Data acquisition

In [1]:

```
# library for importing datasets

import pandas as pd
```

In [2]:

```
# movies dataset

movies_data = pd.read_table(r"C:\Users\PKN\Data_Science\DS_w_Python\Final Projects\Proj
```

```
C:\Users\PKN\anaconda3\lib\site-packages\ipykernel_launcher.py:3: ParserWarning: Falling
back to the 'python' engine because the 'c' engine does not support regex separators (se
parators > 1 char and different from '\s+' are interpreted as regex); you can avoid this
warning by specifying engine='python'.
  This is separate from the ipykernel package so we can avoid doing imports until
```

In [3]:

```
movies_data.shape
```

Out[3]:

```
(3883, 3)
```

In [4]:

```
movies_data.head()
```

Out[4]:

	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 [5]:

```
# ratings dataset

ratings_data = pd.read_table(r"C:\Users\PKN\Data_Science\DS_w_Python\Final Projects\Pro
```

```
C:\Users\PKN\anaconda3\lib\site-packages\ipykernel_launcher.py:3: ParserWarning: Falling
back to the 'python' engine because the 'c' engine does not support regex separators (se
parators > 1 char and different from '\s+' are interpreted as regex); you can avoid this
warning by specifying engine='python'.
  This is separate from the ipykernel package so we can avoid doing imports until
```

In [6]:

```
ratings_data.shape
```

Out[6]:

```
(1000209, 4)
```

In [7]:

```
ratings_data.head()
```

Out[7]:

	UserID	MovieID	Ratings	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 [8]:

```
# ratings dataset

users_data = pd.read_table(r"C:\Users\PKN\Data_Science\DS_w_Python\Final Projects\Proje
```

```
C:\Users\PKN\anaconda3\lib\site-packages\ipykernel_launcher.py:3: ParserWarning: Falling
back to the 'python' engine because the 'c' engine does not support regex separators (se
parators > 1 char and different from '\s+' are interpreted as regex); you can avoid this
warning by specifying engine='python'.
  This is separate from the ipykernel package so we can avoid doing imports until
```

In [9]:

```
users_data.shape
```

Out[9]:

```
(6040, 5)
```

In [10]:

```
users_data.head()
```

Out[10]:

	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

Creating a new Master Dataset by merging the previous 3 datasets

In [11]:

```
movielens = movies_data.merge(ratings_data, on = 'MovieID', how = 'inner').merge(users_
```

In [12]:

```
movielens.shape
```

Out[12]:

```
(1000209, 10)
```

In [13]:

```
movielens.head()
```

Out[13]:

	MovieID	Title	Genres	UserID	Ratings	TimeStamp	Gender	Age

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

Exploratory Data Analysis (EDA)

Visualize user age distribution

In [14]:

```python
# Users with Different Age Groups

movielens['Age'].value_counts()
```

Out[14]:

```
25    395556
35    199003
18    183536
45     83633
50     72490
56     38780
1      27211
Name: Age, dtype: int64
```

In [15]:

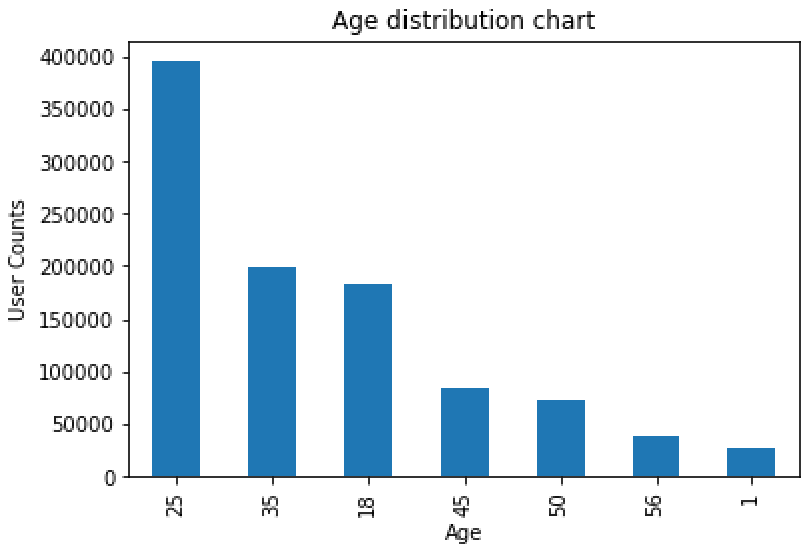
```python
# Libraries for ploting

import matplotlib.pyplot as plt
%matplotlib inline
```

In [16]:

```python
movielens['Age'].value_counts().plot(kind='bar')
plt.title('Age distribution chart')
plt.xlabel('Age')
plt.ylabel('User Counts')
```

Out[16]:

```
Text(0, 0.5, 'User Counts')
```



In [17]:

```
# --------------------EXTRA------------------------
# --------Another style of plotting-----------
# libraries for ploting

import seaborn as sns
```

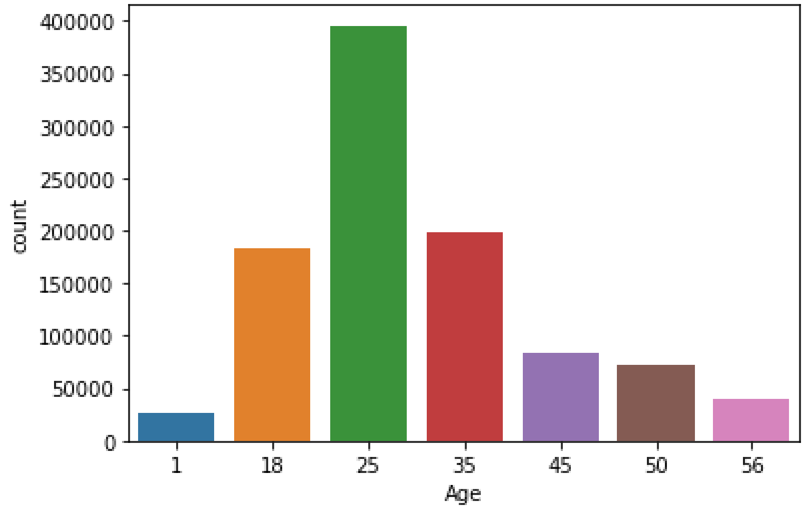
In [18]:

```
# --------------------EXTRA------------------------

sns.countplot(movielens['Age'])
```

```
C:\Users\PKN\anaconda3\lib\site-packages\seaborn\_decorators.py:43: FutureWarning: Pass
the following variable as a keyword arg: x. From version 0.12, the only valid positional
argument will be `data`, and passing other arguments without an explicit keyword will re
sult in an error or misinterpretation.
  FutureWarning
```

