ds304-labassignment3-22bds066

August 23, 2024

[ ]:
```
import numpy as np
```

[ ]:
```
from google.colab import drive
drive.mount('/content/drive')
```

```
Mounted at /content/drive
```

[ ]:
```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

ratings_data = pd.read_csv('/content/drive/MyDrive/Classroom/DS304␣
 ↪Visualization (Aug - Nov 2024) DSAI/ml-100k/u.data', sep='\t',␣
 ↪names=['user_id', 'item_id', 'rating', 'timestamp'])
items_data = pd.read_csv('/content/drive/MyDrive/Classroom/DS304 Visualization␣
 ↪(Aug - Nov 2024) DSAI/ml-100k/u.item', sep='|', encoding='ISO-8859-1',␣
 ↪names=['movie_id', 'movie_title', 'release_date', 'video_release_date',
              'IMDb_URL', 'unknown', 'Action', 'Adventure', 'Animation',
              "Children's", 'Comedy', 'Crime', 'Documentary', 'Drama',␣
 ↪'Fantasy',
              'Film-Noir', 'Horror', 'Musical', 'Mystery', 'Romance', 'Sci-Fi',
              'Thriller', 'War', 'Western'])
user_data = pd.read_csv('/content/drive/MyDrive/Classroom/DS304 Visualization␣
 ↪(Aug - Nov 2024) DSAI/ml-100k/u.user', sep='|', names=['user_id', 'age',␣
 ↪'gender', 'occupation', 'zip code'])
```

[ ]:
```
ratings_data.head()
```

[ ]:

	user_id	item_id	rating	timestamp
0	196	242	3	881250949
1	186	302	3	891717742
2	22	377	1	878887116
3	244	51	2	880606923
4	166	346	1	886397596

[ ]:
```
items_data.head()
```

[ ]:
```
   movie_id        movie_title release_date  video_release_date  \
0         1   Toy Story (1995)  01-Jan-1995                 NaN
1         2   GoldenEye (1995)  01-Jan-1995                 NaN
2         3  Four Rooms (1995)  01-Jan-1995                 NaN
3         4  Get Shorty (1995)  01-Jan-1995                 NaN
4         5     Copycat (1995)  01-Jan-1995                 NaN

                                            IMDb_URL  unknown  Action  \
0  http://us.imdb.com/M/title-exact?Toy%20Story%2…        0       0
1  http://us.imdb.com/M/title-exact?GoldenEye%20(…        0       1
2  http://us.imdb.com/M/title-exact?Four%20Rooms%…        0       0
3  http://us.imdb.com/M/title-exact?Get%20Shorty%…        0       1
4  http://us.imdb.com/M/title-exact?Copycat%20(1995)        0       0

   Adventure  Animation  Children's  …  Fantasy  Film-Noir  Horror  Musical  \
0          0          1           1  …        0          0       0        0
1          1          0           0  …        0          0       0        0
2          0          0           0  …        0          0       0        0
3          0          0           0  …        0          0       0        0
4          0          0           0  …        0          0       0        0

   Mystery  Romance  Sci-Fi  Thriller  War  Western
0        0        0       0         0    0        0
1        0        0       0         1    0        0
2        0        0       0         1    0        0
3        0        0       0         0    0        0
4        0        0       0         1    0        0

[5 rows x 24 columns]
```

[ ]:
```
user_data.head()
```

[ ]:
```
   user_id  age gender  occupation zip code
0        1   24      M  technician    85711
1        2   53      F       other    94043
2        3   23      M      writer    32067
3        4   24      M  technician    43537
4        5   33      F       other    15213
```

[ ]:
```
item_id_count = ratings_data['item_id'].nunique()
movie_id_count = items_data['movie_id'].nunique()

print("item_id count:", item_id_count)
print("movie_id count:", movie_id_count)
```

```
item_id count: 1682
movie_id count: 1682
```

[ ]:
```
merged_data = pd.merge(ratings_data, items_data, left_on='item_id',␣
↪right_on='movie_id', how='inner')
```

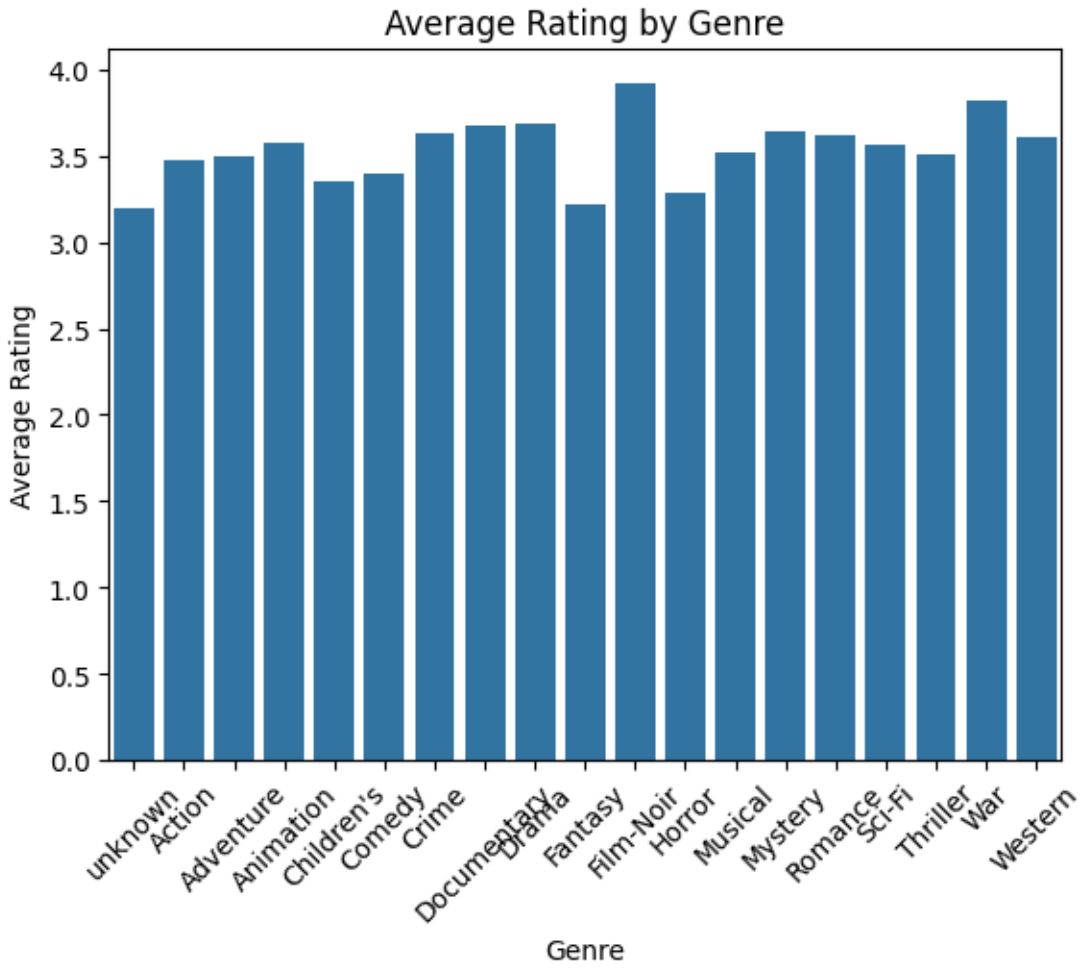
[ ]:
```
data = pd.merge(merged_data, user_data, on='user_id', how='inner')
```

