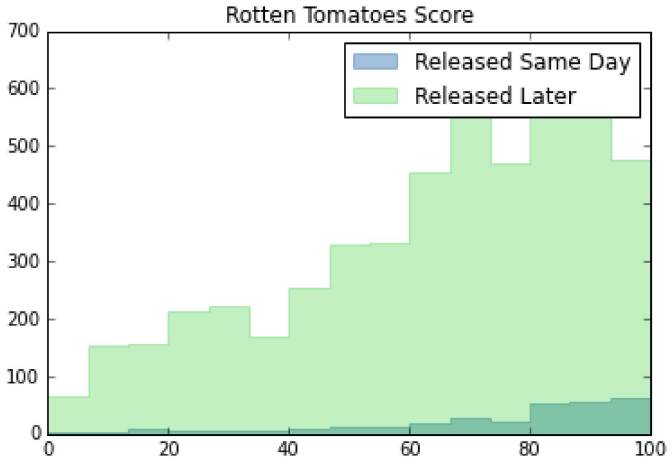
In [6]:
```
plt.hist(netflix_rel["IMDb Score"], bins=15, histtype="stepfilled", color="steelblue", edgecolor="steelblue", alpha = 0.5, lab
plt.hist(netflix_nonrel["IMDb Score"], bins=15, histtype="stepfilled", color="limegreen", edgecolor="limegreen", alpha = 0.3,
plt.legend()
plt.title("IMDB Score")
```

Out[6]:
```
Text(0.5, 1.0, 'IMDB Score')
```



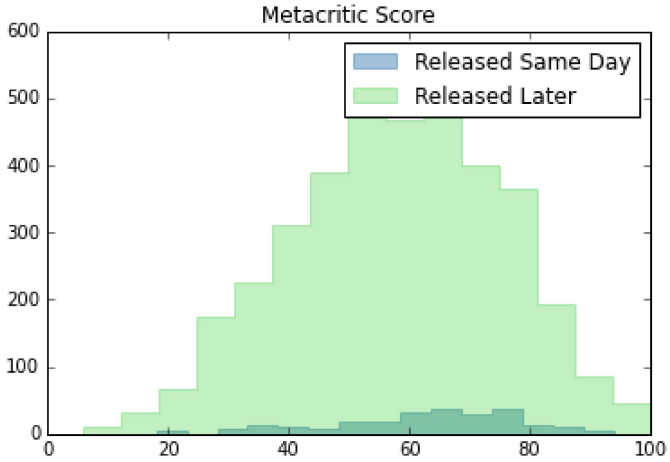
In [7]:
```
plt.hist(netflix_rel["Rotten Tomatoes Score"], bins=15, histtype="stepfilled", color="steelblue", edgecolor="steelblue", alpha
plt.hist(netflix_nonrel["Rotten Tomatoes Score"], bins=15, histtype="stepfilled", color="limegreen", edgecolor="limegreen", al
plt.legend()
plt.title("Rotten Tomatoes Score")
```

Out[7]:
```
Text(0.5, 1.0, 'Rotten Tomatoes Score')
```



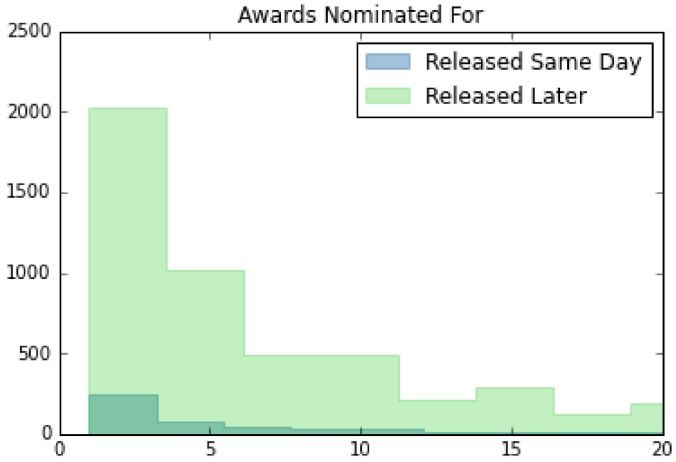
In [8]:
```
plt.hist(netflix_rel["Metacritic Score"], bins=15, histtype="stepfilled", color="steelblue", edgecolor="steelblue", alpha = 0.
plt.hist(netflix_nonrel["Metacritic Score"], bins=15, histtype="stepfilled", color="limegreen", edgecolor="limegreen", alpha =
plt.legend()
plt.title("Metacritic Score")
```

Out[8]:
```
Text(0.5, 1.0, 'Metacritic Score')
```



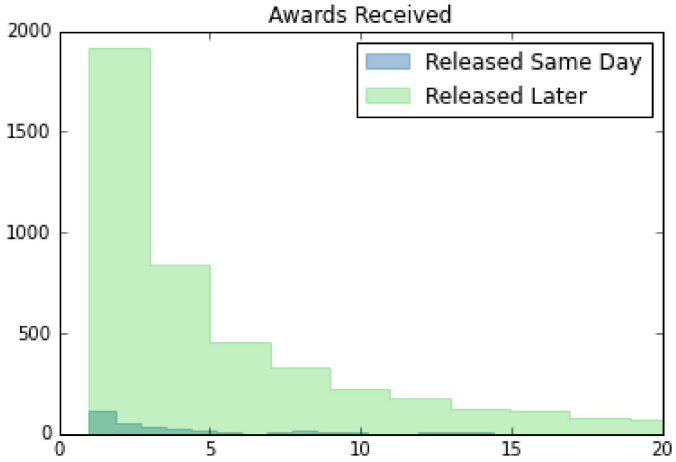
In [9]:
```
plt.hist(netflix_rel["Awards Nominated For"], bins=150, histtype="stepfilled", color="steelblue", edgecolor="steelblue", alpha
plt.hist(netflix_nonrel["Awards Nominated For"], bins=150, histtype="stepfilled", color="limegreen", edgecolor="limegreen", al
plt.xlim(0,20)
plt.legend()
plt.title("Awards Nominated For")
```

Out[9]: Text(0.5, 1.0, 'Awards Nominated For')



In [10]:
```
plt.hist(netflix_rel["Awards Received"], bins=150, histtype="stepfilled", color="steelblue", edgecolor="steelblue", alpha = 0.
plt.hist(netflix_nonrel["Awards Received"], bins=150, histtype="stepfilled", color="limegreen", edgecolor="limegreen", alpha =
plt.xlim(0,20)
plt.legend()
plt.title("Awards Received")
```

Out[10]:
```
Text(0.5, 1.0, 'Awards Received')
```



Findings

From the above analysis and graphs, same day releases tend to do slightly better in ratings metrics (IMDb, Roten Tomatoes, and Metacritic), but worse for awards. The overall distribution, however, looks similar for all metrics. Netflix clearly has more content that was released later than content that was released same day.

In [11]:
```
print(sp.stats.ttest_ind(netflix_rel["Awards Received"], netflix_nonrel["Awards Received"], nan_policy="omit"))
print(sp.stats.ttest_ind(netflix_rel["Metacritic Score"], netflix_nonrel["Metacritic Score"], nan_policy="omit"))
print(sp.stats.ttest_ind(netflix_rel["IMDb Score"], netflix_nonrel["IMDb Score"], nan_policy="omit"))
```

```
Ttest_indResult(statistic=-3.6479126235294426, pvalue=0.00026695722943390597)
Ttest_indResult(statistic=4.25895186332051, pvalue=2.100142994661915e-05)
Ttest_indResult(statistic=4.664152901062096, pvalue=3.1415989320023794e-06)
```

Are Netflix Movies or Series better?

Using the netflix_1, netflix_series, and netflix_movie tables, we will try to answer if movies or series are better on Netflix.

I will use pandas functionality to find values in this case.

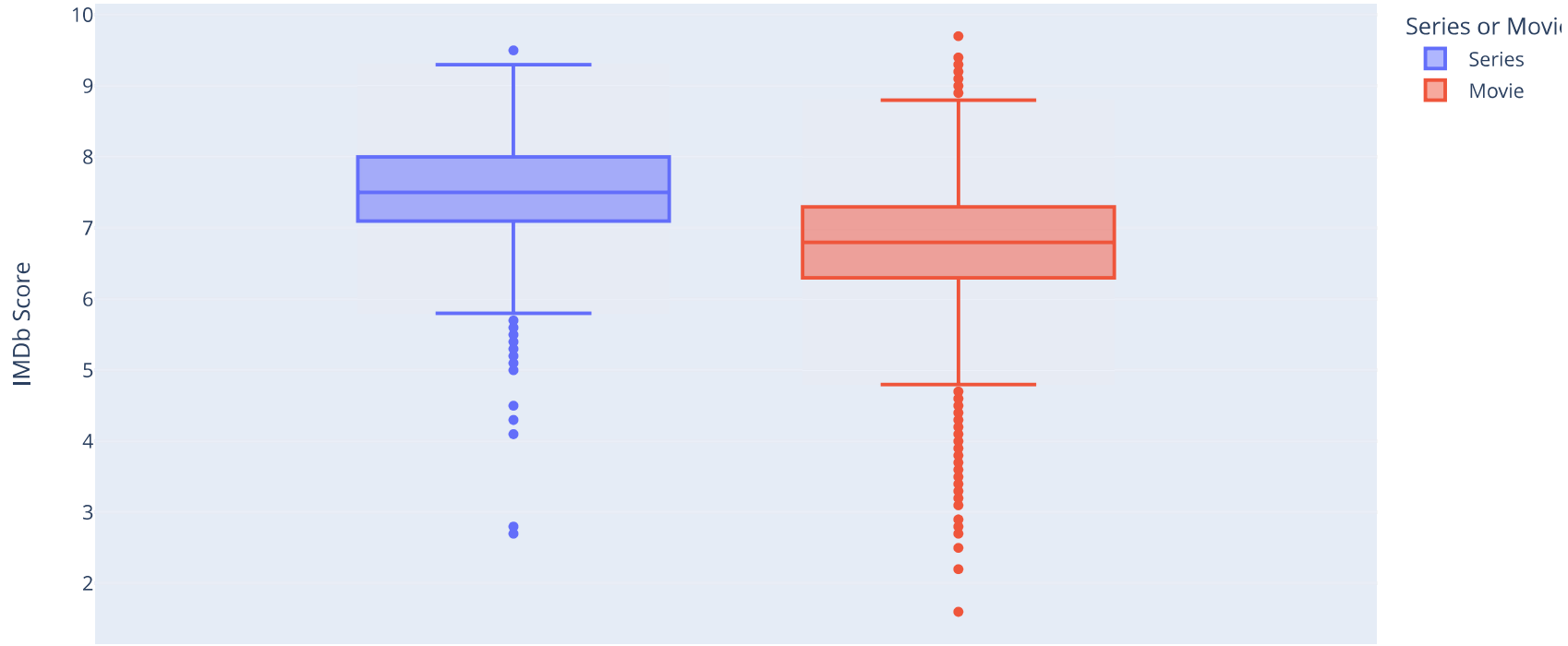
In [13]:
```
ms_imdb = netflix_1.groupby("Series or Movie").agg({"IMDb Score": ["mean", "median", "min", "max"]})
ms_rt = netflix_1.groupby("Series or Movie").agg({"Rotten Tomatoes Score":  ["mean", "median", "min", "max"]})
ms_mc = netflix_1.groupby("Series or Movie").agg({"Metacritic Score":  ["mean", "median", "min", "max"]})
ms_awards_n = netflix_1.groupby("Series or Movie").agg({"Awards Nominated For":  ["mean", "median", "min", "max"]})
ms_awards_r = netflix_1.groupby("Series or Movie").agg({"Awards Received":  ["mean", "median", "min", "max"]})

ms_imdb.loc["Dif"] = ms_imdb.apply(lambda x:x["Movie"] - x["Series"])
ms_rt.loc["Dif"] = ms_rt.apply(lambda x:x["Movie"] - x["Series"])
ms_mc.loc["Dif"] = ms_mc.apply(lambda x:x["Movie"] - x["Series"])
ms_awards_n.loc["Dif"] = ms_awards_n.apply(lambda x:x["Movie"] - x["Series"])
ms_awards_r.loc["Dif"] = ms_awards_r.apply(lambda x:x["Movie"] - x["Series"])


print(ms_imdb)
print(ms_rt)
print(ms_mc)
print(ms_awards_n)
print(ms_awards_r)
```

```
                IMDb Score
                      mean median  min  max
Series or Movie
Movie             6.752828    6.8  1.6  9.7
Series            7.543188    7.5  2.7  9.5
Dif              -0.790361   -0.7 -1.1  0.2
                Rotten Tomatoes Score
                                 mean median  min    max
Series or Movie
Movie                       64.608014   70.0  0.0  100.0
Series                      67.551948   69.0  8.0  100.0
Dif                         -2.943934    1.0 -8.0    0.0
                Metacritic Score
                            mean median   min    max
Series or Movie
Movie                  58.064766   59.0   6.0  100.0
Series                 60.457831   61.0  24.0   93.0
Dif                    -2.393065   -2.0 -18.0    7.0
                Awards Nominated For
                                mean median  min    max
Series or Movie
Movie                      16.031134    6.0  1.0  355.0
Series                     16.053586    5.0  1.0  386.0
Dif                        -0.022452    1.0  0.0  -31.0
                Awards Received
                           mean median  min    max
Series or Movie
Movie                 10.060777    4.0  1.0  300.0
```

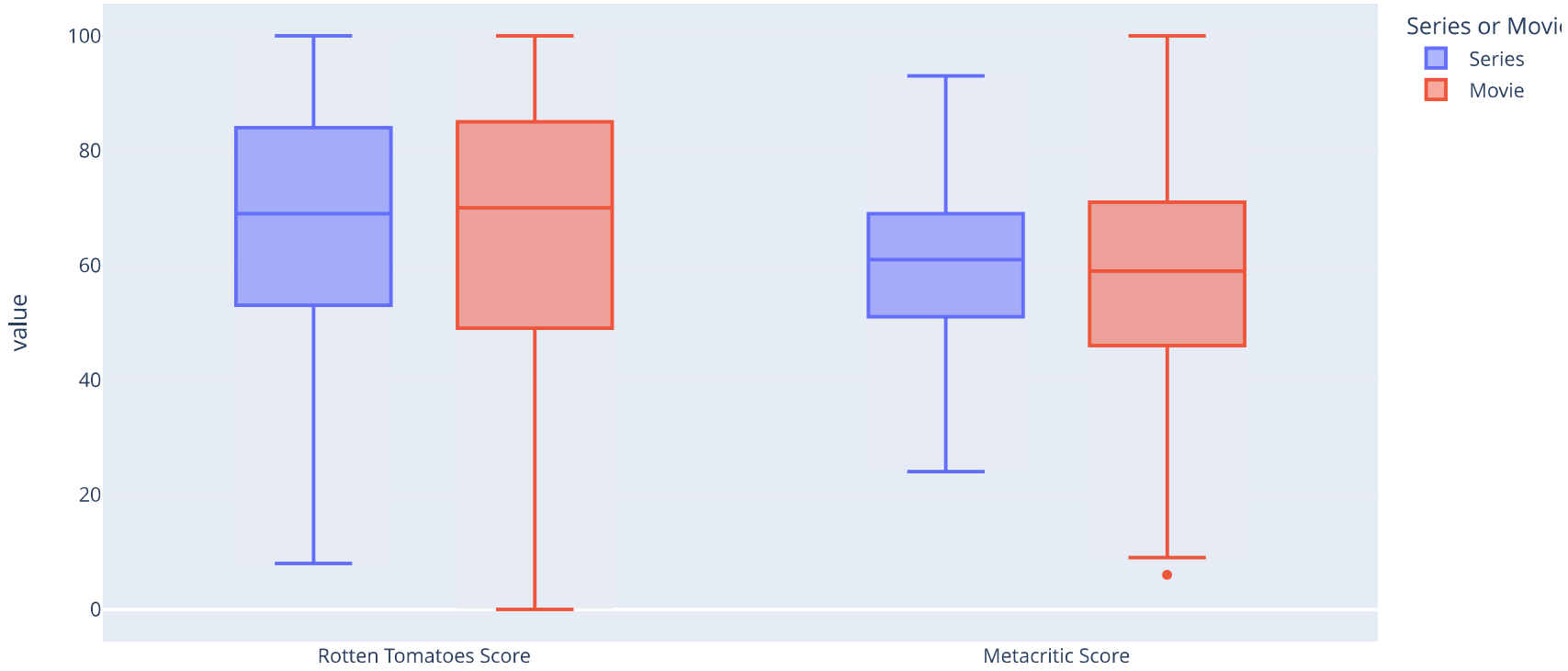
```
Series                8.330275    3.0  1.0  232.0
Dif                   1.730502    1.0  0.0   68.0
```

Plotly Box Plots

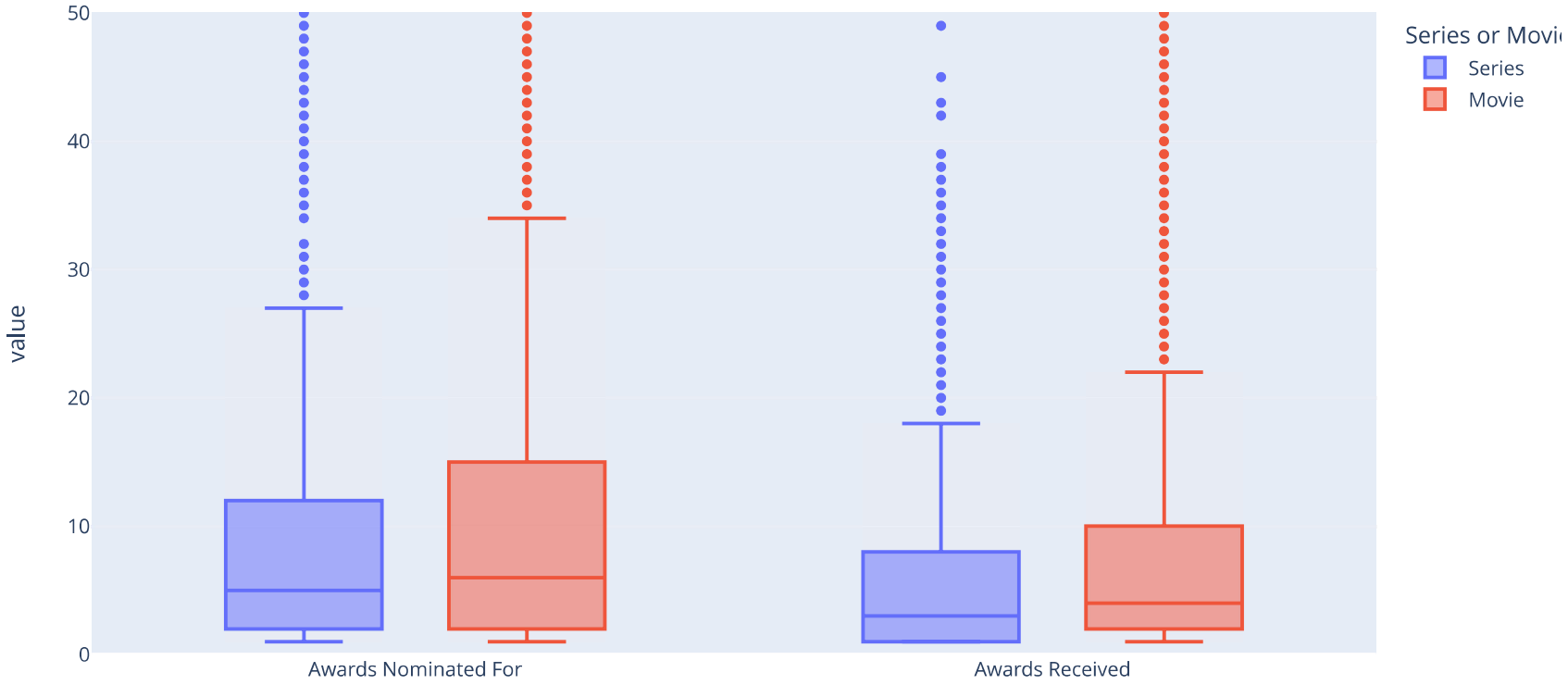
In [168]:
```
px.box(netflix_1, y="IMDb Score", color="Series or Movie")
```



In [40]:
```
fig = px.box(netflix_1, y=["Rotten Tomatoes Score","Metacritic Score"], color="Series or Movie")
fig.update_layout(xaxis_title="")
```



In [42]:
```
fig = px.box(netflix_1, y=["Awards Nominated For","Awards Received"] , color="Series or Movie")
fig.update_layout(yaxis=dict(range=[0,50]), xaxis_title="")
```



Dash Interactive Plot (work in progress)

```
import dash
import dash_core_components as dcc
import dash_html_components as html
from dash.dependencies import Input, Output

app = dash.Dash(__name__)

app.layout = html.Div([
```

```
    html.P("y-axis:"),
    dcc.RadioItems(
        id="y-axis",
        options=[{"value":x, "label":x}
                for x in ["IMDb Score", "Rotten Tomatoes Score", "Metacritic Score", "Awards Nominated For", "Awards
Received"]],
        value="IMDb Score",
        labelStyle={"display":"inline-block"}
    ),
    dcc.Graph(id="box-plot"),
])

@app.callback(
    Output("box-plot", "figure"),
    [Input("y-axis", "value")]
)

def generate_chart(y):
    fig = px.box(netflix_1, x="Series or Movie", y=y)
    return fig

app.run_server(debug=True)
```

Findings

From the above analysis and graphs, Series tend to do better than Movies except in awards recieved.

Have Netflix offerings in the US gotten better over time?

In [50]:
```
print(sp.stats.describe(netflix_usa["IMDb Score"], nan_policy="omit"))
print(sp.stats.describe(netflix_usa["Rotten Tomatoes Score"], nan_policy="omit"))
print(sp.stats.describe(netflix_usa["Metacritic Score"], nan_policy="omit"))
print(sp.stats.describe(netflix_usa["Awards Nominated For"], nan_policy="omit"))
print(sp.stats.describe(netflix_usa["Awards Received"], nan_policy="omit"))

print(sp.stats.describe(netflix_int["IMDb Score"], nan_policy="omit"))
print(sp.stats.describe(netflix_int["Rotten Tomatoes Score"], nan_policy="omit"))
print(sp.stats.describe(netflix_int["Metacritic Score"], nan_policy="omit"))
print(sp.stats.describe(netflix_int["Awards Nominated For"], nan_policy="omit"))
print(sp.stats.describe(netflix_int["Awards Received"], nan_policy="omit"))
```

```
DescribeResult(nobs=3427, minmax=(masked_array(data=3.1,
             mask=False,
       fill_value=1e+20), masked_array(data=9.5,
             mask=False,
       fill_value=1e+20)), mean=7.108987452582434, variance=0.7507656703036957, skewness=masked_array(data=-0.58494017,
             mask=False,
       fill_value=1e+20), kurtosis=0.97092352948447)
DescribeResult(nobs=1398, minmax=(masked_array(data=0.,
             mask=False,
       fill_value=1e+20), masked_array(data=100.,
             mask=False,
       fill_value=1e+20)), mean=70.29828326180258, variance=556.8193384966559, skewness=masked_array(data=-0.95555808,
             mask=False,
       fill_value=1e+20), kurtosis=0.28785962243728)
DescribeResult(nobs=889, minmax=(masked_array(data=11.,
             mask=False,
       fill_value=1e+20), masked_array(data=99.,
             mask=False,
       fill_value=1e+20)), mean=61.008998875140605, variance=263.16883784797176, skewness=masked_array(data=-0.34313274,
             mask=False,
       fill_value=1e+20), kurtosis=-0.24167529977164692)
DescribeResult(nobs=1998, minmax=(masked_array(data=1.,
             mask=False,
       fill_value=1e+20), masked_array(data=386.,
             mask=False,
       fill_value=1e+20)), mean=14.783783783783784, variance=1012.4720053052552, skewness=masked_array(data=5.06791624,
             mask=False,
       fill_value=1e+20), kurtosis=33.043619260042334)
DescribeResult(nobs=1560, minmax=(masked_array(data=1.,
             mask=False,
       fill_value=1e+20), masked_array(data=251.,
             mask=False,
       fill_value=1e+20)), mean=8.888461538461538, variance=338.11840430256086, skewness=masked_array(data=6.20063926,
             mask=False,
       fill_value=1e+20), kurtosis=53.107288568802055)
```

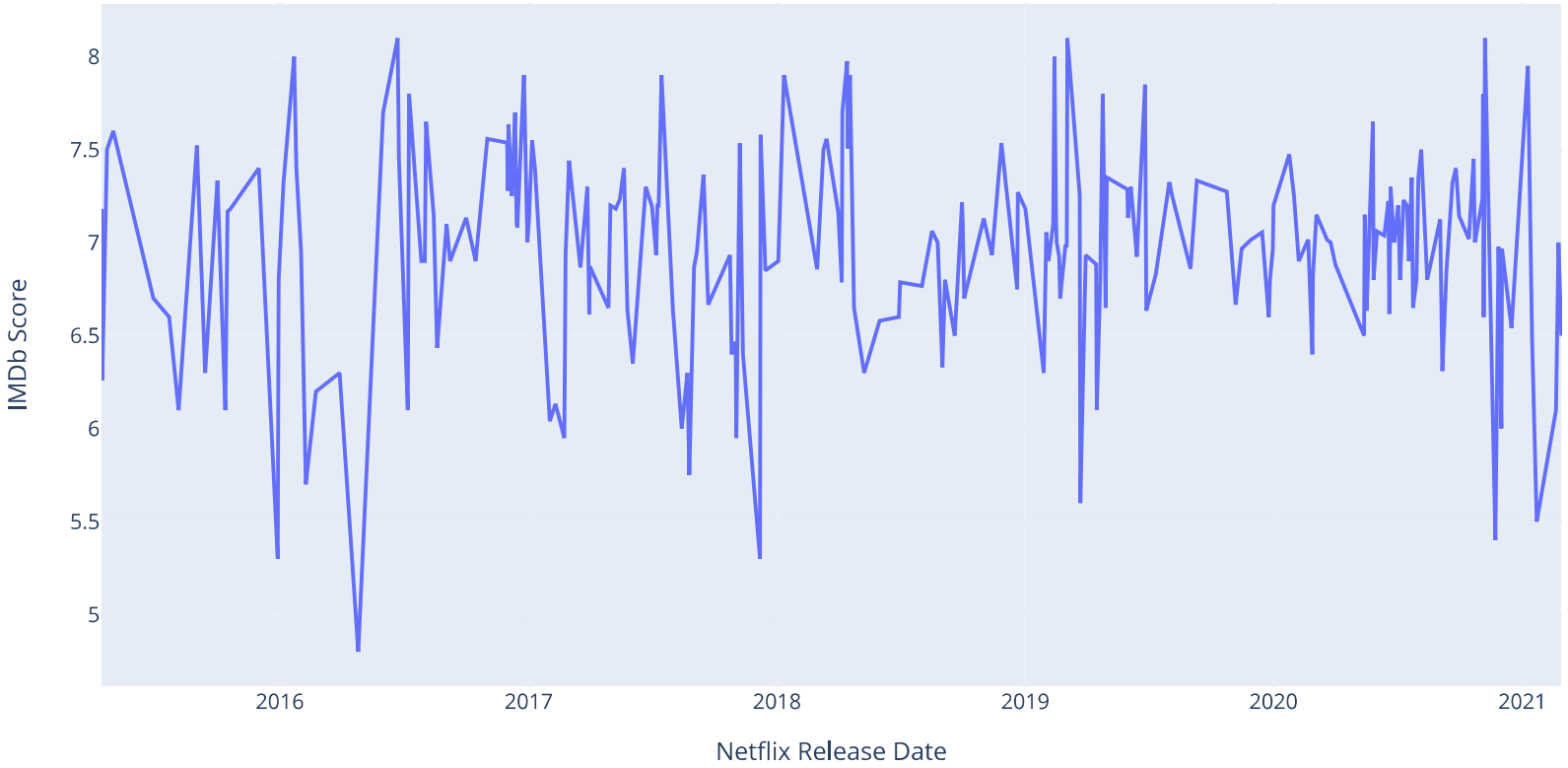
```
DescribeResult(nobs=5979, minmax=(masked_array(data=1.6,
             mask=False,
       fill_value=1e+20), masked_array(data=9.7,
             mask=False,
       fill_value=1e+20)), mean=6.867620003345041, variance=0.8224475129888926, skewness=masked_array(data=-0.67596619,
             mask=False,
       fill_value=1e+20), kurtosis=1.4157715600612804)
DescribeResult(nobs=4040, minmax=(masked_array(data=0.,
             mask=False,
       fill_value=1e+20), masked_array(data=100.,
             mask=False,
       fill_value=1e+20)), mean=62.74480198019802, variance=652.1841769847942, skewness=masked_array(data=-0.55751596,
             mask=False,
       fill_value=1e+20), kurtosis=-0.6884438498993233)
DescribeResult(nobs=3187, minmax=(masked_array(data=6.,
             mask=False,
       fill_value=1e+20), masked_array(data=100.,
             mask=False,
       fill_value=1e+20)), mean=57.294006903043616, variance=299.3984668963742, skewness=masked_array(data=-0.1170702,
             mask=False,
       fill_value=1e+20), kurtosis=-0.49802215814851447)
DescribeResult(nobs=4371, minmax=(masked_array(data=1.,
             mask=False,
       fill_value=1e+20), masked_array(data=383.,
             mask=False,
       fill_value=1e+20)), mean=16.600320292839168, variance=1048.573171522103, skewness=masked_array(data=4.90868371,
             mask=False,
       fill_value=1e+20), kurtosis=31.481340395802768)
DescribeResult(nobs=3659, minmax=(masked_array(data=1.,
             mask=False,
       fill_value=1e+20), masked_array(data=300.,
             mask=False,
       fill_value=1e+20)), mean=10.075157146761411, variance=396.3828135004485, skewness=masked_array(data=5.83951315,
             mask=False,
       fill_value=1e+20), kurtosis=50.26291545901329)
```

Creating Time Series

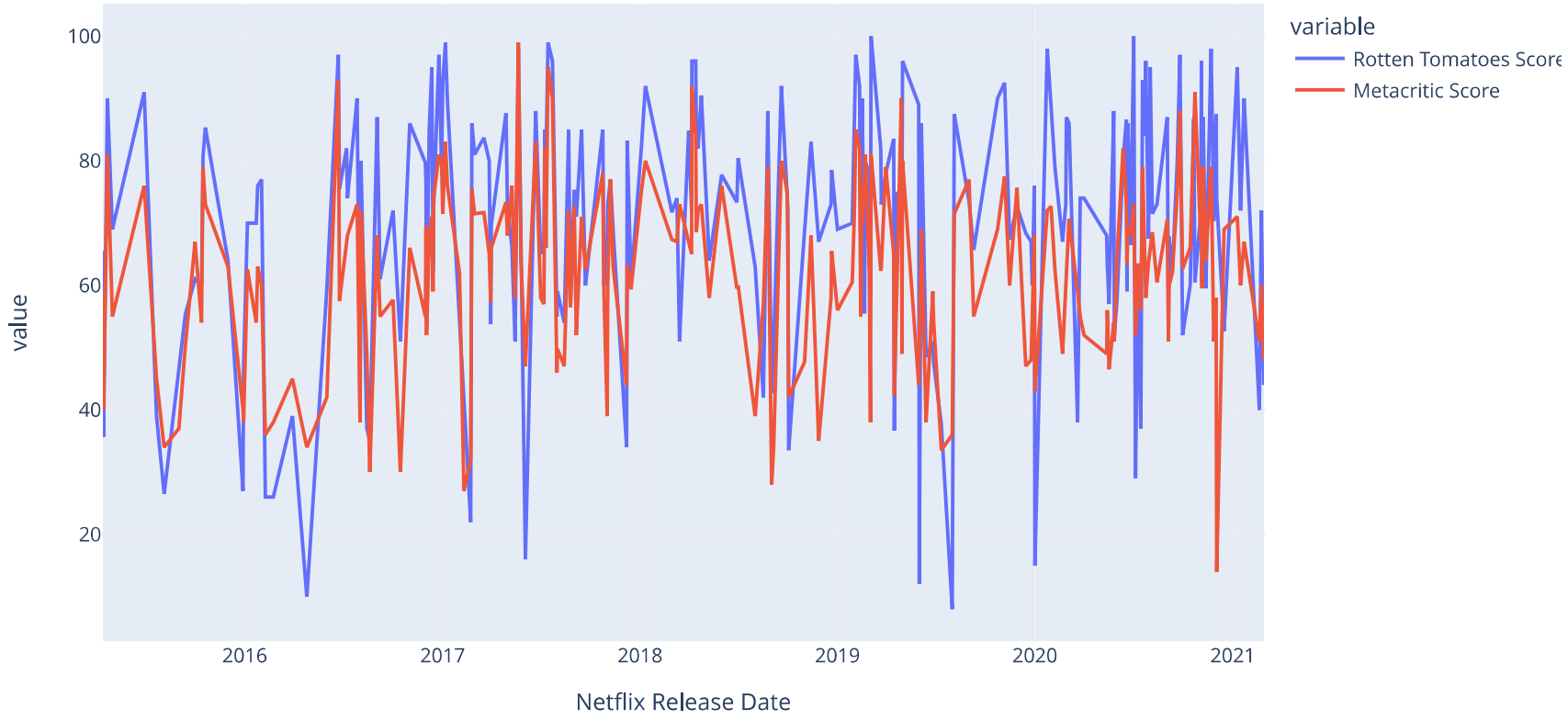
In [163]:
```
netflix_usa_t = netflix_usa.groupby(pd.Grouper(key ="Netflix Release Date", axis=0, freq="1D", sort=True)).mean().dropna()
netflix_usa_t2 = netflix_usa.groupby(pd.Grouper(key ="Netflix Release Date", axis=0, freq="1D", sort=True)).mean().dropna()
netflix_index = pd.Series(np.array(range(1,224)))
netflix_usa_t2 = netflix_usa_t2.set_index(netflix_index)
```

Time Series Plots

In [129]:
```
px.line(netflix_usa_t, x=netflix_usa_t.index, y="IMDb Score")
```



In [92]:
```
px.line(netflix_usa_t, x=netflix_usa_t.index, y=["Rotten Tomatoes Score","Metacritic Score"])
```



Linear Regression of IMDb Score

In [165]:
```
imdb_x = np.array(netflix_usa_t2.index).reshape((-1,1))
imdb_y = np.array(netflix_usa_t2["IMDb Score"])
imdb_model = LinearRegression().fit(imdb_x, imdb_y)

imdb_model.score(imdb_x, imdb_y)
print("slope: ",imdb_model.coef_)
print("intercept: ", imdb_model.intercept_)
```

```
slope:  [5.19102418e-05]
intercept:  6.961315171694573
```

From the above results, we can see that the average Netflix offering in the US has not gotten better over time.