In [1]:
```python
# import library
import pandas as pd
import numpy as np
import warnings
warnings.filterwarnings('ignore')
import matplotlib.pyplot as plt
```

Import the three datasets.

In [2]:
```python
movies = pd.read_csv('movies.dat' , delimiter = '::' , names = ['MovieID' , 'Title' , 'Genres'],encoding='latin-1')
ratings = pd.read_csv('ratings.dat' , delimiter = '::' , names = ['UserID' , 'MovieID' , 'Rating' , 'Timestamp'],encoding='latin-1' )
users = pd.read_csv('users.dat' , delimiter = '::' , names = ['UserID' , 'Gender' , 'Age' ,'Occupation' ,'Zip_code'],encoding='latin-1')
```

Descriptive Statistics

In [3]:
```python
# On movies data
movies.head()
```

Out[3]:

	MovieID	Title	Genres
0	1	Toy Story (1995)	Animation|Children's|Comedy
1	2	Jumanji (1995)	Adventure|Children's|Fantasy
2	3	Grumpier Old Men (1995)	Comedy|Romance
3	4	Waiting to Exhale (1995)	Comedy|Drama
4	5	Father of the Bride Part II (1995)	Comedy

In [4]:
```python
movies.shape
```

Out[4]:
```
(3883, 3)
```

In [5]:
```python
# Results show that no columns are empty or null.
movies.isnull().sum()
```

Out[5]:
```
MovieID    0
Title      0
Genres     0
dtype: int64
```

In [6]:
```python
movies.describe()
```

Out[6]:

	MovieID
count	3883.000000
mean	1986.049446
std	1146.778349
min	1.000000
25%	982.500000
50%	2010.000000
75%	2980.500000
max	3952.000000

In [7]:
```python
movies.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 3883 entries, 0 to 3882
Data columns (total 3 columns):
 #   Column   Non-Null Count  Dtype 
---  ------   --------------  ----- 
 0   MovieID  3883 non-null   int64 
 1   Title    3883 non-null   object
 2   Genres   3883 non-null   object
dtypes: int64(1), object(2)
memory usage: 91.1+ KB
```

In [8]:
```python
# On ratings data
ratings.head()
```

Out[8]:

	UserID	MovieID	Rating	Timestamp
0	1	1193	5	978300760
1	1	661	3	978302109
2	1	914	3	978301968
3	1	3408	4	978300275
4	1	2355	5	978824291

In [9]:
```python
ratings.shape
```

Out[9]:
```
(1000209, 4)
```

In [10]:
```python
# Results show that no columns are empty or null.
ratings.isnull().sum()
```

Out[10]:
```
UserID       0
MovieID      0
Rating       0
Timestamp    0
dtype: int64
```

In [11]:
```python
ratings.describe()
```

Out[11]:

	UserID	MovieID	Rating	Timestamp
count	1.000209e+06	1.000209e+06	1.000209e+06	1.000209e+06
mean	3.024512e+03	1.865540e+03	3.581564e+00	9.722437e+08
std	1.728413e+03	1.096041e+03	1.117102e+00	1.215256e+07
min	1.000000e+00	1.000000e+00	1.000000e+00	9.567039e+08
25%	1.506000e+03	1.030000e+03	3.000000e+00	9.653026e+08
50%	3.070000e+03	1.835000e+03	4.000000e+00	9.730180e+08
75%	4.476000e+03	2.770000e+03	4.000000e+00	9.752209e+08
max	6.040000e+03	3.952000e+03	5.000000e+00	1.046455e+09

In [12]:
```python
ratings.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1000209 entries, 0 to 1000208
Data columns (total 4 columns):
 #   Column     Non-Null Count    Dtype
---  ------     --------------    -----
 0   UserID     1000209 non-null  int64
 1   MovieID    1000209 non-null  int64
 2   Rating     1000209 non-null  int64
 3   Timestamp  1000209 non-null  int64
dtypes: int64(4)
memory usage: 30.5 MB
```

In [13]:
```python
# On users data
users.head()
```

Out[13]:

	UserID	Gender	Age	Occupation	Zip_code
0	1	F	1	10	48067
1	2	M	56	16	70072
2	3	M	25	15	55117
3	4	M	45	7	02460
4	5	M	25	20	55455

In [14]:
```python
users.shape
```

Out[14]:
```
(6040, 5)
```

In [15]:
```python
# Results show that no columns are empty or null.
users.isnull().sum()
```

Out[15]:
```
UserID        0
Gender        0
Age           0
Occupation    0
Zip_code      0
dtype: int64
```

In [16]:
```python
ratings.describe()
```

Out[16]:

	UserID	MovieID	Rating	Timestamp
count	1.000209e+06	1.000209e+06	1.000209e+06	1.000209e+06
mean	3.024512e+03	1.865540e+03	3.581564e+00	9.722437e+08
std	1.728413e+03	1.096041e+03	1.117102e+00	1.215256e+07
min	1.000000e+00	1.000000e+00	1.000000e+00	9.567039e+08
25%	1.506000e+03	1.030000e+03	3.000000e+00	9.653026e+08
50%	3.070000e+03	1.835000e+03	4.000000e+00	9.730180e+08
75%	4.476000e+03	2.770000e+03	4.000000e+00	9.752209e+08
max	6.040000e+03	3.952000e+03	5.000000e+00	1.046455e+09

In [17]:
```python
ratings.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1000209 entries, 0 to 1000208
Data columns (total 4 columns):
 #   Column     Non-Null Count    Dtype
---  ------     --------------    -----
 0   UserID     1000209 non-null  int64
 1   MovieID    1000209 non-null  int64
 2   Rating     1000209 non-null  int64
 3   Timestamp  1000209 non-null  int64
dtypes: int64(4)
memory usage: 30.5 MB
```

Create a new dataset [Master_Data] with the following columns MovieID Title UserID Age Gender Occupation Rating. (Hint: (i) Merge two tables at a time. (ii) Merge the tables using two primary keys MovieID & UserId).

In [18]:
```python
df = pd.merge(users.drop('Zip_code', axis=1), ratings.drop('Timestamp', axis=1), on='UserID')
Master_Data = pd.merge(df, movies, on='MovieID')
```

In [19]:
```python
Master_Data.head()
```

Out[19]:

	UserID	Gender	Age	Occupation	MovieID	Rating	Title	Genres
0	1	F	1	10	1193	5	One Flew Over the Cuckoo's Nest (1975)	Drama
1	2	M	56	16	1193	5	One Flew Over the Cuckoo's Nest (1975)	Drama
2	12	M	25	12	1193	4	One Flew Over the Cuckoo's Nest (1975)	Drama
3	15	M	25	7	1193	4	One Flew Over the Cuckoo's Nest (1975)	Drama
4	17	M	50	1	1193	5	One Flew Over the Cuckoo's Nest (1975)	Drama

In [20]:
```python
# print columns of Master Data
Master_Data.columns
```

Out[20]:
```
Index(['UserID', 'Gender', 'Age', 'Occupation', 'MovieID', 'Rating', 'Title',
       'Genres'],
      dtype='object')
```

In [21]:
```python
# create data frame with required columns
col = ['MovieID','Title','UserID','Age','Gender','Occupation','Rating','Genres']
Master_Data = Master_Data[col]
```

In [22]:
```python
Master_Data.head()
```

Out[22]:

	MovieID	Title	UserID	Age	Gender	Occupation	Rating	Genres
0	1193	One Flew Over the Cuckoo's Nest (1975)	1	1	F	10	5	Drama
1	1193	One Flew Over the Cuckoo's Nest (1975)	2	56	M	16	5	Drama
2	1193	One Flew Over the Cuckoo's Nest (1975)	12	25	M	12	4	Drama
3	1193	One Flew Over the Cuckoo's Nest (1975)	15	25	M	7	4	Drama
4	1193	One Flew Over the Cuckoo's Nest (1975)	17	50	M	1	5	Drama

In [23]:
```python
Master_Data.shape
```

Out[23]:
```
(1000209, 8)
```

Explore the datasets using visual representations (graphs or tables), also include your comments on the following:

In [24]:
```python
# 1.User Age Distribution
Master_Data.Age.value_counts(normalize=True).to_frame()
```

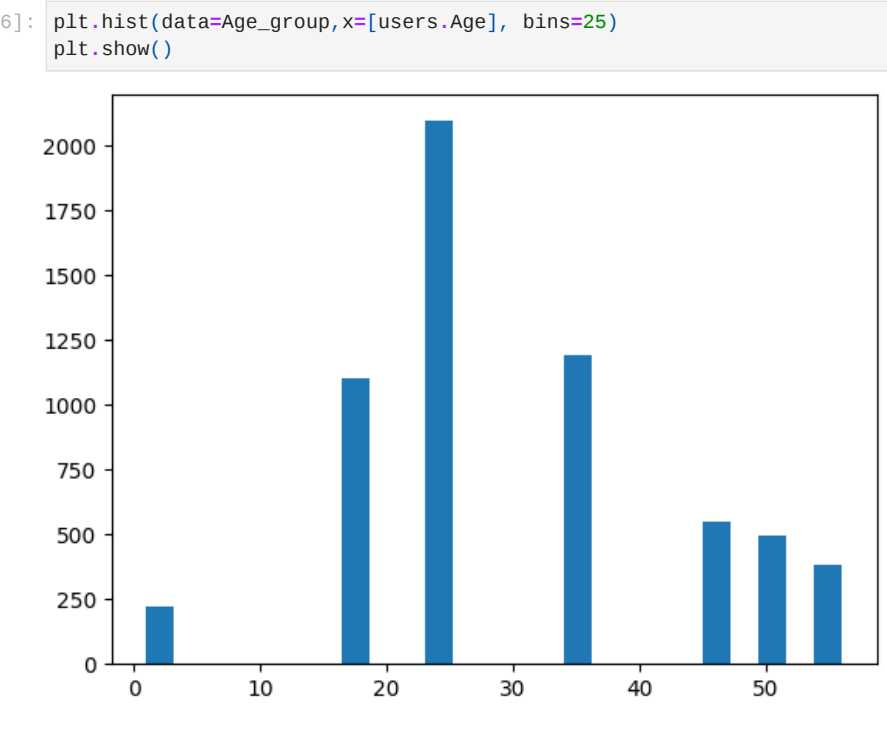
Out[24]:

	proportion
Age	
25	0.395473
35	0.198961
18	0.183498
45	0.083616
50	0.072475
56	0.038772
1	0.027205

In [25]:
```python
Age_group = Master_Data.groupby('Age').size()
Age_group
```

Out[25]:
```
Age
1      27211
18    183536
25    395556
35    199003
45     83633
50     72490
56     38780
dtype: int64
```

In [26]:
```python
plt.hist(data=Age_group,x=[users.Age], bins=25)
plt.show()
```

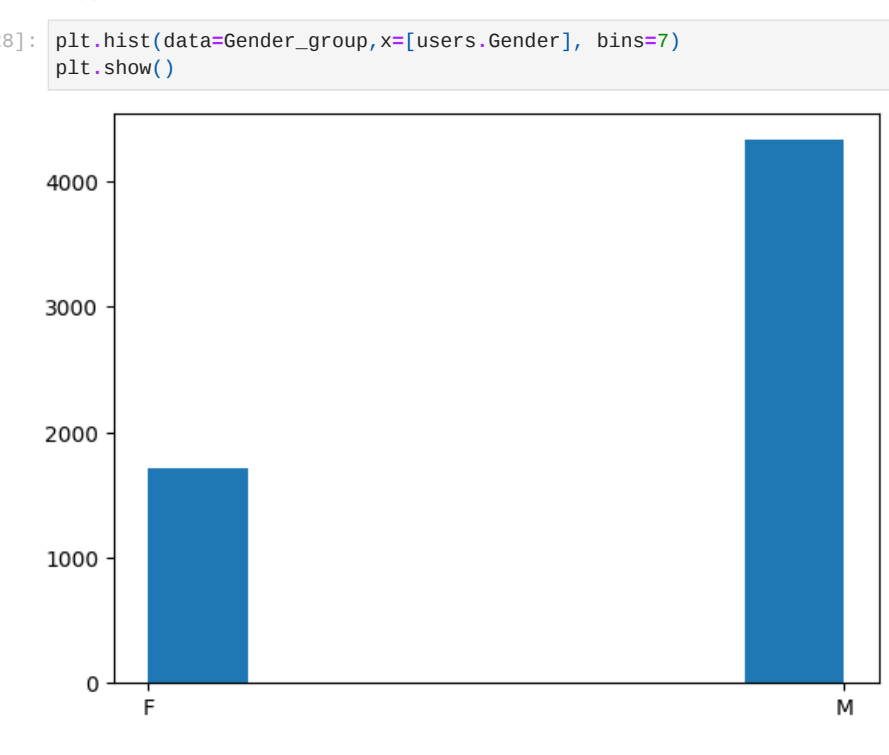


Maximum users are around 25 years of age. Around 75% users are in the age group of 18 to 35 years.

In [27]:
```python
Gender_group = users.groupby('Gender').size()
Gender_group
```

Out[27]:
```
Gender
F    1709
M    4331
dtype: int64
```

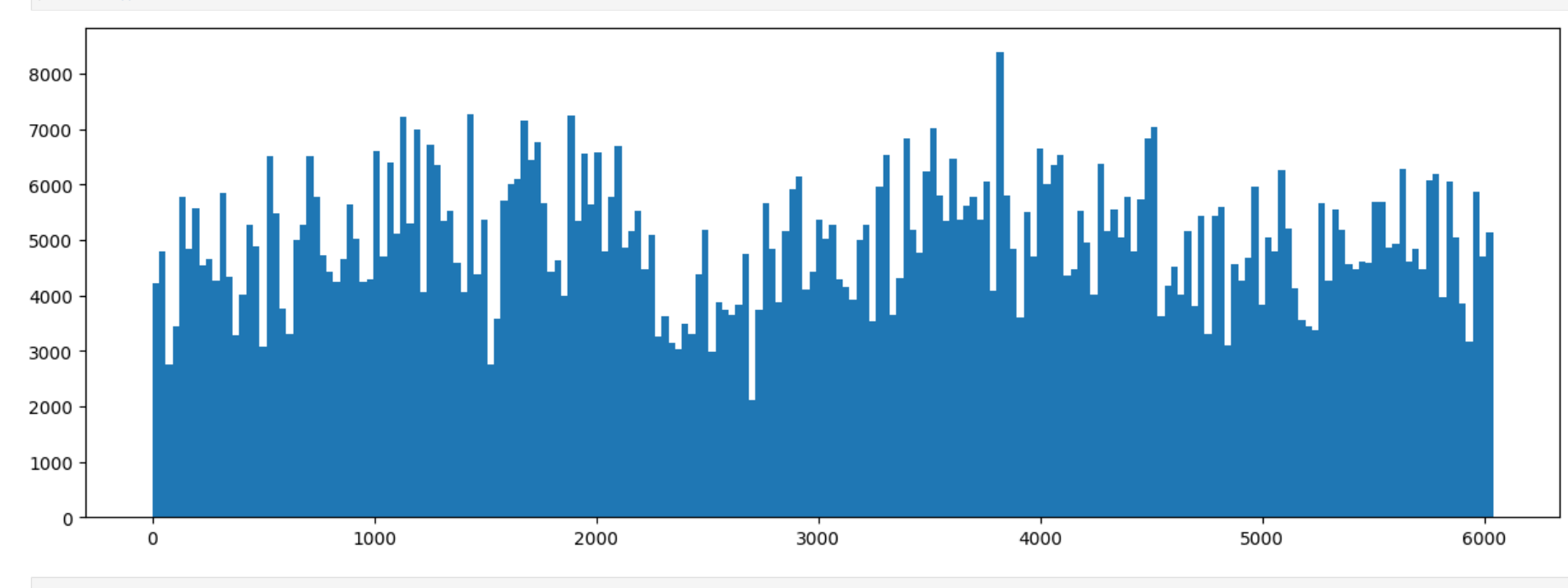
In [28]:
```python
plt.hist(data=Gender_group,x=[users.Gender], bins=7)
plt.show()
```



In [29]:
```python
# 2.User rating of the movie “Toy Story”
User_group = ratings.groupby(['UserID']).size() #user ratings
User_group.head(10)
```

Out[29]:
```
UserID
1      53
2     129
3      51
4      21
5     198
6      71
7      31
8     139
9     106
10    401
dtype: int64
```

In [30]:
```python
plt.figure(figsize=(15,5))
plt.hist(x=[ratings.UserID], bins=200)
plt.show()
```



In [31]:
```python
#toy story data
ToyStory_data = ratings[ratings.MovieID==1] # MovieID=1=Toy Story (1995)
ToyStory_data.head(10)
```

Out[31]:

	UserID	MovieID	Rating	Timestamp
40	1	1	5	978824268
469	6	1	4	978237008
581	8	1	4	978233496
711	9	1	5	978225952
837	10	1	5	978226474
1966	18	1	4	978154768
2276	19	1	5	978555994
2530	21	1	3	978139347
2870	23	1	4	978463614
3405	26	1	3	978130703

In [32]:
```python
ToyStory_data.groupby('Rating').size()
```

Out[32]:
```
Rating
1     16
2     61
3    345
4    835
5    820
dtype: int64
```

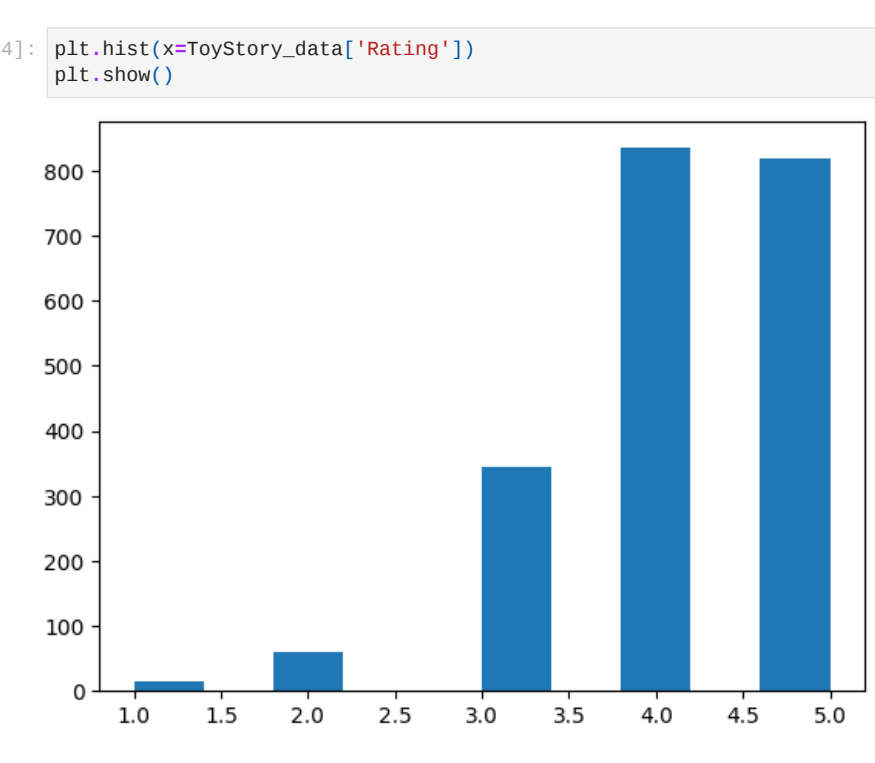
Toy Story (1995) is rated mostly in range 4-5. Very few users have given rating of 1 and 2.

In [33]:
```python
ToyStory_data_group = ToyStory_data.groupby('Rating')
ToyStory_data_group.agg({'Rating':'mean'})
```

Out[33]:

	Rating
Rating	
1	1.0
2	2.0
3	3.0
4	4.0
5	5.0

In [34]:
```python
plt.hist(x=ToyStory_data['Rating'])
plt.show()
```



In [35]:
```python
# 3.Top 25 movies by viewership rating
movie_rating = Master_Data[['Title', 'Rating']].groupby('Title').mean().sort_values('Rating', ascending=False)
movie_rating.head(25)
```

Out[35]:

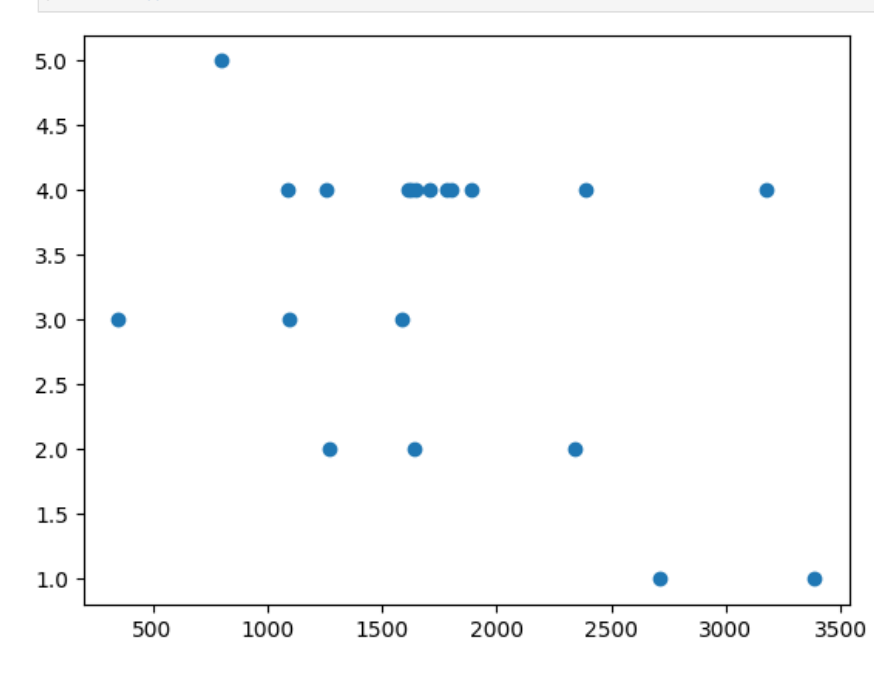
	Rating
Title	
Ulysses (Ulisse) (1954)	5.000000
Lured (1947)	5.000000
Follow the Bitch (1998)	5.000000
Bittersweet Motel (2000)	5.000000
Song of Freedom (1936)	5.000000
One Little Indian (1973)	5.000000
Smashing Time (1967)	5.000000
Schlafes Bruder (Brother of Sleep) (1995)	5.000000
Gate of Heavenly Peace, The (1995)	5.000000
Baby, The (1973)	5.000000
I Am Cuba (Soy Cuba/Ya Kuba) (1964)	4.800000
Lamerica (1994)	4.750000
Apple, The (Sib) (1998)	4.666667
Sanjuro (1962)	4.608696
Seven Samurai (The Magnificent Seven) (Shichinin no samurai) (1954)	4.560510
Shawshank Redemption, The (1994)	4.554558
Godfather, The (1972)	4.524966
Close Shave, A (1995)	4.520548
Usual Suspects, The (1995)	4.517106
Schindler's List (1993)	4.510417
Wrong Trousers, The (1993)	4.507937
Dry Cleaning (Nettoyage à sec) (1997)	4.500000
Inheritors, The (Die Siebtelbauern) (1998)	4.500000
Mamma Roma (1962)	4.500000
Bells, The (1926)	4.500000

In [36]:
```python
# 4.Find the ratings for all the movies reviewed by for a particular user of user id = 2696.
Master_Data = Master_Data[Master_Data['UserID']==2696]
Master_Data.head()
```

Out[36]:

	MovieID	Title	UserID	Age	Gender	Occupation	Rating	Genres
24345	1270	Back to the Future (1985)	2696	25	M	7	2	Comedy|Sci-Fi
29848	1097	E.T. the Extra-Terrestrial (1982)	2696	25	M	7	3	Children's|Drama|Fantasy|Sci-Fi
244232	1617	L.A. Confidential (1997)	2696	25	M	7	4	Crime|Film-Noir|Mystery|Thriller
250014	800	Lone Star (1996)	2696	25	M	7	5	Drama|Mystery
273633	3386	JFK (1991)	2696	25	M	7	1	Drama|Mystery

In [37]:
```python
plt.scatter(x=Master_Data['MovieID'], y=Master_Data['Rating'])
plt.show()
```



Feature Engineering:

In [38]:
```python
# Use column genres:
# 1. Find out all the unique genres.
# (Hint: split the data in column genre making a list and then process the data to find out only the unique categories of genres)
movies['Lis_genres'] = movies['Genres'].apply(lambda x : str(x).split('|'))
movies.head()
```

Out[38]:

	MovieID	Title	Genres	Lis_genres
0	1	Toy Story (1995)	Animation|Children's|Comedy	[Animation, Children's, Comedy]
1	2	Jumanji (1995)	Adventure|Children's|Fantasy	[Adventure, Children's, Fantasy]
2	3	Grumpier Old Men (1995)	Comedy|Romance	[Comedy, Romance]
3	4	Waiting to Exhale (1995)	Comedy|Drama	[Comedy, Drama]
4	5	Father of the Bride Part II (1995)	Comedy	[Comedy]

In [39]:
```python
#unique genres.
Genres=[]
for i in movies['Lis_genres']:
    Genres.extend(i)

Genres=set(Genres)
print(Genres)
```

```
{'Romance', 'Mystery', "Children's", 'Film-Noir', 'Western', 'Action', 'Sci-Fi', 'Documentary', 'War', 'Thriller', 'Comedy', 'Fantasy', 'Horror', 'Musical', 'Animation', 'Crime', 'Adventure', 'Drama'}
```

In [40]:
```python
Master_Data.head()
```

Out[40]:

	MovieID	Title	UserID	Age	Gender	Occupation	Rating	Genres
24345	1270	Back to the Future (1985)	2696	25	M	7	2	Comedy|Sci-Fi
29848	1097	E.T. the Extra-Terrestrial (1982)	2696	25	M	7	3	Children's|Drama|Fantasy|Sci-Fi
244232	1617	L.A. Confidential (1997)	2696	25	M	7	4	Crime|Film-Noir|Mystery|Thriller
250014	800	Lone Star (1996)	2696	25	M	7	5	Drama|Mystery
273633	3386	JFK (1991)	2696	25	M	7	1	Drama|Mystery

In [41]:
```python
# 2.Create a separate column for each genre category with a one-hot encoding ( 1 and 0) whether or not the movie belongs to that genrefor i in Genres:
for i in Genres:
    print(i)
    Master_Data[i]=Master_Data['Genres'].apply(lambda x: 1 if i in x else 0)
Master_Data.head(1)
```

```
Romance
Mystery
Children's
Film-Noir
Western
Action
Sci-Fi
Documentary
War
Thriller
Comedy
Fantasy
Horror
Musical
Animation
Crime
Adventure
Drama
```

Out[41]:

	MovieID	Title	UserID	Age	Gender	Occupation	Rating	Genres	Romance	Mystery	...	War	Thriller	Comedy	Fantasy	Horror	Musical	Animation	Crime	Adventure	Drama
24345	1270	Back to the Future (1985)	2696	25	M	7	2	Comedy|Sci-Fi	0	0	...	0	0	1	0	0	0	0	0	0	0

1 rows × 26 columns

In [42]:
```python
# 3.Determine the features affecting the ratings of any particular movie.
Master_Data.select_dtypes(include=[np.number]).corr()
```

Out[42]:

	MovieID	UserID	Age	Occupation	Rating	Romance	Mystery	Children's	Film-Noir	Western	...	War	Thriller	Comedy	Fantasy	Horror	Musical	Animation	Crime	Adventure	Drama
MovieID	1.000000	NaN	NaN	NaN	-0.398566	NaN	0.010739	-0.207720	-0.026899	NaN	...	NaN	0.172338	-0.122411	-0.207720	0.213847	NaN	NaN	0.030145	NaN	-0.022056
UserID	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Age	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Occupation	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Rating	-0.398566	NaN	NaN	NaN	1.000000	NaN	0.262432	-0.062568	0.212121	NaN	...	NaN	0.104828	-0.090909	-0.062568	-0.277732	NaN	NaN	0.317408	NaN	0.055670
Romance	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Mystery	0.010739	NaN	NaN	NaN	0.262432	NaN	1.000000	-0.397360	0.192450	NaN	...	NaN	0.302614	-0.192450	-0.397360	-0.377964	NaN	NaN	0.125988	NaN	0.235702
Children's	-0.207720	NaN	NaN	NaN	-0.062568	NaN	-0.397360	1.000000	-0.076472	NaN	...	NaN	-0.312641	-0.076472	1.000000	-0.150188	NaN	NaN	-0.150188	NaN	0.280976
Film-Noir	-0.026899	NaN	NaN	NaN	0.212121	NaN	0.192450	-0.076472	1.000000	NaN	...	NaN	0.244600	-0.111111	-0.076472	-0.218218	NaN	NaN	0.145479	NaN	-0.272166
Western	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Action	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Sci-Fi	-0.262374	NaN	NaN	NaN	-0.242424	NaN	-0.577350	0.688247	-0.111111	NaN	...	NaN	-0.454257	0.444444	0.688247	-0.218218	NaN	NaN	-0.218218	NaN	0.068041
Documentary	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
War	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Thriller	0.172338	NaN	NaN	NaN	0.104828	NaN	0.302614	-0.312641	0.244600	NaN	...	NaN	1.000000	-0.454257	-0.312641	0.251630	NaN	NaN	0.022875	NaN	-0.470757
Comedy	-0.122411	NaN	NaN	NaN	-0.090909	NaN	-0.192450	-0.076472	-0.111111	NaN	...	NaN	-0.454257	1.000000	-0.076472	-0.218218	NaN	NaN	0.145479	NaN	0.068041
Fantasy	-0.207720	NaN	NaN	NaN	-0.062568	NaN	-0.397360	1.000000	-0.076472	NaN	...	NaN	-0.312641	-0.076472	1.000000	-0.150188	NaN	NaN	-0.150188	NaN	0.280976
Horror	0.213847	NaN	NaN	NaN	-0.277732	NaN	-0.377964	-0.150188	-0.218218	NaN	...	NaN	0.251630	-0.218218	-0.150188	1.000000	NaN	NaN	0.047619	NaN	-0.534522
Musical	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Animation	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Crime	0.030145	NaN	NaN	NaN	0.317408	NaN	0.125988	-0.150188	0.145479	NaN	...	NaN	0.022875	0.145479	-0.150188	0.047619	NaN	NaN	1.000000	NaN	0.133631
Adventure	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Drama	-0.022056	NaN	NaN	NaN	0.055670	NaN	0.235702	0.280976	-0.272166	NaN	...	NaN	-0.470757	0.068041	0.280976	-0.534522	NaN	NaN	0.133631	NaN	1.000000

23 rows × 23 columns

In [43]:
```python
Master_Data.select_dtypes(include=[np.number]).corr()[['Rating']]
```

Out[43]:

	Rating
MovieID	-0.398566
UserID	NaN
Age	NaN
Occupation	NaN
Rating	1.000000
Romance	NaN
Mystery	0.262432
Children's	-0.062568
Film-Noir	0.212121
Western	NaN
Action	NaN
Sci-Fi	-0.242424
Documentary	NaN
War	NaN
Thriller	0.104828
Comedy	-0.090909
Fantasy	-0.062568
Horror	-0.277732
Musical	NaN
Animation	NaN
Crime	0.317408
Adventure	NaN
Drama	0.055670

In [44]:
```python
Master_Data.columns
```

Out[44]:
```
Index(['MovieID', 'Title', 'UserID', 'Age', 'Gender', 'Occupation', 'Rating',
       'Genres', 'Romance', 'Mystery', 'Children's', 'Film-Noir', 'Western',
       'Action', 'Sci-Fi', 'Documentary', 'War', 'Thriller', 'Comedy',
       'Fantasy', 'Horror', 'Musical', 'Animation', 'Crime', 'Adventure',
       'Drama'],
      dtype='object')
```

In [45]:
```python
Master_Data.head(1)
```

Out[45]:

	MovieID	Title	UserID	Age	Gender	Occupation	Rating	Genres	Romance	Mystery	...	War	Thriller	Comedy	Fantasy	Horror	Musical	Animation	Crime	Adventure	Drama
24345	1270	Back to the Future (1985)	2696	25	M	7	2	Comedy|Sci-Fi	0	0	...	0	0	1	0	0	0	0	0	0	0

1 rows × 26 columns

In [46]:
```python
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
```

In [47]:
```python
# 4.Develop an appropriate model to predict the movie ratings
x=Master_Data[['Age', 'Comedy', 'Adventure', 'Musical', 'Animation','Thriller','Sci-Fi', 'Crime', 'Film-Noir', 'Horror', 'Fantasy', 'Action',
              'War','Mystery', 'Romance', 'Western', 'Drama', "Children's", 'Documentary']] # Feature
y=Master_Data['Rating'] #Target/Label/Y
```

In [48]:
```python
x_train, x_test, y_train, y_test=train_test_split(x,y,test_size=.2)
```

In [49]:
```python
model=LinearRegression()
```

In [50]:
```python
model.fit(x_train,y_train)
```

Out[50]:
```
▾ LinearRegression
LinearRegression()
```

In [51]:
```python
y_pred = model.predict(x_test)
y_pred
```

```
Out[51]: array([2.5, 2.5, 0.5, 4. ])

In [ ]:
```