Out[18]:

```
<AxesSubplot:xlabel='Age', ylabel='count'>
```



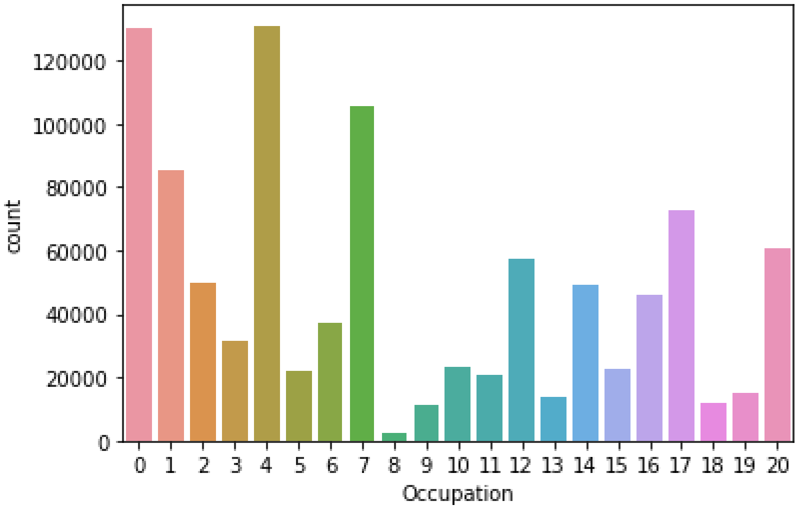
In [19]:

```
# --------------------EXTRA------------------------

sns.countplot(movielens['Occupation'])
```

```
C:\Users\PKN\anaconda3\lib\site-packages\seaborn\_decorators.py:43: FutureWarning: Pass
```

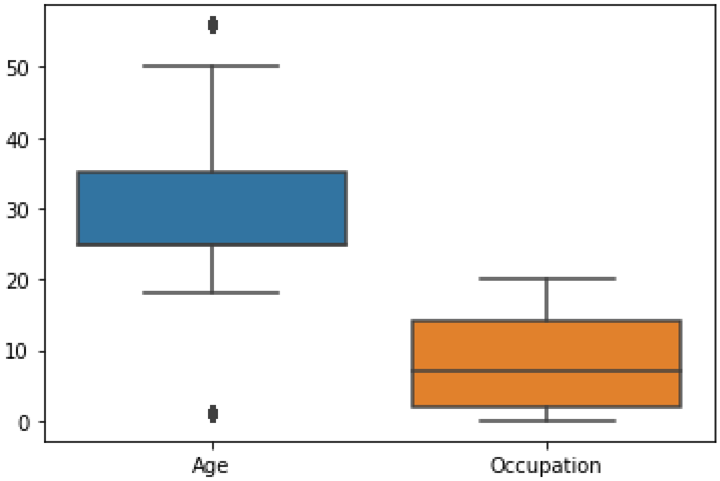
```
the following variable as a keyword arg: x. From version 0.12, the only valid positional
argument will be `data`, and passing other arguments without an explicit keyword will re
sult in an error or misinterpretation.
  FutureWarning
```

Out[19]:
```
<AxesSubplot:xlabel='Occupation', ylabel='count'>
```



In [20]:
```python
# --------------------EXTRA-------------------------
# checking correletion between 'Age' and 'Occupation'

slice_movielens = pd.DataFrame(movielens[['Age','Occupation']])
sns.boxplot(data = slice_movielens)
```

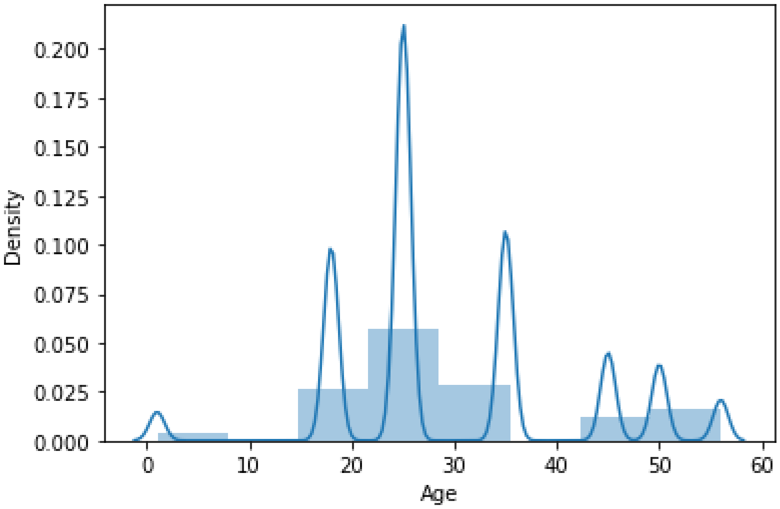
Out[20]:
```
<AxesSubplot:>
```



In [21]:
```python
# --------------------EXTRA-------------------------

sns.distplot(movielens['Age'], bins=8)
```

```
C:\Users\PKN\anaconda3\lib\site-packages\seaborn\distributions.py:2557: FutureWarning: `
distplot` is a deprecated function and will be removed in a future version. Please adapt
your code to use either `displot` (a figure-level function with similar flexibility) or
`histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```

Out[21]:
```
<AxesSubplot:xlabel='Age', ylabel='Density'>
```



Viusalize overall rating by users

In [22]:

```
# Check 'Ratings' Distribution

movielens.groupby('Ratings', axis=0).UserID.count()
```

Out[22]:

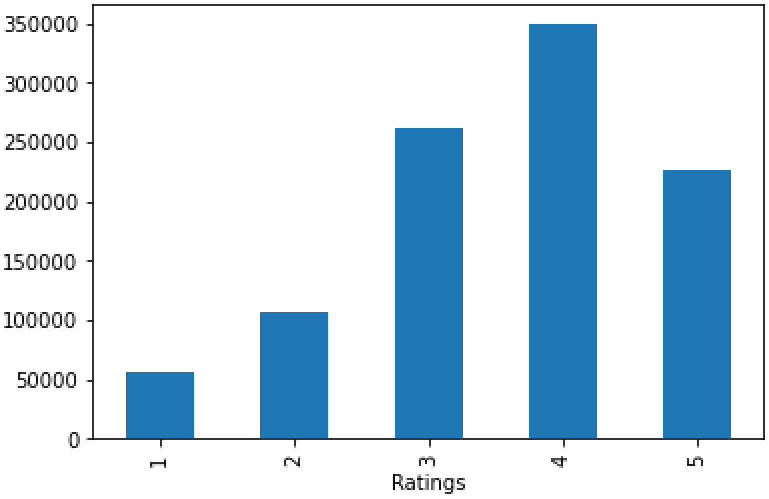
```
Ratings
1     56174
2    107557
3    261197
4    348971
5    226310
Name: UserID, dtype: int64
```

In [23]:

```
# Visualize

movielens.groupby('Ratings', axis=0).UserID.count().plot(kind='bar')
```

Out[23]:

```
<AxesSubplot:xlabel='Ratings'>
```

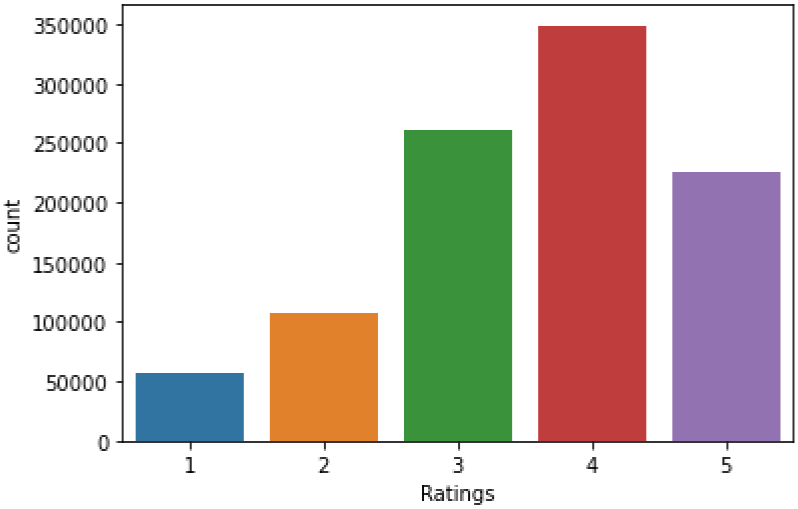


In [24]:

```
# -------------------EXTRA-----------------------

sns.countplot(movielens['Ratings'])
```

```
C:\Users\PKN\anaconda3\lib\site-packages\seaborn\_decorators.py:43: FutureWarning: Pass
the following variable as a keyword arg: x. From version 0.12, the only valid positional
argument will be `data`, and passing other arguments without an explicit keyword will re
sult in an error or misinterpretation.
  FutureWarning
```

Out[24]:
```
<AxesSubplot:xlabel='Ratings', ylabel='count'>
```



visualize the user rating of the movie 'Toy Story'

In [25]:
```python
toystoryRating = movielens[movielens['Title'].str.contains('Toy Story') == True]
toystoryRating
```

Out[25]:

	MovieID	Title	Genres	UserID	Ratings	TimeStamp	Gender	Age	Occu
0	1	Toy Story (1995)	Animation|Children's|Comedy	1	5	978824268	F	1	
50	3114	Toy Story 2 (1999)	Animation|Children's|Comedy	1	4	978302174	F	1	
53	1	Toy Story (1995)	Animation|Children's|Comedy	6	4	978237008	F	50	
124	1	Toy Story (1995)	Animation|Children's|Comedy	8	4	978233496	M	25	
263	1	Toy Story (1995)	Animation|Children's|Comedy	9	5	978225952	M	25	
...	...	...	...	...	...	...	...	...	
998988	3114	Toy Story 2 (1999)	Animation|Children's|Comedy	3023	4	970471948	F	25	

	MovieID	Title	Genres	UserID	Ratings	TimeStamp	Gender	Age	Occu
999027	3114	Toy Story 2 (1999)	Animation|Children's|Comedy	5800	5	958015250	M	35	
999486	3114	Toy Story 2 (1999)	Animation|Children's|Comedy	2189	4	974607816	M	1	
999869	3114	Toy Story 2 (1999)	Animation|Children's|Comedy	159	4	989966944	F	45	
1000192	3114	Toy Story 2 (1999)	Animation|Children's|Comedy	5727	5	958492554	M	25	

3662 rows × 10 columns

In [26]:

```
toystoryRating.groupby(["Title","Ratings"]).size()
```

Out[26]:

