

Movie_recommendation_Markovian_Factorization_of_Matrix_Process

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0.0.1 IMPORT libraries

```
[86]: import numpy as np
import pandas as pd
from datetime import datetime
from scipy import sparse
from sklearn.metrics.pairwise import cosine_similarity

from surprise import SVD
from surprise.model_selection import GridSearchCV
from surprise import Reader, Dataset
from scipy.sparse.linalg import svds

import matplotlib.pyplot as plt
%matplotlib inline

import seaborn as sns
sns.set_style("whitegrid")
```

0.0.2 Load MOVIE LENS Dataset (movie and rating) and Merge it

```
[41]: movie_df=pd.read_csv("movie1.csv")
rating_df=pd.read_csv("rating.csv")
```

```
[42]: movie_df.count()
```

```
[42]: movieId      8999
title          8999
genres         8999
dtype: int64
```

```
[43]: rating_df.count()
```

```
[43]: userId        783359
movieId          783359
rating           783359
```

```
timestamp    783359
dtype: int64
```

Checking for NaN

```
[44]: print("Number of NaN values = "+str(movie_df.isnull().sum()))
```

```
Number of NaN values = movieId    0
title        0
genres       0
dtype: int64
```

```
[45]: print("Number of NaN values = "+str(rating_df.isnull().sum()))
```

```
Number of NaN values = userId      0
movieId      0
rating        0
timestamp     0
dtype: int64
```

```
[46]: movie_df.head()
```

```
[46]:
```

	movieId	title \
0	1	Toy Story (1995)
1	2	Jumanji (1995)
2	3	Grumpier Old Men (1995)
3	4	Waiting to Exhale (1995)
4	5	Father of the Bride Part II (1995)

	genres
0	Adventure Animation Children Comedy Fantasy
1	Adventure Children Fantasy
2	Comedy Romance
3	Comedy Drama Romance
4	Comedy

```
[47]: rating_df.head()
```

```
[47]:
```

	userId	movieId	rating	timestamp
0	1	2	3.5	02/04/2005 23:53
1	1	29	3.5	02/04/2005 23:31
2	1	32	3.5	02/04/2005 23:33
3	1	47	3.5	02/04/2005 23:32
4	1	50	3.5	02/04/2005 23:29

0.0.3 Removing Duplicates

```
[48]: duplicates = rating_df.duplicated(["userId", "movieId", "rating"])
      print("Number of duplicate rows = "+str(duplicates.sum()))
```

Number of duplicate rows = 0

0.0.4 Basic Statistics

```
[49]: print("Total Data:")
      print("Total number of movie ratings = "+str(rating_df.shape[0]))
      print("Number of unique users = "+str(len(np.unique(rating_df["userId"]))))
      print("Number of unique movies = "+str(len(np.unique(rating_df["movieId"]))))
```

Total Data:

Total number of movie ratings = 783359

Number of unique users = 5216

Number of unique movies = 13563

0.0.5 MERGE both movie and rating dataset with key as movieId

```
[50]: df = pd.merge(rating_df, movie_df, on='movieId').dropna()
      df.head()
```

```
[50]:   userId  movieId  rating      timestamp      title \
0        1         2     3.5  02/04/2005 23:53  Jumanji (1995)
1        5         2     3.0  25/12/1996 15:26  Jumanji (1995)
2       13         2     3.0   27/11/1996 8:19  Jumanji (1995)
3       29         2     3.0   23/06/1996 20:36  Jumanji (1995)
4       34         2     3.0   28/10/1996 13:29  Jumanji (1995)

      genres
0  Adventure|Children|Fantasy
1  Adventure|Children|Fantasy
2  Adventure|Children|Fantasy
3  Adventure|Children|Fantasy
4  Adventure|Children|Fantasy
```

```
[51]: df.count()  #695877
```

```
[51]: userId      695877
      movieId     695877
      rating      695877
      timestamp   695877
      title       695877
      genres      695877
      dtype: int64
```

0.0.6 create data frame DF for find avg rating

```
[52]: df.groupby('title')['rating'].mean().sort_values(ascending=False).head()
```

```
[52]: title
Marquise of O, The (Marquise von O..., Die) (1976)    5.0
Killing of Sister George, The (1968)                 5.0
Burnt Money (Plata Quemada) (2000)                  5.0
Swann in Love (Un amour de Swann) (1984)             5.0
Men, The (1950)                                       5.0
Name: rating, dtype: float64
```

0.0.7 number of rating based sorting

```
[53]: df.groupby('title')['rating'].count().sort_values(ascending=False).head()
```

```
[53]: title
Pulp Fiction (1994)                2584
Forrest Gump (1994)                2568
Silence of the Lambs, The (1991)   2386
Shawshank Redemption, The (1994)   2373
Jurassic Park (1993)               2301
Name: rating, dtype: int64
```

0.0.8 create new dataframe name as ratings

```
[54]: ratings = pd.DataFrame(df.groupby('title')['rating'].mean())
ratings['num of ratings'] = pd.DataFrame(df.groupby('title')['rating'].count())
ratings.head()
```

```
[54]:
```

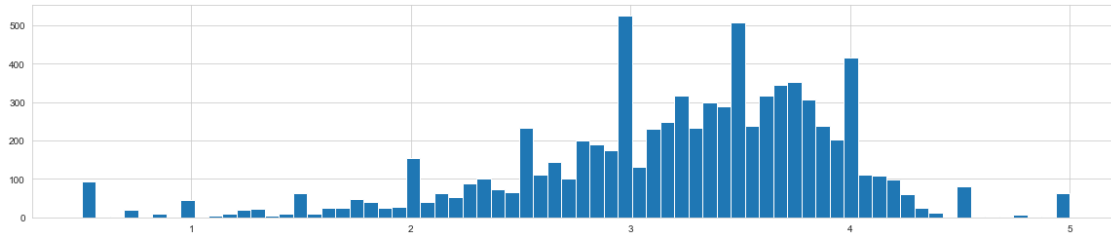
	rating	num of ratings
title		
'Round Midnight (1986)	3.785714	7
'Til There Was You (1997)	2.790323	31
'burbs, The (1989)	3.031008	129
'night Mother (1986)	3.222222	9
*batteries not included (1987)	3.289474	76

0.1 Data Analysis

Total range of data set (i.e from minimum value to maximum value) is divided into 8 to 15 equal parts. These equal parts are known as bins

```
[55]: plt.figure(figsize=(20,4)) #width 20inches and height 4inches
ratings['rating'].hist(bins=70)
```

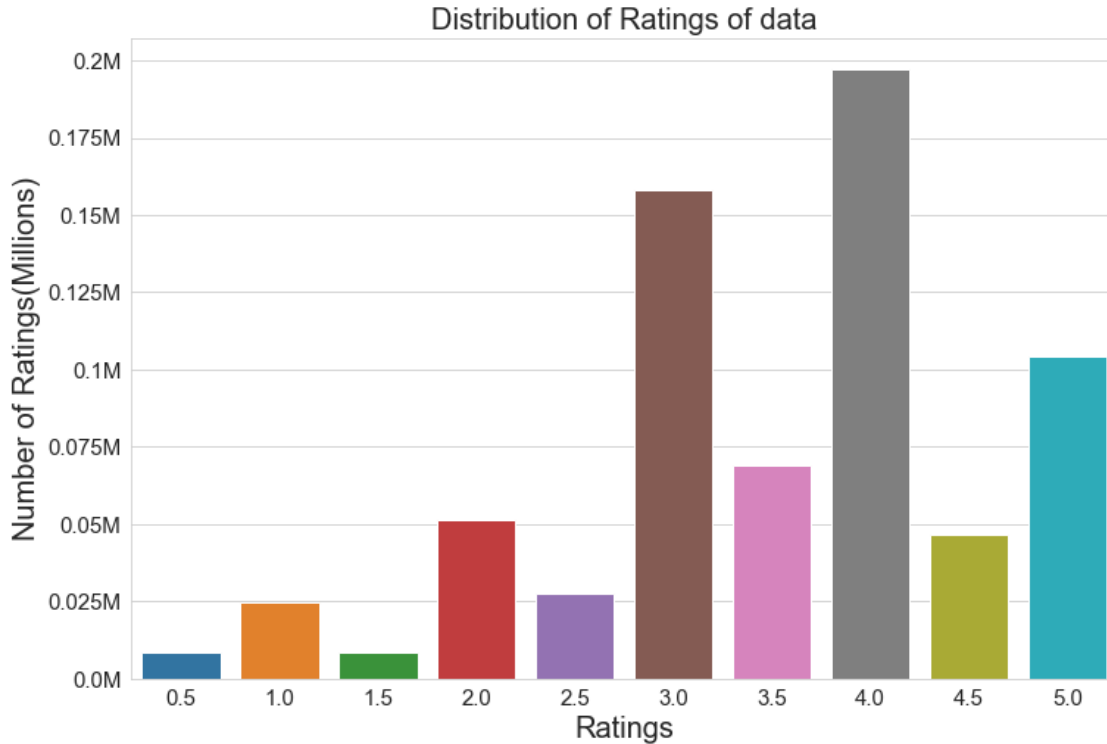
```
[55]: <matplotlib.axes._subplots.AxesSubplot at 0x1f709711c48>
```



it is gaussian normal distribution.PDF probability density function satisfy this

```
[56]: def changingLabels(number):  
       return str(number/10**6) + "M"
```

```
[57]: plt.figure(figsize = (12, 8))  
ax = sns.countplot(x="rating", data=df)  
  
ax.set_yticklabels([changingLabels(num) for num in ax.get_yticks()])  
  
plt.tick_params(labelsize = 15)  
plt.title("Distribution of Ratings of data", fontsize = 20)  
plt.xlabel("Ratings", fontsize = 20)  
plt.ylabel("Number of Ratings(Millions)", fontsize = 20)  
plt.show()
```



problem here is that `to_datetime` silently failed so the dtype remained as `str/object`, if you set `param errors='coerce'` then if the conversion fails for any particular string then those rows are set to `NaT`.

```
[74]: df['Date'] = pd.to_datetime(df['timestamp'], errors='coerce')
      #df["DayOfWeek"] = df.Date.dt.weekday_name
      df['DayOfWeek'] = df['Date'].dt.day_name()
```

```
[75]: df.tail()
```

```
[75]:
```

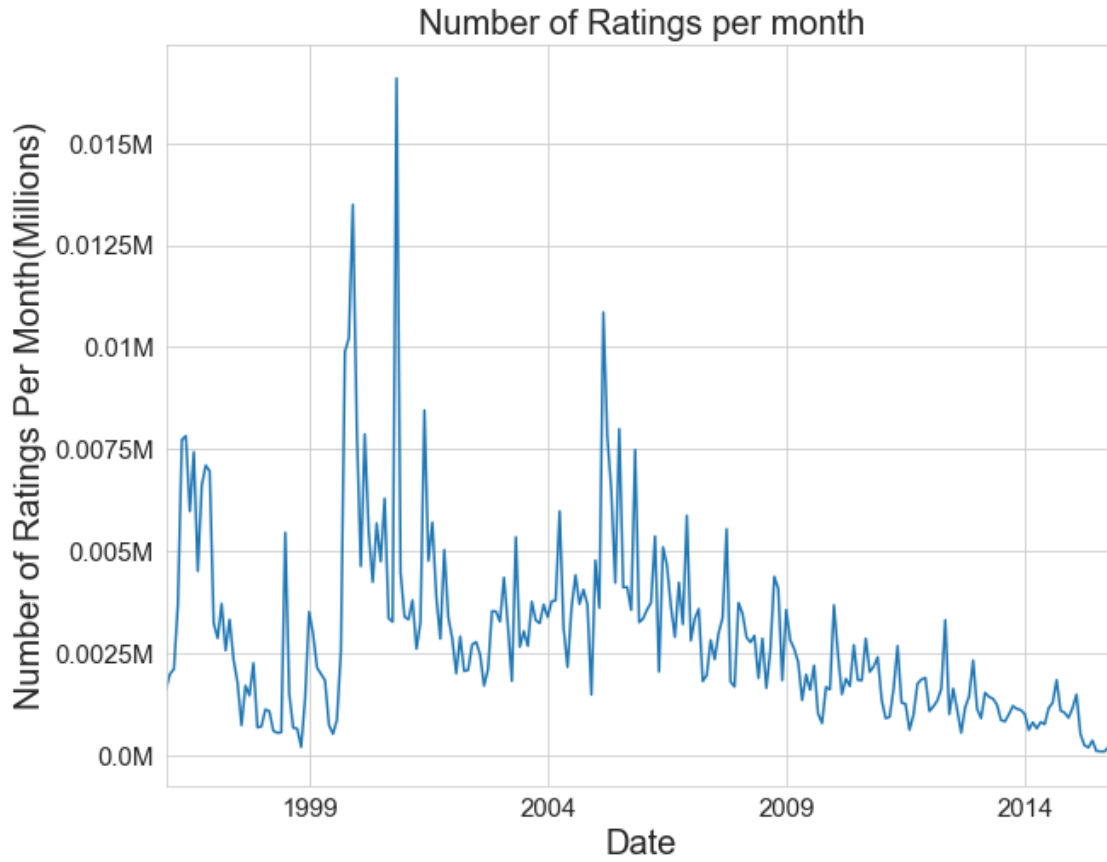
	userId	movieId	rating	timestamp \		title \
695872	5148	26339	3.0	02/01/2010 6:59		Dolemite (1975)
695873	5150	1528	3.0	16/05/1997 10:07		Intimate Relations (1996)
695874	5177	8545	2.5	02/07/2004 23:18		Plain Dirty (a.k.a. Briar Patch) (2003)
695875	5190	3333	5.0	24/04/2000 16:45		Killing of Sister George, The (1968)
695876	5192	6018	4.5	31/01/2015 11:28		Kira's Reason: A Love Story (En Kærlighedshist...

	genres	Date	Weekday	\
695872	Action Comedy Crime Mystery Thriller	2010-02-01 06:59:00	Monday	
695873	Comedy	1997-05-16 10:07:00	Friday	
695874	Drama Romance	2004-02-07 23:18:00	Saturday	
695875	Drama	2000-04-24 16:45:00	Monday	
695876	Drama	2015-01-31 11:28:00	Saturday	

	DayOfWeek
695872	Monday
695873	Friday
695874	Saturday
695875	Monday
695876	Saturday

0.1.1 Number of Ratings per month

```
[62]: plt.figure(figsize = (10,8))
ax = df.resample("M", on = "Date")["rating"].count().plot()
#this above resample() function is a sort of group-by operation. Resample()
    ↳function can work with dates. It can take months,
#days and years values independently. Here, in parameter we have given "M" which
    ↳means it will group all the rows Monthly using
#"Date" which is already present in the DataFrame. Now after grouping the rows
    ↳month wise, we have just counted the ratings
#which are grouped by months and plotted them. So, below plot shows that how
    ↳many ratings are there per month.
#In resample(), we can also give "6M" for grouping the rows every 6-Monthly, we
    ↳can also give "Y" for grouping
#the rows yearly, we can also give "D" for grouping the rows by day.
#Resample() is a function which is designed to work with time and dates.
#This "df.resample("M", on = "Date")["Ratings"].count()" returns a pandas series
    ↳where keys are Dates and values are
#counts of ratings grouped by months. You can even check it and print it. Then we
    ↳are plotting it, where it automatically takes
#Dates--which are keys on--x-axis and counts--which are values on--y-axis.
ax.set_yticklabels([changingLabels(num) for num in ax.get_yticks()])
ax.set_title("Number of Ratings per month", fontsize = 20)
ax.set_xlabel("Date", fontsize = 20)
ax.set_ylabel("Number of Ratings Per Month(Millions)", fontsize = 20)
plt.tick_params(labelsize = 15)
plt.show()
```



0.1.2 Analysis of Ratings given by user

```
[63]: no_of Rated_movies_per_user = df.groupby(by = "userId")["rating"].count().
      ↪sort_values(ascending = False)
```

```
[64]: no_of Rated_movies_per_user.head()
```

```
[64]: userId
903      2608
2261     2380
4358     2244
3318     2186
156      2179
Name: rating, dtype: int64
```

```
[65]: fig, axes = plt.subplots(nrows = 1, ncols = 2, figsize=(14,7))

sns.kdeplot(no_of Rated_movies_per_user.values, shade = True, ax = axes[0])
axes[0].set_title("PDF", fontsize = 18)
```



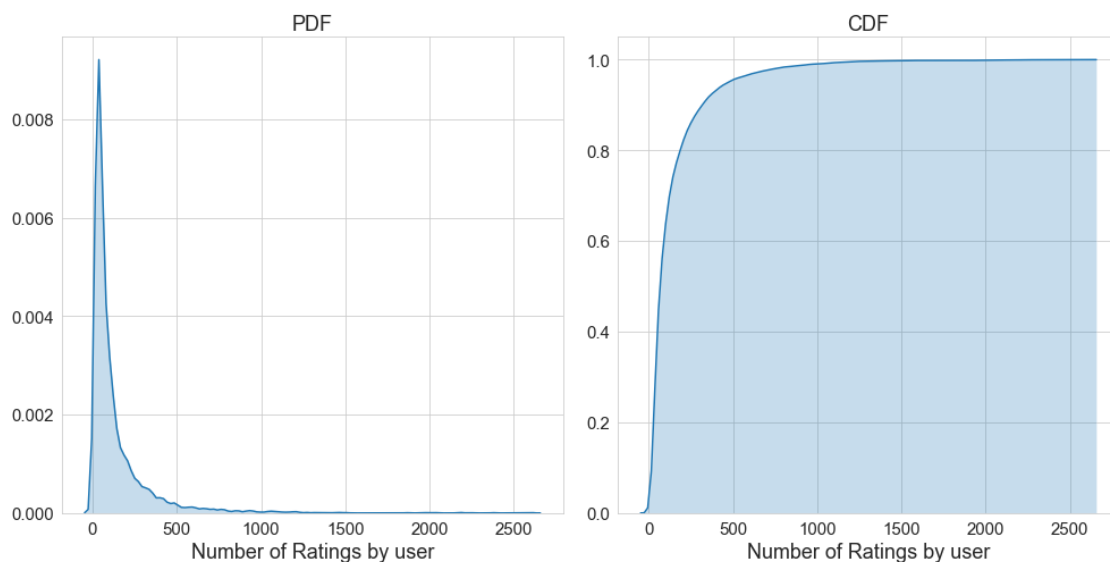
```

axes[0].set_xlabel("Number of Ratings by user", fontsize = 18)
axes[0].tick_params(labelsize = 15)

sns.kdeplot(no_of_rated_movies_per_user.values, shade = True, cumulative = True,
            →ax = axes[1])
axes[1].set_title("CDF", fontsize = 18)
axes[1].set_xlabel("Number of Ratings by user", fontsize = 18)
axes[1].tick_params(labelsize = 15)

fig.subplots_adjust(wspace=2)
plt.tight_layout()
plt.show()

```



- PDF graph shows that almost all of the users give very few ratings. There are very few users who's ratings count is high.
- Similarly, above CDF graph shows that almost 99% of users give very few ratings.

```

[66]: print("Information about movie ratings grouped by users:")
      no_of_rated_movies_per_user.describe()

```

Information about movie ratings grouped by users:

```

[66]: count    5216.000000
      mean      133.412002
      std       195.187249
      min        1.000000
      25%        33.000000
      50%        64.000000
      75%       148.000000

```

```
max      2608.000000
Name: rating, dtype: float64
```

```
[67]: quantiles = no_of_rated_movies_per_user.quantile(np.arange(0,1.01,0.01))
```

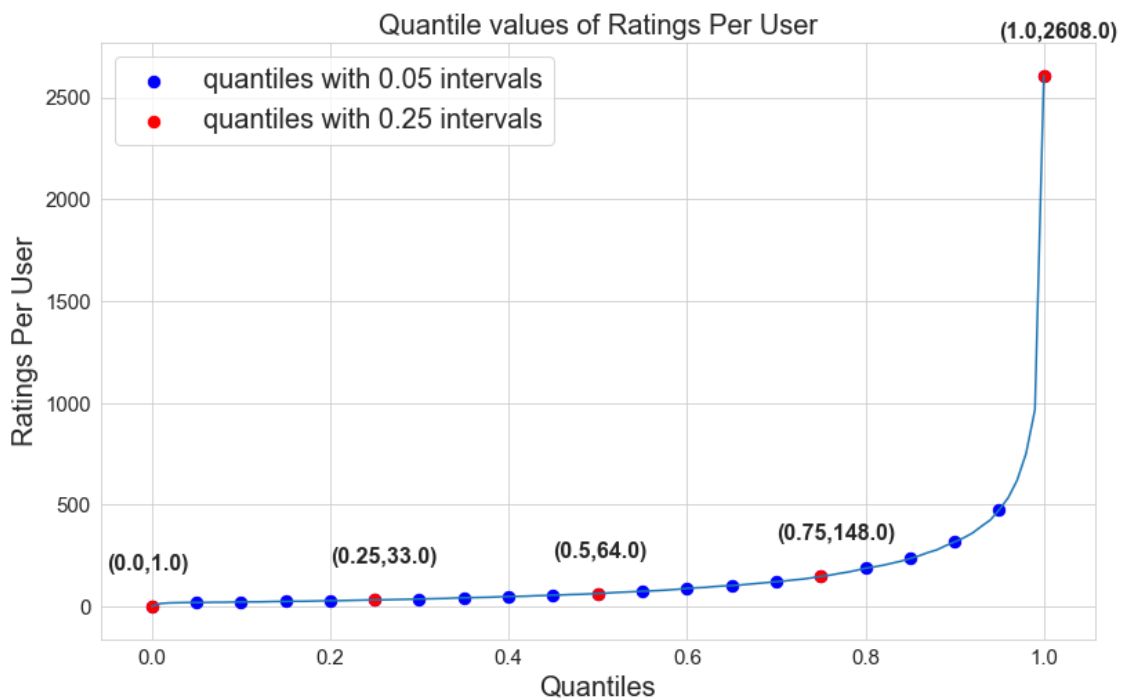
```
[68]: fig = plt.figure(figsize = (10, 6))

axes = fig.add_axes([0.1,0.1,1,1])
axes.set_title("Quantile values of Ratings Per User", fontsize = 20)
axes.set_xlabel("Quantiles", fontsize = 20)
axes.set_ylabel("Ratings Per User", fontsize = 20)
axes.plot(quantiles)

plt.scatter(x = quantiles.index[:5], y = quantiles.values[:5], c = "blue", s = 70, label="quantiles with 0.05 intervals")
plt.scatter(x = quantiles.index[:25], y = quantiles.values[:25], c = "red", s = 70, label="quantiles with 0.25 intervals")
plt.legend(loc='upper left', fontsize = 20)

for x, y in zip(quantiles.index[:25], quantiles.values[:25]):
    plt.annotate(s = '({},{})'.format(x, y), xy = (x, y), fontweight='bold',
        fontsize = 16, xytext=(x-0.05, y+180))

axes.tick_params(labelsize = 15)
```



```
[69]: quantiles[::5]
```

```
[69]: 0.00      1.00
      0.05     20.00
      0.10     22.00
      0.15     25.00
      0.20     29.00
      0.25     33.00
      0.30     37.00
      0.35     43.00
      0.40     49.00
      0.45     56.00
      0.50     64.00
      0.55     75.00
      0.60     89.00
      0.65    103.00
      0.70    122.00
      0.75    148.00
      0.80    188.00
      0.85    235.75
      0.90    317.50
      0.95    475.25
      1.00   2608.00
      Name: rating, dtype: float64
```

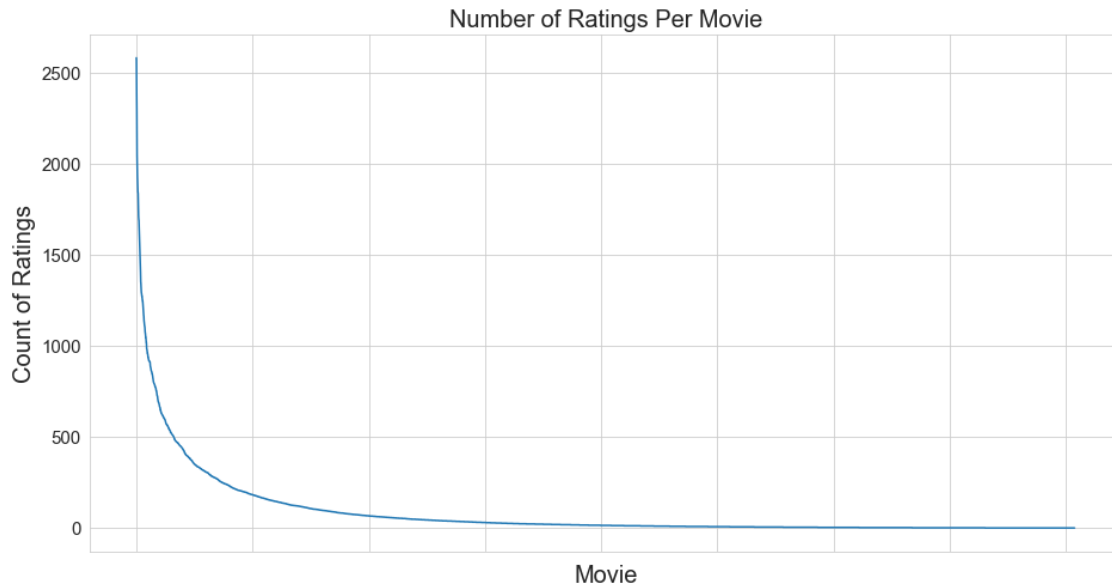
```
[70]: print("Total number of ratings below 75th percentile = ",
      ↪      +str(sum(no_of_rated_movies_per_user.values<=133)))
      print("Total number of ratings above 75th percentile = ",
      ↪      +str(sum(no_of_rated_movies_per_user.values>133)))
```

```
Total number of ratings below 75th percentile = 3794
Total number of ratings above 75th percentile = 1422
```

0.1.3 Analysis of Ratings Per Movie

```
[71]: no_of_ratings_per_movie = df.groupby(by = "movieId")["rating"].count().
      ↪      sort_values(ascending = False)
```

```
[72]: fig = plt.figure(figsize = (12, 6))
      axes = fig.add_axes([0.1,0.1,1,1])
      plt.title("Number of Ratings Per Movie", fontsize = 20)
      plt.xlabel("Movie", fontsize = 20)
      plt.ylabel("Count of Ratings", fontsize = 20)
      plt.plot(no_of_ratings_per_movie.values)
      plt.tick_params(labelsize = 15)
      axes.set_xticklabels([])
      plt.show()
```

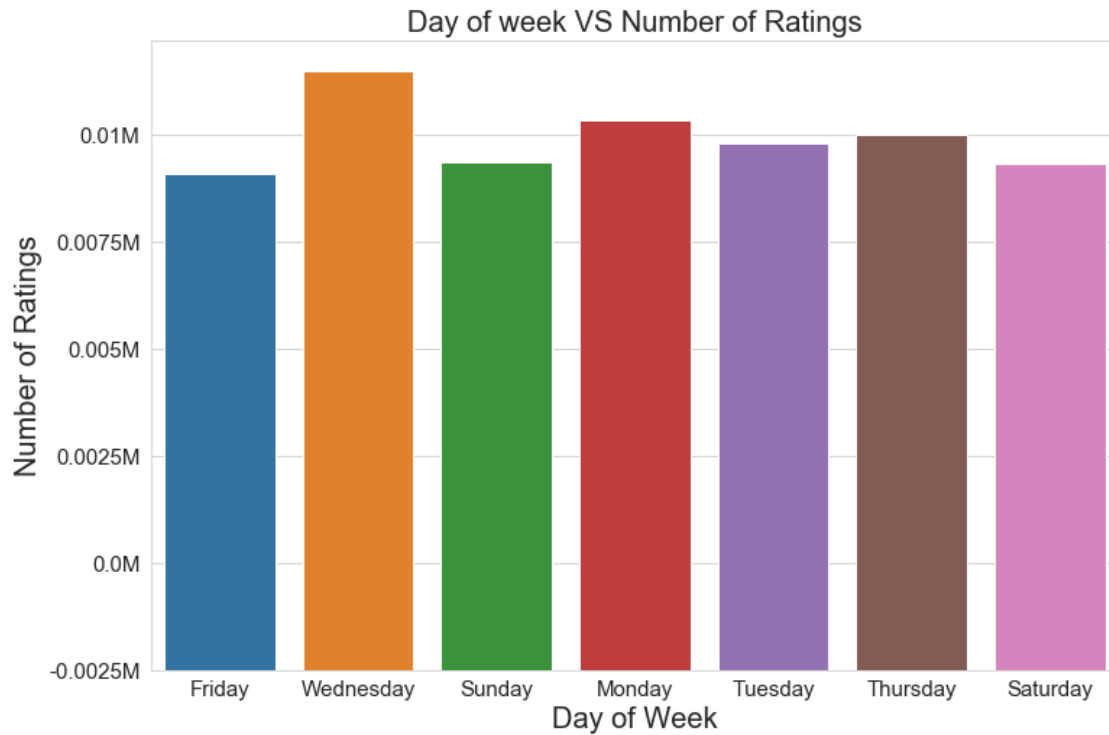


0.1.4 Analysis of Movie Ratings on Day of Week

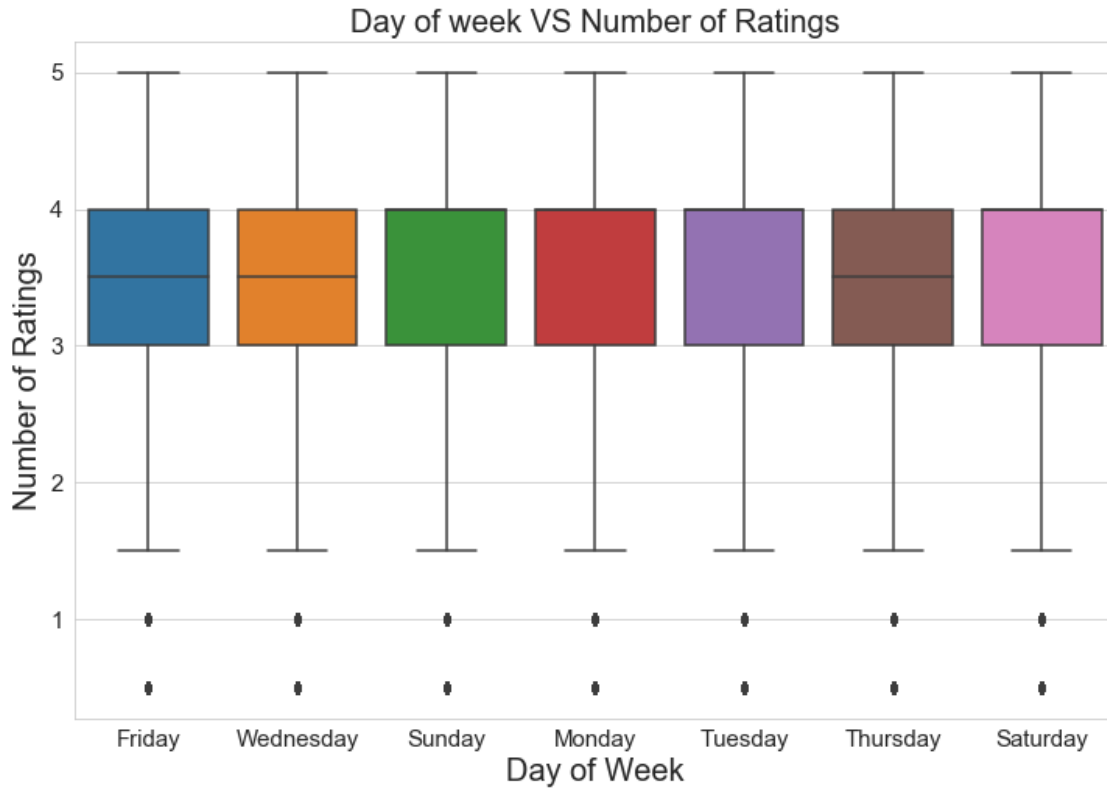
```
[76]: fig = plt.figure(figsize = (12, 8))

axes = sns.countplot(x = "DayOfWeek", data = df)
axes.set_title("Day of week VS Number of Ratings", fontsize = 20)
axes.set_xlabel("Day of Week", fontsize = 20)
axes.set_ylabel("Number of Ratings", fontsize = 20)
axes.set_yticklabels([changingLabels(num) for num in ax.get_yticks()])
axes.tick_params(labelsize = 15)

plt.show()
```



```
[77]: fig = plt.figure(figsize = (12, 8))
axes = sns.boxplot(x = "DayOfWeek", y = "rating", data = df)
axes.set_title("Day of week VS Number of Ratings", fontsize = 20)
axes.set_xlabel("Day of Week", fontsize = 20)
axes.set_ylabel("Number of Ratings", fontsize = 20)
axes.tick_params(labelsize = 15)
plt.show()
```



```
[78]: average_ratings_dayofweek = df.groupby(by = "DayOfWeek")["rating"].mean()
print("Average Ratings on Day of Weeks")
print(average_ratings_dayofweek)
```

```
Average Ratings on Day of Weeks
DayOfWeek
Friday      3.514822
Monday      3.537949
Saturday    3.533855
Sunday      3.524773
Thursday    3.493626
Tuesday     3.545351
Wednesday   3.492801
Name: rating, dtype: float64
```

```
[81]: ratings.sort_values('num of ratings',ascending=False).head(10)
```

```
[81]:
```

	rating	num of ratings
title		
Pulp Fiction (1994)	4.150929	2584
Forrest Gump (1994)	4.058606	2568
Silence of the Lambs, The (1991)	4.178332	2386

Shawshank Redemption, The (1994)	4.473662	2373
Jurassic Park (1993)	3.679270	2301
Star Wars: Episode IV - A New Hope (1977)	4.177010	2127
Braveheart (1995)	4.046188	2046
Terminator 2: Judgment Day (1991)	3.943885	1987
Matrix, The (1999)	4.169878	1972
Schindler's List (1993)	4.273033	1932

0.1.5 Matrix Factorization

```
[79]: MF= df.pivot_table(index='userId',columns='title',values='rating')
MF.head()
```

```
[79]: title    'Round Midnight (1986)  'Til There Was You (1997)  'burbs, The (1989)  \
userId
1              NaN              NaN              NaN
2              NaN              NaN              NaN
3              NaN              NaN              NaN
4              NaN              NaN              NaN
5              NaN              NaN              NaN
```

```
title    'night Mother (1986)  *batteries not included (1987)  \
userId
1              NaN              NaN
2              NaN              NaN
3              NaN              NaN
4              NaN              NaN
5              NaN              NaN
```

```
title    ...All the Marbles (California Dolls, The) (1981)  \
userId
1              NaN
2              NaN
3              NaN
4              NaN
5              NaN
```

```
title    ...And God Spoke (1993)  ...And Justice for All (1979)  \
userId
1              NaN              NaN
2              NaN              NaN
3              NaN              NaN
4              NaN              NaN
5              NaN              NaN
```

```
title    1-900 (06) (1994)  10 (1979)  ...  Zoolander (2001)  Zoot Suit (1981)  \
userId                                     ...
```

1	NaN	NaN	...	NaN	NaN
2	NaN	NaN	...	NaN	NaN
3	NaN	NaN	...	NaN	NaN
4	NaN	NaN	...	NaN	NaN
5	NaN	NaN	...	NaN	NaN

title	Zorba the Greek (Alexis Zorbas) (1964)	Zorro, the Gay Blade (1981)	\
userId			
1	NaN	NaN	
2	NaN	NaN	
3	NaN	NaN	
4	NaN	NaN	
5	NaN	NaN	

title	Zulu (1964)	Zus & Zo (2001)	eXistenZ (1999)	xXx (2002)	\
userId					
1	NaN	NaN	NaN	NaN	
2	NaN	NaN	NaN	NaN	
3	NaN	NaN	NaN	NaN	
4	NaN	NaN	NaN	NaN	
5	NaN	NaN	NaN	NaN	

title	¡Three Amigos! (1986)	À nous la liberté (Freedom for Us) (1931)
userId		
1	NaN	NaN
2	NaN	NaN
3	NaN	NaN
4	NaN	NaN
5	NaN	NaN

[5 rows x 8075 columns]

```
[82]: #Fill missing values with 0's
MF.fillna(0,inplace=True)
MF
```

[82]: title	'Round Midnight (1986)	'Til There Was You (1997)	'burbs, The (1989)	\
userId				
1	0.0	0.0	0.0	
2	0.0	0.0	0.0	
3	0.0	0.0	0.0	
4	0.0	0.0	0.0	
5	0.0	0.0	0.0	
...	
5212	0.0	0.0	0.0	
5213	0.0	0.0	0.0	
5214	0.0	0.0	0.0	

5215	0.0	0.0	0.0
5216	0.0	0.0	0.0

title 'night Mother (1986) *batteries not included (1987) \

userId

1	0.0	0.0
2	0.0	0.0
3	0.0	0.0
4	0.0	0.0
5	0.0	0.0
...
5212	0.0	0.0
5213	0.0	0.0
5214	0.0	0.0
5215	0.0	0.0
5216	0.0	0.0

title ...All the Marbles (California Dolls, The) (1981) \

userId

1	0.0
2	0.0
3	0.0
4	0.0
5	0.0
...	...
5212	0.0
5213	0.0
5214	0.0
5215	0.0
5216	0.0

title ...And God Spoke (1993) ...And Justice for All (1979) \

userId

1	0.0	0.0
2	0.0	0.0
3	0.0	0.0
4	0.0	0.0
5	0.0	0.0
...
5212	0.0	0.0
5213	0.0	0.0
5214	0.0	0.0
5215	0.0	0.0
5216	0.0	0.0

title 1-900 (06) (1994) 10 (1979) ... Zoolander (2001) Zoot Suit (1981) \

userId ...

1	0.0	0.0	...	0.0	0.0
2	0.0	0.0	...	0.0	0.0
3	0.0	0.0	...	0.0	0.0
4	0.0	0.0	...	0.0	0.0
5	0.0	0.0	...	0.0	0.0
...
5212	0.0	0.0	...	0.0	0.0
5213	0.0	0.0	...	0.0	0.0
5214	0.0	0.0	...	0.0	0.0
5215	0.0	0.0	...	0.0	0.0
5216	0.0	0.0	...	0.0	0.0

title	Zorba the Greek (Alexis Zorbas) (1964)	Zorro, the Gay Blade (1981)	\
userId			

1	0.0	0.0
2	0.0	0.0
3	0.0	0.0
4	0.0	0.0
5	0.0	0.0
...
5212	0.0	0.0
5213	0.0	0.0
5214	0.0	0.0
5215	0.0	0.0
5216	0.0	0.0

title	Zulu (1964)	Zus & Zo (2001)	eXistenZ (1999)	xXx (2002)	\
userId					

1	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0
...
5212	0.0	0.0	0.0	0.0
5213	0.0	0.0	0.0	0.0
5214	0.0	0.0	0.0	0.0
5215	0.0	0.0	0.0	0.0
5216	0.0	0.0	0.0	0.0

title	¡Three Amigos! (1986)	À nous la liberté (Freedom for Us) (1931)
userId		

1	0.0	0.0
2	0.0	0.0
3	0.0	0.0
4	0.0	0.0
5	0.0	0.0

```

...
5212          0.0          0.0
5213          0.0          0.0
5214          0.0          0.0
5215          0.0          0.0
5216          0.0          0.0

```

[5216 rows x 8075 columns]

```
[83]: #Normalize the data by converting into numpy array first
```

```

User_mean=np.mean(MF,axis=1)
Matrix_normed=MF-User_mean.values.reshape(-1,1)

```

```
[84]: Matrix_normed
```

```

[84]: title    'Round Midnight (1986)  'Til There Was You (1997)  'burbs, The (1989)  \
userId
1          -0.080619          -0.080619          -0.080619
2          -0.030217          -0.030217          -0.030217
3          -0.095480          -0.095480          -0.095480
4          -0.012384          -0.012384          -0.012384
5          -0.034923          -0.034923          -0.034923
...
5212        -0.010898          -0.010898          -0.010898
5213        -0.012632          -0.012632          -0.012632
5214        -0.062353          -0.062353          -0.062353
5215        -0.068854          -0.068854          -0.068854
5216        -0.039938          -0.039938          -0.039938

title    'night Mother (1986)  *batteries not included (1987)  \
userId
1          -0.080619          -0.080619
2          -0.030217          -0.030217
3          -0.095480          -0.095480
4          -0.012384          -0.012384
5          -0.034923          -0.034923
...
5212        -0.010898          -0.010898
5213        -0.012632          -0.012632
5214        -0.062353          -0.062353
5215        -0.068854          -0.068854
5216        -0.039938          -0.039938

title    ...All the Marbles (California Dolls, The) (1981)  \
userId
1          -0.080619

```

2	-0.030217
3	-0.095480
4	-0.012384
5	-0.034923
...	...
5212	-0.010898
5213	-0.012632
5214	-0.062353
5215	-0.068854
5216	-0.039938

title	...And God Spoke (1993)	...And Justice for All (1979)	\
userId			
1	-0.080619	-0.080619	
2	-0.030217	-0.030217	
3	-0.095480	-0.095480	
4	-0.012384	-0.012384	
5	-0.034923	-0.034923	
...	
5212	-0.010898	-0.010898	
5213	-0.012632	-0.012632	
5214	-0.062353	-0.062353	
5215	-0.068854	-0.068854	
5216	-0.039938	-0.039938	

title	1-900 (06) (1994)	10 (1979)	...	Zoolander (2001)	Zoot Suit (1981)	\
userId			...			
1	-0.080619	-0.080619	...	-0.080619	-0.080619	
2	-0.030217	-0.030217	...	-0.030217	-0.030217	
3	-0.095480	-0.095480	...	-0.095480	-0.095480	
4	-0.012384	-0.012384	...	-0.012384	-0.012384	
5	-0.034923	-0.034923	...	-0.034923	-0.034923	
...	
5212	-0.010898	-0.010898	...	-0.010898	-0.010898	
5213	-0.012632	-0.012632	...	-0.012632	-0.012632	
5214	-0.062353	-0.062353	...	-0.062353	-0.062353	
5215	-0.068854	-0.068854	...	-0.068854	-0.068854	
5216	-0.039938	-0.039938	...	-0.039938	-0.039938	

title	Zorba the Greek (Alexis Zorbas) (1964)	Zorro, the Gay Blade (1981)	\
userId			
1	-0.080619	-0.080619	
2	-0.030217	-0.030217	
3	-0.095480	-0.095480	
4	-0.012384	-0.012384	
5	-0.034923	-0.034923	
...	

5212	-0.010898	-0.010898
5213	-0.012632	-0.012632
5214	-0.062353	-0.062353
5215	-0.068854	-0.068854
5216	-0.039938	-0.039938

title	Zulu (1964)	Zus & Zo (2001)	eXistenZ (1999)	xXx (2002)	\
userId					
1	-0.080619	-0.080619	-0.080619	-0.080619	
2	-0.030217	-0.030217	-0.030217	-0.030217	
3	-0.095480	-0.095480	-0.095480	-0.095480	
4	-0.012384	-0.012384	-0.012384	-0.012384	
5	-0.034923	-0.034923	-0.034923	-0.034923	
...	
5212	-0.010898	-0.010898	-0.010898	-0.010898	
5213	-0.012632	-0.012632	-0.012632	-0.012632	
5214	-0.062353	-0.062353	-0.062353	-0.062353	
5215	-0.068854	-0.068854	-0.068854	-0.068854	
5216	-0.039938	-0.039938	-0.039938	-0.039938	

title	¡Three Amigos! (1986)	À nous la liberté (Freedom for Us) (1931)
userId		
1	-0.080619	-0.080619
2	-0.030217	-0.030217
3	-0.095480	-0.095480
4	-0.012384	-0.012384
5	-0.034923	-0.034923
...
5212	-0.010898	-0.010898
5213	-0.012632	-0.012632
5214	-0.062353	-0.062353
5215	-0.068854	-0.068854
5216	-0.039938	-0.039938

[5216 rows x 8075 columns]

Scipy function used for choose the number of latent factors we want to use to approximate the original ratings matrix

```
[95]: U,sigma,Vt =svds(Matrix_normed,k=50) #number of latent factors is taken 50
```

```
[96]: '''sigma is diagonal matrix but with scipy it returns only those diagonal values.
    ↳so,we need to convert
    It back into a diagonal matrix from.'''
    # that the Sigma$ returned is just the values instead of a diagonal matrix.
    # This is useful, to leverage matrix multiplication to get predictions will
    ↳convert it to the diagonal matrix form.
```

```
Sigma=np.diag(sigma)
```

```
[98]: all_user_predicted_ratings = np.dot(np.dot(U, Sigma), Vt) + User_mean.values.  
      →reshape(-1, 1)
```

```
[99]: preds_df=pd.DataFrame(all_user_predicted_ratings,columns=Matrix_normed.columns)  
      preds_df
```

```
[99]: title  'Round Midnight (1986)  'Til There Was You (1997)  'burbs, The (1989)  \  
0          -0.011734          -0.040783          0.206188  
1          0.005797          0.064766          0.026113  
2          0.025542          0.009791          0.137872  
3          -0.010183         -0.067724         -0.011214  
4          -0.005576          0.040472         -0.079837  
...          ...          ...          ...  
5211        0.019808          0.045691          0.008234  
5212        0.009113         -0.087625          0.015653  
5213       -0.007429         -0.056581         -0.001247  
5214       -0.014958         -0.067123         -0.090309  
5215        0.001517         -0.092399          0.024327
```

```
title  'night Mother (1986)  *batteries not included (1987)  \  
0          0.003349          0.394311  
1          0.020556         -0.042258  
2          0.042656          0.231611  
3         -0.008727         -0.039458  
4         -0.021585         -0.103489  
...          ...          ...  
5211       -0.003457          0.009524  
5212        0.006426          0.012161  
5213       -0.007576          0.047510  
5214        0.028068         -0.171896  
5215       -0.005198         -0.015663
```

```
title  ...All the Marbles (California Dolls, The) (1981)  \  
0          0.007381  
1         -0.002996  
2          0.017404  
3          0.005066  
4         -0.003956  
...          ...  
5211        0.000429  
5212        0.000660  
5213       -0.008615  
5214        0.011528  
5215        0.001227
```

title	...And God Spoke (1993)	...And Justice for All (1979)	\
0	0.068013	-0.047745	
1	-0.011406	-0.004262	
2	-0.004941	0.026556	
3	0.007561	0.028007	
4	-0.003393	0.022523	
...	
5211	-0.002753	0.017613	
5212	-0.006194	0.004380	
5213	-0.007263	-0.047586	
5214	-0.051539	-0.004606	
5215	0.011794	-0.013932	

title	1-900 (06) (1994)	10 (1979)	...	Zoolander (2001)	Zoot Suit (1981)	\
0	-0.001692	0.006396	...	0.225200	0.031294	
1	-0.006299	0.026770	...	0.107379	0.003558	
2	-0.009288	-0.065572	...	0.044164	0.015851	
3	0.004206	-0.004242	...	0.119324	0.000582	
4	0.002010	-0.027378	...	0.064759	-0.013436	
...	
5211	-0.003009	0.006618	...	0.083979	-0.005442	
5212	0.012136	0.026659	...	0.063652	-0.001556	
5213	0.009176	-0.012932	...	-0.045608	0.002534	
5214	0.051379	-0.030486	...	0.086561	0.001536	
5215	0.036851	0.044476	...	0.185462	0.005908	

title	Zorba the Greek (Alexis Zorbas) (1964)	Zorro, the Gay Blade (1981)	\
0	-0.029303	-0.002216	
1	0.045979	-0.003640	
2	-0.019577	0.005834	
3	0.033273	0.013690	
4	0.024323	-0.035116	
...	
5211	-0.030472	-0.008484	
5212	0.005241	0.001148	
5213	0.032626	-0.008874	
5214	-0.001675	-0.088473	
5215	0.000616	0.003618	

title	Zulu (1964)	Zus & Zo (2001)	eXistenZ (1999)	xXx (2002)	\
0	0.143533	-0.004540	0.219033	-0.057879	
1	0.000005	-0.004212	0.300646	-0.073929	
2	-0.012441	-0.005592	0.485630	-0.200937	
3	0.038459	0.002285	-0.040935	-0.017897	
4	-0.056717	0.000976	-0.111418	-0.073074	
...	
5211	-0.012350	-0.000752	-0.022547	0.029713	

5212	-0.001048	-0.006226	-0.169360	0.031951
5213	0.053405	-0.003323	0.400503	0.152930
5214	-0.072677	0.026050	0.247734	0.119325
5215	0.021713	0.006661	0.160892	0.059524

title	Three Amigos! (1986)	À nous la liberté (Freedom for Us) (1931)
0	0.126604	0.065733
1	0.024721	-0.026800
2	0.336020	-0.036906
3	0.006746	0.003888
4	-0.062897	0.003419
...
5211	0.101406	-0.000576
5212	0.106163	0.005326
5213	-0.105396	-0.010115
5214	0.240126	-0.028844
5215	0.071100	-0.022951

[5216 rows x 8075 columns]

0.1.6 Find Correlation movies from matrix table

```
[100]: Correction_of_movies= preds_df['Jurassic Park (1993)']
Correction_of_movies.head()
```

```
[100]: 0    0.108348
1    2.128924
2    3.437256
3    2.853359
4    4.308042
Name: Jurassic Park (1993), dtype: float64
```

```
[106]: similar_movies = preds_df.corrwith(Correction_of_movies)
corr_movie = pd.DataFrame(similar_movies,columns=['Correlation']).
    ↳sort_values('Correlation',ascending=False)
corr_movie.dropna(inplace=True)
corr_movie =corr_movie.join(ratings['num of ratings'])
corr_movie[corr_movie['num of ratings']>100].
    ↳sort_values('Correlation',ascending=False)
corr_movie.head()
```

```
[106]:
```

	Correlation	num of ratings
title		
Jurassic Park (1993)	1.000000	2301
Speed (1994)	0.853797	1614
Terminator 2: Judgment Day (1991)	0.850423	1987
Forrest Gump (1994)	0.807348	2568

Fugitive, The (1993)	0.790349	1901
----------------------	----------	------

0.1.7 make function for correlation

```
[109]: def correlation_finding(movie):
        Correction_of_movies= preds_df[movie]
        similar_movies = preds_df.corrwith(Correction_of_movies)
        corr_movie = pd.DataFrame(similar_movies,columns=['Correlation']).
        →sort_values('Correlation',ascending=False)
        corr_movie.dropna(inplace=True)
        corr_movie =corr_movie.join(ratings['num of ratings'])
        corr_movie[corr_movie['num of ratings']>100].
        →sort_values('Correlation',ascending=False)
        return corr_movie[:15]
```

```
[110]: correlation_finding('Jurassic Park (1993)')
```

```
[110]:
```

	Correlation	num of ratings
title		
Jurassic Park (1993)	1.000000	2301
Speed (1994)	0.853797	1614
Terminator 2: Judgment Day (1991)	0.850423	1987
Forrest Gump (1994)	0.807348	2568
Fugitive, The (1993)	0.790349	1901
True Lies (1994)	0.765397	1666
Mask, The (1994)	0.731634	1363
Mrs. Doubtfire (1993)	0.724606	1326
Batman (1989)	0.696866	1774
Home Alone (1990)	0.686613	1107
Lion King, The (1994)	0.684303	1520
Apollo 13 (1995)	0.682232	1844
Stargate (1994)	0.678231	1265
Ghost (1990)	0.677028	1149
Die Hard: With a Vengeance (1995)	0.671414	1331

```
[113]: correlation_finding('Home Alone (1990)') #Adventure/Children/Fantasy
```

```
[113]:
```

	Correlation	num of ratings
title		
Home Alone (1990)	1.000000	1107
Mrs. Doubtfire (1993)	0.919373	1326
Mask, The (1994)	0.872569	1363
Jumanji (1995)	0.818125	872
Pretty Woman (1990)	0.807869	1347
Ghost (1990)	0.796402	1149
Lion King, The (1994)	0.786418	1520
Speed (1994)	0.760061	1614

Robin Hood: Men in Tights (1993)	0.758477	586
Ace Ventura: When Nature Calls (1995)	0.752343	847
Dumb & Dumber (Dumb and Dumber) (1994)	0.737735	1293
Ace Ventura: Pet Detective (1994)	0.736352	1524
Sleepless in Seattle (1993)	0.734580	1115
Maverick (1994)	0.714323	681
Flintstones, The (1994)	0.706425	394

0.1.8 Make Predictions

lets see user 0's recommendation

```
[114]: #Recommendations for user_id=0 in a sorted manner
Preds_0=preds_df.iloc[0,:].sort_values(ascending=False)
Preds_0
```

```
[114]: title
Alien (1979)
5.353043
Raiders of the Lost Ark (Indiana Jones and the Raiders of the Lost Ark) (1981)
4.975585
Lord of the Rings: The Two Towers, The (2002)
4.836424
Lord of the Rings: The Fellowship of the Ring, The (2001)
4.719337
Lord of the Rings: The Return of the King, The (2003)
4.602093
...
Negotiator, The (1998)
-0.640541
Manhattan (1979)
-0.654709
Private Parts (1997)
-0.670897
Men in Black (a.k.a. MIB) (1997)
-0.736429
Forrest Gump (1994)
-1.248313
Name: 0, Length: 8075, dtype: float64
```

```
[115]: #Recommendations if user has rated the movie previously
recommendations_0=[i for i in Preds_0.index if preds_df.loc[0,i]!=0]
recommendations_0
```

```
[115]: ['Alien (1979)',
'Raiders of the Lost Ark (Indiana Jones and the Raiders of the Lost Ark)
(1981)',
```

'Lord of the Rings: The Two Towers, The (2002)',
 'Lord of the Rings: The Fellowship of the Ring, The (2001)',
 'Lord of the Rings: The Return of the King, The (2003)',
 'Aliens (1986)',
 'Seven (a.k.a. Se7en) (1995)',
 'Silence of the Lambs, The (1991)',
 'Indiana Jones and the Last Crusade (1989)',
 'Monty Python and the Holy Grail (1975)',
 'Shining, The (1980)',
 'Star Wars: Episode V - The Empire Strikes Back (1980)',
 'Princess Bride, The (1987)',
 'Blade Runner (1982)',
 'Terminator, The (1984)',
 'Usual Suspects, The (1995)',
 'Die Hard (1988)',
 'Reservoir Dogs (1992)',
 'Star Wars: Episode IV - A New Hope (1977)',
 'Pirates of the Caribbean: The Curse of the Black Pearl (2003)',
 'Shawshank Redemption, The (1994)',
 'Psycho (1960)',
 'Interview with the Vampire: The Vampire Chronicles (1994)',
 'Sixth Sense, The (1999)',
 'Exorcist, The (1973)',
 'Twelve Monkeys (a.k.a. 12 Monkeys) (1995)',
 'Fight Club (1999)',
 'Léon: The Professional (a.k.a. The Professional) (Léon) (1994)',
 'X-Men (2000)',
 'Army of Darkness (1993)',
 'Ghostbusters (a.k.a. Ghost Busters) (1984)',
 'X2: X-Men United (2003)',
 'Jaws (1975)',
 'Full Metal Jacket (1987)',
 'Trainspotting (1996)',
 'Kill Bill: Vol. 1 (2003)',
 'Harry Potter and the Prisoner of Azkaban (2004)',
 'Monty Python's Life of Brian (1979)',
 'Donnie Darko (2001)',
 'Pulp Fiction (1994)',
 'Crouching Tiger, Hidden Dragon (Wo hu cang long) (2000)',
 'Shaun of the Dead (2004)',
 'Good, the Bad and the Ugly, The (Buono, il brutto, il cattivo, Il) (1966)',
 'Poltergeist (1982)',
 'Memento (2000)',
 'Highlander (1986)',
 'Incredibles, The (2004)',
 'Apocalypse Now (1979)',
 'Misery (1990)',

'Kill Bill: Vol. 2 (2004)',
 'Evil Dead II (Dead by Dawn) (1987)',
 '2001: A Space Odyssey (1968)',
 'Clockwork Orange, A (1971)',
 'Beetlejuice (1988)',
 '28 Days Later (2002)',
 "Harry Potter and the Sorcerer's Stone (a.k.a. Harry Potter and the
 Philosopher's Stone) (2001)",
 'Abyss, The (1989)',
 'Dark Crystal, The (1982)',
 'Young Frankenstein (1974)',
 'Edward Scissorhands (1990)',
 "One Flew Over the Cuckoo's Nest (1975)",
 'Sleepy Hollow (1999)',
 'Akira (1988)',
 'Star Wars: Episode VI - Return of the Jedi (1983)',
 'Harry Potter and the Chamber of Secrets (2002)',
 "Dracula (Bram Stoker's Dracula) (1992)",
 'Thing, The (1982)',
 'Others, The (2001)',
 'Who Framed Roger Rabbit? (1988)',
 ' Fargo (1996)',
 'Predator (1987)',
 'Indiana Jones and the Temple of Doom (1984)',
 "Monty Python's The Meaning of Life (1983)",
 "Ferris Bueller's Day Off (1986)",
 'Labyrinth (1986)',
 'Carrie (1976)',
 'Shrek (2001)',
 'Birds, The (1963)',
 'Goonies, The (1985)',
 'Close Encounters of the Third Kind (1977)',
 'Snatch (2000)',
 'Lock, Stock & Two Smoking Barrels (1998)',
 'Matrix, The (1999)',
 'American Werewolf in London, An (1981)',
 'Willow (1988)',
 'Unforgiven (1992)',
 'Stand by Me (1986)',
 'Wizard of Oz, The (1939)',
 'Road Warrior, The (Mad Max 2) (1981)',
 'Night of the Living Dead (1968)',
 'Spider-Man (2002)',
 'Crow, The (1994)',
 'Spider-Man 2 (2004)',
 'NeverEnding Story, The (1984)',
 'Evil Dead, The (1981)',

'Monsters, Inc. (2001)',
 'Finding Nemo (2003)',
 'Princess Mononoke (Mononoke-hime) (1997)',
 'Great Escape, The (1963)',
 'Nightmare Before Christmas, The (1993)',
 'Nightmare on Elm Street, A (1984)',
 'Dead Poets Society (1989)',
 'Halloween (1978)',
 'Platoon (1986)',
 'Spirited Away (Sen to Chihiro no kamikakushi) (2001)',
 'Bridge on the River Kwai, The (1957)',
 'Lost Boys, The (1987)',
 'Green Mile, The (1999)',
 'Minority Report (2002)',
 'Willy Wonka & the Chocolate Factory (1971)',
 'Fish Called Wanda, A (1988)',
 'Bourne Identity, The (2002)',
 'Blues Brothers, The (1980)',
 'Terminator 2: Judgment Day (1991)',
 'Mummy, The (1999)',
 'Ring, The (2002)',
 'Star Trek II: The Wrath of Khan (1982)',
 'Omen, The (1976)',
 'Run Lola Run (Lola rennt) (1998)',
 'Breakfast Club, The (1985)',
 'American History X (1998)',
 'O Brother, Where Art Thou? (2000)',
 'Back to the Future (1985)',
 'Blair Witch Project, The (1999)',
 'Untouchables, The (1987)',
 "Monty Python's And Now for Something Completely Different (1971)",
 'Mad Max (1979)',
 'Ghost in the Shell (Kôkaku kidôtai) (1995)',
 "Rosemary's Baby (1968)",
 'Time Bandits (1981)',
 'Excalibur (1981)',
 'Gremlins (1984)',
 'Batman (1989)',
 'Office Space (1999)',
 'Unbreakable (2000)',
 'Sling Blade (1996)',
 "Bill & Ted's Excellent Adventure (1989)",
 'Planet of the Apes (1968)',
 'Deliverance (1972)',
 'Fugitive, The (1993)',
 'Dark City (1998)',
 'E.T. the Extra-Terrestrial (1982)',

'Invasion of the Body Snatchers (1956)',
 'Goodfellas (1990)',
 'Fistful of Dollars, A (Per un pugno di dollari) (1964)',
 'L.A. Confidential (1997)',
 'Alien³ (a.k.a. Alien 3) (1992)',
 'Last of the Mohicans, The (1992)',
 'Dirty Dozen, The (1967)',
 'City of Lost Children, The (Cité des enfants perdus, La) (1995)',
 'Femme Nikita, La (Nikita) (1990)',
 'Last Samurai, The (2003)',
 'Rocky Horror Picture Show, The (1975)',
 'Dune (1984)',
 'Tombstone (1993)',
 'Scream (1996)',
 'Galaxy Quest (1999)',
 'Frankenstein (1931)',
 'Goldfinger (1964)',
 'Signs (2002)',
 'For a Few Dollars More (Per qualche dollaro in più) (1965)',
 'Star Wars: Episode II - Attack of the Clones (2002)',
 'Dr. Strangelove or: How I Learned to Stop Worrying and Love the Bomb (1964)',
 'Natural Born Killers (1994)',
 'Fifth Element, The (1997)',
 'Schindler's List (1993)',
 'Dead Zone, The (1983)',
 'Boondock Saints, The (2000)',
 'Shrek 2 (2004)',
 'Ladyhawke (1985)',
 'Big Fish (2003)',
 'Professional, The (Le professionnel) (1981)',
 'Matrix Reloaded, The (2003)',
 'Gladiator (2000)',
 'Hero (Ying xiong) (2002)',
 'RoboCop (1987)',
 'Fantasia (1940)',
 'Cool Hand Luke (1967)',
 'Fly, The (1986)',
 'Spaceballs (1987)',
 'Eternal Sunshine of the Spotless Mind (2004)',
 'Heavenly Creatures (1994)',
 'Brazil (1985)',
 'Tron (1982)',
 'Name of the Rose, The (Name der Rose, Der) (1986)',
 'Addams Family Values (1993)',
 'Witness (1985)',
 'Ocean's Eleven (2001)',
 'Blazing Saddles (1974)',

'Ghost (1990)',
 'Ace Ventura: Pet Detective (1994)',
 'Secret of NIMH, The (1982)',
 'Big Trouble in Little China (1986)',
 'Hellboy (2004)',
 'Big Lebowski, The (1998)',
 'From Hell (2001)',
 'Heathers (1989)',
 'Saving Private Ryan (1998)',
 'Airplane! (1980)',
 'Legend (1985)',
 'Dogma (1999)',
 'Rosencrantz and Guildenstern Are Dead (1990)',
 'Rob Roy (1995)',
 'Craft, The (1996)',
 'Equilibrium (2002)',
 'Stargate (1994)',
 'True Romance (1993)',
 'Pitch Black (2000)',
 'Blade (1998)',
 'My Neighbor Totoro (Tonari no Totoro) (1988)',
 'Amadeus (1984)',
 'Magnificent Seven, The (1960)',
 'This Is Spinal Tap (1984)',
 'Groundhog Day (1993)',
 "Jacob's Ladder (1990)",
 'Delicatessen (1991)',
 'Hook (1991)',
 'Dawn of the Dead (1978)',
 'Frighteners, The (1996)',
 'Dawn of the Dead (2004)',
 'M*A*S*H (a.k.a. MASH) (1970)',
 'Butch Cassidy and the Sundance Kid (1969)',
 'Christmas Story, A (1983)',
 'Nosferatu (Nosferatu, eine Symphonie des Grauens) (1922)',
 'Superman (1978)',
 'Re-Animator (1985)',
 'Honey, I Shrunk the Kids (1989)',
 'To Kill a Mockingbird (1962)',
 'Matrix Revolutions, The (2003)',
 'WarGames (1983)',
 'Big (1988)',
 'Austin Powers: The Spy Who Shagged Me (1999)',
 "What's Eating Gilbert Grape (1993)",
 'King Kong (1933)',
 'Pink Floyd: The Wall (1982)',
 'Elizabeth (1998)',

'Godfather, The (1972)',
'From Dusk Till Dawn (1996)',
'Escape from New York (1981)',
'Enter the Dragon (1973)',
'Crying Game, The (1992)',
'South Park: Bigger, Longer and Uncut (1999)',
"Wayne's World (1992)",
'Bourne Supremacy, The (2004)',
'Ringu (Ring) (1998)',
'Star Trek IV: The Voyage Home (1986)',
'Total Recall (1990)',
'Monty Python Live at the Hollywood Bowl (1982)',
'Arachnophobia (1990)',
'Dances with Wolves (1990)',
'Buffy the Vampire Slayer (1992)',
'Dracula (1931)',
'Boot, Das (Boat, The) (1981)',
'Seven Samurai (Shichinin no samurai) (1954)',
'I, Robot (2004)',
'Dead Alive (Braindead) (1992)',
'Cape Fear (1991)',
'Good Morning, Vietnam (1987)',
'Dragonheart (1996)',
'Rear Window (1954)',
'13th Warrior, The (1999)',
'Robin Hood: Men in Tights (1993)',
'Day the Earth Stood Still, The (1951)',
'Being John Malkovich (1999)',
'Pet Sematary (1989)',
'Ed Wood (1994)',
'Lawrence of Arabia (1962)',
'Killing Fields, The (1984)',
'Adventures of Baron Munchausen, The (1988)',
'Outlaw Josey Wales, The (1976)',
'Manchurian Candidate, The (1962)',
'Raising Arizona (1987)',
'Conan the Barbarian (1982)',
'Cell, The (2000)',
'Addams Family, The (1991)',
"William Shakespeare's Romeo + Juliet (1996)",
'Little Mermaid, The (1989)',
'Mrs. Doubtfire (1993)',
'Splash (1984)',
'Bubba Ho-tep (2002)',
'Shallow Grave (1994)',
'Iron Giant, The (1999)',
'Nausicaä of the Valley of the Wind (Kaze no tani no Naushika) (1984)',

'Mask, The (1994)',
 'Hellraiser (1987)',
 'Dumb & Dumber (Dumb and Dumber) (1994)',
 'Deer Hunter, The (1978)',
 'Ran (1985)',
 'Moulin Rouge (2001)',
 'Adventures of Priscilla, Queen of the Desert, The (1994)',
 'Piano, The (1993)',
 'Spartacus (1960)',
 'Underworld (2003)',
 'American Psycho (2000)',
 'Cowboy Bebop: The Movie (Cowboy Bebop: Tengoku no Tobira) (2001)',
 'Taxi Driver (1976)',
 'Crocodile Dundee (1986)',
 'Saw (2004)',
 'Glory (1989)',
 'Identity (2003)',
 'Star Trek III: The Search for Spock (1984)',
 'Mummy Returns, The (2001)',
 'Dr. No (1962)',
 'Lilo & Stitch (2002)',
 'Clerks (1994)',
 'Village, The (2004)',
 'Angel Heart (1987)',
 'Beverly Hills Cop (1984)',
 'Braveheart (1995)',
 'Romancing the Stone (1984)',
 'Vampire Hunter D: Bloodlust (Banpaia hantâ D) (2000)',
 'Fried Green Tomatoes (1991)',
 'Cube (1997)',
 'Master and Commander: The Far Side of the World (2003)',
 'Forbidden Planet (1956)',
 'Texas Chainsaw Massacre, The (1974)',
 'Tremors (1990)',
 'Wallace & Gromit: The Wrong Trousers (1993)',
 'Muppet Movie, The (1979)',
 'Ace Ventura: When Nature Calls (1995)',
 'Sound of Music, The (1965)',
 'Hannibal (2001)',
 'Dolores Claiborne (1995)',
 "Bug's Life, A (1998)",
 'Alien: Resurrection (1997)',
 "Bill & Ted's Bogus Journey (1991)",
 'Young Guns (1988)',
 'French Connection, The (1971)',
 'Final Fantasy: The Spirits Within (2001)',
 'Dirty Harry (1971)',

'Phantasm (1979)',
 'The Count of Monte Cristo (2002)',
 'Brotherhood of the Wolf (Pacte des loups, Le) (2001)',
 'Hard-Boiled (Lat sau san taam) (1992)',
 'Godfather: Part II, The (1974)',
 'Charlotte's Web (1973)',
 'Mad Max Beyond Thunderdome (1985)',
 'Haunting, The (1963)',
 'School of Rock (2003)',
 'Running Man, The (1987)',
 'Legend of Drunken Master, The (Jui kuen II) (1994)',
 'Firm, The (1993)',
 'Miller's Crossing (1990)',
 'James and the Giant Peach (1996)',
 'Bruce Almighty (2003)',
 'The Butterfly Effect (2004)',
 'Chicken Run (2000)',
 'Flatliners (1990)',
 'Dead Calm (1989)',
 'Invasion of the Body Snatchers (1978)',
 'City Slickers (1991)',
 'Grosse Pointe Blank (1997)',
 'Sting, The (1973)',
 'Red Dragon (2002)',
 'Blood Simple (1984)',
 'Yojimbo (1961)',
 'Three Days of the Condor (3 Days of the Condor) (1975)',
 'Birdcage, The (1996)',
 'Battle Royale (Batoru rowaiaru) (2000)',
 'Fatal Attraction (1987)',
 'Game, The (1997)',
 'Copycat (1995)',
 'Grave of the Fireflies (Hotaru no haka) (1988)',
 'Candyman (1992)',
 'Empire of the Sun (1987)',
 'Blue Velvet (1986)',
 'Amelie (Fabuleux destin d'Amélie Poulain, Le) (2001)',
 'Laputa: Castle in the Sky (Tenkû no shiro Rapyuta) (1986)',
 'Rain Man (1988)',
 'Watership Down (1978)',
 'Fright Night (1985)',
 'Requiem for a Dream (2000)',
 'Cocoon (1985)',
 'Band of Brothers (2001)',
 'Die Hard: With a Vengeance (1995)',
 'House of Flying Daggers (Shi mian mai fu) (2004)',
 'Metropolis (1927)',

'Rocky (1976)',
'Frailty (2001)',
'Top Gun (1986)',
'Animal House (1978)',
'Marathon Man (1976)',
'Clue (1985)',
'Prophecy, The (1995)',
'Jumanji (1995)',
'Creepshow (1982)',
'Shadow of the Vampire (2000)',
'Mystery Science Theater 3000: The Movie (1996)',
'Black Hawk Down (2001)',
'Toy Story 2 (1999)',
'7th Voyage of Sinbad, The (1958)',
'Lone Star (1996)',
'Little Shop of Horrors (1986)',
'Resident Evil (2002)',
'Ghostbusters II (1989)',
'Four Weddings and a Funeral (1994)',
'Blade II (2002)',
'Dead Again (1991)',
'Sister Act (1992)',
'Primal Fear (1996)',
'Dead Man (1995)',
'Lord of the Rings, The (1978)',
'American Graffiti (1973)',
'Strictly Ballroom (1992)',
'Best in Show (2000)',
'AVP: Alien vs. Predator (2004)',
'Cable Guy, The (1996)',
'Gattaca (1997)',
'Friday the 13th (1980)',
'Truman Show, The (1998)',
'Man Who Would Be King, The (1975)',
'Darkman (1990)',
'Witches, The (1990)',
'Alice in Wonderland (1951)',
'Ginger Snaps (2000)',
'Emperor's New Groove, The (2000)',
'Super Size Me (2004)',
'League of Extraordinary Gentlemen, The (a.k.a. LXG) (2003)',
'Wicker Man, The (1973)',
'Field of Dreams (1989)',
'Ice Age (2002)',
'Mariachi, El (1992)',
'Once Upon a Time in the West (C'era una volta il West) (1968)',
'Van Helsing (2004)',

'Jurassic Park III (2001)',
'Austin Powers: International Man of Mystery (1997)',
'Pi (1998)',
'Kiki's Delivery Service (Majo no takkyûbin) (1989)",
'Garden State (2004)',
'Titus (1999)',
'Back to the Future Part II (1989)',
'Videodrome (1983)',
'Hunt for Red October, The (1990)',
'Mary Shelley's Frankenstein (Frankenstein) (1994)",
'Howling, The (1980)',
'Richard III (1995)',
'Jason and the Argonauts (1963)',
'Jungle Book, The (1967)',
'High Plains Drifter (1973)',
'Outbreak (1995)',
'Almost Famous (2000)',
'Muriel's Wedding (1994)",
'I Know What You Did Last Summer (1997)',
'Fisher King, The (1991)',
'Last Emperor, The (1987)',
'Crumb (1994)',
'Last Starfighter, The (1984)',
'Henry V (1989)',
'Killer, The (Die xue shuang xiong) (1989)',
'Clash of the Titans (1981)',
'Star Trek: First Contact (1996)',
'Gladiator (1992)',
'Kalifornia (1993)',
'Boyz N the Hood (1991)',
'Cujo (1983)',
'Dragonslayer (1981)',
'Terminator 3: Rise of the Machines (2003)',
'Time Machine, The (1960)',
'Once Were Warriors (1994)',
'Andromeda Strain, The (1971)',
'Cliffhanger (1993)',
'Repo Man (1984)',
'Sneakers (1992)',
'Chronicles of Riddick, The (2004)',
'Cast Away (2000)',
'Dog Day Afternoon (1975)',
'Lethal Weapon (1987)',
'Bride of Frankenstein, The (Bride of Frankenstein) (1935)',
'Cook the Thief His Wife & Her Lover, The (1989)',
'Bowling for Columbine (2002)',
'Bad Taste (1987)',

'So I Married an Axe Murderer (1993)',
 'Starman (1984)',
 'Happy Gilmore (1996)',
 'In the Name of the Father (1993)',
 'Reign of Fire (2002)',
 'Lord of Illusions (1995)',
 'Star Trek: Nemesis (2002)',
 'Top Secret! (1984)',
 'Last Unicorn, The (1982)',
 'Grease (1978)',
 'Enemy at the Gates (2001)',
 '*batteries not included (1987)',
 'Death Becomes Her (1992)',
 'Boogie Nights (1997)',
 'Cyrano de Bergerac (1990)',
 'Heavy Metal (1981)',
 'Star Trek: The Motion Picture (1979)',
 'Day of the Dead (1985)',
 "Logan's Run (1976)",
 'Searchers, The (1956)',
 'Secret Garden, The (1993)',
 'Sword in the Stone, The (1963)',
 'Conan the Destroyer (1984)',
 'Ninja Scroll (Jûbei ninpûchô) (1995)',
 "Bridget Jones's Diary (2001)",
 'Madness of King George, The (1994)',
 'Finding Neverland (2004)',
 'All Quiet on the Western Front (1930)',
 'First Blood (Rambo: First Blood) (1982)',
 'Mississippi Burning (1988)',
 'Amityville Horror, The (1979)',
 'Drunken Master (Jui kuen) (1978)',
 'In the Line of Fire (1993)',
 'Hulk (2003)',
 'Cape Fear (1962)',
 'Krull (1983)',
 'Mary Poppins (1964)',
 "Young Poisoner's Handbook, The (1995)",
 'Wolf (1994)',
 'Creature Comforts (1989)',
 'Mulan (1998)',
 'Bonnie and Clyde (1967)',
 'Dangerous Liaisons (1988)',
 'Gods Must Be Crazy, The (1980)',
 'Men in Black II (a.k.a. MIIB) (a.k.a. MIB 2) (2002)',
 'Something Wicked This Way Comes (1983)',
 'Muppet Christmas Carol, The (1992)',

'Short Circuit (1986)',
 'Benny & Joon (1993)',
 'Elf (2003)',
 'Shakespeare in Love (1998)',
 'Devil's Backbone, The (Espinazo del diablo, El) (2001)",
 'Mummy, The (1932)',
 'Dead Ringers (1988)',
 'Sky Captain and the World of Tomorrow (2004)',
 'Hidden, The (1987)',
 'Papillon (1973)',
 'Karate Kid, The (1984)',
 'Waterworld (1995)',
 'Red Rock West (1992)',
 'Thelma & Louise (1991)',
 'Teenage Mutant Ninja Turtles (1990)',
 'Haunting, The (1999)',
 'Fear and Loathing in Las Vegas (1998)',
 'Naked Gun 33 1/3: The Final Insult (1994)',
 'Faculty, The (1998)',
 "Pee-wee's Big Adventure (1985)",
 "Charlie's Angels (2000)",
 "Child's Play (1988)",
 'Ninth Gate, The (1999)',
 'House on Haunted Hill (1959)',
 'Henry: Portrait of a Serial Killer (1986)',
 'Jabberwocky (1977)',
 'Chicago (2002)',
 "It's a Wonderful Life (1946)",
 'Dragon: The Bruce Lee Story (1993)',
 'Tampopo (1985)',
 'Austin Powers in Goldmember (2002)',
 'F/X (1986)',
 'Gremlins 2: The New Batch (1990)',
 'Machinist, The (Maquinista, El) (2004)',
 'Romeo and Juliet (1968)',
 'Sex, Lies, and Videotape (1989)',
 'Witches of Eastwick, The (1987)',
 'Fantasia 2000 (1999)',
 "Wes Craven's New Nightmare (Nightmare on Elm Street Part 7: Freddy's Finale,
 A) (1994)",
 'Hollow Man (2000)',
 'Jeepers Creepers (2001)',
 'Planes, Trains & Automobiles (1987)',
 'Nightmare on Elm Street 3: Dream Warriors, A (1987)',
 'Welcome to the Dollhouse (1995)',
 "Devil's Advocate, The (1997)",
 'What Lies Beneath (2000)',

'Dog Soldiers (2002)',
'Serial Mom (1994)',
'Village of the Damned (1960)',
'Them! (1954)',
'Fog, The (1980)',
'Escape to Witch Mountain (1975)',
'Masters of the Universe (1987)',
'Mallrats (1995)',
'Grifters, The (1990)',
'Some Folks Call It a Sling Blade (1993)',
'Return of the Living Dead, The (1985)',
'Napoleon Dynamite (2004)',
'Blob, The (1958)',
'Pale Rider (1985)',
'Species (1995)',
'Right Stuff, The (1983)',
'Roxanne (1987)',
'Metropolis (2001)',
'Weird Science (1985)',
'Soylent Green (1973)',
'Innerspace (1987)',
'My Fair Lady (1964)',
'Tank Girl (1995)',
'High Fidelity (2000)',
'20,000 Leagues Under the Sea (1954)',
'Four Rooms (1995)',
'A.I. Artificial Intelligence (2001)',
'Cat People (1982)',
'Drop Dead Fred (1991)',
'Predator 2 (1990)',
'Snow White and the Seven Dwarfs (1937)',
'Lost in Translation (2003)',
'Ravenous (1999)',
'10 Things I Hate About You (1999)',
'Thing from Another World, The (1951)',
'Starship Troopers (1997)',
'Jay and Silent Bob Strike Back (2001)',
'Eraserhead (1977)',
'Born on the Fourth of July (1989)',
'Truth About Cats & Dogs, The (1996)',
'Gods and Monsters (1998)',
'Naked Lunch (1991)',
'Bullitt (1968)',
'Superman II (1980)',
'Three Men and a Baby (1987)',
'Flight of the Navigator (1986)',
'Hunger, The (1983)',

'Celluloid Closet, The (1995)',
'War of the Worlds, The (1953)',
'Mothman Prophecies, The (2002)',
'Stir of Echoes (1999)',
'Needful Things (1993)',
'Speed (1994)',
'Alien Nation (1988)',
'Omega Man, The (1971)',
'Mars Attacks! (1996)',
'Time Machine, The (2002)',
'Freaks (1932)',
'Ben-Hur (1959)',
'Dracula 2000 (2000)',
'Black Cauldron, The (1985)',
'Tootsie (1982)',
'Plan 9 from Outer Space (1959)',
'Court Jester, The (1956)',
'Adventures of Robin Hood, The (1938)',
'101 Dalmatians (One Hundred and One Dalmatians) (1961)',
'Hellbound: Hellraiser II (1988)',
'Vertigo (1958)',
'Highlander: Endgame (Highlander IV) (2000)',
'Midnight Express (1978)',
'Silverado (1985)',
'Bedknobs and Broomsticks (1971)',
'Flash Gordon (1980)',
'Hot Shots! Part Deux (1993)',
'Grudge, The (2004)',
'Little Big Man (1970)',
'Parenthood (1989)',
'Gothika (2003)',
'Resident Evil: Apocalypse (2004)',
'All Dogs Go to Heaven (1989)',
'Killing Zoe (1994)',
'Mystery Men (1999)',
'Hand That Rocks the Cradle, The (1992)',
'Vampires (1998)',
'Agnes of God (1985)',
'Cinderella (1950)',
'Panic Room (2002)',
'Scream 2 (1997)',
'Some Like It Hot (1959)',
'Ten Commandments, The (1956)',
'Fiddler on the Roof (1971)',
'Bourne Identity, The (1988)',
'Return to Oz (1985)',
'Paradise Lost: The Child Murders at Robin Hood Hills (1996)',

'They Live (1988)',
 'Secret of Roan Inish, The (1994)',
 'Thirteen Ghosts (a.k.a. Thir13en Ghosts) (2001)',
 'Real Genius (1985)',
 'Dune (2000)',
 'Brave Little Toaster, The (1987)',
 'Great Mouse Detective, The (1986)',
 'American Werewolf in Paris, An (1997)',
 'Nell (1994)',
 'Jeremiah Johnson (1972)',
 'Nightmare on Elm Street 4: The Dream Master, A (1988)',
 'Gandhi (1982)',
 'Daredevil (2003)',
 'Fear (1996)',
 'Mister Roberts (1955)',
 'Harvey (1950)',
 'Italian Job, The (2003)',
 'Barry Lyndon (1975)',
 'UHF (1989)',
 'Never Cry Wolf (1983)',
 'American Tail, An (1986)',
 'Hamlet (1990)',
 'Secret Window (2004)',
 'Young Sherlock Holmes (1985)',
 'Creature from the Black Lagoon, The (1954)',
 'Session 9 (2001)',
 'Gorillas in the Mist (1988)',
 'Suspiria (1977)',
 'Relic, The (1997)',
 'Patriot Games (1992)',
 'Star Wars: Episode I - The Phantom Menace (1999)',
 'Doors, The (1991)',
 'Lupin III: The Castle Of Cagliostro (Rupan sansei: Kariosutoro no shiro) (1979)',
 'Grapes of Wrath, The (1940)',
 'Scarface (1983)',
 'Adventures of Buckaroo Banzai Across the 8th Dimension, The (1984)',
 'Invisible Man, The (1933)',
 'Fahrenheit 451 (1966)',
 'House on Haunted Hill (1999)',
 'Children of Dune (2003)',
 'Wolf Man, The (1941)',
 'NeverEnding Story II: The Next Chapter, The (1990)',
 'Badlands (1973)',
 'Client, The (1994)',
 'Event Horizon (1997)',
 'Peeping Tom (1960)',

'Assault on Precinct 13 (1976)',
 'Batman Returns (1992)',
 'Christine (1983)',
 'Westworld (1973)',
 'Unforgiven, The (1960)',
 'Navigator: A Mediaeval Odyssey, The (1988)',
 'Village of the Damned (1995)',
 'Dungeons & Dragons (2000)',
 'Children of the Corn (1984)',
 'Love Actually (2003)',
 'Where Eagles Dare (1968)',
 'Longest Day, The (1962)',
 'Ever After: A Cinderella Story (1998)',
 'Titan A.E. (2000)',
 'Saved! (2004)',
 'Malice (1993)',
 'Changeling, The (1980)',
 'Body Snatchers (1993)',
 'What Ever Happened to Baby Jane? (1962)',
 'Queen of the Damned (2002)',
 'Night of the Comet (1984)',
 'When We Were Kings (1996)',
 'Caddyshack (1980)',
 'Firestarter (1984)',
 'Pillow Book, The (1996)',
 'Kindergarten Cop (1990)',
 'Die Hard 2 (1990)',
 'Harold and Maude (1971)',
 'Fly, The (1958)',
 'Near Dark (1987)',
 'Lion in Winter, The (1968)',
 'American Movie (1999)',
 'Enemy Mine (1985)',
 'Bend It Like Beckham (2002)',
 'Shine (1996)',
 'Spanish Prisoner, The (1997)',
 'Dirty Dancing (1987)',
 'Shaolin Soccer (Siu lam juk kau) (2001)',
 'Priest (1994)',
 'Congo (1995)',
 'There's Something About Mary (1998)",
 'Team America: World Police (2004)',
 'From Russia with Love (1963)',
 'National Treasure (2004)',
 'Dirty Rotten Scoundrels (1988)',
 'Trekkies (1997)',
 'Thin Blue Line, The (1988)',

'Contact (1997)',
'Transformers: The Movie (1986)',
'Young Einstein (1988)',
'Bound (1996)',
'Hitcher, The (1986)',
'Kelly's Heroes (1970)',
'Babylon 5: In the Beginning (1998)',
'Howards End (1992)',
'Hedwig and the Angry Inch (2000)',
'Hot Shots! (1991)',
'Harry and the Hendersons (1987)',
'Tora! Tora! Tora! (1970)',
'Star Trek V: The Final Frontier (1989)',
'Great Muppet Caper, The (1981)',
'Diva (1981)',
'Kung Pow: Enter the Fist (2002)',
'Demolition Man (1993)',
'Land Before Time, The (1988)',
'Maltese Falcon, The (1941)',
'Man from Snowy River, The (1982)',
'Attack of the Killer Tomatoes! (1978)',
'Blink (1994)',
'Idle Hands (1999)',
'Ferngully: The Last Rainforest (1992)',
'Crimson Tide (1995)',
'Koyaanisqatsi (a.k.a. Koyaanisqatsi: Life Out of Balance) (1983)',
'Escape from Alcatraz (1979)',
'Godzilla (Gojira) (1954)',
'Evolution (2001)',
'In the Mouth of Madness (1995)',
'Scanners (1981)',
'Death and the Maiden (1994)',
'No Way Out (1987)',
'Beneath the Planet of the Apes (1970)',
'Three Kings (1999)',
'Knight's Tale, A (2001)',
'Zoolander (2001)',
'Lord of the Flies (1963)',
'History of the World: Part I (1981)',
'Collateral (2004)',
'Cat Ballou (1965)',
'Clan of the Cave Bear, The (1986)',
'Cold Comfort Farm (1995)',
'Cronos (1993)',
'Along Came a Spider (2001)',
'Limey, The (1999)',
'Poltergeist II: The Other Side (1986)',

'Desperado (1995)',
 'Tales from the Crypt Presents: Demon Knight (1995)',
 'Supercop (Police Story 3: Supercop) (Jing cha gu shi III: Chao ji jing cha) (1992)',
 'eXistenZ (1999)',
 'Go (1999)',
 'Romper Stomper (1992)',
 'King and I, The (1956)',
 'Dark Half, The (1993)',
 'Erik the Viking (1989)',
 'Commitments, The (1991)',
 "Cat's Eye (1985)",
 'Quick and the Dead, The (1995)',
 'League of Their Own, A (1992)',
 'Stand and Deliver (1988)',
 'Butcher Boy, The (1997)',
 'Hamlet (1996)',
 'Scary Movie 3 (2003)',
 'Basic Instinct (1992)',
 'Rumble in the Bronx (Hont faan kui) (1995)',
 'Music Man, The (1962)',
 'Guns of Navarone, The (1961)',
 "Nightmare on Elm Street 2: Freddy's Revenge, A (1985)",
 'Awakenings (1990)',
 'Battlefield Earth (2000)',
 'Manhunter (1986)',
 'Reversal of Fortune (1990)',
 'Erin Brockovich (2000)',
 'Abbott and Costello Meet Frankenstein (1948)',
 'Boy Who Could Fly, The (1986)',
 'Kingpin (1996)',
 'Quest for Fire (Guerre du feu, La) (1981)',
 'Robin Hood: Prince of Thieves (1991)',
 'Ice Storm, The (1997)',
 'Cabinet of Dr. Caligari, The (Cabinet des Dr. Caligari., Das) (1920)',
 'Producers, The (1968)',
 'Toys (1992)',
 'Halloween II (1981)',
 'Dazed and Confused (1993)',
 'Jesus of Montreal (Jésus de Montréal) (1989)',
 'Lady in White (a.k.a. The Mystery of the Lady in White) (1988)',
 'Pleasantville (1998)',
 'Stepfather, The (1987)',
 'Cry-Baby (1990)',
 'Sleeping Beauty (1959)',
 'Anastasia (1997)',
 'High Noon (1952)',

'Miracle on 34th Street (1947)',
 'Bio-Dome (1996)',
 'About a Boy (2002)',
 'Dead Man Walking (1995)',
 'How the Grinch Stole Christmas (a.k.a. The Grinch) (2000)',
 'Troy (2004)',
 'Pump Up the Volume (1990)',
 'Quiet Man, The (1952)',
 'Company of Wolves, The (1984)',
 'Grumpier Old Men (1995)',
 "'burbs, The (1989)",
 'Dodgeball: A True Underdog Story (2004)',
 'Ghost World (2001)',
 'Blade: Trinity (2004)',
 'Wishmaster (1997)',
 'Sense and Sensibility (1995)',
 'American Beauty (1999)',
 'Hairspray (1988)',
 'Time to Kill, A (1996)',
 "Hang 'Em High (1968)",
 'Twister (1996)',
 'Wonderful, Horrible Life of Leni Riefenstahl, The (Macht der Bilder: Leni Riefenstahl, Die) (1993)',
 'Fox and the Hound, The (1981)',
 'Wallace & Gromit: The Best of Aardman Animation (1996)',
 'Lord of the Flies (1990)',
 'Girl, Interrupted (1999)',
 'Legends of the Fall (1994)',
 'True Grit (1969)',
 'Crash (1996)',
 'Grand Hotel (1932)',
 'Wedding Singer, The (1998)',
 'Frequency (2000)',
 'Raise the Red Lantern (Da hong deng long gao gao gua) (1991)',
 'Romeo Is Bleeding (1993)',
 'Little Man Tate (1991)',
 'Night of the Hunter, The (1955)',
 'Yellow Submarine (1968)',
 'Maximum Overdrive (1986)',
 'Monkey Shines (1988)',
 'Italian Job, The (1969)',
 'Darkness Falls (2003)',
 'Uncle Buck (1989)',
 'Father Goose (1964)',
 "Jumpin' Jack Flash (1986)",
 'Wild Bunch, The (1969)',
 'Fresh (1994)',

'Little Shop of Horrors, The (1960)',
 'Scary Movie (2000)',
 'Sandlot, The (1993)',
 'Brother from Another Planet, The (1984)',
 'Faster Pussycat! Kill! Kill! (1965)',
 'Baraka (1992)',
 'Pride and Prejudice (1995)',
 'Meet the Feebles (1989)',
 'Glengarry Glen Ross (1992)',
 'Hocus Pocus (1993)',
 'Explorers (1985)',
 '"Who's Afraid of Virginia Woolf? (1966)",
 'Queen Margot (Reine Margot, La) (1994)',
 'Tokyo Godfathers (2003)',
 'Paris Is Burning (1990)',
 'Mummy, The (1959)',
 'Serpent and the Rainbow, The (1988)',
 'Birdy (1984)',
 'African Queen, The (1951)',
 'Tales from the Crypt Presents: Bordello of Blood (1996)',
 'Day of the Triffids, The (1962)',
 '"Pete's Dragon (1977)",
 'Funny Bones (1995)',
 '"Akira Kurosawa's Dreams (Dreams) (1990)",
 'House of 1000 Corpses (2003)',
 '"William Shakespeare's A Midsummer Night's Dream (1999)",
 'Man for All Seasons, A (1966)',
 'Dark Days (2000)',
 'Hudsucker Proxy, The (1994)',
 'Perfect Blue (1997)',
 '"Look Who's Talking (1989)",
 'Natural, The (1984)',
 'THX 1138 (1971)',
 'Monster Squad, The (1987)',
 'Shanghai Noon (2000)',
 'White Squall (1996)',
 'Scream 3 (2000)',
 'Happiness (1998)',
 'Willard (2003)',
 'Sleepwalkers (1992)',
 'Last Seduction, The (1994)',
 'Patton (1970)',
 'Audrey Rose (1977)',
 'Lost in La Mancha (2002)',
 'Strange Brew (1983)',
 'Bedazzled (1967)',
 'Innocents, The (1961)',

'Pit and the Pendulum, The (1961)',
 'Rocketeer, The (1991)',
 'Dreamscape (1984)',
 'Annie (1982)',
 'Laura (1944)',
 'X-Files: Fight the Future, The (1998)',
 'Toxic Avenger, The (1985)',
 'Blob, The (1988)',
 'Barbarella (1968)',
 'Brainstorm (1983)',
 'Seven Brides for Seven Brothers (1954)',
 'Better Off Dead... (1985)',
 'Ella Enchanted (2004)',
 'Blind Swordsman: Zatoichi, The (Zatôichi) (2003)',
 'Topsy-Turvy (1999)',
 'Wallace & Gromit: A Close Shave (1995)',
 'Hear My Song (1991)',
 'Hound of the Baskervilles, The (1959)',
 'Memphis Belle (1990)',
 'Dangerous Lives of Altar Boys, The (2002)',
 'Mighty Wind, A (2003)',
 'Fast, Cheap & Out of Control (1997)',
 'Run Silent Run Deep (1958)',
 'Red Sonja (1985)',
 'Commando (1985)',
 'Chinatown (1974)',
 'Peter Pan (1953)',
 'Cleopatra (1963)',
 'Hellraiser III: Hell on Earth (1992)',
 'Immortal Beloved (1994)',
 'Elephant Man, The (1980)',
 'Say Anything... (1989)',
 'Heavy Metal 2000 (2000)',
 'Gallipoli (1981)',
 'Beauty and the Beast (La belle et la bête) (1946)',
 'Room with a View, A (1986)',
 'Chopper (2000)',
 'Chitty Chitty Bang Bang (1968)',
 'Nightmare on Elm Street 5: The Dream Child, A (1989)',
 'Halloween H20: 20 Years Later (Halloween 7: The Revenge of Laurie Strode) (1998)',
 'Beastmaster, The (1982)',
 'Mr. Death: The Rise and Fall of Fred A. Leuchter, Jr. (1999)',
 'Full Monty, The (1997)',
 'K-PAX (2001)',
 'After Life (Wandafuru raifu) (1998)',
 'Parents (1989)',

```
'Thirty-Two Short Films About Glenn Gould (1993)',
'Time After Time (1979)',
'Twins (1988)',
'Tales from the Darkside: The Movie (1990)',
'Exorcist III, The (1990)',
'Theremin: An Electronic Odyssey (1993)',
'Stigmata (1999)',
'Faust (1994)',
'Piranha (1978)',
'Farewell My Concubine (Ba wang bie ji) (1993)',
'Rescuers Down Under, The (1990)',
'Hellraiser: Bloodline (1996)',
'Critters (1986)',
'Father of the Bride (1991)',
'Seventh Sign, The (1988)',
'Best Years of Our Lives, The (1946)',
'Remains of the Day, The (1993)',
...]
```

```
[116]: ##recommend Only top 10 items
final_recommendations_0=recommendations_0[:10]
#print("Recommendations for user with id 0 are: "+ ', '.
→join(final_recommendations_0))
print("Recommendations for user with id 0 are: ")
final_recommendations_0
```

Recommendations for user with id 0 are:

```
[116]: ['Alien (1979)',
'Raiders of the Lost Ark (Indiana Jones and the Raiders of the Lost Ark)
(1981)',
'Lord of the Rings: The Two Towers, The (2002)',
'Lord of the Rings: The Fellowship of the Ring, The (2001)',
'Lord of the Rings: The Return of the King, The (2003)',
'Aliens (1986)',
'Seven (a.k.a. Se7en) (1995)',
'Silence of the Lambs, The (1991)',
'Indiana Jones and the Last Crusade (1989)',
'Monty Python and the Holy Grail (1975)']
```

```
[301]: ds=df.query('title=="Alien (1979)"')
ds
```

```
[301]:
```

	userId	movieId	rating	timestamp	title	genres	\
41851	1	1214	4.0	10/09/2004 3:12	Alien (1979)	Horror Sci-Fi	
41852	2	1214	5.0	21/11/2000 15:36	Alien (1979)	Horror Sci-Fi	
41853	3	1214	5.0	11/12/1999 13:27	Alien (1979)	Horror Sci-Fi	

41854	11	1214	5.0	01/01/2009 4:30	Alien (1979)	Horror Sci-Fi
41855	21	1214	5.0	10/06/2001 16:10	Alien (1979)	Horror Sci-Fi
...
43044	5195	1214	4.0	13/10/1999 14:29	Alien (1979)	Horror Sci-Fi
43045	5204	1214	3.5	30/12/2007 22:48	Alien (1979)	Horror Sci-Fi
43046	5208	1214	3.5	15/02/2015 14:43	Alien (1979)	Horror Sci-Fi
43047	5209	1214	5.0	20/11/2000 1:53	Alien (1979)	Horror Sci-Fi
43048	5210	1214	4.0	17/03/2000 19:33	Alien (1979)	Horror Sci-Fi

		Date	Weekday	DayOfWeek
41851	2004-10-09	03:12:00	Saturday	Saturday
41852	2000-11-21	15:36:00	Tuesday	Tuesday
41853	1999-11-12	13:27:00	Friday	Friday
41854	2009-01-01	04:30:00	Thursday	Thursday
41855	2001-10-06	16:10:00	Saturday	Saturday
...
43044	1999-10-13	14:29:00	Wednesday	Wednesday
43045	2007-12-30	22:48:00	Sunday	Sunday
43046	2015-02-15	14:43:00	Sunday	Sunday
43047	2000-11-20	01:53:00	Monday	Monday
43048	2000-03-17	19:33:00	Friday	Friday

[1198 rows x 9 columns]

```
[305]: ds['genres'].drop_duplicates()
```

```
[305]: 41851    Horror|Sci-Fi
      Name: genres, dtype: object
```

Function making for user_id based recommendation

```
[117]: def recommendation_for(userid):
      #Recommendations for user_id passed in parameter in a sorted manner
      Preds_userid=preds_df.iloc[userid,:].sort_values(ascending=False)
      #Recommendations if user has rated the movie previously
      recommendations_userid=[i for i in Preds_userid.index if preds_df.loc[0,i]!
      →=0]
      ##recommend Only top 10 items
      final_recommendations_userid=recommendations_userid[:10]
      #print("Recommendations for user id are: "+ ', '.
      →join(final_recommendations_0))
      print("Recommendations for "+ str(userid) + " are: ")
      return final_recommendations_userid
```

```
[119]: recommendation_for(0)
```

Recommendations for 0 are:

```
[119]: ['Alien (1979)',
        'Raiders of the Lost Ark (Indiana Jones and the Raiders of the Lost Ark)
(1981)',
        'Lord of the Rings: The Two Towers, The (2002)',
        'Lord of the Rings: The Fellowship of the Ring, The (2001)',
        'Lord of the Rings: The Return of the King, The (2003)',
        'Aliens (1986)',
        'Seven (a.k.a. Se7en) (1995)',
        'Silence of the Lambs, The (1991)',
        'Indiana Jones and the Last Crusade (1989)',
        'Monty Python and the Holy Grail (1975)']
```

0.1.9 Markov process

```
[196]: import mchmm as mc
```

Markov process in which the time is discrete. Markov chain is a stochastic process over a discrete state space satisfying the Markov property. The probability of moving from the current state to the next state depends solely on the present state.

In terms of probability distribution, given that the system is at time instance n , the conditional distribution of the states at the next time instance, $n + 1$, is conditionally independent of the state of the system at time instances $\{1, 2, \dots, n-1\}$.

$$Pr(X_{n+1} = x | X_1 = x_1, X_2 = x_2, \dots, X_n = x_n) = Pr(X_{n+1} = x | X_n = x_n)$$

```
[198]: states=MF.columns
```

```
[199]: states
```

```
[199]: Index(['Round Midnight (1986)', 'Til There Was You (1997)',
            'burbs, The (1989)', 'night Mother (1986)',
            '*batteries not included (1987)',
            '...All the Marbles (California Dolls, The) (1981)',
            '...And God Spoke (1993)', '...And Justice for All (1979)',
            '1-900 (06) (1994)', '10 (1979)',
            ...,
            'Zoolander (2001)', 'Zoot Suit (1981)',
            'Zorba the Greek (Alexis Zorbas) (1964)', 'Zorro, the Gay Blade (1981)',
            'Zulu (1964)', 'Zus & Zo (2001)', 'eXistenZ (1999)', 'xXx (2002)',
            '¡Three Amigos! (1986)', 'À nous la liberté (Freedom for Us) (1931)'],
            dtype='object', name='title', length=8075)
```

```
[200]: transition_matrix=preds_df
```

```
[201]: transition_matrix = np.atleast_2d(transition_matrix)
states = states
index_dict = {states[index]: index for index in
               range(len(states))}
state_dict = {index: states[index] for index in
               range(len(states))}
```

```
[202]: transition_matrix
```

```
[202]: array([[ -0.01173362, -0.04078342,  0.20618808, ..., -0.05787899,
                0.1266037 ,  0.06573253],
               [ 0.0057974 ,  0.06476628,  0.02611344, ..., -0.0739291 ,
                0.02472141, -0.02680017],
               [ 0.02554202,  0.00979126,  0.13787154, ..., -0.20093719,
                0.3360195 , -0.03690627],
               ...,
               [-0.00742896, -0.05658112, -0.00124695, ...,  0.15292954,
                -0.10539649, -0.01011509],
               [-0.01495759, -0.06712312, -0.09030866, ...,  0.11932493,
                0.24012576, -0.02884447],
               [ 0.00151662, -0.0923985 ,  0.02432669, ...,  0.05952391,
                0.07110011, -0.02295111]])
```

```
[203]: index_dict
```

```
[203]: {'Round Midnight (1986)': 0,
        "'Til There Was You (1997)": 1,
        "'burbs, The (1989)": 2,
        "'night Mother (1986)": 3,
        '*batteries not included (1987)': 4,
        '...All the Marbles (California Dolls, The) (1981)': 5,
        '...And God Spoke (1993)': 6,
        '...And Justice for All (1979)': 7,
        '1-900 (06) (1994)': 8,
        '10 (1979)': 9,
        '10 Rillington Place (1971)': 10,
        '10 Things I Hate About You (1999)': 11,
        '10 to Midnight (1983)': 12,
        '100 Girls (2000)': 13,
        '1000 Eyes of Dr. Mabuse, The (Die 1000 Augen des Dr. Mabuse) (1960)': 14,
        '101 Dalmatians (1996)': 15,
        '101 Dalmatians (One Hundred and One Dalmatians) (1961)': 16,
        '101 Reykjavik (101 Reykjavík) (2000)': 17,
        '102 Dalmatians (2000)': 18,
        '10th Victim, The (La decima vittima) (1965)': 19,
        '11\'09\\\\"01 - September 11 (2002)": 20,
        '12 Angry Men (1957)': 21,
```

'13 Ghosts (1960)': 22,
 '13 Going on 30 (2004)': 23,
 '13 Rue Madeleine (1947)': 24,
 '13th Warrior, The (1999)': 25,
 '1492: Conquest of Paradise (1992)': 26,
 '15 Minutes (2001)': 27,
 '1776 (1972)': 28,
 '18 Again! (1988)': 29,
 '187 (One Eight Seven) (1997)': 30,
 '1900 (Novecento) (1976)': 31,
 '1941 (1979)': 32,
 '1969 (1988)': 33,
 '1984 (Nineteen Eighty-Four) (1984)': 34,
 '2 Days in the Valley (1996)': 35,
 '2 Fast 2 Furious (Fast and the Furious 2, The) (2003)': 36,
 '2 ou 3 choses que je sais d'elle (2 or 3 Things I Know About Her) (1967)": 37,
 '20 Dates (1998)': 38,
 '20 Million Miles to Earth (1957)': 39,
 '20,000 Leagues Under the Sea (1954)': 40,
 '200 Cigarettes (1999)': 41,
 '2001: A Space Odyssey (1968)': 42,
 '2010: The Year We Make Contact (1984)': 43,
 '21 Grams (2003)': 44,
 '24 7: Twenty Four Seven (1997)': 45,
 '24 Hour Party People (2002)': 46,
 '24 Hour Woman, The (1998)': 47,
 '25th Hour (2002)': 48,
 '28 Days (2000)': 49,
 '28 Days Later (2002)': 50,
 '28 Up (1985)': 51,
 '29th Street (1991)': 52,
 '3 Godfathers (1948)': 53,
 '3 Ninjas (1992)': 54,
 '3 Ninjas Kick Back (1994)': 55,
 '3 Ninjas Knuckle Up (1995)': 56,
 '3 Ninjas: High Noon On Mega Mountain (1998)': 57,
 '3 Strikes (2000)': 58,
 '3 Women (Three Women) (1977)': 59,
 '3000 Miles to Graceland (2001)': 60,
 '301, 302 (301/302) (1995)': 61,
 '36 fillette (1988)': 62,
 '39 Steps, The (1935)': 63,
 '3:10 to Yuma (1957)': 64,
 '4 Little Girls (1997)': 65,
 '4 for Texas (1963)': 66,
 '40 Days and 40 Nights (2002)': 67,
 '400 Blows, The (Les quatre cents coups) (1959)': 68,

'42 Up (1998)': 69,
 '42nd Street (1933)': 70,
 '47 Ronin, The (Genroku Chûshingura) (1941)': 71,
 '47 Samurai (Chûshingura) (Loyal 47 Ronin, The) (1962)': 72,
 '48 Hrs. (1982)': 73,
 '5 Deadly Venoms, The (Wu du) (Five Deadly Venoms) (1978)': 74,
 '5,000 Fingers of Dr. T, The (1953)': 75,
 '50 First Dates (2004)': 76,
 '52 Pick-Up (1986)': 77,
 '54 (1998)': 78,
 '5th Musketeer, The (a.k.a. Fifth Musketeer, The) (1979)': 79,
 '633 Squadron (1964)': 80,
 '6th Day, The (2000)': 81,
 '6th Man, The (Sixth Man, The) (1997)': 82,
 '7th Voyage of Sinbad, The (1958)': 83,
 '8 1/2 (8½) (1963)': 84,
 '8 Heads in a Duffel Bag (1997)': 85,
 '8 Mile (2002)': 86,
 '8 Seconds (1994)': 87,
 '8 Women (2002)': 88,
 '8 ½ Women (a.k.a. 8 1/2 Women) (a.k.a. Eight and a Half Women) (1999)': 89,
 '84 Charing Cross Road (1987)': 90,
 '8MM (1999)': 91,
 '9 1/2 Weeks (Nine 1/2 Weeks) (1986)': 92,
 '976-EVIL (1989)': 93,
 'A Home at the End of the World (2004)': 94,
 'A.I. Artificial Intelligence (2001)': 95,
 'ABBA: The Movie (1977)': 96,
 'AVP: Alien vs. Predator (2004)': 97,
 'Abandon (2002)': 98,
 'Abbott and Costello Meet Frankenstein (1948)': 99,
 'Abbott and Costello Meet the Mummy (1955)': 100,
 'Aberdeen (2000)': 101,
 'Abominable Dr. Phibes, The (1971)': 102,
 'Abominable Snowman, The (Abominable Snowman of the Himalayas, The) (1957)':
 103,
 'About Adam (2000)': 104,
 'About Last Night... (1986)': 105,
 'About Schmidt (2002)': 106,
 'About a Boy (2002)': 107,
 'Above Suspicion (1995)': 108,
 'Above the Law (1988)': 109,
 'Above the Rim (1994)': 110,
 'Absence of Malice (1981)': 111,
 'Absent-Minded Professor, The (1961)': 112,
 'Absolute Beginners (1986)': 113,
 'Absolute Power (1997)': 114,

'Abyss, The (1989)': 115,
 'Accattone (1961)': 116,
 'Accident (1967)': 117,
 'Accidental Tourist, The (1988)': 118,
 'Accused, The (1988)': 119,
 'Ace Ventura: Pet Detective (1994)': 120,
 'Ace Ventura: When Nature Calls (1995)': 121,
 'Ace in the Hole (Big Carnival, The) (1951)': 122,
 'Aces: Iron Eagle III (1992)': 123,
 'Acid House, The (1998)': 124,
 'Across 110th Street (1972)': 125,
 'Across the Pacific (1942)': 126,
 'Across the Sea of Time (1995)': 127,
 'Action Jackson (1988)': 128,
 'Action in the North Atlantic (1943)': 129,
 "Actor's Revenge, An (Yukinojô henge) (1963)": 130,
 "Adam's Rib (1949)": 131,
 'Adanggaman (2000)': 132,
 'Adaptation (2002)': 133,
 'Addams Family Values (1993)': 134,
 'Addams Family, The (1991)': 135,
 'Addicted to Love (1997)': 136,
 'Addiction, The (1995)': 137,
 'Adrenalin: Fear the Rush (1996)': 138,
 "Adventure of Sherlock Holmes' Smarter Brother, The (1975)": 139,
 'Adventures in Babysitting (1987)': 140,
 'Adventures of Baron Munchausen, The (1988)': 141,
 'Adventures of Buckaroo Banzai Across the 8th Dimension, The (1984)': 142,
 'Adventures of Elmo in Grouchland, The (1999)': 143,
 'Adventures of Felix, The (a.k.a. Funny Felix) (Drôle de Félix) (2000)': 144,
 'Adventures of Ford Fairlane, The (1990)': 145,
 'Adventures of Huck Finn, The (1993)': 146,
 'Adventures of Huckleberry Finn, The (1960)': 147,
 'Adventures of Ichabod and Mr. Toad, The (1949)': 148,
 'Adventures of Milo and Otis, The (Koneko monogatari) (1986)': 149,
 'Adventures of Picasso, The (Picassos äventyr) (1978)': 150,
 'Adventures of Pinocchio, The (1996)': 151,
 'Adventures of Pluto Nash, The (2002)': 152,
 'Adventures of Priscilla, Queen of the Desert, The (1994)': 153,
 'Adventures of Robin Hood, The (1938)': 154,
 'Adventures of Rocky and Bullwinkle, The (2000)': 155,
 'Adventures of Sebastian Cole, The (1998)': 156,
 'Adventures of Sherlock Holmes, The (1939)': 157,
 'Advise and Consent (1962)': 158,
 'Affair of Love, An (Liaison pornographique, Une) (1999)': 159,
 'Affair of the Necklace, The (2001)': 160,
 'Affair to Remember, An (1957)': 161,

'Affliction (1997)': 162,
 'Africa Screams (1949)': 163,
 'Africa: The Serengeti (1994)': 164,
 'African Queen, The (1951)': 165,
 'After Dark, My Sweet (1990)': 166,
 'After Hours (1985)': 167,
 'After Life (Wandafuru raifu) (1998)': 168,
 'After the Fox (Caccia alla volpe) (1966)': 169,
 'After the Life (2002)': 170,
 'After the Sunset (2004)': 171,
 'After the Thin Man (1936)': 172,
 'Afterglow (1997)': 173,
 'Against All Odds (1984)': 174,
 'Against the Ropes (2004)': 175,
 "Agatha Christie's 'Ten Little Indians' (Ten Little Indians) (And Then There Were None) (1965)": 176,
 'Age of Innocence, The (1993)': 177,
 'Agent Cody Banks (2003)': 178,
 'Agent Cody Banks 2: Destination London (2004)': 179,
 'Agnes Browne (1999)': 180,
 'Agnes of God (1985)': 181,
 'Aguirre: The Wrath of God (Aguirre, der Zorn Gottes) (1972)': 182,
 'Aileen: Life and Death of a Serial Killer (2003)': 183,
 'Aimée & Jaguar (1999)': 184,
 'Air America (1990)': 185,
 'Air Bud (1997)': 186,
 'Air Bud: Golden Receiver (1998)': 187,
 'Air Force One (1997)': 188,
 'Air Up There, The (1994)': 189,
 'Airheads (1994)': 190,
 'Airplane II: The Sequel (1982)': 191,
 'Airplane! (1980)': 192,
 "Airport '77 (1977)": 193,
 'Airport (1970)': 194,
 'Airport 1975 (1974)': 195,
 'Akira (1988)': 196,
 "Akira Kurosawa's Dreams (Dreams) (1990)": 197,
 'Al Capone (1959)': 198,
 'Aladdin (1992)': 199,
 'Aladdin and the King of Thieves (1996)': 200,
 'Alamo, The (1960)': 201,
 'Alamo, The (2004)': 202,
 'Alan Smithee Film: Burn Hollywood Burn, An (1997)': 203,
 'Alarmist, The (a.k.a. Life During Wartime) (1997)': 204,
 'Alaska (1996)': 205,
 'Alaska: Spirit of the Wild (1997)': 206,
 'Albino Alligator (1996)': 207,

'Alex and Emma (2003)': 208,
 'Alexander (2004)': 209,
 'Alexander Nevsky (Aleksandr Nevskiy) (1938)': 210,
 'Alexander the Great (1956)': 211,
 "Alexander's Ragtime Band (1938)": 212,
 'Alfie (1966)': 213,
 'Alfie (2004)': 214,
 'Algiers (1938)': 215,
 'Ali (2001)': 216,
 'Ali: Fear Eats the Soul (Angst essen Seele auf) (1974)': 217,
 'Alias Betty (Betty Fisher et autres histoires) (2001)': 218,
 'Alice (1990)': 219,
 'Alice (Neco z Alenky) (1988)': 220,
 'Alice Adams (1935)': 221,
 "Alice Doesn't Live Here Anymore (1974)": 222,
 'Alice and Martin (Alice et Martin) (1998)': 223,
 'Alice in Wonderland (1951)': 224,
 "Alice's Restaurant (1969)": 225,
 'Alice, Sweet Alice (a.k.a. Communion) (a.k.a. Holy Terror) (1976)': 226,
 'Alien (1979)': 227,
 'Alien Contamination (1980)': 228,
 'Alien Escape (1995)': 229,
 'Alien Nation (1988)': 230,
 'Alien from L.A. (1988)': 231,
 'Alien: Resurrection (1997)': 232,
 'Aliens (1986)': 233,
 'Alien³ (a.k.a. Alien 3) (1992)': 234,
 'Alive (1993)': 235,
 'All About Eve (1950)': 236,
 'All About Lily Chou-Chou (Riri Shushu no subete) (2001)': 237,
 'All About My Mother (Todo sobre mi madre) (1999)': 238,
 'All About the Benjamins (2002)': 239,
 'All Dogs Go to Heaven (1989)': 240,
 'All Dogs Go to Heaven 2 (1996)': 241,
 'All I Want (Try Seventeen) (2002)': 242,
 'All I Want for Christmas (1991)': 243,
 'All Night Long (1981)': 244,
 'All Over Me (1997)': 245,
 'All Over the Guy (2001)': 246,
 'All Quiet on the Western Front (1930)': 247,
 'All That Heaven Allows (1955)': 248,
 'All That Jazz (1979)': 249,
 'All Things Fair (Lust och fägring stor) (1995)': 250,
 'All of Me (1984)': 251,
 'All or Nothing (2002)': 252,
 "All the King's Men (1949)": 253,
 'All the Little Animals (1998)': 254,

"All the President's Men (1976)": 255,
 'All the Pretty Horses (2000)': 256,
 "All the Queen's Men (2001)": 257,
 "All the Rage (It's the Rage) (1999)": 258,
 'All the Real Girls (2003)': 259,
 'All the Right Moves (1983)': 260,
 'All the Vermeers in New York (1990)': 261,
 'Allan Quatermain and the Lost City of Gold (1987)': 262,
 'Allegro non troppo (1977)': 263,
 'Alligator (1980)': 264,
 'Alligator People, The (1959)': 265,
 'Allnighter, The (1987)': 266,
 'Almost Famous (2000)': 267,
 'Almost Heroes (1998)': 268,
 'Almost an Angel (1990)': 269,
 'Alone in the Dark (1982)': 270,
 'Along Came Polly (2004)': 271,
 'Along Came a Spider (2001)': 272,
 'Alphaville (Alphaville, une étrange aventure de Lemmy Caution) (1965)': 273,
 'Altered States (1980)': 274,
 'Alvarez Kelly (1966)': 275,
 'Always (1989)': 276,
 'Always Tell Your Wife (1914)': 277,
 'Amadeus (1984)': 278,
 'Amandla! A Revolution in Four Part Harmony (2002)': 279,
 'Amarcord (1973)': 280,
 'Amateur (1994)': 281,
 'Amateur, The (1981)': 282,
 'Amati Girls, The (2000)': 283,
 'Amazing Adventure, The (a.k.a. The Amazing Quest of Ernest Bliss) (1936)':
 284,
 'Amazing Grace and Chuck (1987)': 285,
 'Amazing Panda Adventure, The (1995)': 286,
 'Amazon Women on the Moon (1987)': 287,
 'Ambush (Rukajärven tie) (1999)': 288,
 "Amelie (Fabuleux destin d'Amélie Poulain, Le) (2001)": 289,
 'Amen. (2002)': 290,
 "America's Sweethearts (2001)": 291,
 'American Adobo (2000)': 292,
 'American Astronaut, The (2001)': 293,
 'American Beauty (1999)': 294,
 'American Buffalo (1996)': 295,
 'American Dream (1990)': 296,
 'American Flyers (1985)': 297,
 'American Friend, The (Amerikanische Freund, Der) (1977)': 298,
 'American Gigolo (1980)': 299,
 'American Graffiti (1973)': 300,

'American Gun (2002)': 301,
 'American Heart (1992)': 302,
 'American History X (1998)': 303,
 'American Me (1992)': 304,
 'American Movie (1999)': 305,
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 67: '40 Days and 40 Nights (2002)',
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 69: '42 Up (1998)',
 70: '42nd Street (1933)',
 71: '47 Ronin, The (Genroku Chûshingura) (1941)',
 72: '47 Samurai (Chûshingura) (Loyal 47 Ronin, The) (1962)',
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 74: '5 Deadly Venoms, The (Wu du) (Five Deadly Venoms) (1978)',
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 77: '52 Pick-Up (1986)',
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 79: '5th Musketeer, The (a.k.a. Fifth Musketeer, The) (1979)',
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 94: 'A Home at the End of the World (2004)',
 95: 'A.I. Artificial Intelligence (2001)',
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 98: 'Abandon (2002)',
 99: 'Abbott and Costello Meet Frankenstein (1948)',
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 101: 'Aberdeen (2000)',
 102: 'Abominable Dr. Phibes, The (1971)',
 103: 'Abominable Snowman, The (Abominable Snowman of the Himalayas, The) (1957)',
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 179: 'Agent Cody Banks 2: Destination London (2004)',
 180: 'Agnes Browne (1999)',
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 354: 'Anchorman: The Legend of Ron Burgundy (2004)',
 355: 'Anchors Aweigh (1945)',
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 357: 'And God Created Woman (Et Dieu... créa la femme) (1956)',
 358: 'And Now... Ladies and Gentlemen... (2002)',
 359: 'And Then There Were None (1945)',
 360: 'And Your Mother Too (Y tu mamá también) (2001)',
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 362: 'And the Ship Sails On (E la nave va) (1983)',
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371: 'Angel and the Badman (1947)',
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 398: 'Anniversary Party, The (2001)',
 399: 'Another 48 Hrs. (1990)',
 400: 'Another Day in Paradise (1998)',
 401: 'Another Stakeout (1993)',
 402: 'Another Thin Man (1939)',
 403: 'Another Woman (1988)',
 404: 'Another You (1991)',
 405: 'Antitrust (2001)',
 406: "Antonia's Line (Antonia) (1995)",
 407: 'Antwone Fisher (2002)',
 408: 'Antz (1998)',
 409: 'Any Given Sunday (1999)',
 410: 'Any Which Way You Can (1980)',
 411: 'Anything Else (2003)',
 412: 'Anywhere But Here (1999)',
 413: 'Apache (1954)',
 414: 'Apartment Zero (1988)',
 415: 'Apartment, The (1960)',
 416: "Apartment, The (Appartement, L') (1996)",
 417: 'Ape, The (1940)',

418: 'Apocalypse Now (1979)',
 419: 'Apollo 13 (1995)',
 420: 'Apostle, The (1997)',
 421: 'Apple Dumpling Gang Rides Again, The (1979)',
 422: 'Apple Dumpling Gang, The (1975)',
 423: 'Apple, The (1980)',
 424: 'Apple, The (Sib) (1998)',
 425: 'Appointment with Death (1988)',
 426: 'April Fool's Day (1986)',
 427: 'Apt Pupil (1998)',
 428: 'Arachnophobia (1990)',
 429: 'Ararat (2002)',
 430: 'Arena, The (a.k.a. Naked Warriors) (1974)',
 431: 'Arguing the World (1998)',
 432: 'Ariel (1988)',
 433: 'Aristocats, The (1970)',
 434: 'Arizona Dream (1993)',
 435: 'Arlington Road (1999)',
 436: 'Armageddon (1998)',
 437: 'Armed and Dangerous (1986)',
 438: 'Armour of God (Long xiong hu di) (1987)',
 439: 'Armour of God II: Operation Condor (Operation Condor) (Fei ying gai wak) (1991)',
 440: 'Army of Darkness (1993)',
 441: 'Around the World in 80 Days (1956)',
 442: 'Around the World in 80 Days (2004)',
 443: 'Arrival, The (1996)',
 444: 'Arsenic and Old Lace (1944)',
 445: 'Art of War, The (2000)',
 446: 'Artemisia (1997)',
 447: 'Arthur (1981)',
 448: 'Arthur 2: On the Rocks (1988)',
 449: 'Article 99 (1992)',
 450: 'As Good as It Gets (1997)',
 451: 'Ash Wednesday (2002)',
 452: 'Ashes and Diamonds (Popiół i diament) (1958)',
 453: 'Ashes of Time (Dung che sai duk) (1994)',
 454: 'Asoka (Ashoka the Great) (2001)',
 455: 'Aspen Extreme (1993)',
 456: 'Asphalt Jungle, The (1950)',
 457: 'Assassination (1987)',
 458: 'Assassination Bureau, The (1969)',
 459: 'Assassination Tango (2002)',
 460: 'Assassins (1995)',
 461: 'Assault on Precinct 13 (1976)',
 462: 'Assignment, The (1997)',
 463: 'Associate, The (1996)',

464: "Associate, The (Associé, L') (1979)",
 465: 'Asterix and Cleopatra (Astérix et Cléopâtre) (1968)',
 466: 'Asterix and the Gauls (Astérix le Gaulois) (1967)',
 467: "Astronaut's Wife, The (1999)",
 468: 'Asylum (1972)',
 469: 'At Close Range (1986)',
 470: 'At First Sight (1999)',
 471: 'At First Sight (Entre Nous) (Coup de foudre) (1983)',
 472: 'At Play in the Fields of the Lord (1991)',
 473: 'At War with the Army (1950)',
 474: "At the Earth's Core (1976)",
 475: "Atalante, L' (1934)",
 476: 'Atlantic City (1980)',
 477: 'Atlantis, the Lost Continent (1961)',
 478: 'Atlantis: The Lost Empire (2001)',
 479: 'Atomic Cafe, The (1982)',
 480: 'Attack Force Z (a.k.a. The Z Men) (Z-tzu te kung tui) (1982)',
 481: 'Attack of the Crab Monsters (1957)',
 482: 'Attack of the Giant Leeches (1959)',
 483: 'Attack of the Killer Tomatoes! (1978)',
 484: 'Attack of the Puppet People (1958)',
 485: 'Attack the Gas Station! (Juyuso seubgyuksageun) (1999)',
 486: 'Attack! (1956)',
 487: 'Attila (Attila Flagello di Dio) (1982)',
 488: 'Attraction (2000)',
 489: 'Au Hasard Balthazar (1966)',
 490: 'Au revoir les enfants (1987)',
 491: 'Audrey Rose (1977)',
 492: 'August (1996)',
 493: 'Auntie Mame (1958)',
 494: 'Austin Powers in Goldmember (2002)',
 495: 'Austin Powers: International Man of Mystery (1997)',
 496: 'Austin Powers: The Spy Who Shagged Me (1999)',
 497: 'Author! Author! (1982)',
 498: 'Auto Focus (2002)',
 499: 'Autopsy (Macchie Solari) (1975)',
 500: 'Autumn Heart, The (1999)',
 501: 'Autumn Sonata (Höstsonaten) (1978)',
 502: 'Autumn Spring (Babí léto) (2001)',
 503: "Autumn Tale, An (Conte d'automne) (1998)",
 504: 'Autumn in New York (2000)',
 505: 'Avalanche (1978)',
 506: 'Avalon (1990)',
 507: 'Avalon (2001)',
 508: 'Avanti! (1972)',
 509: 'Avengers, The (1998)',
 510: "Aviator's Wife, The (La femme de l'aviateur) (1981)",

511: 'Aviator, The (1985)',
 512: "Avventura, L' (Adventure, The) (1960)",
 513: 'Awakening, The (1980)',
 514: 'Awakenings (1990)',
 515: 'Awful Truth, The (1937)',
 516: 'Awfully Big Adventure, An (1995)',
 517: 'Ay, Carmela! (¡Ay, Carmela!) (1990)',
 518: 'Ayn Rand: A Sense of Life (1997)',
 519: 'B*A*P*S (1997)',
 520: 'B. Monkey (1998)',
 521: 'BASEketball (1998)',
 522: "Baadasssss! (How to Get the Man's Foot Outta Your Ass) (2003)",
 523: 'Babe (1995)',
 524: 'Babe, The (1992)',
 525: 'Babe: Pig in the City (1998)',
 526: 'Babes in Toyland (1961)',
 527: "Babette's Feast (Babettes gæstebud) (1987)",
 528: 'Baby Boom (1987)',
 529: 'Baby Boy (2001)',
 530: 'Baby Doll (1956)',
 531: 'Baby Geniuses (1999)',
 532: "Baby's Day Out (1994)",
 533: 'Baby, The (1973)',
 534: 'Baby, the Rain Must Fall (1965)',
 535: 'Baby-Sitters Club, The (1995)',
 536: 'Baby... Secret of the Lost Legend (1985)',
 537: 'Babyfever (1994)',
 538: 'Babylon 5: A Call to Arms (1999)',
 539: 'Babylon 5: In the Beginning (1998)',
 540: 'Babylon 5: The River of Souls (1998)',
 541: 'Babylon 5: Thirdspace (1998)',
 542: 'Babysitter, The (1995)',
 543: 'Bachelor Mother (1939)',
 544: 'Bachelor Party (1984)',
 545: 'Bachelor and the Bobby-Soxer, The (1947)',
 546: 'Bachelor, The (1999)',
 547: 'Back to Bataan (1945)',
 548: 'Back to School (1986)',
 549: 'Back to the Beach (1987)',
 550: 'Back to the Future (1985)',
 551: 'Back to the Future Part II (1989)',
 552: 'Back to the Future Part III (1990)',
 553: 'Backbeat (1993)',
 554: 'Backdraft (1991)',
 555: 'Backtrack (Catchfire) (1990)',
 556: 'Bad Boys (1983)',
 557: 'Bad Boys (1995)',

558: 'Bad Boys II (2003)',
 559: 'Bad Company (1972)',
 560: 'Bad Company (1995)',
 561: 'Bad Company (2002)',
 562: 'Bad Day at Black Rock (1955)',
 563: 'Bad Dreams (1988)',
 564: 'Bad Education (La mala educación) (2004)',
 565: 'Bad Girls (1994)',
 566: 'Bad Influence (1990)',
 567: 'Bad Lieutenant (1992)',
 568: 'Bad Moon (1996)',
 569: 'Bad News Bears Go to Japan, The (1978)',
 570: 'Bad News Bears in Breaking Training, The (1977)',
 571: 'Bad News Bears, The (1976)',
 572: 'Bad Santa (2003)',
 573: 'Bad Seed, The (1956)',
 574: 'Bad Sleep Well, The (Warui yatsu hodo yoku nemuru) (1960)',
 575: 'Bad Taste (1987)',
 576: 'Bad Timing: A Sensual Obsession (1980)',
 577: 'Bad and the Beautiful, The (1952)',
 578: 'Badlands (1973)',
 579: 'Bagdad Cafe (Out of Rosenheim) (1987)',
 580: 'Bait (2000)',
 581: 'Ball of Fire (1941)',
 582: 'Ballad of Cable Hogue, The (1970)',
 583: 'Ballad of Little Jo, The (1993)',
 584: 'Ballad of Narayama, The (Narayama Bushiko) (1958)',
 585: 'Ballad of Narayama, The (Narayama bushiko) (1983)',
 586: "Ballad of Ramblin' Jack, The (2000)",
 587: 'Ballad of a Soldier (Ballada o soldate) (1959)',
 588: 'Ballistic: Ecks vs. Sever (2002)',
 589: 'Balto (1995)',
 590: 'Bamba, La (1987)',
 591: 'Bambi (1942)',
 592: 'Bamboozled (2000)',
 593: 'Banana Joe (1981)',
 594: 'Bananas (1971)',
 595: 'Band Wagon, The (1953)',
 596: 'Band of Brothers (2001)',
 597: 'Band of Outsiders (Bande à part) (1964)',
 598: 'Band of the Hand (1986)',
 599: 'Bandit Queen (1994)',
 600: 'Bandits (1997)',
 601: 'Bandits (2001)',
 602: 'Bandolero! (1968)',
 603: 'Bang (1995)',
 604: 'Bang the Drum Slowly (1973)',

605: "Bang, Bang, You're Dead (2002)",
 606: 'Banger Sisters, The (2002)',
 607: 'Bangkok Dangerous (2000)',
 608: 'Bank Dick, The (1940)',
 609: 'Bank, The (2001)',
 610: 'Bar Girls (1994)',
 611: 'Barabbas (1961)',
 612: 'Baraka (1992)',
 613: 'Baran (2001)',
 614: 'Barb Wire (1996)',
 615: 'Barbarella (1968)',
 616: 'Barbarian Invasions, The (Les invasions barbares) (2003)',
 617: 'Barbarosa (1982)',
 618: 'Barber of Siberia, The (Sibirskij tsiryulnik) (1998)',
 619: 'Barbershop (2002)',
 620: 'Barbershop 2: Back in Business (2004)',
 621: 'Barcelona (1994)',
 622: 'Barefoot Contessa, The (1954)',
 623: 'Barefoot Executive, The (1971)',
 624: 'Barefoot in the Park (1967)',
 625: 'Barenaked in America (1999)',
 626: 'Barfly (1987)',
 627: "Barney's Great Adventure (1998)",
 628: 'Baron Blood (Orrori del castello di Norimberga, Gli) (1972)',
 629: 'Barry Lyndon (1975)',
 630: 'Barton Fink (1991)',
 631: 'Basic (2003)',
 632: 'Basic Instinct (1992)',
 633: 'Basket Case (1982)',
 634: 'Basket Case 2 (1990)',
 635: 'Basket Case 3: The Progeny (1992)',
 636: 'Basketball Diaries, The (1995)',
 637: 'Basquiat (1996)',
 638: 'Bastard Out of Carolina (1996)',
 639: 'Bat Whispers, The (1930)',
 640: 'Bat*21 (1988)',
 641: 'Bat, The (1959)',
 642: 'Batman & Robin (1997)',
 643: 'Batman (1966)',
 644: 'Batman (1989)',
 645: 'Batman Forever (1995)',
 646: 'Batman Returns (1992)',
 647: 'Batman: Mask of the Phantasm (1993)',
 648: 'Baton Rouge (Bâton rouge) (1988)',
 649: 'Bats (1999)',
 650: 'Battle Beyond the Stars (1980)',
 651: 'Battle Creek Brawl (Big Brawl, The) (1980)',

652: 'Battle Cry (1955)',
 653: 'Battle Royale (Batoru rowaiaru) (2000)',
 654: 'Battle for the Planet of the Apes (1973)',
 655: 'Battle of Algiers, The (La battaglia di Algeri) (1966)',
 656: 'Battle of Britain (1969)',
 657: 'Battle of Shaker Heights, The (2003)',
 658: 'Battlefield Earth (2000)',
 659: 'Battleground (1949)',
 660: 'Battleship Potemkin (1925)',
 661: 'Battling Butler (1926)',
 662: 'Baxter (1989)',
 663: 'Bay of Blood (a.k.a. Twitch of the Death Nerve) (Reazione a catena) (1971)',
 664: 'Beach Blanket Bingo (1965)',
 665: 'Beach Party (1963)',
 666: 'Beach, The (2000)',
 667: 'Beaches (1988)',
 668: 'Bean (1997)',
 669: 'Bear, The (Ours, L') (1988)",
 670: 'Beast Within, The (1982)',
 671: 'Beast from 20,000 Fathoms, The (1953)',
 672: 'Beast of War, The (Beast, The) (1988)',
 673: 'Beast of Yucca Flats, The (1961)',
 674: 'Beastmaster, The (1982)',
 675: 'Beat Street (1984)',
 676: 'Beat the Devil (1953)',
 677: 'Beau Pere (a.k.a. Stepfather) (Beau-père) (1981)',
 678: 'Beautician and the Beast, The (1997)',
 679: 'Beautiful (2000)',
 680: 'Beautiful Creatures (2000)',
 681: 'Beautiful Girls (1996)',
 682: 'Beautiful Mind, A (2001)',
 683: 'Beautiful People (1999)',
 684: 'Beautiful Thing (1996)',
 685: 'Beauty and the Beast (1991)',
 686: 'Beauty and the Beast (La belle et la bête) (1946)',
 687: 'Beauty of the Day (Belle de jour) (1967)',
 688: 'Beavis and Butt-Head Do America (1996)',
 689: 'Bebe's Kids (1992)",
 690: 'Becket (1964)',
 691: 'Bed of Roses (1996)',
 692: 'Bedazzled (1967)',
 693: 'Bedazzled (2000)',
 694: 'Bedford Incident, The (1965)',
 695: 'Bedknobs and Broomsticks (1971)',
 696: 'Bedroom Window, The (1987)',
 697: 'Bedrooms & Hallways (1998)',

698: 'Beefcake (1999)',
 699: 'Beethoven (1992)',
 700: 'Beethoven's 2nd (1993)',
 701: 'Beetlejuice (1988)',
 702: 'Before Night Falls (2000)',
 703: 'Before Sunrise (1995)',
 704: 'Before Sunset (2004)',
 705: 'Before and After (1996)',
 706: 'Before the Rain (Pred dozhdot) (1994)',
 707: 'Beginning of the End (1957)',
 708: 'Beguiled, The (1971)',
 709: 'Behind Enemy Lines (2001)',
 710: 'Behind the Sun (Abril Despedaçado) (2001)',
 711: 'Beijing Bicycle (Shiqi sui de dan che) (2001)',
 712: 'Being Human (1993)',
 713: 'Being John Malkovich (1999)',
 714: 'Being Julia (2004)',
 715: 'Being There (1979)',
 716: 'Believer, The (2001)',
 717: 'Believers, The (1987)',
 718: 'Belizaire the Cajun (1986)',
 719: 'Bell, Book and Candle (1958)',
 720: 'Bellboy, The (1960)',
 721: 'Belle époque (1992)',
 722: 'Belles of St. Trinian's, The (1954)',
 723: 'Belles on Their Toes (1952)',
 724: 'Bells of St. Mary's, The (1945)',
 725: 'Bells, The (1926)',
 726: 'Belly (1998)',
 727: 'Belly of an Architect, The (1987)',
 728: 'Beloved (1998)',
 729: 'Below (2002)',
 730: 'Ben-Hur (1959)',
 731: 'Ben-Hur: A Tale of the Christ (1925)',
 732: 'Bend It Like Beckham (2002)',
 733: 'Bend of the River (1952)',
 734: 'Beneath the Planet of the Apes (1970)',
 735: 'Benji (1974)',
 736: 'Benji the Hunted (1987)',
 737: 'Benji: Off the Leash! (2004)',
 738: 'Benny & Joon (1993)',
 739: 'Benny Goodman Story, The (1955)',
 740: 'Bent (1997)',
 741: 'Berkeley in the '60s (1990)',
 742: 'Berlin: Symphony of a Great City (Berlin: Die Sinfonie der Großstadt) (1927)',
 743: 'Besieged (a.k.a. L' Assedio) (1998)',

744: 'Besotted (2001)',
 745: 'Best Boy (1979)',
 746: 'Best Defense (1984)',
 747: 'Best Friends (1982)',
 748: 'Best Laid Plans (1999)',
 749: 'Best Little Whorehouse in Texas, The (1982)',
 750: 'Best Man, The (1964)',
 751: 'Best Man, The (1999)',
 752: 'Best Man, The (Testimone dello sposo, Il) (1998)',
 753: 'Best Men (1997)',
 754: 'Best Seller (1987)',
 755: 'Best Years of Our Lives, The (1946)',
 756: 'Best in Show (2000)',
 757: 'Best of Times, The (1986)',
 758: 'Best of Youth, The (La meglio gioventù) (2003)',
 759: 'Best of the Best (1989)',
 760: 'Best of the Best 2 (1993)',
 761: 'Best of the Best 3: No Turning Back (1995)',
 762: 'Betrayed (1988)',
 763: "Betsy's Wedding (1990)",
 764: 'Better Living Through Circuitry (1999)',
 765: 'Better Luck Tomorrow (2002)',
 766: 'Better Off Dead... (1985)',
 767: 'Better Than Chocolate (1999)',
 768: 'Better Than Sex (2000)',
 769: 'Better Tomorrow, A (Ying hung boon sik) (1986)',
 770: 'Betty Blue (37°2 le matin) (1986)',
 771: 'Between Strangers (2002)',
 772: 'Beverly Hillbillies, The (1993)',
 773: 'Beverly Hills Cop (1984)',
 774: 'Beverly Hills Cop II (1987)',
 775: 'Beverly Hills Cop III (1994)',
 776: 'Beverly Hills Ninja (1997)',
 777: 'Beyond Bedlam (1993)',
 778: 'Beyond Borders (2003)',
 779: 'Beyond Hypothermia (Sip si 32 doe) (1996)',
 780: 'Beyond Rangoon (1995)',
 781: 'Beyond Re-Animator (2003)',
 782: 'Beyond Silence (Jenseits der Stille) (1996)',
 783: 'Beyond Therapy (1987)',
 784: 'Beyond the Clouds (Al di là delle nuvole) (1996)',
 785: 'Beyond the Mat (1999)',
 786: 'Beyond the Poseidon Adventure (1979)',
 787: 'Beyond the Valley of the Dolls (1970)',
 788: "Beyond, The (E tu vivrai nel terrore - L'aldilà) (1981)",
 789: 'Bhaji on the Beach (1993)',
 790: 'Bible, The (a.k.a. Bible... In the Beginning, The) (1966)',

791: 'Bicentennial Man (1999)',
 792: 'Bicycle Thieves (a.k.a. The Bicycle Thief) (a.k.a. The Bicycle Thieves) (Ladri di biciclette) (1948)',
 793: 'Big (1988)',
 794: 'Big Bad Love (2001)',
 795: 'Big Bad Mama (1974)',
 796: 'Big Bad Mama II (1987)',
 797: 'Big Bird Cage, The (1972)',
 798: 'Big Blue, The (Grand bleu, Le) (1988)',
 799: 'Big Boss, The (Fists of Fury) (Tang shan da xiong) (1971)',
 800: 'Big Bounce, The (2004)',
 801: 'Big Bully (1996)',
 802: 'Big Business (1988)',
 803: 'Big Chill, The (1983)',
 804: 'Big Clock, The (1948)',
 805: 'Big Combo, The (1955)',
 806: 'Big Country, The (1958)',
 807: 'Big Daddy (1999)',
 808: 'Big Deal on Madonna Street (I Soliti Ignoti) (1958)',
 809: 'Big Doll House, The (1971)',
 810: 'Big Easy, The (1987)',
 811: 'Big Eden (2000)',
 812: 'Big Empty, The (2003)',
 813: 'Big Fat Liar (2002)',
 814: 'Big Fish (2003)',
 815: 'Big Green, The (1995)',
 816: 'Big Heat, The (1953)',
 817: 'Big Hit, The (1998)',
 818: 'Big Jake (1971)',
 819: 'Big Kahuna, The (2000)',
 820: 'Big Knife, The (1955)',
 821: 'Big Lebowski, The (1998)',
 822: 'Big Momma's House (2000)',
 823: 'Big Night (1996)',
 824: 'Big One, The (1997)',
 825: 'Big Picture, The (1989)',
 826: 'Big Red One, The (1980)',
 827: 'Big Shots (1987)',
 828: 'Big Sleep, The (1946)',
 829: 'Big Squeeze, The (1996)',
 830: 'Big Tease, The (1999)',
 831: 'Big Time Operators (Smallest Show on Earth, The) (1957)',
 832: 'Big Top Pee-Wee (1988)',
 833: 'Big Town, The (1987)',
 834: 'Big Trail, The (1930)',
 835: 'Big Trees, The (1952)',
 836: 'Big Trouble (1986)',

837: 'Big Trouble (2002)',
 838: 'Big Trouble in Little China (1986)',
 839: 'Big Wednesday (1978)',
 840: 'Biggie and Tupac (2002)',
 841: 'Biggles (1986)',
 842: 'Biker Boyz (2003)',
 843: 'Bikini Beach (1964)',
 844: "Bill & Ted's Bogus Journey (1991)",
 845: "Bill & Ted's Excellent Adventure (1989)",
 846: 'Bill Cosby, Himself (1983)',
 847: 'Billy Bathgate (1991)',
 848: 'Billy Elliot (2000)',
 849: 'Billy Jack (1971)',
 850: 'Billy Jack Goes to Washington (1977)',
 851: 'Billy Liar (1963)',
 852: 'Billy Madison (1995)',
 853: "Billy's Holiday (1995)",
 854: "Billy's Hollywood Screen Kiss (1997)",
 855: 'Biloxi Blues (1988)',
 856: 'Bingo (1991)',
 857: 'Bio-Dome (1996)',
 858: 'Bird (1988)',
 859: 'Bird of Prey (1996)',
 860: 'Bird on a Wire (1990)',
 861: 'Birdcage, The (1996)',
 862: 'Birdman of Alcatraz (1962)',
 863: 'Birds, The (1963)',
 864: 'Birdy (1984)',
 865: 'Birth (2004)',
 866: 'Birth of a Nation, The (1915)',
 867: 'Birthday Girl (2001)',
 868: "Bishop's Wife, The (1947)",
 869: 'Bite the Bullet (1975)',
 870: 'Bitter Moon (1992)',
 871: 'Bitter Sugar (Azúcar amarga) (1996)',
 872: 'Black Beauty (1971)',
 873: 'Black Beauty (1994)',
 874: 'Black Cat, The (1934)',
 875: 'Black Cat, White Cat (Crna macka, beli macor) (1998)',
 876: 'Black Cauldron, The (1985)',
 877: 'Black Christmas (1974)',
 878: 'Black Dog (1998)',
 879: 'Black Hawk Down (2001)',
 880: 'Black Hole, The (1979)',
 881: 'Black Knight (2001)',
 882: 'Black Like Me (1964)',
 883: 'Black Mask (Hak hap) (1996)',

884: 'Black Moon Rising (1986)',
 885: 'Black Narcissus (1947)',
 886: 'Black Orpheus (Orfeu Negro) (1959)',
 887: 'Black Pirate, The (1926)',
 888: 'Black Rain (1989)',
 889: 'Black Robe (1991)',
 890: 'Black Sabbath (Tre volti della paura, I) (1963)',
 891: 'Black Scorpion, The (1957)',
 892: 'Black Sheep (1996)',
 893: 'Black Stallion Returns, The (1983)',
 894: 'Black Stallion, The (1979)',
 895: 'Black Sunday (1977)',
 896: 'Black Sunday (La maschera del demonio) (1960)',
 897: 'Black Tar Heroin: The Dark End of the Street (2000)',
 898: 'Black Widow (1987)',
 899: 'Black and White (1999)',
 900: 'Black and White in Color (Noirs et blancs en couleur) (1976)',
 901: 'Blackbeard's Ghost (1968)',
 902: 'Blackboard Jungle (1955)',
 903: 'Blackmail (1929)',
 904: 'Blackout, The (1997)',
 905: 'Blackrock (1997)',
 906: 'Blacula (1972)',
 907: 'Blade (1998)',
 908: 'Blade II (2002)',
 909: 'Blade Runner (1982)',
 910: 'Blade: Trinity (2004)',
 911: 'Blair Witch Project, The (1999)',
 912: 'Blame It on Rio (1984)',
 913: 'Blame It on the Bellboy (1992)',
 914: 'Blank Check (1994)',
 915: 'Blankman (1994)',
 916: 'Blast from the Past (1999)',
 917: 'Blaze (1989)',
 918: 'Blazing Saddles (1974)',
 919: 'Bless the Child (2000)',
 920: 'Blind Beast (Môjuu) (1969)',
 921: 'Blind Chance (Przypadek) (1981)',
 922: 'Blind Date (1984)',
 923: 'Blind Date (1987)',
 924: 'Blind Fury (1989)',
 925: 'Blind Spot: Hitler's Secretary (Im toten Winkel - Hitlers Sekretärin) (2002)',
 926: 'Blind Swordsman: Zatoichi, The (Zatôichi) (2003)',
 927: 'Blindness (2003)',
 928: 'Blink (1994)',
 929: 'Bliss (1997)',

930: 'Blob, The (1958)',
 931: 'Blob, The (1988)',
 932: 'Blood Beach (1981)',
 933: 'Blood Feast (1963)',
 934: 'Blood Simple (1984)',
 935: 'Blood Spattered Bride, The (La novia ensangrentada) (1972)',
 936: 'Blood Work (2002)',
 937: 'Blood and Sand (Sangre y Arena) (1989)',
 938: 'Blood and Wine (Blood & Wine) (1996)',
 939: "Blood for Dracula (Andy Warhol's Dracula) (1974)",
 940: 'Blood of Heroes, The (Salute of the Jugger, The) (1989)',
 941: 'Blood on the Sun (1945)',
 942: 'Blood, Guts, Bullets and Octane (1998)',
 943: 'Bloodsport (1988)',
 944: 'Bloodsport 2 (a.k.a. Bloodsport II: The Next Kumite) (1996)',
 945: 'Bloody Angels (1732 Høtten: Marerittet har et postnummer) (1998)',
 946: 'Bloody Child, The (1996)',
 947: 'Bloody Mama (1970)',
 948: 'Bloody Sunday (2002)',
 949: 'Blow (2001)',
 950: 'Blow Dry (a.k.a. Never Better) (2001)',
 951: 'Blow Out (1981)',
 952: 'Blow-Out (La grande bouffe) (1973)',
 953: 'Blow-Up (Blowup) (1966)',
 954: 'Blown Away (1994)',
 955: 'Blue Angel, The (Blaue Engel, Der) (1930)',
 956: 'Blue Car (2002)',
 957: 'Blue Chips (1994)',
 958: 'Blue Collar (1978)',
 959: 'Blue Collar Comedy Tour: The Movie (2003)',
 960: 'Blue Crush (2002)',
 961: 'Blue Dahlia, The (1946)',
 962: 'Blue Gardenia, The (1953)',
 963: 'Blue Hawaii (1961)',
 964: 'Blue Juice (1995)',
 965: 'Blue Kite, The (Lan feng zheng) (1993)',
 966: 'Blue Lagoon, The (1980)',
 967: 'Blue Max, The (1966)',
 968: 'Blue Sky (1994)',
 969: 'Blue Spring (Aoi haru) (2001)',
 970: 'Blue Steel (1990)',
 971: 'Blue Streak (1999)',
 972: 'Blue Thunder (1983)',
 973: 'Blue Velvet (1986)',
 974: 'Blue in the Face (1995)',
 975: 'Blues Brothers 2000 (1998)',
 976: 'Blues Brothers, The (1980)',

```

977: 'Boat Trip (2003)',
978: 'Bob & Carol & Ted & Alice (1969)',
979: 'Bob Roberts (1992)',
980: 'Bob le Flambeur (1955)',
981: 'Bodies, Rest & Motion (1993)',
982: 'Body Double (1984)',
983: 'Body Heat (1981)',
984: 'Body Parts (1991)',
985: 'Body Shots (1999)',
986: 'Body Snatcher, The (1945)',
987: 'Body Snatchers (1993)',
988: 'Body and Soul (1947)',
989: 'Body of Evidence (1993)',
990: 'Body, The (2001)',
991: 'Bodyguard, The (1992)',
992: 'Bogus (1996)',
993: 'Boiler Room (2000)',
994: 'Boiling Point (1993)',
995: 'Bolero (Uns et les autres, Les) (1981)',
996: 'Bollywood/Hollywood (2002)',
997: "Bon Voyage, Charlie Brown (and Don't Come Back!) (1980)",
998: 'Bone Collector, The (1999)',
999: 'Bones (2001)',
...}

```

```
[205]: current_state="'Round Midnight (1986)'"
```

```
[206]: p=transition_matrix[index_dict[current_state]]
```

```
[207]: p
```

```
[207]: array([-0.01173362, -0.04078342,  0.20618808, ..., -0.05787899,
          0.1266037 ,  0.06573253])
```

```
[208]: a = mc.MarkovChain().from_data(preds_df)
```

```
[214]: a.observed_matrix
```

```
[214]: array([[0., 1., 0., ..., 0., 0., 0.],
          [0., 0., 1., ..., 0., 0., 0.],
          [0., 0., 0., ..., 0., 0., 0.],
          ...,
          [0., 0., 0., ..., 0., 1., 0.],
          [0., 0., 0., ..., 0., 0., 1.],
          [0., 0., 0., ..., 0., 0., 0.]])
```

```
[219]: a.observed_p_matrix
```

```
[219]: array([[ 0.,  1.,  0., ...,  0.,  0.,  0.],
             [ 0.,  0.,  1., ...,  0.,  0.,  0.],
             [ 0.,  0.,  0., ...,  0.,  0.,  0.],
             ...,
             [ 0.,  0.,  0., ...,  0.,  1.,  0.],
             [ 0.,  0.,  0., ...,  0.,  0.,  1.],
             [nan, nan, nan, ..., nan, nan, nan]])
```

```
[223]: aa=pd.DataFrame(a.observed_matrix, index=a.states, columns=a.states, dtype=float)
```

```
[227]: a.expected_matrix
```

```
[227]: array([[0.          , 0.00012385, 0.00012385, ..., 0.00012385, 0.00012385,
             0.00012385],
             [0.          , 0.00012385, 0.00012385, ..., 0.00012385, 0.00012385,
             0.00012385],
             [0.          , 0.00012385, 0.00012385, ..., 0.00012385, 0.00012385,
             0.00012385],
             ...,
             [0.          , 0.00012385, 0.00012385, ..., 0.00012385, 0.00012385,
             0.00012385],
             [0.          , 0.00012385, 0.00012385, ..., 0.00012385, 0.00012385,
             0.00012385],
             [0.          , 0.          , 0.          , ..., 0.          , 0.          ,
             0.          ]])
```

```
[231]: a.n_order_matrix(a.observed_p_matrix, order=2)
```

```
[231]: array([[nan, nan, nan, ..., nan, nan, nan],
             [nan, nan, nan, ..., nan, nan, nan],
             [nan, nan, nan, ..., nan, nan, nan],
             ...,
             [nan, nan, nan, ..., nan, nan, nan],
             [nan, nan, nan, ..., nan, nan, nan],
             [nan, nan, nan, ..., nan, nan, nan]])
```

```
[235]: a.chisquare(a.observed_matrix, a.expected_matrix, axis=None)
```

```
[235]: Power_divergenceResult(statistic=nan, pvalue=nan)
```

```
[239]: ids, states = a.simulate(10, start="Home Alone (1990)", seed=100)
```

```
[240]: ids
```

```
[240]: array([3367, 3368, 3369, 3370, 3371, 3372, 3373, 3374, 3375, 3376])
```

```
[241]: states
```

```
[241]: array(['Home Alone (1990)', 'Home Alone 2: Lost in New York (1992)',
            'Home Alone 3 (1997)', 'Home Fries (1998)', 'Home Page (1999)',
            'Home Room (2002)', 'Home for the Holidays (1995)',
            'Home of Our Own, A (1993)', 'Home on the Range (2004)',
            'Homegrown (1998)'], dtype='<U134')
```

```
[242]: ", ".join(states)
```

```
[242]: 'Home Alone (1990),Home Alone 2: Lost in New York (1992),Home Alone 3
(1997),Home Fries (1998),Home Page (1999),Home Room (2002),Home for the Holidays
(1995),Home of Our Own, A (1993),Home on the Range (2004),Homegrown (1998)'
```

Performance metric

1. Mean Absolute Percentage Error
2. Root Mean Square Error

-> RMSE: Root Mean Square Error: RMSE is the error of each point which is squared. Then mean is calculated. Finally root of that mean is taken as final value.

-> MAPE: Mean Absolute Percentage Error: The mean absolute percentage error (MAPE), also known as mean absolute percentage deviation (MAPD), is a measure of prediction accuracy of a forecasting method.

where A_t is the actual value and F_t is the forecast value.

The difference between A_t and F_t is divided by the actual value A_t again. The absolute value in this calculation is summed for every forecasted point in time and divided by the number of fitted points n . Multiplying by 100% makes it a percentage error.

$$RMSE = \sqrt{\frac{\sum_{i=1}^N (Predicted_i - Actual_i)^2}{N}}$$

Surprise

To load a data set from the above pandas data frame, we will use the `load_from_df()` method, we will also need a Reader object, and the `rating_scale` parameter must be specified. The data frame must have three columns, corresponding to the user ids, the item ids, and the ratings in this order. Each row thus corresponds to a given rating.

```
[134]: reader = Reader(rating_scale=(0, 5))
data = Dataset.load_from_df(df[['userId', 'title', 'rating']], reader)
```



```
[133]: models_evaluation_train = dict()
models_evaluation_test = dict()
models_evaluation_train, models_evaluation_test
```

```
[133]: ({}, {})
```

```
[152]: from sklearn.metrics import mean_squared_error
```

```
[135]: # build the trainset from traindata.., It is of dataset format from surprise_
→library..
trainset = data.build_full_trainset()
```

```
[158]: testset = list(zip(df["userId"].values, df["movieId"].values, df["rating"].
→values))
```

```
[159]: testset[:5]
```

```
[159]: [(1, 2, 3.5), (5, 2, 3.0), (13, 2, 3.0), (29, 2, 3.0), (34, 2, 3.0)]
```

```
[332]: def get_ratings(predictions):
actual = np.array([pred.r_ui for pred in predictions])
predicted = np.array([pred.est for pred in predictions])
return actual, predicted
```

```
[333]: def get_error(predictions):
actual, predicted = get_ratings(predictions)
rmse = np.sqrt(mean_squared_error(actual, predicted))
mape = np.mean(abs((actual - predicted)/actual))*100
return rmse, mape
```

```
[169]: def RMSE(real, predicted):
"""
Calculate the root mean squared error between a matrix of real ratings and_
→predicted ratings
:param real: A matrix containing the real ratings (with 'NaN' for any_
→missing elements)
:param predicted: A matrix of predictions
:return: The RMSE as a float
"""
return np.sqrt(np.nanmean(np.square(real - predicted)))
```

```
[171]: RMSE(Matrix_normed, preds_df)
```

```
[171]: 0.5247939503744018
```

```

[335]: def run_surprise(algo, trainset, testset, model_name):
    startTime = datetime.now()

    train = dict()
    test = dict()

    algo.fit(trainset)

    #-----Evaluating Train Data-----#
    print("-"*50)
    print("TRAIN DATA")
    train_pred = algo.test(trainset.build_testset())
    # https://surprise.readthedocs.io/en/stable/getting\_started.html
    train_actual, train_predicted = get_ratings(train_pred)
    train_rmse, train_mape = get_error(train_pred)
    print("RMSE = {}".format(train_rmse))
    print("MAPE = {}".format(train_mape))
    print("-"*50)
    train = {"RMSE": train_rmse, "MAPE": train_mape, "Prediction":
    ↪train_predicted}

    #-----Evaluating Test Data-----#
    print("TEST DATA")
    test_pred = algo.test(testset)
    test_actual, test_predicted = get_ratings(test_pred)
    test_rmse, test_mape = get_error(test_pred)
    print("RMSE = {}".format(test_rmse))
    print("MAPE = {}".format(test_mape))
    print("-"*50)
    test = {"RMSE": test_rmse, "MAPE": test_mape, "Prediction": test_predicted}

    print("Time Taken = "+str(datetime.now() - startTime))
    make_table(model_name, train_rmse, train_mape, test_rmse, test_mape)
    return train, test

[336]: error_table = pd.DataFrame(columns = ["Model", "Train RMSE", "Train MAPE", "Test_
    ↪RMSE", "Test MAPE"])
    model_train_evaluation = dict()
    model_test_evaluation = dict()

[337]: def make_table(model_name, rmse_train, mape_train, rmse_test, mape_test):
    global error_table
    error_table = error_table.append(pd.DataFrame([[model_name, rmse_train,
    ↪mape_train, rmse_test, mape_test]],
                                                    columns = ["Model", "Train_
    ↪RMSE", "Train MAPE", "Test RMSE", "Test MAPE"]))
    error_table.reset_index(drop = True, inplace = True)

```

```
[338]: algo = SVD(n_factors = gs.best_params['rmse']['n_factors'], biased=True,
    ↪ verbose=True)
train_result, test_result = run_surprise(algo, trainset, testset, "SVD")
model_train_evaluation["SVD"] = train_result
model_test_evaluation["SVD"] = test_result
```

```
Processing epoch 0
Processing epoch 1
Processing epoch 2
Processing epoch 3
Processing epoch 4
Processing epoch 5
Processing epoch 6
Processing epoch 7
Processing epoch 8
Processing epoch 9
Processing epoch 10
Processing epoch 11
Processing epoch 12
Processing epoch 13
Processing epoch 14
Processing epoch 15
Processing epoch 16
Processing epoch 17
Processing epoch 18
Processing epoch 19
```

```
-----
TRAIN DATA
```

```
RMSE = 0.7297093669161853
```

```
MAPE = 23.55769316736481
```

```
-----
TEST DATA
```

```
RMSE = 0.9862218968330987
```

```
MAPE = 33.31743951713742
```

```
-----
Time Taken = 0:01:58.641797
```

```
[339]: param_grid = {'n_factors': [5,7,10,15,20,25,35,50,70,90]}
gs = GridSearchCV(SVD, param_grid, measures=['rmse', 'mae'], cv=3)
gs.fit(data)
# best RMSE score
print(gs.best_score['rmse'])
# combination of parameters that gave the best RMSE score
print(gs.best_params['rmse'])
# best mae score
print(gs.best_score['mae'])
# combination of parameters that gave the best mae score
```

```
print(gs.best_params['mae'])
```

```
0.8501647493298675
{'n_factors': 50}
0.6532501331623201
{'n_factors': 50}

RMSE SCORE IS 0.8501647
```

0.1.10 Cold Start Problem

Cold Start Problem with Users

```
[253]: def getAverageRatings(sparseMatrix, if_user):
        ax = 1 if if_user else 0
        #axis = 1 means rows and axis = 0 means columns
        sumOfRatings = sparseMatrix.sum(axis = ax).A1
        #this will give an array of sum of all the ratings of user if axis = 1 else
        #sum of all the ratings of movies if axis = 0
        noOfRatings = (sparseMatrix!=0).sum(axis = ax).A1
        #this will give a boolean True or False array, and True means 1 and False
        #means 0, and further we are summing it to get the count of all the non-zero
        →cells means length of non-zero cells
        rows, cols = sparseMatrix.shape
        averageRatings = {i: sumOfRatings[i]/noOfRatings[i] for i in range(rows if
        →if_user else cols) if noOfRatings[i]!=0}
        return averageRatings
```

```
[269]: print("We are creating sparse data")
TrainUISparseData = sparse.csr_matrix((df.rating, (df.userId, df.movieId)))
print("Creation done. Shape of sparse matrix = "+str(TrainUISparseData.shape))
```

```
We are creating sparse data
Creation done. Shape of sparse matrix = (5217, 26703)
```

```
[280]: ### Average Rating Per User
AvgRatingUser = getAverageRatings(TrainUISparseData, True)
print("Average rating of user 5216 = {}".format(AvgRatingUser[5216]))
```

```
Average rating of user 5216 = 3.8855421686746987
```

```
[292]: ### Average Rating Per Movie
AvgRatingMovie = getAverageRatings(TrainUISparseData, False)
print("Average rating of movie 4500 = {}".format(AvgRatingMovie[4500]))
```

```
Average rating of movie 4500 = 3.9722222222222223
```

```
[278]: total_users = len(np.unique(df["userId"]))
train_users = len(AvgRatingUser)
```

```

uncommonUsers = total_users - train_users

print("Total number of Users = {}".format(total_users))
print("Number of Users in train data= {}".format(train_users))
print("Number of Users not present in train data = {}({}%)"
      ↳format(uncommonUsers, np.round((uncommonUsers/total_users)*100), 2))

```

Total number of Users = 5216
 Number of Users in train data= 5216
 Number of Users not present in train data = 0(0.0%)

Cold Start Problem with Movies

```

[279]: total_movies = len(np.unique(df["movieId"]))
        train_movies = len(AvgRatingMovie)
        uncommonMovies = total_movies - train_movies

print("Total number of Movies = {}".format(total_movies))
print("Number of Movies in train data= {}".format(train_movies))
print("Number of Movies not present in train data = {}({}%)"
      ↳format(uncommonMovies, np.round((uncommonMovies/total_movies)*100), 2))

```

Total number of Movies = 8075
 Number of Movies in train data= 8075
 Number of Movies not present in train data = 0(0.0%)