In [3]:
```
!pip install numpy
```

```
Requirement already satisfied: numpy in c:\users\hp\anaconda3\lib\site-packages (1.26.4)
```

In [4]:
```
!pip install pandas
```

```
Requirement already satisfied: pandas in c:\users\hp\anaconda3\lib\site-packages (2.1.4)
Requirement already satisfied: numpy<2,>=1.23.2 in c:\users\hp\anaconda3\lib\site-packages (from pandas) (1.26.4)
Requirement already satisfied: python-dateutil>=2.8.2 in c:\users\hp\anaconda3\lib\site-packages (from pandas)
(2.8.2)
Requirement already satisfied: pytz>=2020.1 in c:\users\hp\anaconda3\lib\site-packages (from pandas) (2023.3.post1)
Requirement already satisfied: tzdata>=2022.1 in c:\users\hp\anaconda3\lib\site-packages (from pandas) (2023.3)
Requirement already satisfied: six>=1.5 in c:\users\hp\anaconda3\lib\site-packages (from python-dateutil>=2.8.2->pand
as) (1.16.0)
```

In [5]:
```
!pip install matplotlib
```

```
Requirement already satisfied: matplotlib in c:\users\hp\anaconda3\lib\site-packages (3.8.0)
Requirement already satisfied: contourpy>=1.0.1 in c:\users\hp\anaconda3\lib\site-packages (from matplotlib) (1.2.0)
Requirement already satisfied: cycler>=0.10 in c:\users\hp\anaconda3\lib\site-packages (from matplotlib) (0.11.0)
Requirement already satisfied: fonttools>=4.22.0 in c:\users\hp\anaconda3\lib\site-packages (from matplotlib) (4.2
5.0)
Requirement already satisfied: kiwisolver>=1.0.1 in c:\users\hp\anaconda3\lib\site-packages (from matplotlib) (1.4.4)
Requirement already satisfied: numpy<2,>=1.21 in c:\users\hp\anaconda3\lib\site-packages (from matplotlib) (1.26.4)
Requirement already satisfied: packaging>=20.0 in c:\users\hp\anaconda3\lib\site-packages (from matplotlib) (23.1)
Requirement already satisfied: pillow>=6.2.0 in c:\users\hp\anaconda3\lib\site-packages (from matplotlib) (10.2.0)
Requirement already satisfied: pyparsing>=2.3.1 in c:\users\hp\anaconda3\lib\site-packages (from matplotlib) (3.0.9)
Requirement already satisfied: python-dateutil>=2.7 in c:\users\hp\anaconda3\lib\site-packages (from matplotlib)
(2.8.2)
Requirement already satisfied: six>=1.5 in c:\users\hp\anaconda3\lib\site-packages (from python-dateutil>=2.7->matplo
tlib) (1.16.0)
```

In [6]:
```
!pip install seaborn
```

```
Requirement already satisfied: seaborn in c:\users\hp\anaconda3\lib\site-packages (0.12.2)
Requirement already satisfied: numpy!=1.24.0,>=1.17 in c:\users\hp\anaconda3\lib\site-packages (from seaborn) (1.2
6.4)
Requirement already satisfied: pandas>=0.25 in c:\users\hp\anaconda3\lib\site-packages (from seaborn) (2.1.4)
Requirement already satisfied: matplotlib!=3.6.1,>=3.1 in c:\users\hp\anaconda3\lib\site-packages (from seaborn)
(3.8.0)
Requirement already satisfied: contourpy>=1.0.1 in c:\users\hp\anaconda3\lib\site-packages (from matplotlib!=3.6.1,>=
3.1->seaborn) (1.2.0)
Requirement already satisfied: cycler>=0.10 in c:\users\hp\anaconda3\lib\site-packages (from matplotlib!=3.6.1,>=3.1-
>seaborn) (0.11.0)
Requirement already satisfied: fonttools>=4.22.0 in c:\users\hp\anaconda3\lib\site-packages (from matplotlib!=3.6.1,>
=3.1->seaborn) (4.25.0)
Requirement already satisfied: kiwisolver>=1.0.1 in c:\users\hp\anaconda3\lib\site-packages (from matplotlib!=3.6.1,>
=3.1->seaborn) (1.4.4)
Requirement already satisfied: packaging>=20.0 in c:\users\hp\anaconda3\lib\site-packages (from matplotlib!=3.6.1,>=
3.1->seaborn) (23.1)
Requirement already satisfied: pillow>=6.2.0 in c:\users\hp\anaconda3\lib\site-packages (from matplotlib!=3.6.1,>=
3.1->seaborn) (10.2.0)
Requirement already satisfied: pyparsing>=2.3.1 in c:\users\hp\anaconda3\lib\site-packages (from matplotlib!=3.6.1,>=
3.1->seaborn) (3.0.9)
Requirement already satisfied: python-dateutil>=2.7 in c:\users\hp\anaconda3\lib\site-packages (from matplotlib!=
3.6.1,>=3.1->seaborn) (2.8.2)
Requirement already satisfied: pytz>=2020.1 in c:\users\hp\anaconda3\lib\site-packages (from pandas>=0.25->seaborn)
(2023.3.post1)
Requirement already satisfied: tzdata>=2022.1 in c:\users\hp\anaconda3\lib\site-packages (from pandas>=0.25->seaborn)
(2023.3)
Requirement already satisfied: six>=1.5 in c:\users\hp\anaconda3\lib\site-packages (from python-dateutil>=2.7->matplo
tlib!=3.6.1,>=3.1->seaborn) (1.16.0)
```

In [9]:
```
!pip install -U scikit-learn
```

```
Requirement already satisfied: scikit-learn in c:\users\hp\anaconda3\lib\site-packages (1.5.0)
Requirement already satisfied: numpy>=1.19.5 in c:\users\hp\anaconda3\lib\site-packages (from scikit-learn) (1.26.4)
Requirement already satisfied: scipy>=1.6.0 in c:\users\hp\anaconda3\lib\site-packages (from scikit-learn) (1.11.4)
Requirement already satisfied: joblib>=1.2.0 in c:\users\hp\anaconda3\lib\site-packages (from scikit-learn) (1.2.0)
Requirement already satisfied: threadpoolctl>=3.1.0 in c:\users\hp\anaconda3\lib\site-packages (from scikit-learn)
(3.5.0)
```

import numpy as np import pandas as pd import matplotlib.pyplot as plt import seaborn as sns import re import nltk import string from nltk.corpus import stopwords from nltk.stem import LancasterStemmer from sklearn.feature_extraction.text import TfidfVectorizer from sklearn.model_selection import train_test_split from sklearn.naive_bayes import MultinomialNB from sklearn.metrics import accuracy_score, classification_report train_path = "train_data.txt" train_data = pd.read_csv(train_path, sep=':::', names=['Title', 'Genre', 'Description'], engine='python')

In [11]:
```
test_path = "test_data.txt"
```

```
test_data = pd.read_csv(test_path, sep=':::', names=['Id', 'Title', 'Description'], engine='python')
test_data
```

Out[11]:

	Id	Title	Description
0	1	Edgar's Lunch (1998)	L.R. Brane loves his life - his car, his apar...
1	2	La guerra de papá (1977)	Spain, March 1964: Quico is a very naughty ch...
2	3	Off the Beaten Track (2010)	One year in the life of Albin and his family ...
3	4	Meu Amigo Hindu (2015)	His father has died, he hasn't spoken with hi...
4	5	Er nu zhai (1955)	Before he was known internationally as a mart...
...	...	...	...
54195	54196	"Tales of Light & Dark" (2013)	Covering multiple genres, Tales of Light & Da...
54196	54197	Der letzte Mohikaner (1965)	As Alice and Cora Munro attempt to find their...
54197	54198	Oliver Twink (2007)	A movie 169 years in the making. Oliver Twist...
54198	54199	Slipstream (1973)	Popular, but mysterious rock DJ Mike Mallard...
54199	54200	Curitiba Zero Grau (2010)	Curitiba is a city in movement, with rhythms ...

54200 rows × 3 columns

In [6]:
```
train_data.describe()
```

Out[6]:

	Title	Genre	Description
count	54214	54214	54214
unique	54214	27	54086
top	Oscar et la dame rose (2009)	drama	Grammy - music award of the American academy ...
freq	1	13613	12

In [14]:
```
test_data.describe()
```

Out[14]:

	Id
count	54200.000000
mean	27100.500000
std	15646.336632
min	1.000000
25%	13550.750000
50%	27100.500000
75%	40650.250000
max	54200.000000

In [15]:
```
train_data.isnull().sum()
```

Out[15]:
```
Title          0
Genre          0
Description    0
dtype: int64
```

In [16]:
```
test_data.isnull().sum()
```

Out[16]:
```
Id             0
Title          0
Description    0
dtype: int64
```

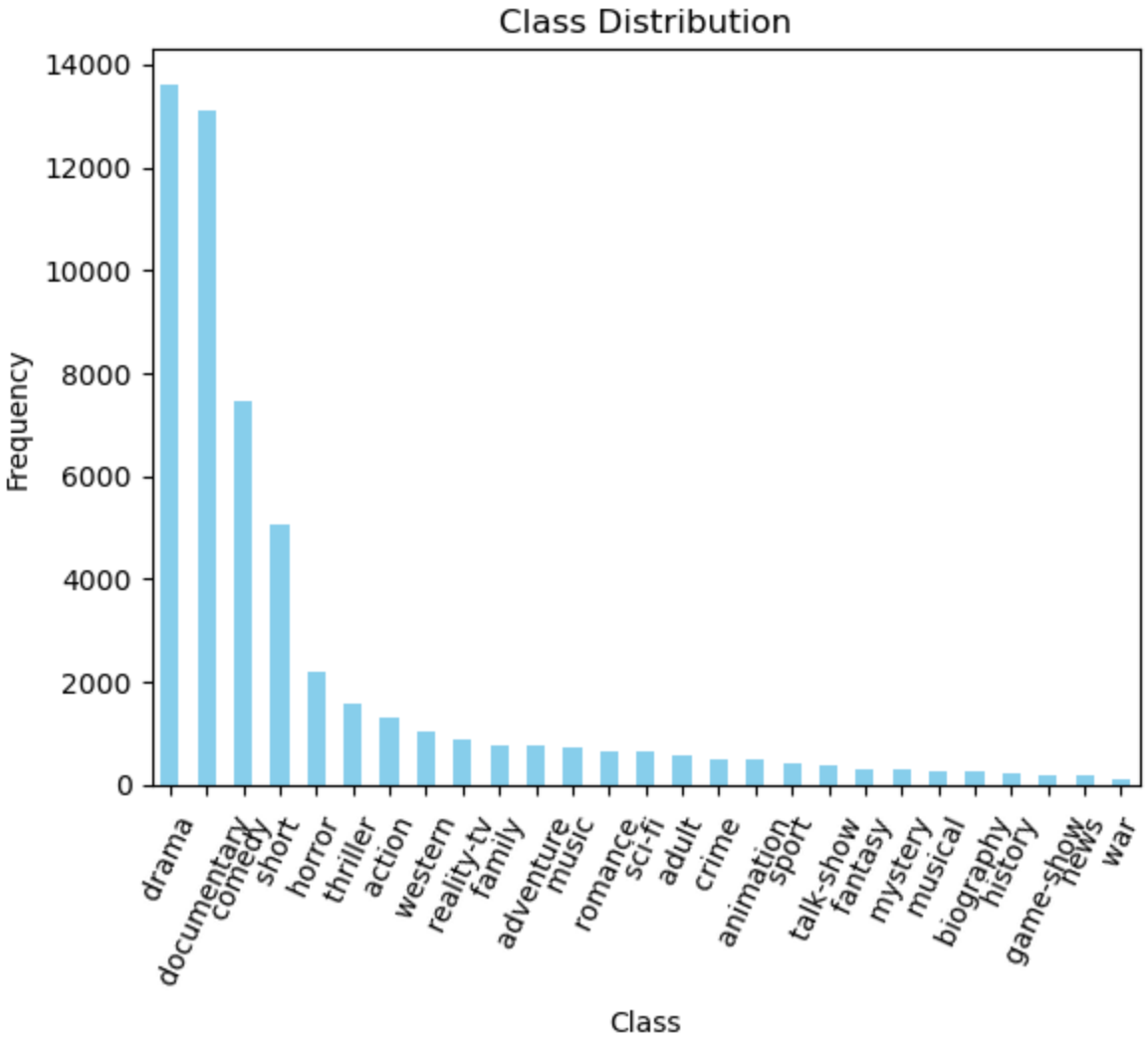
In [18]:
```
class_distribution = train_data['Genre'].value_counts()
print("Class Distribution:")
print(class_distribution)
```

```
Class Distribution:
Genre
 drama           13613
 documentary     13096
 comedy           7447
 short            5073
 horror           2204
 thriller         1591
 action           1315
 western          1032
 reality-tv        884
 family            784
 adventure         775
 music             731
 romance           672
 sci-fi            647
 adult             590
 crime             505
 animation         498
 sport             432
 talk-show         391
 fantasy           323
 mystery           319
 musical           277
 biography         265
 history           243
 game-show         194
 news              181
 war               132
Name: count, dtype: int64
```

In [19]:
```
imbalance_ratio = class_distribution.min() / class_distribution.max()
print("Imbalance Ratio:", imbalance_ratio)
```

```
Imbalance Ratio: 0.009696613531183427
```

In [20]:
```
class_distribution.plot(kind='bar', color='skyblue')
plt.title('Class Distribution')
plt.xlabel('Class')
plt.ylabel('Frequency')
plt.xticks(rotation=65)
plt.show()
```



In [21]:
```
tfidf_vectorizer = TfidfVectorizer(max_features=5000)
X_train_tfidf = tfidf_vectorizer.fit_transform(train_data['Description'])
y_train = train_data['Genre']


nb_classifier = MultinomialNB()
nb_classifier.fit(X_train_tfidf, y_train)
```

```
y_train_pred = nb_classifier.predict(X_train_tfidf)


print("Accuracy on training set:", accuracy_score(y_train, y_train_pred))
print("Classification Report on training set:\n", classification_report(y_train, y_train_pred))
```

```
Accuracy on training set: 0.5359132327443096
C:\Users\HP\anaconda3\Lib\site-packages\sklearn\metrics\_classification.py:1517: UndefinedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
C:\Users\HP\anaconda3\Lib\site-packages\sklearn\metrics\_classification.py:1517: UndefinedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
```

```
Classification Report on training set:
               precision    recall  f1-score   support

      action       0.70      0.09      0.16      1315
       adult       0.79      0.05      0.10       590
   adventure       0.76      0.05      0.10       775
   animation       0.00      0.00      0.00       498
   biography       0.00      0.00      0.00       265
      comedy       0.56      0.45      0.50      7447
       crime       0.00      0.00      0.00       505
 documentary       0.57      0.90      0.70     13096
       drama       0.47      0.84      0.60     13613
      family       1.00      0.00      0.01       784
     fantasy       0.00      0.00      0.00       323
   game-show       1.00      0.14      0.24       194
     history       0.00      0.00      0.00       243
      horror       0.78      0.36      0.50      2204
       music       0.90      0.16      0.27       731
     musical       0.00      0.00      0.00       277
     mystery       0.00      0.00      0.00       319
        news       0.00      0.00      0.00       181
  reality-tv       0.85      0.03      0.05       884
     romance       0.00      0.00      0.00       672
      sci-fi       0.85      0.04      0.09       647
       short       0.66      0.11      0.19      5073
       sport       0.80      0.11      0.19       432
   talk-show       1.00      0.01      0.02       391
    thriller       0.71      0.02      0.05      1591
         war       0.00      0.00      0.00       132
     western       0.97      0.59      0.73      1032

    accuracy                           0.54     54214
   macro avg       0.50      0.15      0.17     54214
weighted avg       0.57      0.54      0.46     54214


C:\Users\HP\anaconda3\Lib\site-packages\sklearn\metrics\_classification.py:1517: UndefinedMetricWarning: Precision is
ill-defined and being set to 0.0 in labels with no predicted samples. Use `zero_division` parameter to control this b
ehavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
```

In [23]:
```
tfidf_vectorizer = TfidfVectorizer(max_features=5000)
X_test = tfidf_vectorizer.fit_transform(test_data['Description'])
```

In [24]:
```
X_test_predictions = nb_classifier.predict(X_test)
test_data['Predicted_Genre'] = X_test_predictions
```

In [25]:
```
test_data.to_csv('predicted_genres.csv', index=False)

print(test_data)
```

```
          Id                             Title  \
0          1             Edgar's Lunch (1998)
1          2          La guerra de papá (1977)
2          3       Off the Beaten Track (2010)
3          4            Meu Amigo Hindu (2015)
4          5                 Er nu zhai (1955)
...      ...                               ...
54195  54196   "Tales of Light & Dark" (2013)
54196  54197      Der letzte Mohikaner (1965)
54197  54198              Oliver Twink (2007)
54198  54199                Slipstream (1973)
54199  54200        Curitiba Zero Grau (2010)

                                     Description Predicted_Genre
0       L.R. Brane loves his life - his car, his apar...          drama
1       Spain, March 1964: Quico is a very naughty ch...          drama
2       One year in the life of Albin and his family ...    documentary
3       His father has died, he hasn't spoken with hi...    documentary
4       Before he was known internationally as a mart...    documentary
...                                                   ...            ...
54195   Covering multiple genres, Tales of Light & Da...          drama
54196   As Alice and Cora Munro attempt to find their...          drama
54197   A movie 169 years in the making. Oliver Twist...    documentary
54198   Popular, but mysterious rock D.J Mike Mallard...          drama
54199   Curitiba is a city in movement, with rhythms ...          short

[54200 rows x 4 columns]
```

In [26]:
```
import pickle
with open('tfidf_vectorizer.pkl', 'wb') as file:
    pickle.dump(tfidf_vectorizer, file)
```

```
with open('nb_classifier.pkl', 'wb') as file:
    pickle.dump(nb_classifier, file)

print("Models pickled successfully.")
```

```
Models pickled successfully.
```

In [ ]: