In [2]:

```python
import pandas as pd
from sklearn.model_selection import train_test_split
import numpy as np
from scipy.sparse.linalg import svds
from scipy.sparse import csr_matrix
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.metrics import mean_absolute_error
from sklearn.metrics import mean_squared_error
```

In [ ]:

```python
df = pd.read_csv('Netflix_User_Ratings.csv')
```

In [3]:

```python
# Como nosso dataset possue mais de 100 milhões de linhas, preciso dividir em chunk
ratings = pd.read_csv('Netflix_User_Ratings.csv', nrows=100000)
```

In [3]:

```python
ratings
```

Out[3]:

	CustId	Rating	Date	MovieId
0	1488844	3	2005-09-06	1
1	822109	5	2005-05-13	1
2	885013	4	2005-10-19	1
3	30878	4	2005-12-26	1
4	823519	3	2004-05-03	1
...	...	...	...	...
99995	2146325	5	2004-04-29	30
99996	2103907	3	2004-07-14	30
99997	2581477	4	2005-08-27	30
99998	2182488	4	2004-08-21	30
99999	2515863	4	2004-08-02	30

100000 rows × 4 columns

In [4]:

```python
# Aqui normalizamos os tipos de dados garantindo que não há erros e divergencias
ratings['CustId'] = ratings['CustId'].astype('int')
ratings['MovieId'] = ratings['MovieId'].astype('int')
```

In [5]:

```python
ratings.apply(lambda ratings: ratings.duplicated(), axis=1).sum()
```

Out[5]:

```
CustId        0
Rating        0
Date          0
MovieId    1116
dtype: int64
```

In [51]:

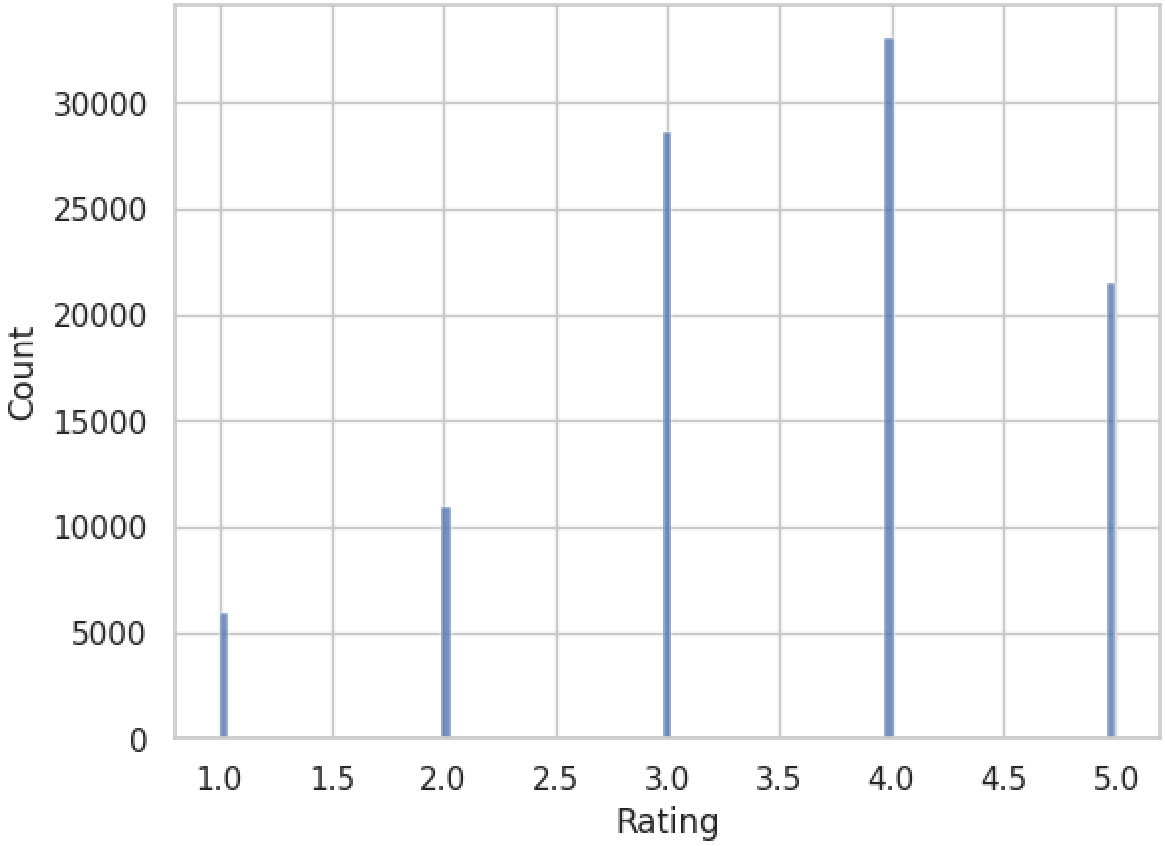
```python
ratings.isna().sum()
```

Out[51]:

```
CustId     0
Rating     0
Date       0
MovieId    0
dtype: int64
```

In [53]:

```
ax = sns.histplot(ratings, x='Rating')
plt.show()
plt.close()
```



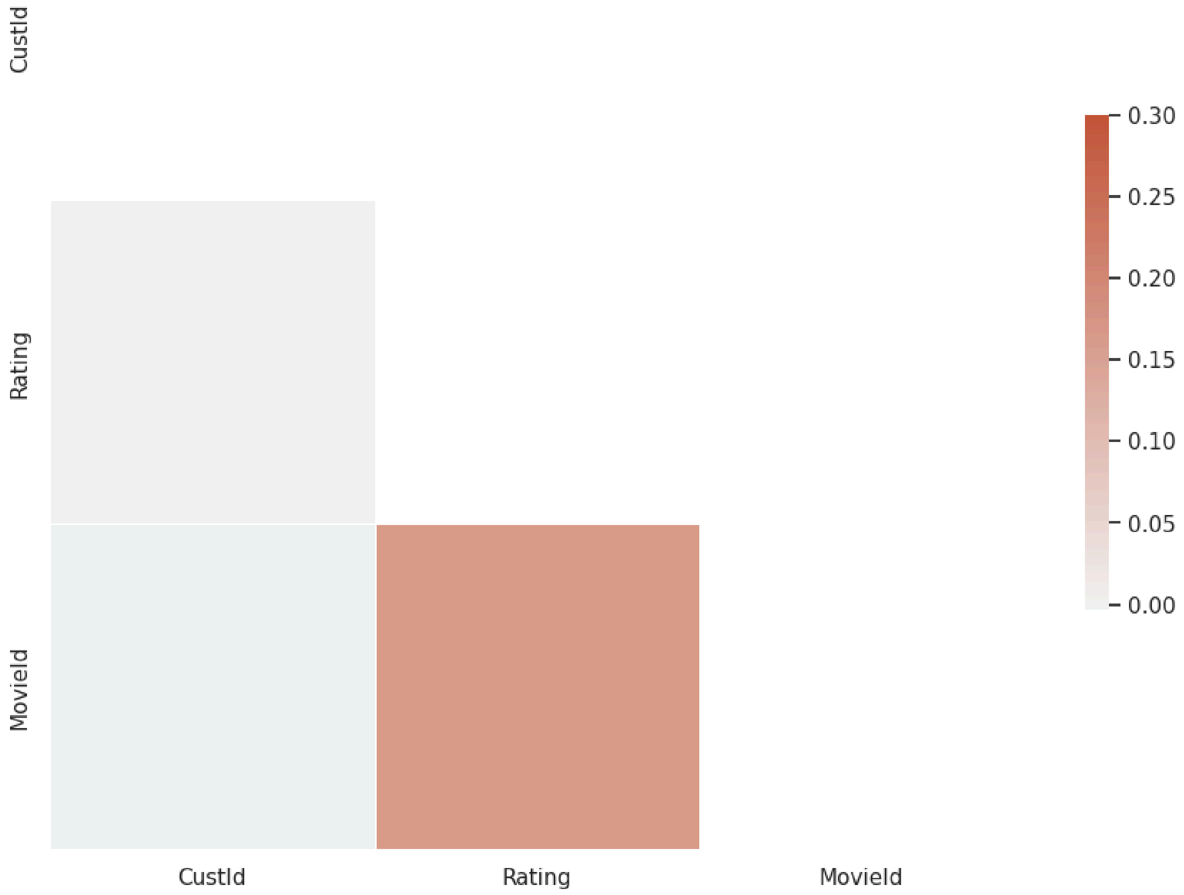
In [54]:

```
corr = ratings.corr()

mask = np.triu(np.ones_like(corr, dtype=bool))
f, ax = plt.subplots(figsize=(11, 9))
cmap = sns.diverging_palette(230, 20, as_cmap=True)

sns.heatmap(corr, mask=mask, cmap=cmap, vmax=.3, center=0,
            square=True, linewidths=.5, cbar_kws={"shrink": .5})
plt.show()
```

```
/tmp/ipykernel_28241/2574582863.py:1: FutureWarning: The default value of numeric_
only in DataFrame.corr is deprecated. In a future version, it will default to Fals
e. Select only valid columns or specify the value of numeric_only to silence this
warning.
  corr = ratings.corr()
```



```
In [1]: from sklearn.preprocessing import StandardScaler
        from sklearn.cluster import DBSCAN

        # Assuming your dataframe is named 'df'
        # Select relevant columns for clustering
        selected_columns = ['CustId']

        # Extract the features for clustering
        X = ratings[selected_columns]

        # Standardize the features
        scaler = StandardScaler()
        X_scaled = scaler.fit_transform(X)

        # Perform DBSCAN clustering
        dbscan = DBSCAN(eps=0.5, min_samples=500)
        clusters = dbscan.fit_predict(X_scaled)

        # Add the cluster labels to the dataframe
        ratings['Cluster'] = clusters

        # Visualize the clusters
        plt.figure(figsize=(10, 6))
        sns.scatterplot(x='CustId', y='MovieId', hue='Cluster', data=ratings, palette='viri
        plt.title('DBSCAN Clustering of Movie Ratings')
        plt.show()
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
Cell In[1], line 9
      6 selected_columns = ['CustId']
      8 # Extract the features for clustering
----> 9 X = ratings[selected_columns]
     11 # Standardize the features
     12 scaler = StandardScaler()

NameError: name 'ratings' is not defined
```

In [ ]:

In [ ]:

In [ ]:

In [11]:

```
train_data, test_data = train_test_split(ratings, test_size=0.2, random_state=42)
```

In [12]:

```
ratings_train_matrix = train_data.pivot(index='CustId', columns='MovieId', values='
```

In [ ]:

In [ ]:

In [13]:

```
sparse_ratings_matrix = csr_matrix(ratings_train_matrix)

U, sigma, Vt = svds(sparse_ratings_matrix, k=min(sparse_ratings_matrix.shape)-1)

sigma_diag_matrix = np.diag(sigma)

predicted_ratings = np.dot(np.dot(U, sigma_diag_matrix), Vt)
```

In [25]:

```
user_id = 387418
user_index = ratings_train_matrix.index.get_loc(user_id)

user_vector = U[user_index, :]

predicted_ratings_for_user = np.dot(user_vector, Vt)

num_recommendations = 10
recommended_movie_indices = np.argsort(predicted_ratings_for_user)[-num_recommendat

recommended_movie_ids = ratings_train_matrix.columns[recommended_movie_indices]

print(f"Top Recommendations for User {user_id}:", recommended_movie_ids.tolist())
```

```
Top Recommendations for User 387418: [14, 22, 4, 15, 10, 9, 20, 24, 19, 11]
```

In [26]:

```
user_id_test = 387418
user_index_train = train_data[train_data['CustId'] == user_id_test].index[0]
user_vector_test = U_train[user_index_train, :]

predicted_ratings_for_user_test = np.dot(user_vector_test, Vt_train)

num_recommendations_test = 10
recommended_movie_indices_test = np.argsort(predicted_ratings_for_user_test)[-num_r
recommended_movie_ids_test = train_matrix.columns[recommended_movie_indices_test]

print(f"Top Recommendations for User {user_id_test} in Test Set:", recommended_movi
Top Recommendations for User 387418 in Test Set: [8, 7, 23, 5, 20, 19, 15, 14, 27,
9]
```

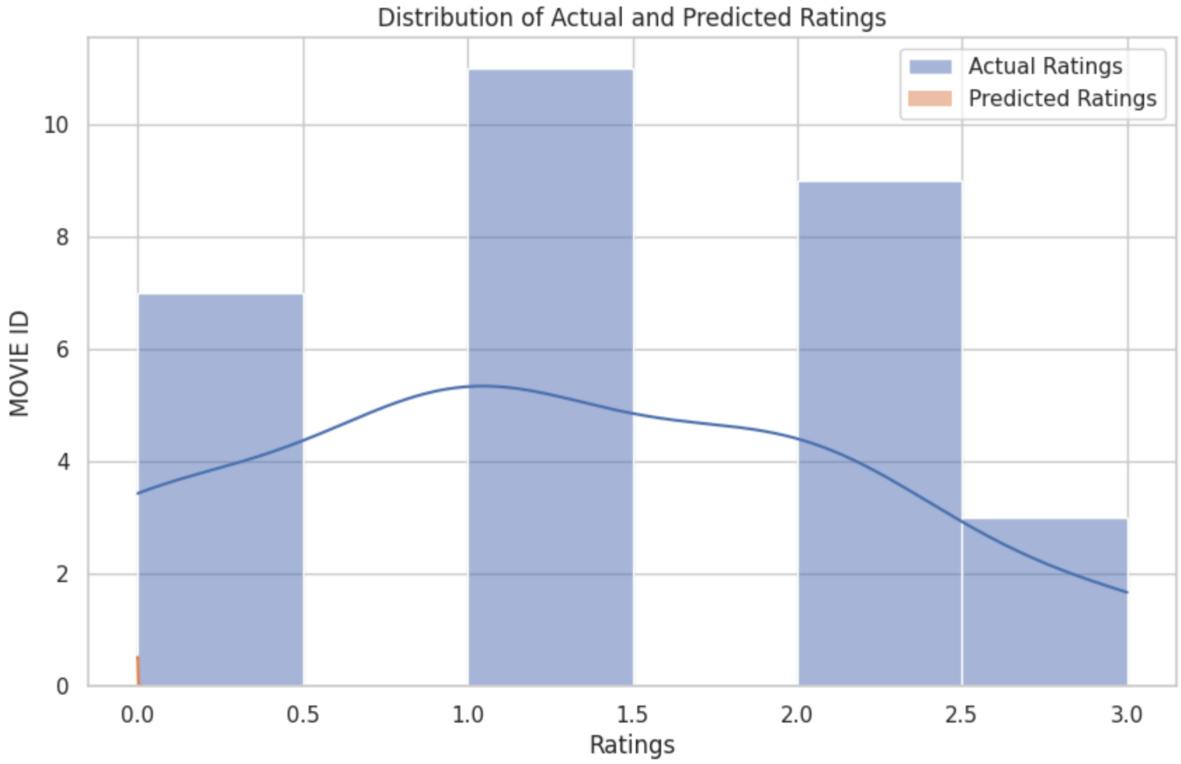
In [32]:

```python
user_index_test = 387418

# Extract the actual ratings from the test set
actual_ratings_test = train_matrix.loc[user_index_test]

# Extract the predicted ratings for the user
predicted_ratings_for_user_test = np.dot(U_train[user_index_train, :], Vt_train)

# Create a distribution plot
sns.set(style="whitegrid")
plt.figure(figsize=(10, 6))
sns.histplot(actual_ratings_test, label='Actual Ratings', kde=True)
sns.histplot(predicted_ratings_for_user_test, label='Predicted Ratings', kde=True)
plt.title('Distribution of Actual and Predicted Ratings')
plt.xlabel('Ratings')
plt.ylabel('MOVIE ID')
plt.legend()
plt.show()
```



In [39]:

```python
mse = mean_squared_error(actual_ratings_test, predicted_ratings_for_user_test)
print("Mean Squared Error (MSE):", mse)

rmse = np.sqrt(mse)
print("Root Mean Squared Error (RMSE):", rmse)


mae = mean_absolute_error(actual_ratings_test, predicted_ratings_for_user_test)
print("Mean Absolute Error (MAE):", mae)
```

```
Mean Squared Error (MSE): 2.4661787895404204
Root Mean Squared Error (RMSE): 1.5704072050078033
Mean Absolute Error (MAE): 1.2663982027379157
```

In [40]:

```python
from sklearn.metrics import r2_score
```

```
r_squared = r2_score(actual_ratings_test, predicted_ratings_for_user_test)
print("R-squared (R²):", r_squared)
```

```
R-squared (R²): -1.8602589053948178
```

In [41]:

```
from sklearn.metrics import median_absolute_error

medae = median_absolute_error(actual_ratings_test, predicted_ratings_for_user_test)
print("Median Absolute Error (MedAE):", medae)
```

```
Median Absolute Error (MedAE): 1.0000873091555962
```

In [ ]: