Movie Recommender System (Filming)

- Recommender system used to suggest movies or songs or any other kind of products to users based on their interest, or usage history
- Applied Item-Based Collaborative Filter

Dataset:

- Dataset MovieLens: https://grouplens.org/datasets/movielens/100k/

In [1]:

```
# Importing Libraries
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
```

In [3]:

```
# Importing Dataset
movie_titles_df = pd.read_csv('Movie_Id_Titles')
```

In [4]:

```
movie_titles_df.head(5)
```

Out[4]:

	item_id	title
0	1	Toy Story (1995)
1	2	GoldenEye (1995)
2	3	Four Rooms (1995)
3	4	Get Shorty (1995)
4	5	Copycat (1995)

In [12]:

```
movies_rating_df = pd.read_csv('u.data', sep = '\t', names = ['user_id','item_id','rating','timestamp'])
```

In [13]:

```
movies_rating_df.drop(['timestamp'], axis = 1, inplace = True)
```

In [14]:

```
movies_rating_df.head(5)
```

Out[14]:

	user_id	item_id	rating
0	0	50	5
1	0	172	5
2	0	133	1
3	196	242	3
4	186	302	3

In [16]:

```
movies_rating_df['rating'].describe()
```

Out[16]:

```
count    100003.000000
mean          3.529864
std           1.125704
min           1.000000
25%           3.000000
50%           4.000000
75%           4.000000
max           5.000000
Name: rating, dtype: float64
```

In [17]:

```
movies_rating_df = pd.merge(movies_rating_df, movie_titles_df, on = 'item_id')
```

In [18]:

```
movies_rating_df.head()
```

Out[18]:

	user_id	item_id	rating	title
0	0	50	5	Star Wars (1977)
1	290	50	5	Star Wars (1977)
2	79	50	4	Star Wars (1977)
3	2	50	5	Star Wars (1977)
4	8	50	5	Star Wars (1977)

In [20]:

```
movies_rating_df.shape # 100003 samples
```

Out[20]:
```
(100003, 4)
```

In [22]:
```
movies_rating_df.groupby('title')['rating'].describe()
```

Out[22]:

	count	mean	std	min	25%	50%	75%	max
title								
'Til There Was You (1997)	9.0	2.333333	1.000000	1.0	2.00	2.0	3.0	4.0
1-900 (1994)	5.0	2.600000	1.516575	1.0	1.00	3.0	4.0	4.0
101 Dalmatians (1996)	109.0	2.908257	1.076184	1.0	2.00	3.0	4.0	5.0
12 Angry Men (1957)	125.0	4.344000	0.719588	2.0	4.00	4.0	5.0	5.0
187 (1997)	41.0	3.024390	1.172344	1.0	2.00	3.0	4.0	5.0
...	...	...	...	...	...	...	...	...
Young Guns II (1990)	44.0	2.772727	1.008421	1.0	2.00	3.0	3.0	5.0
Young Poisoner's Handbook, The (1995)	41.0	3.341463	1.237129	1.0	3.00	4.0	4.0	5.0
Zeus and Roxanne (1997)	6.0	2.166667	0.983192	1.0	1.25	2.5	3.0	3.0
unknown	9.0	3.444444	1.130388	1.0	3.00	4.0	4.0	5.0
Á köldum klaka (Cold Fever) (1994)	1.0	3.000000	NaN	3.0	3.00	3.0	3.0	3.0

1664 rows × 8 columns

In [23]:
```
ratings_df_mean = movies_rating_df.groupby('title')['rating'].describe()['mean']
```

In [24]:
```
ratings_df_mean.head(10)
```

Out[24]:
```
title
'Til There Was You (1997)                               2.333333
1-900 (1994)                                            2.600000
101 Dalmatians (1996)                                   2.908257
12 Angry Men (1957)                                     4.344000
187 (1997)                                              3.024390
2 Days in the Valley (1996)                             3.225806
20,000 Leagues Under the Sea (1954)                     3.500000
2001: A Space Odyssey (1968)                            3.969112
3 Ninjas: High Noon At Mega Mountain (1998)             1.000000
39 Steps, The (1935)                                    4.050847
Name: mean, dtype: float64
```

In [26]:
```
ratings_df_count = movies_rating_df.groupby('title')['rating'].describe()['count']
```

In [27]:
```
ratings_df_count.head(10)
```

Out[27]:
```
title
'Til There Was You (1997)                                 9.0
1-900 (1994)                                              5.0
101 Dalmatians (1996)                                   109.0
12 Angry Men (1957)                                     125.0
187 (1997)                                               41.0
2 Days in the Valley (1996)                              93.0
20,000 Leagues Under the Sea (1954)                      72.0
2001: A Space Odyssey (1968)                            259.0
3 Ninjas: High Noon At Mega Mountain (1998)               5.0
39 Steps, The (1935)                                     59.0
Name: count, dtype: float64
```

In [28]:
```
ratings_mean_count_df = pd.concat([ratings_df_count, ratings_df_mean], axis = 1)
```

In [31]:
```
ratings_mean_count_df.reset_index().head(7)
```

Out[31]:

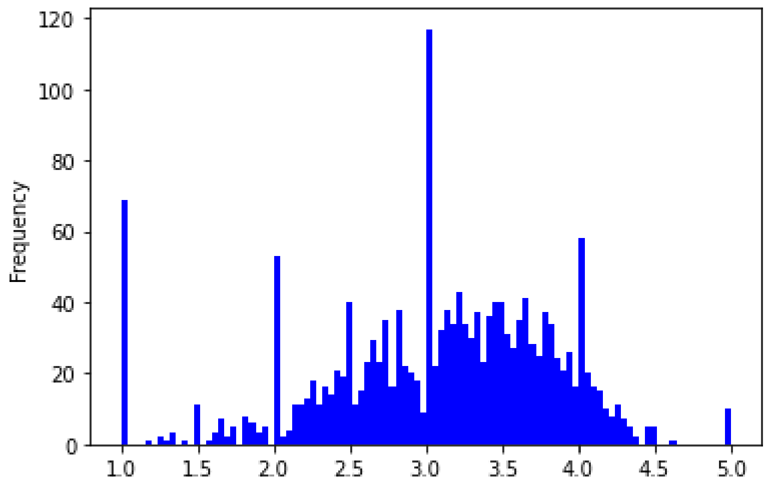
	title	count	mean
0	'Til There Was You (1997)	9.0	2.333333
1	1-900 (1994)	5.0	2.600000
2	101 Dalmatians (1996)	109.0	2.908257
3	12 Angry Men (1957)	125.0	4.344000
4	187 (1997)	41.0	3.024390
5	2 Days in the Valley (1996)	93.0	3.225806
6	20,000 Leagues Under the Sea (1954)	72.0	3.500000

Data Visualization:

In [33]:
```
ratings_mean_count_df['mean'].plot(bins = 100, kind = 'hist', color = 'blue')
```

Out[33]:

```
<AxesSubplot:ylabel='Frequency'>
```

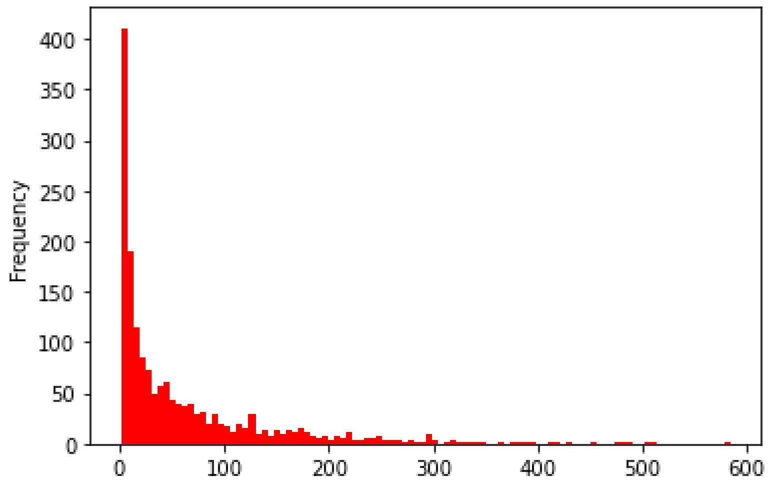


In [34]:

```
ratings_mean_count_df['count'].plot(bins = 100, kind = 'hist', color = 'red')
```

Out[34]:

```
<AxesSubplot:ylabel='Frequency'>
```



In [36]:

```
ratings_mean_count_df[ratings_mean_count_df['mean'] == 5 ].reset_index()
```

Out[36]:

	title	count	mean
0	Aiqing wansui (1994)	1.0	5.0
1	Entertaining Angels: The Dorothy Day Story (1996)	1.0	5.0
2	Great Day in Harlem, A (1994)	1.0	5.0
3	Marlene Dietrich: Shadow and Light (1996)	1.0	5.0
4	Prefontaine (1997)	3.0	5.0
5	Saint of Fort Washington, The (1993)	2.0	5.0
6	Santa with Muscles (1996)	2.0	5.0
7	Someone Else's America (1995)	1.0	5.0
8	Star Kid (1997)	3.0	5.0
9	They Made Me a Criminal (1939)	1.0	5.0

In [38]:

```
ratings_mean_count_df.sort_values('count', ascending = False).head(7).reset_index()
```

Out[38]:

	title	count	mean
0	Star Wars (1977)	584.0	4.359589
1	Contact (1997)	509.0	3.803536
2	Fargo (1996)	508.0	4.155512
3	Return of the Jedi (1983)	507.0	4.007890
4	Liar Liar (1997)	485.0	3.156701
5	English Patient, The (1996)	481.0	3.656965
6	Scream (1996)	478.0	3.441423

ITEM-BASED COLLABORATIVE FILTERING:

In [40]:

```
movies_rating_df.head(7)
```

Out[40]:

	user_id	item_id	rating	title
0	0	50	5	Star Wars (1977)
1	290	50	5	Star Wars (1977)
2	79	50	4	Star Wars (1977)
3	2	50	5	Star Wars (1977)

	user_id	item_id	rating	title
4	8	50	5	Star Wars (1977)
5	274	50	5	Star Wars (1977)
6	227	50	4	Star Wars (1977)

In [41]:
```
userid_movietitle_matrix = movies_rating_df.pivot_table(index = 'user_id', columns = 'title', values = 'rating')
```

In [44]:
```
userid_movietitle_matrix # We can find out which user watched which movie
```

Out[44]:

title	'Til There Was You (1997)	1-900 (1994)	101 Dalmatians (1996)	12 Angry Men (1957)	187 (1997)	2 Days in the Valley (1996)	20,000 Leagues Under the Sea (1954)	2001: A Space Odyssey (1968)	3 Ninjas: High Noon At Mega Mountain (1998)	39 Steps, The (1935)	...	Yankee Zulu (1994)	Year of the Horse (1997)	You So Crazy (1994)	Young Frankenstein (1974)	Young Guns (1988)	Young Guns II (1990)	You Poisone Handboo The (199
user_id																		
0	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	NaN	NaN	N
1	NaN	NaN	2.0	5.0	NaN	NaN	3.0	4.0	NaN	NaN	...	NaN	NaN	NaN	5.0	3.0	NaN	N
2	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	1.0	NaN	...	NaN	NaN	NaN	NaN	NaN	NaN	N
3	NaN	NaN	NaN	NaN	2.0	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	NaN	NaN	N
4	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	NaN	NaN	N
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
939	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	NaN	NaN	N
940	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	NaN	NaN	N
941	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	NaN	NaN	N
942	NaN	NaN	NaN	NaN	NaN	NaN	NaN	3.0	NaN	3.0	...	NaN	NaN	NaN	NaN	NaN	NaN	N
943	NaN	NaN	NaN	NaN	NaN	2.0	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	4.0	3.0	N

944 rows × 1664 columns

In [46]:
```
titanic = userid_movietitle_matrix['Titanic (1997)']
```

In [47]:
```
titanic # The matrix shows who watched titanic and NaN stands for user never watchs titanic
```

Out[47]:
```
user_id
0      NaN
1      NaN
2      5.0
3      NaN
4      NaN
      ...
939    NaN
940    5.0
941    NaN
942    3.0
943    NaN
Name: Titanic (1997), Length: 944, dtype: float64
```

In [51]:
```
titanic_correlations = pd.DataFrame(userid_movietitle_matrix.corrwith(titanic), columns = ['Correlation'])
```

```
C:\Users\tsai2\anaconda3\lib\site-packages\numpy\lib\function_base.py:2634: RuntimeWarning: Degrees of freedom <= 0 for slice
  c = cov(x, y, rowvar, dtype=dtype)
C:\Users\tsai2\anaconda3\lib\site-packages\numpy\lib\function_base.py:2493: RuntimeWarning: divide by zero encountered in true_divide
  c *= np.true_divide(1, fact)
```

In [53]:
```
titanic_correlations.reset_index().head(7)
```

Out[53]:

	title	Correlation
0	'Til There Was You (1997)	-0.062017
1	1-900 (1994)	NaN
2	101 Dalmatians (1996)	0.120113
3	12 Angry Men (1957)	0.077700
4	187 (1997)	0.315654
5	2 Days in the Valley (1996)	0.017295
6	20,000 Leagues Under the Sea (1954)	0.246718

In [54]:
```
titanic_correlations = titanic_correlations.join(ratings_mean_count_df['count'])
```

In [56]:

```
titanic_correlations.reset_index().head(7)
```

Out[56]:

	title	Correlation	count
0	'Til There Was You (1997)	-0.062017	9.0
1	1-900 (1994)	NaN	5.0
2	101 Dalmatians (1996)	0.120113	109.0
3	12 Angry Men (1957)	0.077700	125.0
4	187 (1997)	0.315654	41.0
5	2 Days in the Valley (1996)	0.017295	93.0
6	20,000 Leagues Under the Sea (1954)	0.246718	72.0

In [58]:

```
titanic_correlations.dropna(inplace=True)
```

In [59]:

```
titanic_correlations.sort_values('Correlation', ascending = False)
```

Out[59]:

	Correlation	count
title		
Nadja (1994)	1.0	8.0
Pest, The (1997)	1.0	8.0
Savage Nights (Nuits fauves, Les) (1992)	1.0	3.0
For Ever Mozart (1996)	1.0	3.0
Jerky Boys, The (1994)	1.0	3.0
...	...	...
Pather Panchali (1955)	-1.0	8.0
Angel Baby (1995)	-1.0	4.0
Blood Beach (1981)	-1.0	6.0
Two Bits (1995)	-1.0	5.0
Faces (1968)	-1.0	4.0

1356 rows × 2 columns

In [63]:

```
titanic_correlations[titanic_correlations['count']>50].sort_values('Correlation',ascending=False).head(7).reset_index()
```

Out[63]:

	title	Correlation	count
0	Titanic (1997)	1.000000	350.0
1	Adventures of Robin Hood, The (1938)	0.597532	67.0
2	Mallrats (1995)	0.580393	54.0
3	Robin Hood: Men in Tights (1993)	0.533114	56.0
4	Manon of the Spring (Manon des sources) (1986)	0.523459	58.0
5	Weekend at Bernie's (1989)	0.508548	60.0
6	River Wild, The (1994)	0.497600	146.0

In [64]:

```
# Item-based Collaborative Filter on Star Wars (1977)
starwars = userid_movietitle_matrix['Star Wars (1977)']
starwars
```

Out[64]:

```
user_id
0      5.0
1      5.0
2      5.0
3      NaN
4      5.0
      ...
939    NaN
940    4.0
941    NaN
942    5.0
943    4.0
Name: Star Wars (1977), Length: 944, dtype: float64
```

In [67]:

```
# Adding correlation to the data frame
starwars_correlations = pd.DataFrame(userid_movietitle_matrix.corrwith(starwars), columns = ['Correlation'])
# Adding total count to the data frame
starwars_correlations = starwars_correlations.join(ratings_mean_count_df['count'])
# Drop missing values
starwars_correlations.dropna(inplace=True)
# Sort by the correlation with ascending order which shows highest correlation on the top
starwars_correlations.sort_values('Correlation', ascending = False)
```

```
# Show data frame
starwars_correlations.reset_index().head(7)
```

```
C:\Users\tsai2\anaconda3\lib\site-packages\numpy\lib\function_base.py:2634: RuntimeWarning: Degrees of freedom <= 0 for slice
  c = cov(x, y, rowvar, dtype=dtype)
C:\Users\tsai2\anaconda3\lib\site-packages\numpy\lib\function_base.py:2493: RuntimeWarning: divide by zero encountered in true_divide
  c *= np.true_divide(1, fact)
```

Out[67]:

	title	Correlation	count
0	'Til There Was You (1997)	0.872872	9.0
1	1-900 (1994)	-0.645497	5.0
2	101 Dalmatians (1996)	0.211132	109.0
3	12 Angry Men (1957)	0.184289	125.0
4	187 (1997)	0.027398	41.0
5	2 Days in the Valley (1996)	0.066654	93.0
6	20,000 Leagues Under the Sea (1954)	0.289768	72.0

In [68]:

```
starwars_correlations[starwars_correlations['count']>50].sort_values('Correlation',ascending=False).head(7).reset_index()
```

Out[68]:

	title	Correlation	count
0	Star Wars (1977)	1.000000	584.0
1	Empire Strikes Back, The (1980)	0.748353	368.0
2	Return of the Jedi (1983)	0.672556	507.0
3	Raiders of the Lost Ark (1981)	0.536117	420.0
4	Giant (1956)	0.488093	51.0
5	Life Less Ordinary, A (1997)	0.411638	53.0
6	Austin Powers: International Man of Mystery (1...	0.377433	130.0

Create An Item-Based Collaborative Filter on the Entire Dataset：

In [70]:

```
userid_movietitle_matrix.head(7)
```

Out[70]:

title	'Til There Was You (1997)	1-900 (1994)	101 Dalmatians (1996)	12 Angry Men (1957)	187 (1997)	2 Days in the Valley (1996)	20,000 Leagues Under the Sea (1954)	2001: A Space Odyssey (1968)	3 Ninjas: High Noon At Mega Mountain (1998)	39 Steps, The (1935)	...	Yankee Zulu (1994)	Year of the Horse (1997)	You So Crazy (1994)	Young Frankenstein (1974)	Young Guns (1988)	Young Guns II (1990)	You Poisone Handboo The (199
user_id																		
0	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	NaN	NaN	N
1	NaN	NaN	2.0	5.0	NaN	NaN	3.0	4.0	NaN	NaN	...	NaN	NaN	NaN	5.0	3.0	NaN	N
2	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	1.0	NaN	...	NaN	NaN	NaN	NaN	NaN	NaN	N
3	NaN	NaN	NaN	NaN	2.0	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	NaN	NaN	N
4	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	NaN	NaN	N
5	NaN	NaN	2.0	NaN	NaN	NaN	NaN	4.0	NaN	NaN	...	NaN	NaN	NaN	4.0	NaN	NaN	N
6	NaN	NaN	NaN	4.0	NaN	NaN	NaN	5.0	NaN	NaN	...	NaN	NaN	NaN	4.0	NaN	NaN	N

7 rows × 1664 columns

In [72]:

```
movie_correlations = userid_movietitle_matrix.corr(method = 'pearson', min_periods = 50)
movie_correlations
```

Out[72]:

title	'Til There Was You (1997)	1-900 (1994)	101 Dalmatians (1996)	12 Angry Men (1957)	187 (1997)	2 Days in the Valley (1996)	20,000 Leagues Under the Sea (1954)	2001: A Space Odyssey (1968)	3 Ninjas: High Noon At Mega Mountain (1998)	39 Steps, The (1935)	...	Yankee Zulu (1994)	Year of the Horse (1997)	You So Crazy (1994)	Young Frankenstein (1974)	Young Guns (1988)	Young Guns II (1990)	Poi Han The
title																		
'Til There Was You (1997)	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	NaN	NaN	
1-900 (1994)	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	NaN	NaN	
101 Dalmatians (1996)	NaN	NaN	1.0	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	NaN	NaN	

title	'Til There Was You (1997)	1-900 (1994)	101 Dalmatians (1996)	12 Angry Men (1957)	187 (1997)	2 Days in the Valley (1996)	20,000 Leagues Under the Sea (1954)	2001: A Space Odyssey (1968)	3 Ninjas: High Noon At Mega Mountain (1998)	39 Steps, The (1935)	...	Yankee Zulu (1994)	Year of the Horse (1997)	You So Crazy (1994)	Young Frankenstein (1974)	Young Guns (1988)	Young Guns II (1990)	Poi Han The
title																		
12 Angry Men (1957)	NaN	NaN	NaN	1.0	NaN	NaN	NaN	0.178848	NaN	NaN	...	NaN	NaN	NaN	0.096546	NaN	NaN	
187 (1997)	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	NaN	NaN	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Young Guns II (1990)	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	NaN	NaN	
Young Poisoner's Handbook, The (1995)	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	NaN	NaN	
Zeus and Roxanne (1997)	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	NaN	NaN	
unknown	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	NaN	NaN	
Á köldum klaka (Cold Fever) (1994)	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	NaN	NaN	

1664 rows × 1664 columns

In [73]:

```
myRatings = pd.read_csv('My_Ratings.csv')
myRatings
```

Out[73]:

	Movie Name	Ratings
0	Liar Liar (1997)	5
1	Star Wars (1977)	1

In [74]:

```
myRatings['Movie Name'][0]
```

Out[74]:

```
'Liar Liar (1997)'
```

In [76]:

```
similar_movies_list = pd.Series()

for i in range(0, 2):
    # Get same movies with same ratings
    similar_movie = movie_correlations[myRatings['Movie Name'][i]].dropna()

    # Scale the similarity by your given ratings
    similar_movie = similar_movie.map(lambda x: x * myRatings['Ratings'][i])

    similar_movies_list = similar_movies_list.append(similar_movie)
```

```
<ipython-input-76-a1412db7e06a>:1: DeprecationWarning: The default dtype for empty Series will be 'object' instead of 'float64' in a future vers
ion. Specify a dtype explicitly to silence this warning.
  similar_movies_list = pd.Series()
```

In [78]:

```
similar_movies_list.sort_values(inplace = True, ascending = False)
print(similar_movies_list.head(7))
```

```
Liar Liar (1997)          5.000000
Batman Forever (1995)     2.584838
Bean (1997)               2.523447
Mask, The (1994)          2.423249
Down Periscope (1996)     2.363403
Con Air (1997)            2.349141
Pretty Woman (1990)       2.348951
dtype: float64
```