```
Title              Ratings
Toy Story (1995)   1           16
                   2           61
                   3          345
                   4          835
                   5          820
Toy Story 2 (1999) 1           25
                   2           44
                   3          214
                   4          578
                   5          724
dtype: int64
```

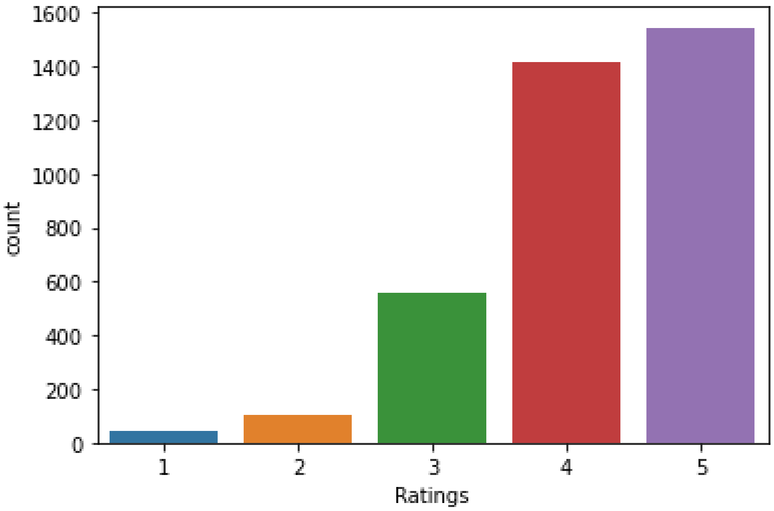
In [27]:

```
# Visualize

sns.countplot(toystoryRating['Ratings'])
```

```
C:\Users\PKN\anaconda3\lib\site-packages\seaborn\_decorators.py:43: FutureWarning: Pass
the following variable as a keyword arg: x. From version 0.12, the only valid positional
argument will be `data`, and passing other arguments without an explicit keyword will re
sult in an error or misinterpretation.
  FutureWarning
```

Out[27]:

```
<AxesSubplot:xlabel='Ratings', ylabel='count'>
```



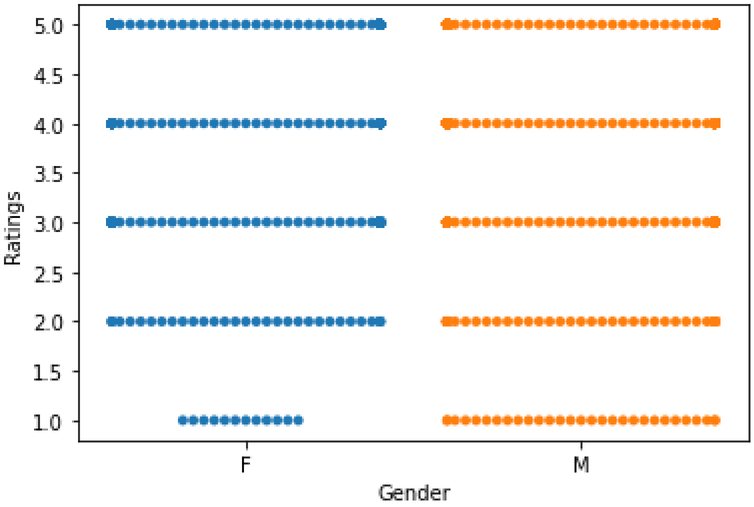
In [28]:

```
sns.swarmplot(x = 'Gender', y = 'Ratings', data = toystoryRating)
```

```
C:\Users\PKN\anaconda3\lib\site-packages\seaborn\categorical.py:1296: UserWarning: 89.1%
of the points cannot be placed; you may want to decrease the size of the markers or use
stripplot.
  warnings.warn(msg, UserWarning)
C:\Users\PKN\anaconda3\lib\site-packages\seaborn\categorical.py:1296: UserWarning: 95.3%
of the points cannot be placed; you may want to decrease the size of the markers or use
stripplot.
  warnings.warn(msg, UserWarning)
```

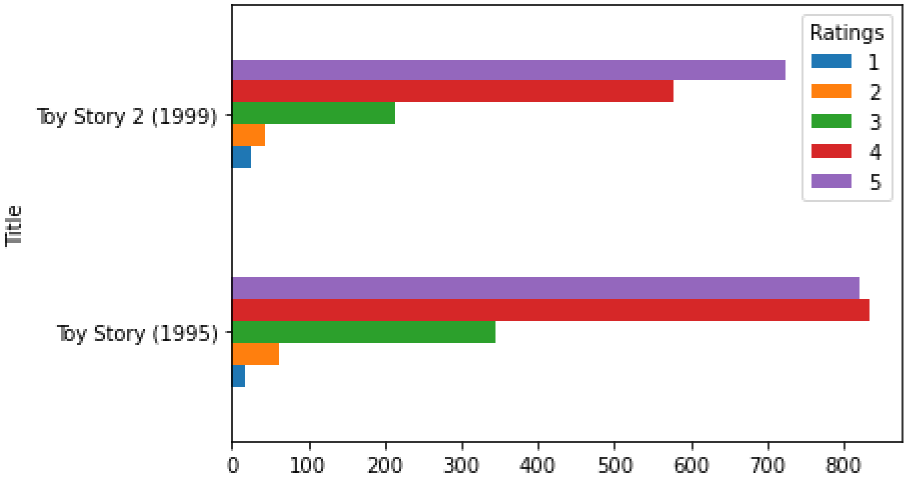
Out[28]:

```
<AxesSubplot:xlabel='Gender', ylabel='Ratings'>
```



In [29]:

```
toystoryRating.groupby(["Title","Ratings"]).size().unstack().plot(kind='barh',stacked=F
plt.show()
```



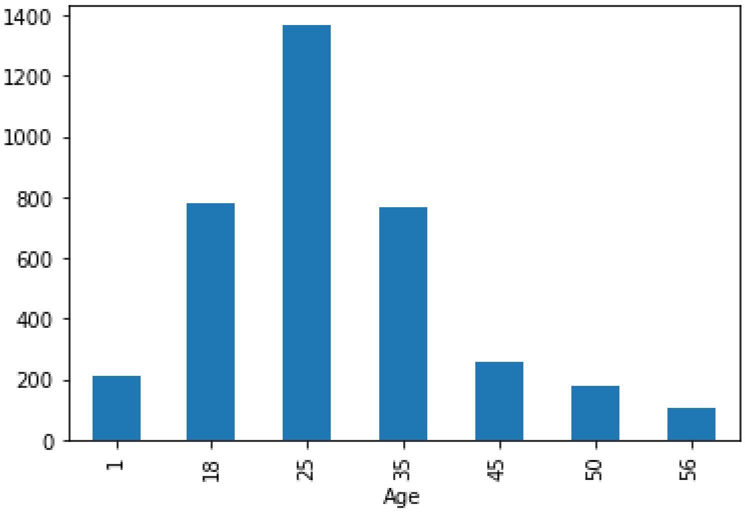
visualize the viewership of the movie "Toy Story" by age group

In [30]:

```
toystoryRating.groupby('Age', axis = 0).Ratings.count().plot(kind = 'bar')
```

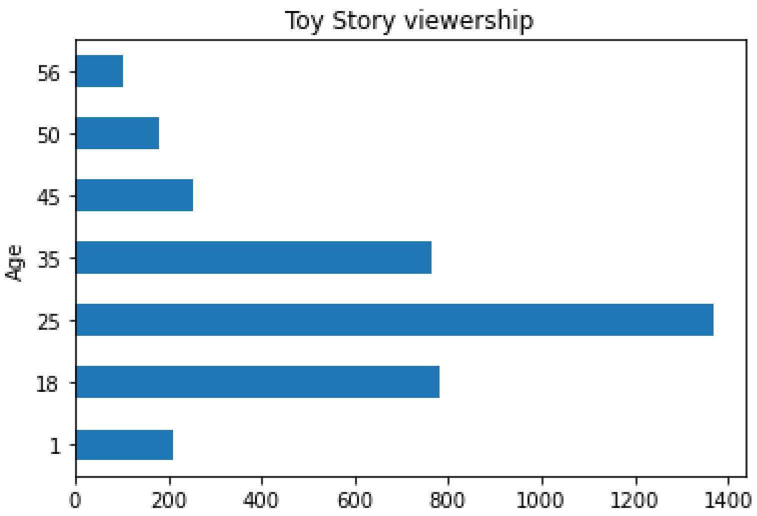
Out[30]:

```
<AxesSubplot:xlabel='Age'>
```



In [31]:

```
toystoryRating.groupby(["Age"]).size().plot(kind='barh')
plt.title('Toy Story viewership')
plt.show()
```



visualize the top 25 movies by viewership

In [32]:

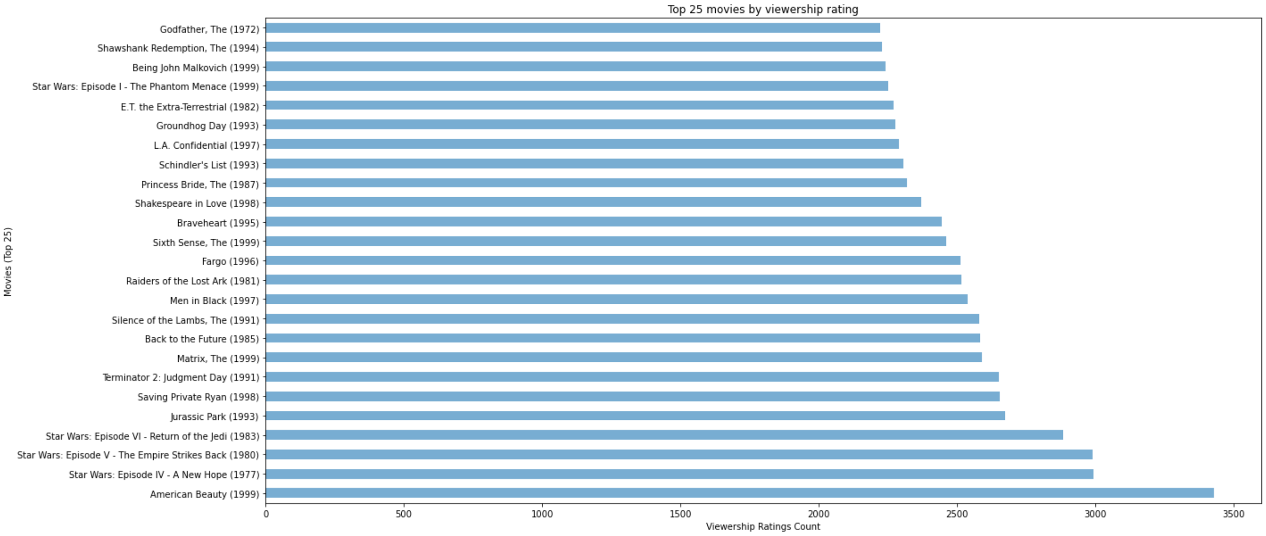
```
top25Movies = movielens.groupby('Title').size().sort_values(ascending=False)[:25]
top25Movies
```

Out[32]:

```
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
dtype: int64
```

In [33]:

```
top25Movies.plot(kind='barh',alpha=0.6,figsize=(20,10))
plt.xlabel("Viewership Ratings Count")
plt.ylabel("Movies (Top 25)")
plt.title("Top 25 movies by viewership rating")
plt.show()
```



rating for a particular user of user id = 2696

```
In [34]:  id2696Rating = movielens[movielens.UserID == 2696]
          id2696Rating
```

Out[34]:

	MovieID	Title	Genres	UserID	Ratings	TimeStamp	Gender	Age
991035	350	Client, The (1994)	Drama|Mystery|Thriller	2696	3	973308886	M	25
991036	800	Lone Star (1996)	Drama|Mystery	2696	5	973308842	M	25
991037	1092	Basic Instinct (1992)	Mystery|Thriller	2696	4	973308886	M	25
991038	1097	E.T. the Extra-Terrestrial (1982)	Children's|Drama|Fantasy|Sci-Fi	2696	3	973308690	M	25
991039	1258	Shining, The (1980)	Horror	2696	4	973308710	M	25
991040	1270	Back to the Future (1985)	Comedy|Sci-Fi	2696	2	973308676	M	25
991041	1589	Cop Land (1997)	Crime|Drama|Mystery	2696	3	973308865	M	25
991042	1617	L.A. Confidential (1997)	Crime|Film-Noir|Mystery|Thriller	2696	4	973308842	M	25
991043	1625	Game, The (1997)	Mystery|Thriller	2696	4	973308842	M	25

	MovieID	Title	Genres	UserID	Ratings	TimeStamp	Gender	Age
991044	1644	I Know What You Did Last Summer (1997)	Horror|Mystery|Thriller	2696	2	973308920	M	25
991045	1645	Devil's Advocate, The (1997)	Crime|Horror|Mystery|Thriller	2696	4	973308904	M	25
991046	1711	Midnight in the Garden of Good and Evil (1997)	Comedy|Crime|Drama|Mystery	2696	4	973308904	M	25
991047	1783	Palmetto (1998)	Film-Noir|Mystery|Thriller	2696	4	973308865	M	25
991048	1805	Wild Things (1998)	Crime|Drama|Mystery|Thriller	2696	4	973308886	M	25
991049	1892	Perfect Murder, A (1998)	Mystery|Thriller	2696	4	973308904	M	25
991050	2338	I Still Know What You Did Last Summer (1998)	Horror|Mystery|Thriller	2696	2	973308920	M	25
991051	2389	Psycho (1998)	Crime|Horror|Thriller	2696	4	973308710	M	25
991052	2713	Lake Placid (1999)	Horror|Thriller	2696	1	973308710	M	25
991053	3176	Talented Mr. Ripley, The (1999)	Drama|Mystery|Thriller	2696	4	973308865	M	25
991054	3386	JFK (1991)	Drama|Mystery	2696	1	973308842	M	25

Visualize the rating data by user of user if = 2696

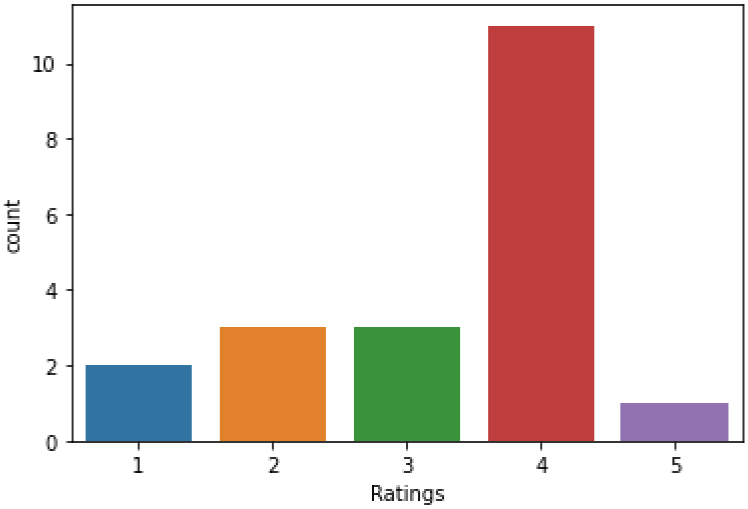
In [35]:

```
sns.countplot(id2696Rating['Ratings'])
```

```
C:\Users\PKN\anaconda3\lib\site-packages\seaborn\_decorators.py:43: FutureWarning: Pass
the following variable as a keyword arg: x. From version 0.12, the only valid positional
argument will be `data`, and passing other arguments without an explicit keyword will re
sult in an error or misinterpretation.
  FutureWarning
```

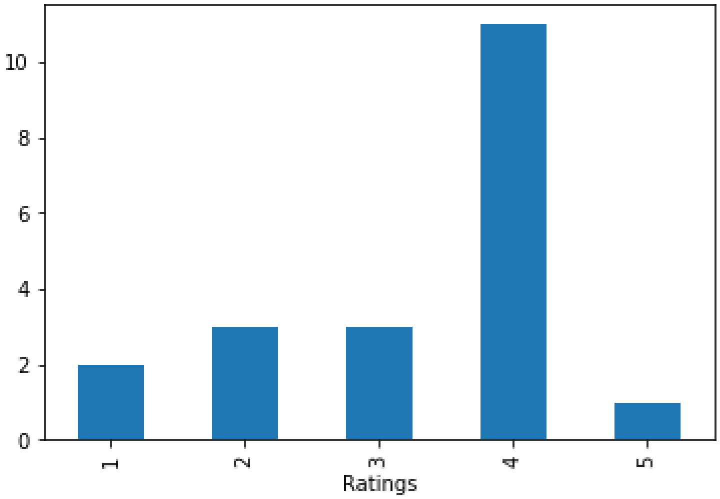
Out[35]:

```
<AxesSubplot:xlabel='Ratings', ylabel='count'>
```



In [36]:
```
movielens[movielens.UserID == 2696].groupby('Ratings').Ratings.count().plot(kind='bar')
```

Out[36]:
```
<AxesSubplot:xlabel='Ratings'>
```



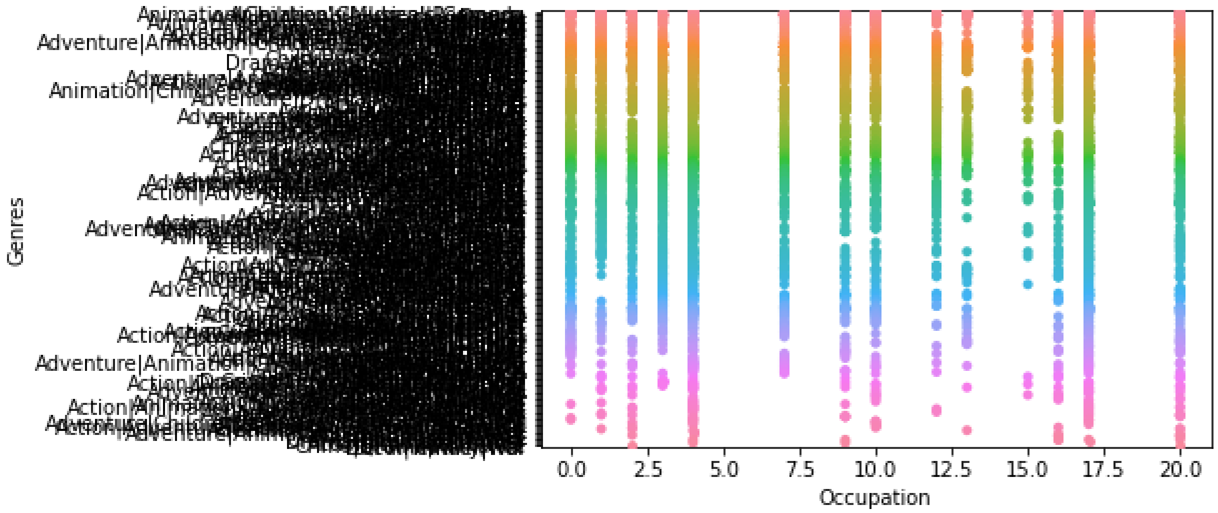
In [37]:
```
sliceData = pd.DataFrame(movielens.iloc[0:10000, :])
```

In [38]:
```
sliceData.columns
```

Out[38]:
```
Index(['MovieID', 'Title', 'Genres', 'UserID', 'Ratings', 'TimeStamp',
       'Gender', 'Age', 'Occupation', 'Zip-Code'],
      dtype='object')
```

In [39]:
```
sns.stripplot(y = 'Genres', x = 'Occupation', data = sliceData)
```

Out[39]:
```
<AxesSubplot:xlabel='Occupation', ylabel='Genres'>
```



Perform Machine Learning

first 500 extracted records on MovieID, Age, Occupation with Rating as label

In [40]:
```
movielens.columns
```

Out[40]:
```
Index(['MovieID', 'Title', 'Genres', 'UserID', 'Ratings', 'TimeStamp',
       'Gender', 'Age', 'Occupation', 'Zip-Code'],
      dtype='object')
```

In [41]:
```
first500 = movielens.iloc[:500, [0,7,8,4]]
```

In [42]:
```
first500.shape
```

Out[42]:
```
(500, 4)
```

In [43]:
```
first500.head()
```

Out[43]:

	MovieID	Age	Occupation	Ratings
0	1	1	10	5
1	48	1	10	5
2	150	1	10	5
3	260	1	10	4
4	527	1	10	5

In [44]:
```
fetaures = first500.iloc[:,[0,1,2]].values
label = first500.iloc[:,-1].values
```

Create train and test data

In [45]:

```
#import library for ML model

from sklearn.model_selection import train_test_split
```

In [46]:

```
x_train, x_test, y_train, y_test = train_test_split(fetaures, label, test_size=0.2, ran
```

Let's create the ML Model for prediction

In [47]:

```
# import KNN model library

from sklearn.neighbors import KNeighborsClassifier
```

In [48]:

```
knnmodel = KNeighborsClassifier(n_neighbors = 7)
knnmodel.fit(x_train, y_train)
```

Out[48]:

```
KNeighborsClassifier(n_neighbors=7)
```

In [49]:

```
print('Accuracy on training data:', knnmodel.score(x_train, y_train))
```

```
Accuracy on training data: 0.5125
```

In [50]:

```
print('Accuracy on test data:', knnmodel.score(x_test, y_test))
```

```
Accuracy on test data: 0.35
```

*The accuracy score is **very bad** because we are feeding only 500 data points*

In [51]:

```
y_pred = knnmodel.predict(x_test)
y_pred
```

Out[51]:

```
array([4, 4, 4, 5, 4, 5, 4, 4, 3, 4, 4, 4, 4, 4, 5, 5, 3, 4, 3, 3, 4, 4,
       4, 3, 4, 4, 4, 4, 3, 3, 4, 3, 4, 4, 5, 4, 5, 5, 4, 3, 4, 4, 4, 3,
       4, 4, 4, 4, 5, 3, 4, 4, 5, 4, 4, 4, 4, 5, 4, 4, 4, 3, 4, 5, 4, 3,
       4, 3, 5, 4, 3, 5, 3, 4, 5, 4, 4, 3, 4, 5, 4, 3, 4, 3, 3, 4, 5, 3,
       3, 4, 3, 4, 3, 4, 5, 4, 5, 5, 4, 4], dtype=int64)
```

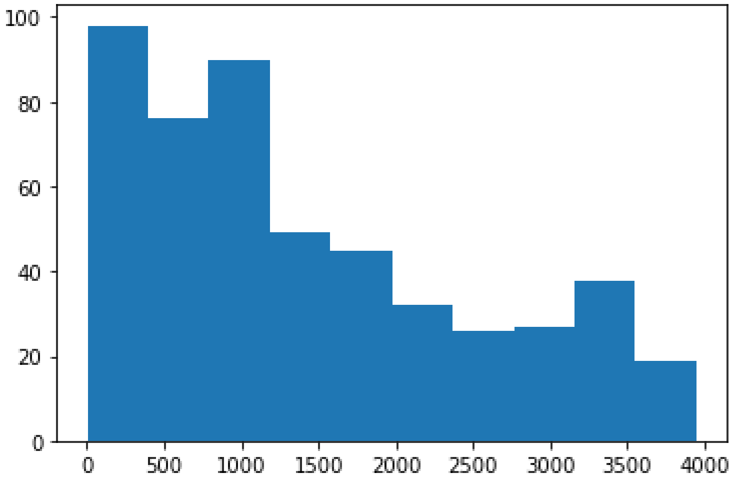
MovieID Plot

In [52]:

```
plt.hist(first500.MovieID)
```

Out[52]:

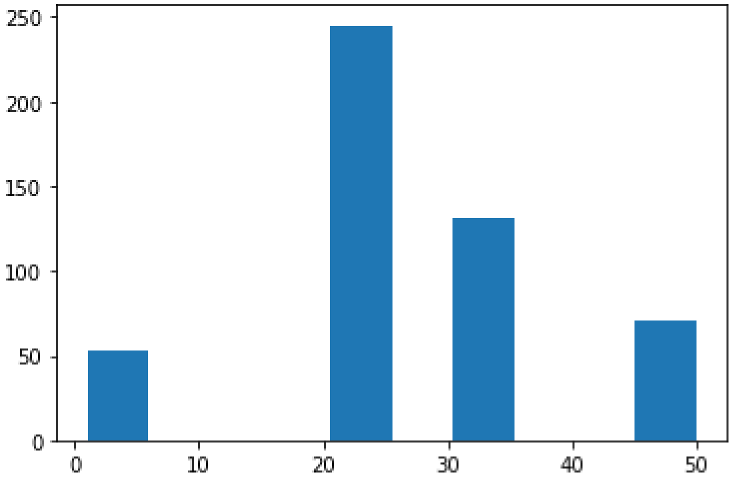
```
(array([98., 76., 90., 49., 45., 32., 26., 27., 38., 19.]),
 array([1.0000e+00, 3.9570e+02, 7.9040e+02, 1.1851e+03, 1.5798e+03,
        1.9745e+03, 2.3692e+03, 2.7639e+03, 3.1586e+03, 3.5533e+03,
        3.9480e+03]),
 <BarContainer object of 10 artists>)
```



Age Plot

```
In [53]: plt.hist(first500.Age)
```

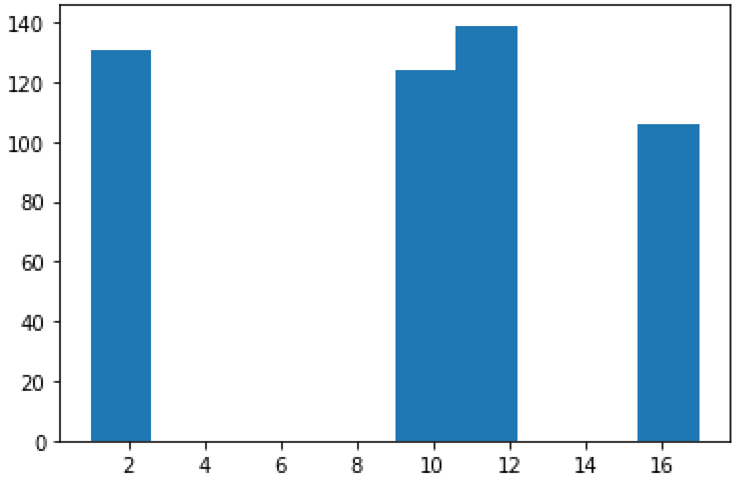
```
Out[53]: (array([ 53.,   0.,   0.,   0., 245.,   0., 131.,   0.,   0.,  71.]),
          array([ 1. ,  5.9, 10.8, 15.7, 20.6, 25.5, 30.4, 35.3, 40.2, 45.1, 50. ]),
          <BarContainer object of 10 artists>)
```



Occupation Plot

```
In [54]: plt.hist(first500.Occupation)
```

```
Out[54]: (array([131.,   0.,   0.,   0.,   0., 124., 139.,   0.,   0., 106.]),
          array([ 1. ,  2.6,  4.2,  5.8,  7.4,  9. , 10.6, 12.2, 13.8, 15.4, 17. ]),
          <BarContainer object of 10 artists>)
```



In [55]:

```
# import SVC model library

from sklearn.svm import SVC
```

In [56]:

```
svcModel = SVC(gamma='auto')
svcModel.fit(x_train, y_train)
```

Out[56]:

```
SVC(gamma='auto')
```

In [57]:

```
print('Accuracy on training data:', svcModel.score(x_train, y_train))
```

```
Accuracy on training data: 0.9775
```

In [58]:

```
print('Accuracy on test data:', svcModel.score(x_test, y_test))
```

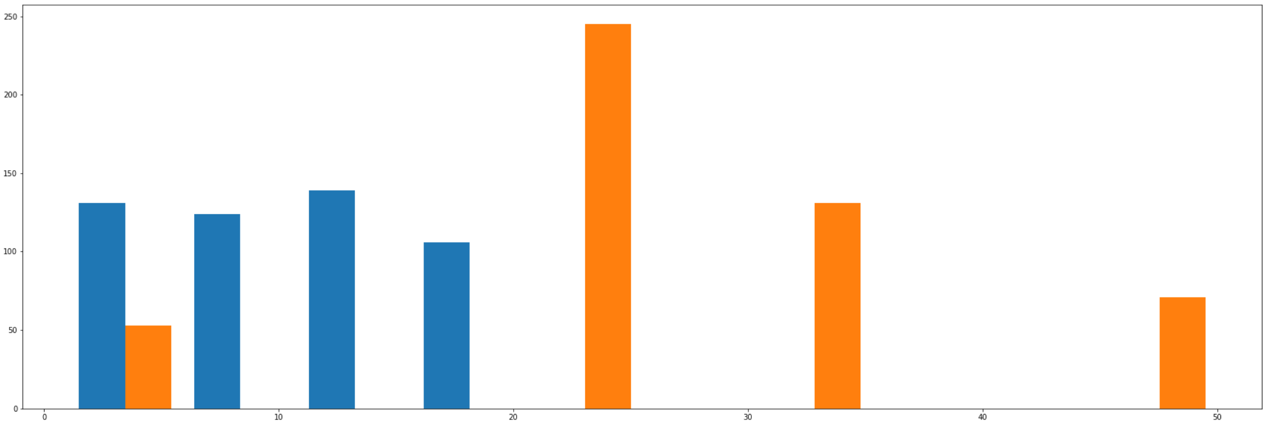
```
Accuracy on test data: 0.37
```

In [59]:

```
# Visualize

plt.figure( figsize=(30,10))
#plt.xscale('log')
plt.hist([first500.Occupation,first500.Age], bins=10, label=['Occupation','Age',])
#plt.hist(combinedData.Age)
```

Out[59]:

```
(array([[131., 124., 139., 106.,   0.,   0.,   0.,   0.,   0.,   0.],
        [ 53.,   0.,   0.,   0., 245.,   0., 131.,   0.,   0.,  71.]]),
 array([ 1. ,  5.9, 10.8, 15.7, 20.6, 25.5, 30.4, 35.3, 40.2, 45.1, 50. ]),
 <a list of 2 BarContainer objects>)
```



In [ ]: