In [21]:

```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
```

In [22]:

```
'''
The GroupLens Research Project is a research group in the Department of Computer Sci
The details of these projects and the scope of each project are listed in the sectio
☐   Data acquisition of the movielens dataset
•   users dataset
•   rating dataset
•   movies dataset
☐   Perform the Exploratory Data Analysis (EDA) for the users dataset
•   Visualize user age distribution --- Histogram of Age column
•   Visualize overall rating by users --- Visualize it using pie,bar
•   Find and visualize the user rating of the movie “Toy Story (1995)”
•   Find and visualize the viewership of the movie “Toy Story (1995)” by age group
•   Find and visualize the top 25 movies by viewership rating
•   Find the rating for a particular user of user id = 2696
o   Visualize the rating data by user of user id = 2696
☐   Perform machine learning on first 500 extracted records (hint: use head(500))
•   Use the following features:
o   movie id
o   age
o   occupation
☐   Use rating as label
☐   Create train and test data set and perform the following:
•   Create Model
•   Check for Generalization
•   Deploy model (Show user input)
'''
```

Out[22]:

```
'\nThe GroupLens Research Project is a research group in the Departmen
t of Computer Science and Engineering in the University of Minnesota.
The researchers of this group are involved in many research projects r
elated to the fields of information filtering, collaborative filterin
g, and recommender systems. Here, we ask you to perform the analysis u
sing the Exploratory Data Analysis technique. \nThe details of these p
rojects and the scope of each project are listed in the sections belo
w.\n\uf0d8\tData acquisition of the movielens dataset\n•\tusers datase
t\n•\trating dataset\n•\tmovies dataset\n\uf0d8\tPerform the Explorato
ry Data Analysis (EDA) for the users dataset\n•\tVisualize user age di
stribution --- Histogram of Age column\n•\tVisualize overall rating by
users --- Visualize it using pie,bar\n•\tFind and visualize the user r
ating of the movie “Toy Story (1995)”\n•\tFind and visualize the viewe
rship of the movie “Toy Story (1995)” by age group\n•\tFind and visual
ize the top 25 movies by viewership rating\n•\tFind the rating for a p
articular user of user id = 2696\no\tVisualize the rating data by user
of user id = 2696\n\uf0d8\tPerform machine learning on first 500 extra
cted records (hint: use head(500))\n•\tUse the following features:\no
\tmovie id\no\tage\no\toccupation\n\uf0d8\tUse rating as label\n\uf0d8
\tCreate train and test data set and perform the following:\n•\tCreate
Model\n•\tCheck for Generalization \n•\tDeploy model (Show user input)
\n'
```

In [44]:

```
#Load data
movies = pd.read_csv("Data/movies.dat", sep='::' , header=None, names =['MovieID','T
ratings = pd.read_csv("Data/ratings.dat" , sep='::' , header=None, names =['UserID',
users = pd.read_csv("Data/users.dat", sep='::' , header=None, names =['UserID','Genc
```

In [45]:

```
#Merge Dataset
tempDataset = pd.merge(movies,ratings, on='MovieID')
finalDF = pd.merge(tempDataset,users, on='UserID')
finalDF.head()
```

Out[45]:

	MovieID	Title	Genres	UserID	Rating	Timestamp	Gender
0	1	Toy Story (1995)	Animation|Children's|Comedy	1	5	978824268	F
1	48	Pocahontas (1995)	Animation|Children's|Musical|Romance	1	5	978824351	F
2	150	Apollo 13 (1995)	Drama	1	5	978301777	F
3	260	Star Wars: Episode IV - A New Hope (1977)	Action|Adventure|Fantasy|Sci-Fi	1	4	978300760	F
4	527	Schindler's List (1993)	Drama|War	1	5	978824195	F

In [27]:

```
movies.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 3883 entries, 0 to 3882
Data columns (total 3 columns):
MovieId      3883 non-null int64
MovieName    3883 non-null object
Geners       3883 non-null object
dtypes: int64(1), object(2)
memory usage: 91.1+ KB
```

In [28]:

```
ratings.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1000209 entries, 0 to 1000208
Data columns (total 4 columns):
UserId       1000209 non-null int64
MovieId      1000209 non-null int64
Ratings      1000209 non-null int64
TimeStamp    1000209 non-null int64
dtypes: int64(4)
memory usage: 30.5 MB
```

In [49]:

```
users.info()
```

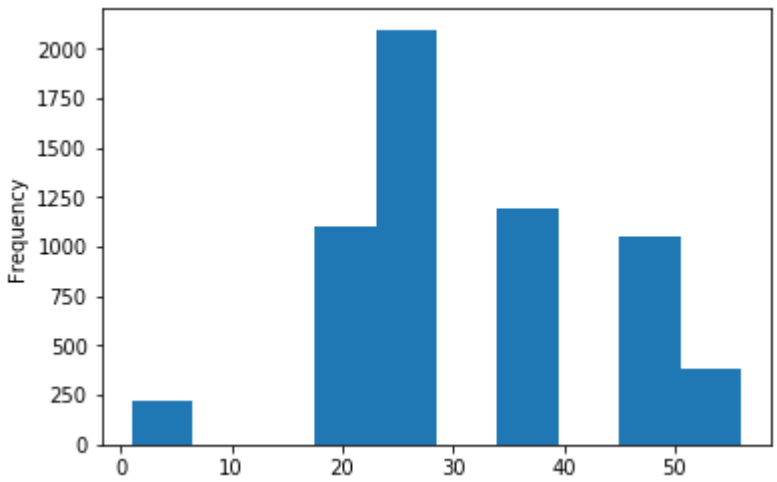
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 6040 entries, 0 to 6039
Data columns (total 5 columns):
UserID        6040 non-null int64
Gender        6040 non-null object
Age           6040 non-null int64
Occupation    6040 non-null int64
Zip-code      6040 non-null object
dtypes: int64(3), object(2)
memory usage: 236.0+ KB
```

In [50]:

```
#Visualize user age distribution --- Histogram of Age column
users.Age.plot(kind="hist")
```

Out[50]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x1a19b4d828>
```



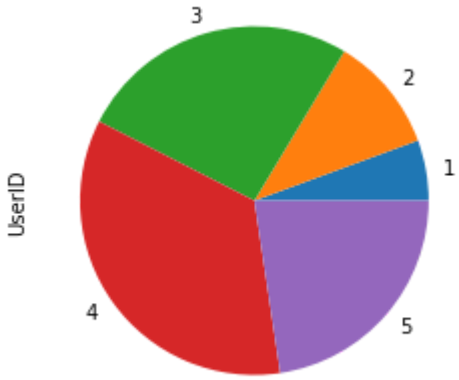
In [51]:

```
#Visualize overall rating by users --- Visualize it using pie,bar

ratings.groupby("Rating")['UserID'].count().plot(kind='pie')
```

Out[51]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x1a1e96eef0>
```

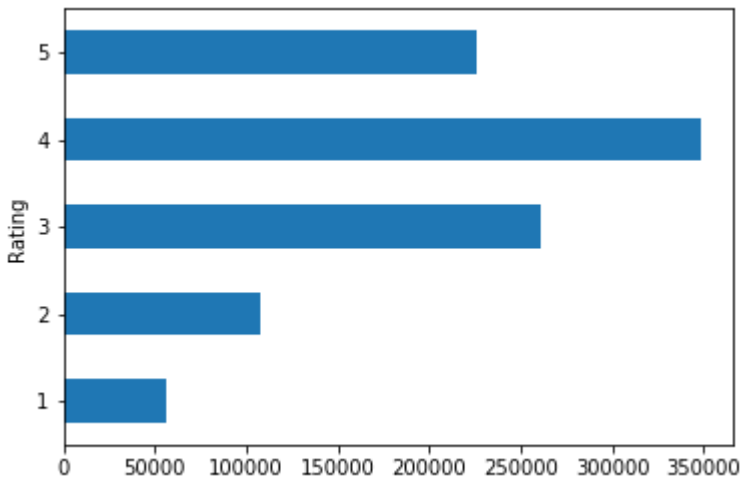


In [52]:

```
finalDF.groupby('Rating')['UserID'].count().plot(kind='barh')
```

Out[52]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x1a1eb13c50>
```



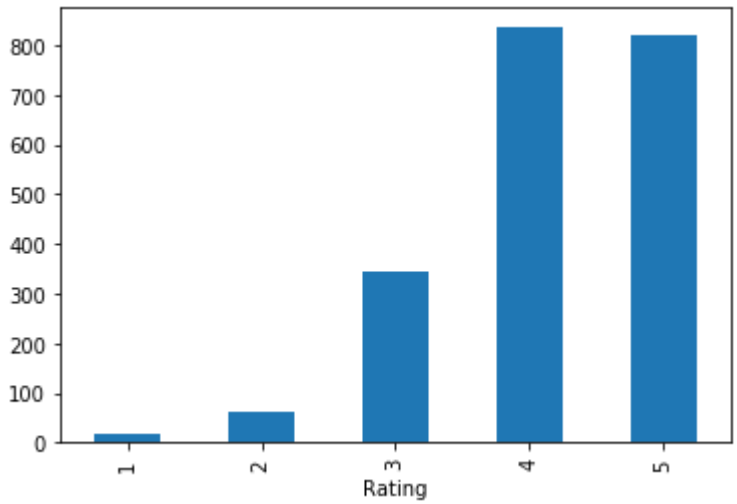
In [63]:

```
#Find and visualize the user rating of the movie “Toy Story (1995)”
print(finalDF[finalDF.Title == 'Toy Story (1995)'].groupby('Rating')['UserID'].count
finalDF[finalDF.Title == 'Toy Story (1995)'].groupby('Rating')['UserID'].count().plo
```

```
Rating
1     16
2     61
3    345
4    835
5    820
Name: UserID, dtype: int64
```

Out[63]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x1a2bd865f8>
```

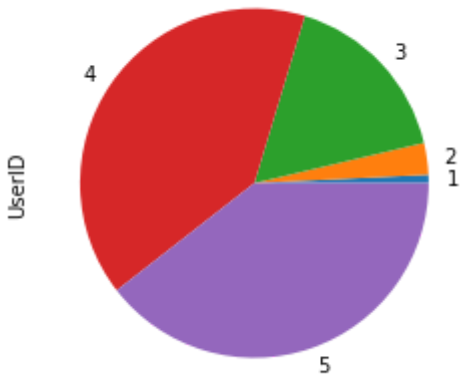


In [64]:

```
finalDF[finalDF.Title == 'Toy Story (1995)'].groupby('Rating')['UserID'].count().plo
```

Out[64]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x1a2f1b33c8>
```



In [65]:

```
# • Find and visualize the viewership of the movie "Toy Story (1995)" by age group
print(finalDF[finalDF.Title == 'Toy Story (1995)'].groupby('Age')['UserID'].count())
finalDF[finalDF.Title == 'Toy Story (1995)'].groupby('Age')['UserID'].count().plot(k
```

```
Age
1     112
18    448
25    790
35    423
45    143
50    108
56     53
Name: UserID, dtype: int64
```

Out[65]:

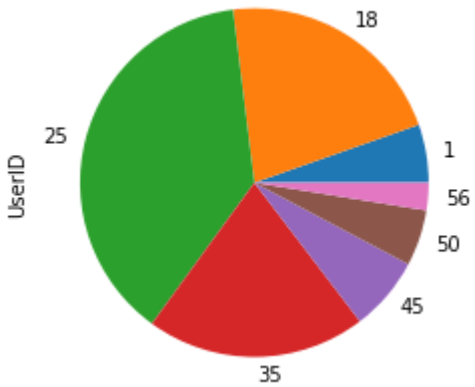
```
<matplotlib.axes._subplots.AxesSubplot at 0x1a2f205160>
```

In [66]:

```
finalDF[finalDF.Title == 'Toy Story (1995)'].groupby('Age')['UserID'].count().plot(k
```

Out[66]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x1a2f201748>
```



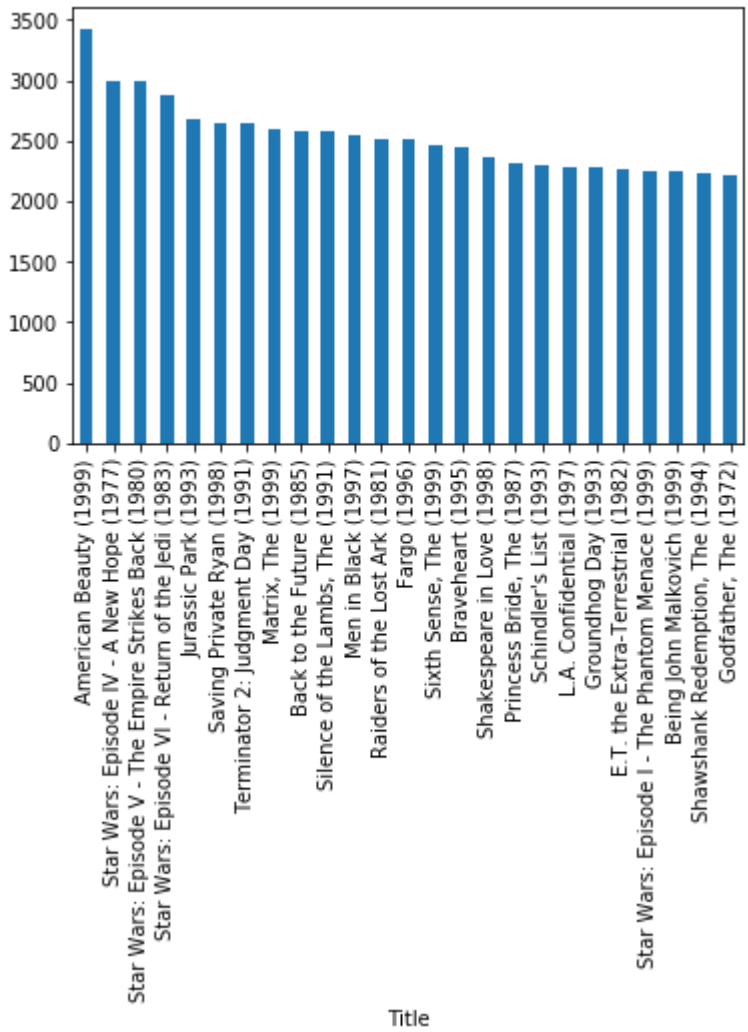
In [70]:

```
#•  Find and visualize the top 25 movies by viewership rating
print(finalDF.groupby('Title').Rating.count().nlargest(25))
finalDF.groupby('Title').Rating.count().nlargest(25).plot(kind='bar')
```

```
Title
American Beauty (1999)                                3428
Star Wars: Episode IV - A New Hope (1977)             2991
Star Wars: Episode V - The Empire Strikes Back (1980) 2990
Star Wars: Episode VI - Return of the Jedi (1983)     2883
Jurassic Park (1993)                                  2672
Saving Private Ryan (1998)                            2653
Terminator 2: Judgment Day (1991)                     2649
Matrix, The (1999)                                    2590
Back to the Future (1985)                             2583
Silence of the Lambs, The (1991)                      2578
Men in Black (1997)                                   2538
Raiders of the Lost Ark (1981)                        2514
Fargo (1996)                                          2513
Sixth Sense, The (1999)                               2459
Braveheart (1995)                                     2443
Shakespeare in Love (1998)                            2369
Princess Bride, The (1987)                            2318
Schindler's List (1993)                               2304
L.A. Confidential (1997)                              2288
Groundhog Day (1993)                                  2278
E.T. the Extra-Terrestrial (1982)                     2269
Star Wars: Episode I - The Phantom Menace (1999)      2250
Being John Malkovich (1999)                           2241
Shawshank Redemption, The (1994)                      2227
Godfather, The (1972)                                 2223
Name: Rating, dtype: int64
```

Out[70]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x1a2abf99e8>
```


3500
3000
2500
2000
1500
1000
500
0
American Beauty (1999)
Star Wars: Episode IV - A New Hope (1977)
Star Wars: Episode V - The Empire Strikes Back (1980)
Star Wars: Episode VI - Return of the Jedi (1983)
Jurassic Park (1993)
Saving Private Ryan (1998)
Terminator 2: Judgment Day (1991)
Matrix, The (1999)
Back to the Future (1985)
Silence of the Lambs, The (1991)
Men in Black (1997)
Raiders of the Lost Ark (1981)
Fargo (1996)
Sixth Sense, The (1999)
Braveheart (1995)
Shakespeare in Love (1998)
Princess Bride, The (1987)
Schindler's List (1993)
L.A. Confidential (1997)
Groundhog Day (1993)
E.T. the Extra-Terrestrial (1982)
Star Wars: Episode I - The Phantom Menace (1999)
Being John Malkovich (1999)
Shawshank Redemption, The (1994)
Godfather, The (1972)
Title

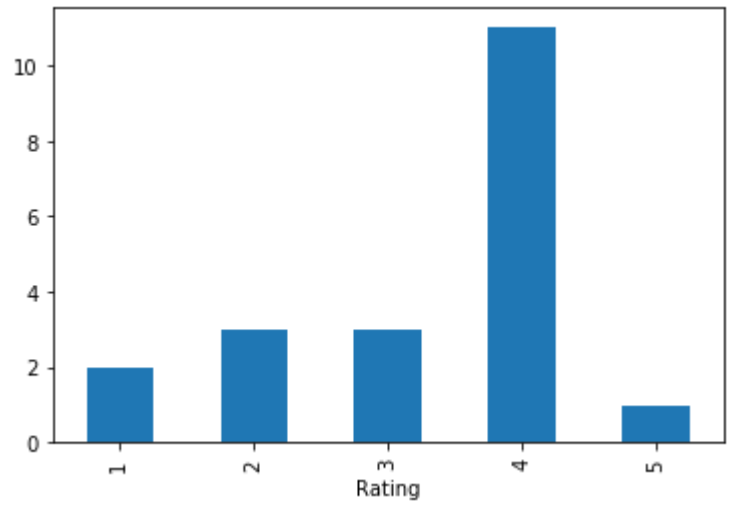
In [72]:

```
# • Find the rating for a particular user of user id = 2696
print(finalDF[finalDF.UserID == 2696].groupby('Rating')['MovieID'].count())
finalDF[finalDF.UserID == 2696].groupby('Rating')['MovieID'].count().plot(kind='bar
```

```
Rating
1     2
2     3
3     3
4    11
5     1
Name: MovieID, dtype: int64
```

Out[72]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x1a414a2860>
```



In [73]:

```
#ML Part
mlData = finalDF.head(500)
mlData.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 500 entries, 0 to 499
Data columns (total 10 columns):
MovieID       500 non-null int64
Title         500 non-null object
Genres        500 non-null object
UserID        500 non-null int64
Rating        500 non-null int64
Timestamp     500 non-null int64
Gender        500 non-null object
Age           500 non-null int64
Occupation    500 non-null int64
Zip-code      500 non-null object
dtypes: int64(6), object(4)
memory usage: 43.0+ KB
```

In [74]:

```
features = mlData.iloc[:,[0,7,8]].values
label = mlData.iloc[:,4].values
```

In [75]:

```
# Multiclass Classification
# K-NN
#Create Train Test Split

from sklearn.neighbors import KNeighborsClassifier
from sklearn.model_selection import train_test_split

for i in range(1,501):
    X_train,X_test,y_train,y_test = train_test_split(features,
                                                     label,
                                                     test_size = 0.2,
                                                     random_state=i)

    model = KNeighborsClassifier(n_neighbors=17)
    model.fit(X_train,y_train)
    training_score = model.score(X_train,y_train)
    testing_score = model.score(X_test,y_test)

    #Only Generalized model will be outputted
    if testing_score > training_score:
        print("Training Score {} Testing Score {} for Random State {}".format(train
```

```
Training Score 0.405 Testing Score 0.42 for Random State 82
Training Score 0.4025 Testing Score 0.42 for Random State 104
Training Score 0.4225 Testing Score 0.45 for Random State 145
Training Score 0.41 Testing Score 0.43 for Random State 158
Training Score 0.415 Testing Score 0.42 for Random State 271
Training Score 0.395 Testing Score 0.41 for Random State 283
Training Score 0.405 Testing Score 0.41 for Random State 291
Training Score 0.3825 Testing Score 0.43 for Random State 460
```

In [84]:

```
#Create final model based on the discovered k value
#Identify which k value gives generalized

X_train,X_test,y_train,y_test = train_test_split(features,
                                                 label,
                                                 test_size = 0.2,
                                                 random_state=145)

finalModel = KNeighborsClassifier(n_neighbors=17)
finalModel.fit(X_train,y_train)
```

Out[84]:

```
KNeighborsClassifier(algorithm='auto', leaf_size=30, metric='minkowsk
i',
           metric_params=None, n_jobs=None, n_neighbors=17, p=2,
           weights='uniform')
```

In [85]:

```
#Training Score Score
finalModel.score(X_train,y_train)
```

Out[85]:

```
0.4225
```

In [86]:

```
#Test Score
finalModel.score(X_test,y_test)
```

Out[86]:

```
0.45
```

In [87]:

```
#Model Deployment
import pickle
pickle.dump(finalModel, open("MovieLens.model" , "wb"))
```

In [ ]:

```

```