[ ]:
```
data.head()
```

[ ]:
```
   user_id  item_id  rating  timestamp  movie_id  \
0      196      242       3  881250949       242
1      196      257       2  881251577       257
2      196      111       4  881251793       111
3      196       25       4  881251955        25
4      196      382       4  881251843       382

                                       movie_title release_date  \
0                                     Kolya (1996)  24-Jan-1997
1                                Men in Black (1997)  04-Jul-1997
2                Truth About Cats & Dogs, The (1996)  26-Apr-1996
3                                Birdcage, The (1996)  08-Mar-1996
4  Adventures of Priscilla, Queen of the Desert, …  01-Jan-1994

   video_release_date                                              IMDb_URL  \
0                 NaN    http://us.imdb.com/M/title-exact?Kolya%20(1996)
1                 NaN  http://us.imdb.com/M/title-exact?Men+in+Black+…
2                 NaN  http://us.imdb.com/M/title-exact?Truth%20About…
3                 NaN  http://us.imdb.com/M/title-exact?Birdcage,%20T…
4                 NaN  http://us.imdb.com/M/title-exact?Adventures%20…

   unknown  …  Romance  Sci-Fi  Thriller  War  Western  age  gender  \
0        0  …        0       0         0    0        0   49       M
1        0  …        0       1         0    0        0   49       M
2        0  …        1       0         0    0        0   49       M
3        0  …        0       0         0    0        0   49       M
4        0  …        0       0         0    0        0   49       M

   occupation  zip code                                genres
0      writer     55105                             [Comedy]
1      writer     55105  [Action, Adventure, Comedy, Sci-Fi]
2      writer     55105                   [Comedy, Romance]
3      writer     55105                             [Comedy]
4      writer     55105                     [Comedy, Drama]

[5 rows x 33 columns]
```

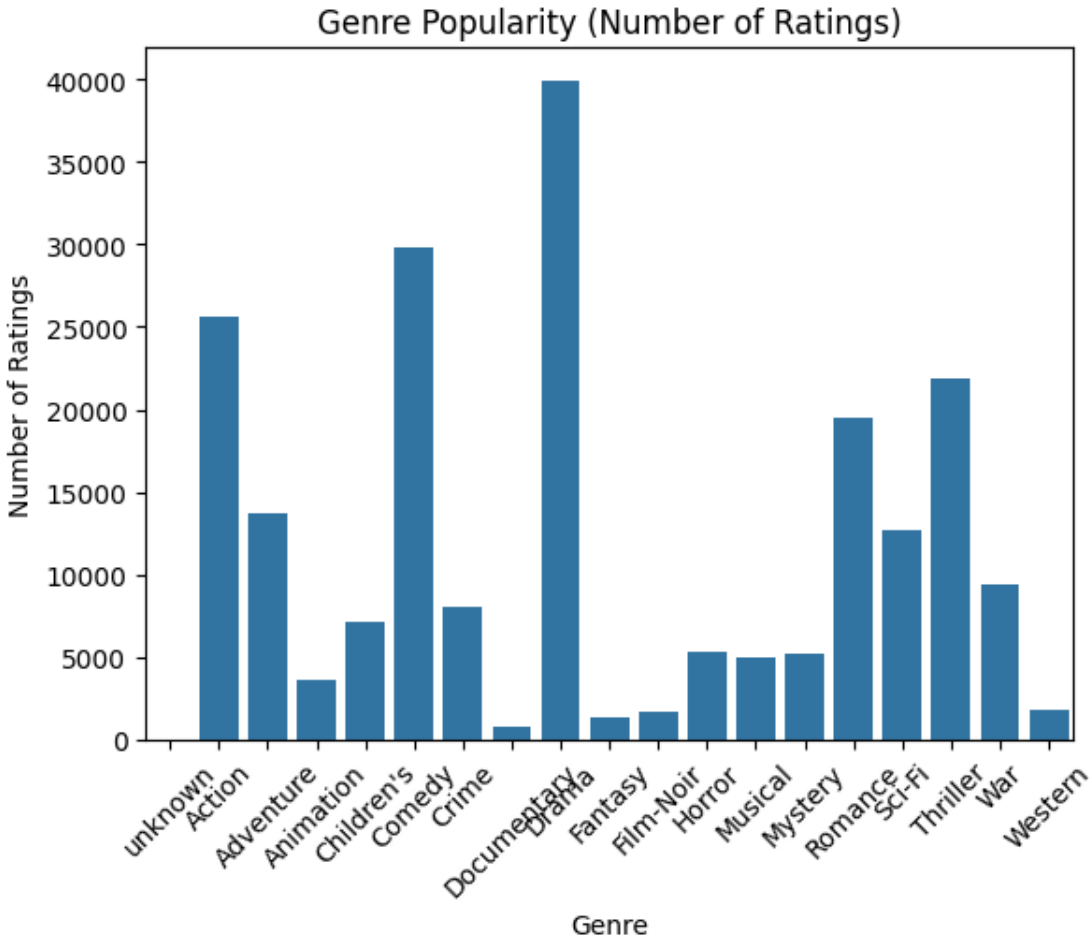
What is the average rating for each movie genre?

[ ]:
```
genre_cols = data.columns[9:28]
average_ratings = {}
for genre_col in genre_cols:
 genre_data = merged_data[merged_data[genre_col] == 1]
 average_rating = genre_data['rating'].mean()
 average_ratings[genre_col] = average_rating

sns.barplot(x=list(average_ratings.keys()), y=list(average_ratings.values()))
plt.title('Average Rating by Genre')
plt.xlabel('Genre')
plt.ylabel('Average Rating')
plt.xticks(rotation=45)
plt.show()
```



Which genres are the most popular based on the number of ratings received?

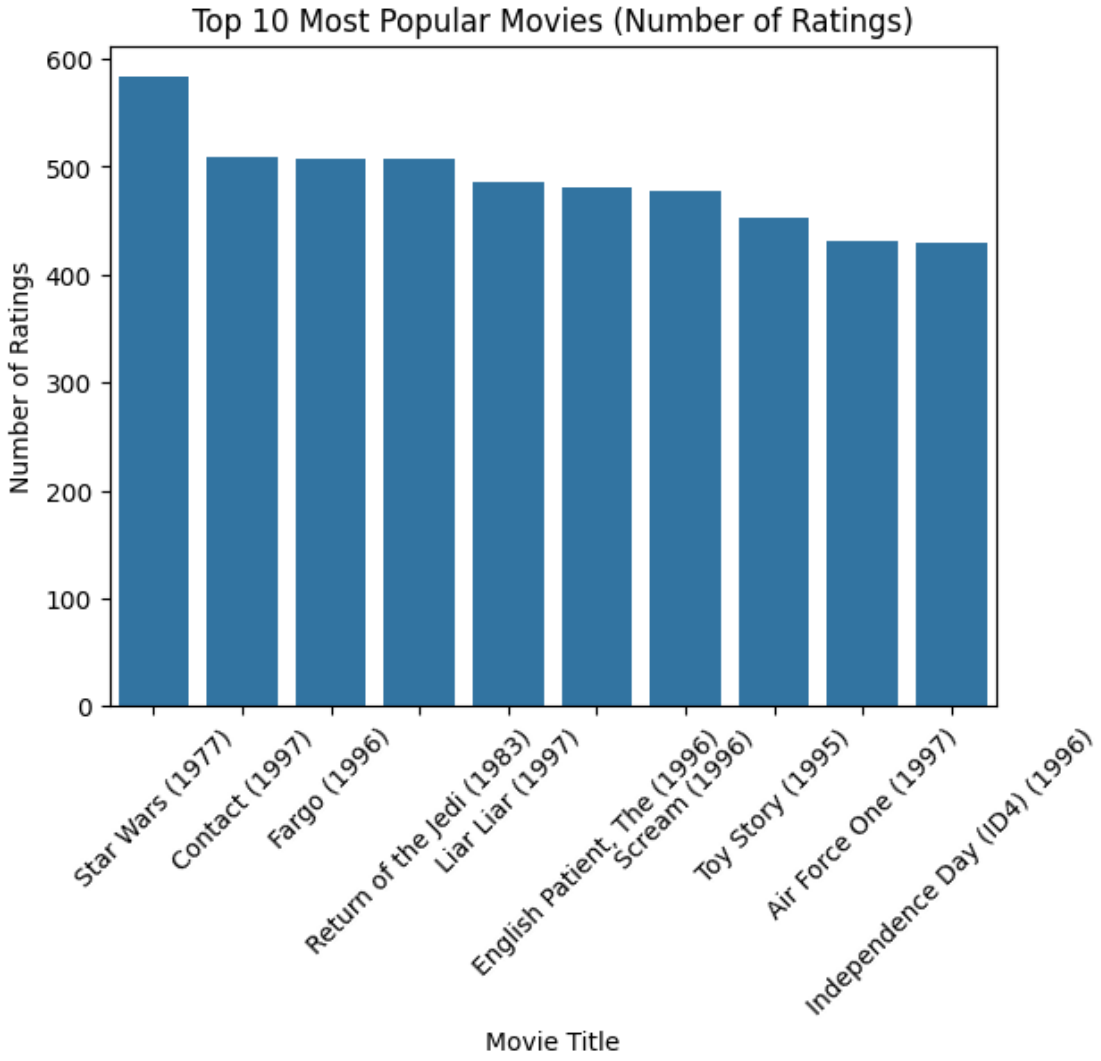
[ ]:
```
genre_counts = data[genre_cols].sum()

sns.barplot(x=genre_counts.index, y=genre_counts.values)
plt.title('Genre Popularity (Number of Ratings)')
plt.xlabel('Genre')
plt.ylabel('Number of Ratings')
plt.xticks(rotation=45)
plt.show()
```



Which movies (Top-10) have received the highest number of ratings?

[ ]:
```
movie_counts = data['movie_title'].value_counts()
top_10_movies = movie_counts.head(10)
sns.barplot(x=top_10_movies.index, y=top_10_movies.values)
plt.title('Top 10 Most Popular Movies (Number of Ratings)')
plt.xlabel('Movie Title')
plt.ylabel('Number of Ratings')
```

```
plt.xticks(rotation=45)
plt.show()
```



[ ]:
```
genre_columns = ['Action', 'Adventure', 'Animation', 'Children\'s', 'Comedy',␣
↪'Crime',
                 'Documentary', 'Drama', 'Fantasy', 'Film-Noir', 'Horror',␣
↪'Musical',
                 'Mystery', 'Romance', 'Sci-Fi', 'Thriller', 'War', 'Western']

def get_genres(row):
    return [genre for genre in genre_columns if row[genre] == 1]

data['genres'] = data[genre_columns].apply(get_genres, axis=1)
```

```
print(data[['movie_title', 'genres']].head())
```

```
                                        movie_title  \
0                                    Kolya (1996)
1                              Men in Black (1997)
2            Truth About Cats & Dogs, The (1996)
3                             Birdcage, The (1996)
4  Adventures of Priscilla, Queen of the Desert, …

                              genres
0                           [Comedy]
1  [Action, Adventure, Comedy, Sci-Fi]
2                  [Comedy, Romance]
3                           [Comedy]
4                    [Comedy, Drama]
```

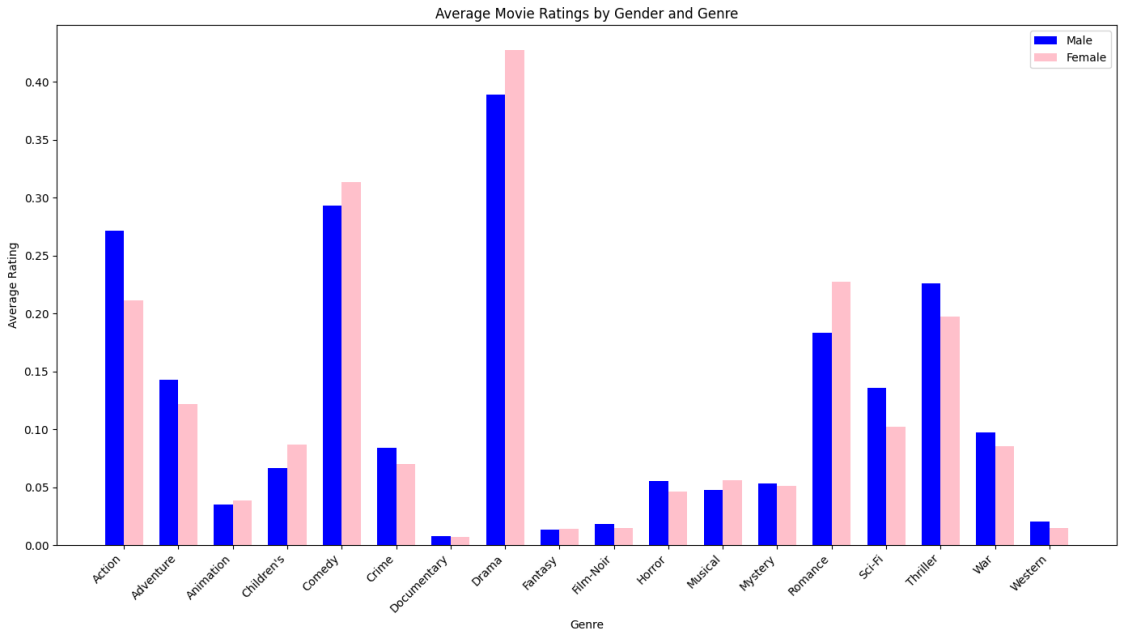
Are there any significant differences in the preferences for different movie genres between male and female users?

[ ]:
```
grouped_data = data.groupby(['gender'])[genre_columns].mean().reset_index()

grouped_data.columns = ['gender'] + [f'{col}_rating' for col in genre_columns]

male_ratings = grouped_data[grouped_data['gender'] == 'M'].iloc[0, 1:].values
female_ratings = grouped_data[grouped_data['gender'] == 'F'].iloc[0, 1:].values

for genre in genre_columns:
    male_avg = grouped_data[grouped_data['gender'] == 'M'][f'{genre}_rating'].
 ↪values[0]
    female_avg = grouped_data[grouped_data['gender'] == 'F'][f'{genre}_rating'].
 ↪values[0]
    print(f"Genre: {genre}")
    print(f"Male Average Rating: {male_avg}")
    print(f"Female Average Rating: {female_avg}")
    print("-----------------------------------")

x = np.arange(len(genre_columns))
width = 0.35

plt.figure(figsize=(14, 8))
plt.bar(x - width/2, male_ratings, width, label='Male', color='blue')
plt.bar(x + width/2, female_ratings, width, label='Female', color='pink')

plt.title('Average Movie Ratings by Gender and Genre')
plt.xlabel('Genre')
plt.ylabel('Average Rating')
plt.xticks(x, genre_columns, rotation=45, ha='right')
plt.legend()
```

```
plt.tight_layout()
plt.show()
```

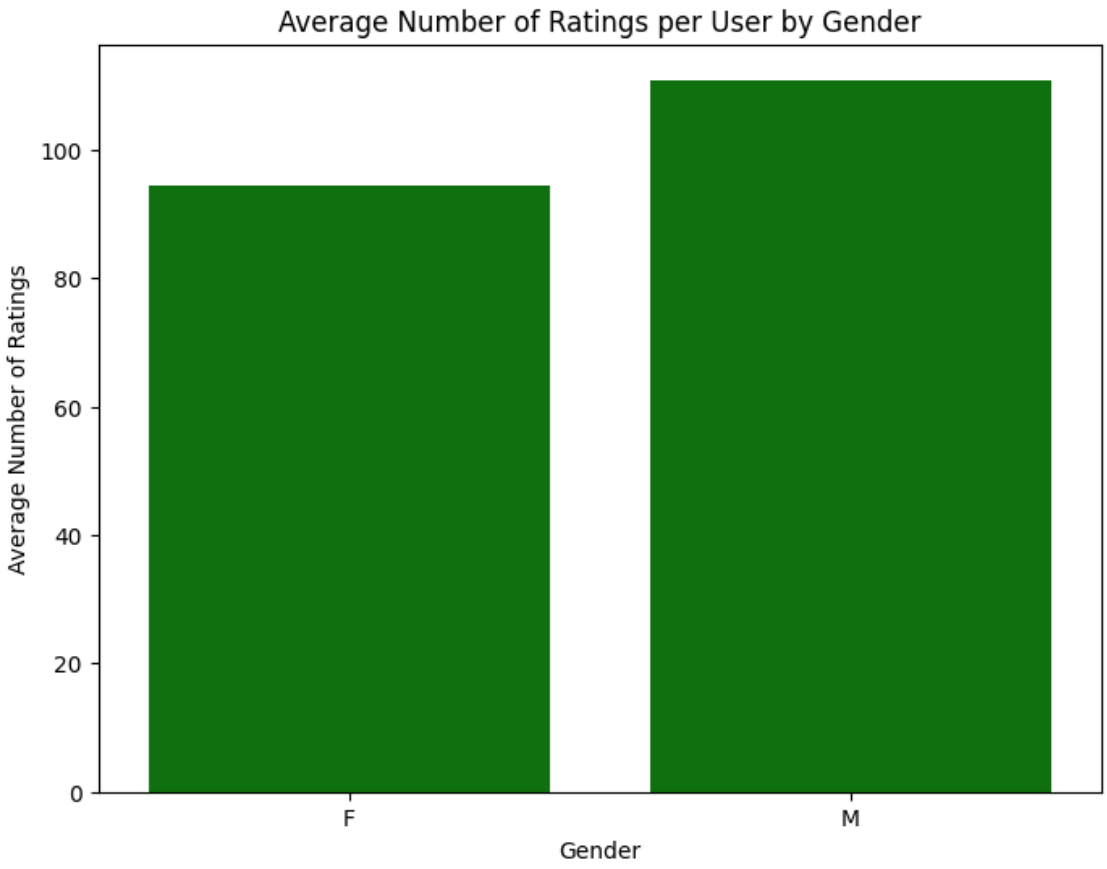
```
Genre: Action
Male Average Rating: 0.27130352814435765
Female Average Rating: 0.2114219114219114
-----------------------------------
Genre: Adventure
Male Average Rating: 0.14290331268516024
Female Average Rating: 0.12202797202797203
-----------------------------------
Genre: Animation
Male Average Rating: 0.03514678157823862
Female Average Rating: 0.038655788655788656
-----------------------------------
Genre: Children's
Male Average Rating: 0.06665768920010773
Female Average Rating: 0.08671328671328671
-----------------------------------
Genre: Comedy
Male Average Rating: 0.2930783732830595
Female Average Rating: 0.3134421134421134
-----------------------------------
Genre: Crime
Male Average Rating: 0.08431187718825747
Female Average Rating: 0.0696969696969697
-----------------------------------
Genre: Documentary
Male Average Rating: 0.007689200107729599
Female Average Rating: 0.007264957264957265
-----------------------------------
Genre: Drama
Male Average Rating: 0.3889981147320226
Female Average Rating: 0.42766122766122766
-----------------------------------
Genre: Fantasy
Male Average Rating: 0.01331807164018314
Female Average Rating: 0.014102564102564103
-----------------------------------
Genre: Film-Noir
Male Average Rating: 0.01815243738217075
Female Average Rating: 0.014957264957264958
-----------------------------------
Genre: Horror
Male Average Rating: 0.05548074333423108
Female Average Rating: 0.04650349650349651
```

```
-----------------------------------
Genre: Musical
Male Average Rating: 0.047293293832480474
Female Average Rating: 0.05602175602175602
-----------------------------------
Genre: Mystery
Male Average Rating: 0.05293563156477242
Female Average Rating: 0.05104895104895105
-----------------------------------
Genre: Romance
Male Average Rating: 0.1831807164018314
Female Average Rating: 0.2275835275835276
-----------------------------------
Genre: Sci-Fi
Male Average Rating: 0.13602208456773499
Female Average Rating: 0.10213675213675213
-----------------------------------
Genre: Thriller
Male Average Rating: 0.22604363048747644
Female Average Rating: 0.1975912975912976
-----------------------------------
Genre: War
Male Average Rating: 0.09707783463506599
Female Average Rating: 0.08504273504273505
-----------------------------------
Genre: Western
Male Average Rating: 0.01997037436035551
Female Average Rating: 0.014413364413364414
-----------------------------------
```



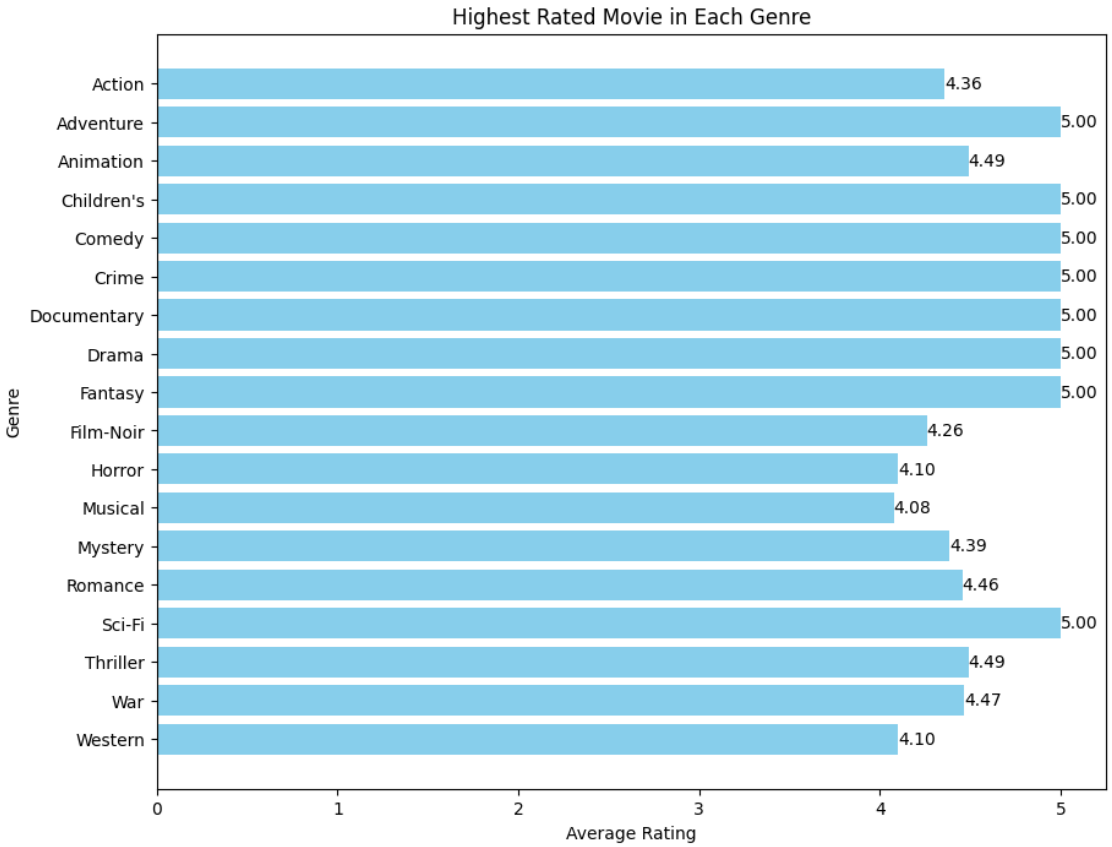
Do male or female users rate more movies on average?

```
[ ]: ratings_count = data.groupby(['user_id', 'gender']).size().
      ↪reset_index(name='ratings_count')
     average_ratings_by_gender = ratings_count.groupby('gender')['ratings_count'].
      ↪mean()

     plt.figure(figsize=(8, 6))
     sns.barplot(x=average_ratings_by_gender.index, y=average_ratings_by_gender.
      ↪values, color='green')
     plt.title('Average Number of Ratings per User by Gender')
     plt.xlabel('Gender')
     plt.ylabel('Average Number of Ratings')
     plt.show()
```



Which movies have the highest average ratings within each genre?

[ ]:
```
average_ratings = data.groupby('movie_title')['rating'].mean().reset_index()
average_ratings.rename(columns={'rating': 'average_rating'}, inplace=True)
merged_with_genres = pd.merge(average_ratings, items_data,␣
 ↪left_on='movie_title', right_on='movie_title', how='inner')
top_movies = {}

for genre in genre_columns:
    genre_movies = merged_with_genres[merged_with_genres[genre] == 1]
    top_movie = genre_movies.loc[genre_movies['average_rating'].idxmax()]
    top_movies[genre] = top_movie

top_movies_df = pd.DataFrame(top_movies).T.reset_index()
top_movies_df = top_movies_df[['index', 'movie_title', 'average_rating']]

plt.figure(figsize=(10, 8))
plt.barh(top_movies_df['index'], top_movies_df['average_rating'],␣
 ↪color='skyblue')
plt.xlabel('Average Rating')
plt.ylabel('Genre')
plt.title('Highest Rated Movie in Each Genre')
plt.gca().invert_yaxis()
for index, value in enumerate(top_movies_df['average_rating']):
    plt.text(value, index, f'{value:.2f}', va='center')
plt.show()
```

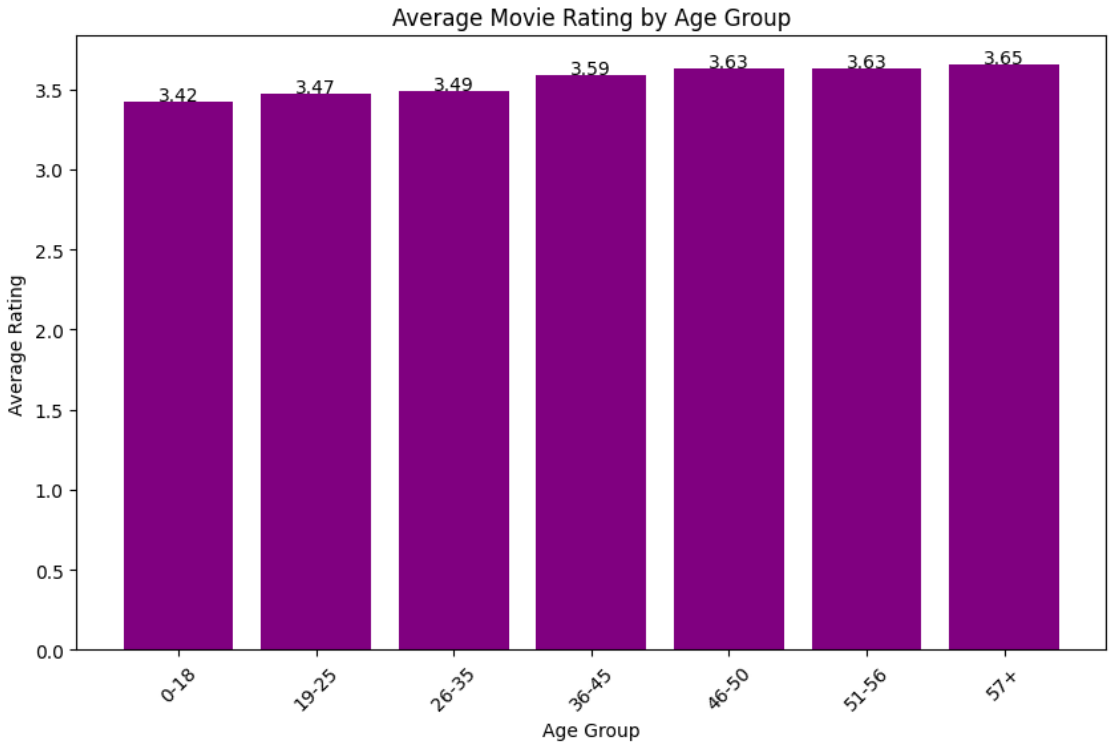


How do ratings vary across different user age groups?

[ ]:
```
bins = [0, 18, 25, 35, 45, 50, 56, 100]
labels = ['0-18', '19-25', '26-35', '36-45', '46-50', '51-56', '57+']
data['age_group'] = pd.cut(data['age'], bins=bins, labels=labels, right=False)

age_group_ratings = data.groupby('age_group')['rating'].mean().reset_index()

plt.figure(figsize=(10, 6))
plt.bar(age_group_ratings['age_group'], age_group_ratings['rating'],␣
 ↪color='purple')
plt.xlabel('Age Group')
plt.ylabel('Average Rating')
plt.title('Average Movie Rating by Age Group')
plt.xticks(rotation=45)
for index, value in enumerate(age_group_ratings['rating']):
    plt.text(index, value + 0.01, f'{value:.2f}', ha='center')
plt.show()
```

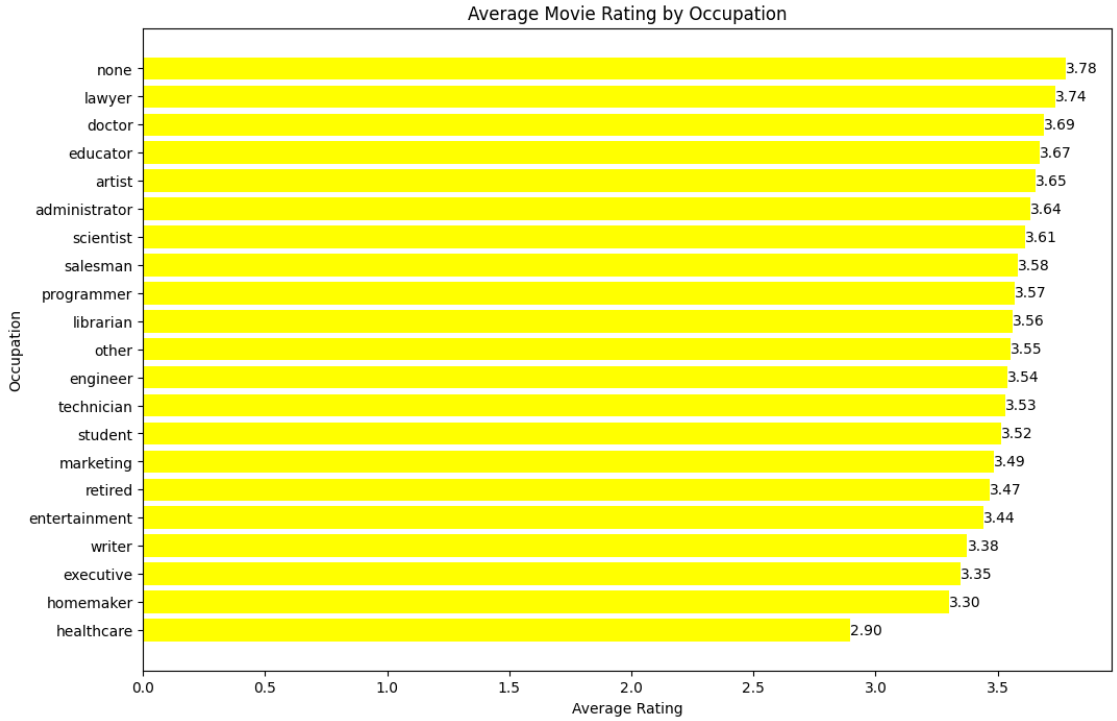
```
<ipython-input-133-ae3e03c90951>:5: FutureWarning: The default of observed=False
is deprecated and will be changed to True in a future version of pandas. Pass
```

```
observed=False to retain current behavior or observed=True to adopt the future
default and silence this warning.
  age_group_ratings = data.groupby('age_group')['rating'].mean().reset_index()
```



How do ratings vary across different user occupations?

[ ]:
```
occupation_ratings = data.groupby('occupation')['rating'].mean().reset_index()

occupation_ratings = occupation_ratings.sort_values(by='rating',␣
 ↪ascending=False)

plt.figure(figsize=(12, 8))
plt.barh(occupation_ratings['occupation'], occupation_ratings['rating'],␣
 ↪color='yellow')
plt.xlabel('Average Rating')
plt.ylabel('Occupation')
plt.title('Average Movie Rating by Occupation')
plt.gca().invert_yaxis()
for index, value in enumerate(occupation_ratings['rating']):
    plt.text(value, index, f'{value:.2f}', va='center')
plt.show()
```



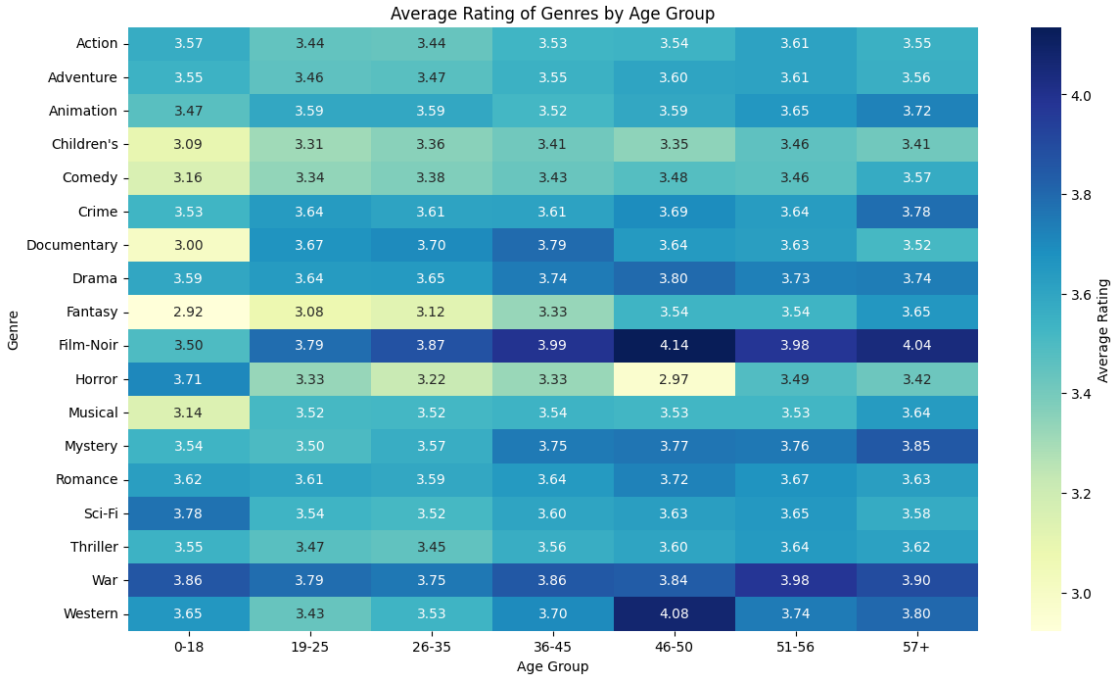
Which genres are preferred by different age groups?

[ ]:
```
bins = [0, 18, 25, 35, 45, 50, 56, 100]
labels = ['0-18', '19-25', '26-35', '36-45', '46-50', '51-56', '57+']
data['age_group'] = pd.cut(data['age'], bins=bins, labels=labels, right=False)

age_genre_ratings = {}

for genre in genre_columns:
    genre_data = data[data[genre] == 1]
    avg_ratings_by_age = genre_data.groupby('age_group')['rating'].mean().
 ↪reset_index()
    age_genre_ratings[genre] = avg_ratings_by_age.
 ↪set_index('age_group')['rating']

age_genre_df = pd.DataFrame(age_genre_ratings)

plt.figure(figsize=(14, 8))
sns.heatmap(age_genre_df.T, annot=True, fmt=".2f", cmap="YlGnBu",␣
 ↪cbar_kws={'label': 'Average Rating'})
plt.xlabel('Age Group')
plt.ylabel('Genre')
plt.title('Average Rating of Genres by Age Group')
plt.show()
```

```
<ipython-input-135-0d2b9bee4cf9>:9: FutureWarning: The default of observed=False
is deprecated and will be changed to True in a future version of pandas. Pass
observed=False to retain current behavior or observed=True to adopt the future
default and silence this warning.
  avg_ratings_by_age =
genre_data.groupby('age_group')['rating'].mean().reset_index()
<ipython-input-135-0d2b9bee4cf9>:9: FutureWarning: The default of observed=False
is deprecated and will be changed to True in a future version of pandas. Pass
observed=False to retain current behavior or observed=True to adopt the future
default and silence this warning.
  avg_ratings_by_age =
genre_data.groupby('age_group')['rating'].mean().reset_index()
<ipython-input-135-0d2b9bee4cf9>:9: FutureWarning: The default of observed=False
is deprecated and will be changed to True in a future version of pandas. Pass
observed=False to retain current behavior or observed=True to adopt the future
default and silence this warning.
  avg_ratings_by_age =
genre_data.groupby('age_group')['rating'].mean().reset_index()
<ipython-input-135-0d2b9bee4cf9>:9: FutureWarning: The default of observed=False
is deprecated and will be changed to True in a future version of pandas. Pass
observed=False to retain current behavior or observed=True to adopt the future
default and silence this warning.
  avg_ratings_by_age =
genre_data.groupby('age_group')['rating'].mean().reset_index()
<ipython-input-135-0d2b9bee4cf9>:9: FutureWarning: The default of observed=False
is deprecated and will be changed to True in a future version of pandas. Pass
observed=False to retain current behavior or observed=True to adopt the future
default and silence this warning.
  avg_ratings_by_age =
genre_data.groupby('age_group')['rating'].mean().reset_index()
<ipython-input-135-0d2b9bee4cf9>:9: FutureWarning: The default of observed=False
is deprecated and will be changed to True in a future version of pandas. Pass
observed=False to retain current behavior or observed=True to adopt the future
default and silence this warning.
  avg_ratings_by_age =
genre_data.groupby('age_group')['rating'].mean().reset_index()
<ipython-input-135-0d2b9bee4cf9>:9: FutureWarning: The default of observed=False
is deprecated and will be changed to True in a future version of pandas. Pass
observed=False to retain current behavior or observed=True to adopt the future
default and silence this warning.
  avg_ratings_by_age =
genre_data.groupby('age_group')['rating'].mean().reset_index()
<ipython-input-135-0d2b9bee4cf9>:9: FutureWarning: The default of observed=False
is deprecated and will be changed to True in a future version of pandas. Pass
observed=False to retain current behavior or observed=True to adopt the future
default and silence this warning.
  avg_ratings_by_age =
genre_data.groupby('age_group')['rating'].mean().reset_index()
```

```
<ipython-input-135-0d2b9bee4cf9>:9: FutureWarning: The default of observed=False
is deprecated and will be changed to True in a future version of pandas. Pass
observed=False to retain current behavior or observed=True to adopt the future
default and silence this warning.
  avg_ratings_by_age =
genre_data.groupby('age_group')['rating'].mean().reset_index()
<ipython-input-135-0d2b9bee4cf9>:9: FutureWarning: The default of observed=False
is deprecated and will be changed to True in a future version of pandas. Pass
observed=False to retain current behavior or observed=True to adopt the future
default and silence this warning.
  avg_ratings_by_age =
genre_data.groupby('age_group')['rating'].mean().reset_index()
<ipython-input-135-0d2b9bee4cf9>:9: FutureWarning: The default of observed=False
is deprecated and will be changed to True in a future version of pandas. Pass
observed=False to retain current behavior or observed=True to adopt the future
default and silence this warning.
  avg_ratings_by_age =
genre_data.groupby('age_group')['rating'].mean().reset_index()
<ipython-input-135-0d2b9bee4cf9>:9: FutureWarning: The default of observed=False
is deprecated and will be changed to True in a future version of pandas. Pass
observed=False to retain current behavior or observed=True to adopt the future
default and silence this warning.
  avg_ratings_by_age =
genre_data.groupby('age_group')['rating'].mean().reset_index()
<ipython-input-135-0d2b9bee4cf9>:9: FutureWarning: The default of observed=False
is deprecated and will be changed to True in a future version of pandas. Pass
observed=False to retain current behavior or observed=True to adopt the future
default and silence this warning.
  avg_ratings_by_age =
genre_data.groupby('age_group')['rating'].mean().reset_index()
<ipython-input-135-0d2b9bee4cf9>:9: FutureWarning: The default of observed=False
is deprecated and will be changed to True in a future version of pandas. Pass
observed=False to retain current behavior or observed=True to adopt the future
default and silence this warning.
  avg_ratings_by_age =
genre_data.groupby('age_group')['rating'].mean().reset_index()
<ipython-input-135-0d2b9bee4cf9>:9: FutureWarning: The default of observed=False
is deprecated and will be changed to True in a future version of pandas. Pass
observed=False to retain current behavior or observed=True to adopt the future
default and silence this warning.
  avg_ratings_by_age =
genre_data.groupby('age_group')['rating'].mean().reset_index()
<ipython-input-135-0d2b9bee4cf9>:9: FutureWarning: The default of observed=False
is deprecated and will be changed to True in a future version of pandas. Pass
observed=False to retain current behavior or observed=True to adopt the future
default and silence this warning.
  avg_ratings_by_age =
genre_data.groupby('age_group')['rating'].mean().reset_index()
```

```
<ipython-input-135-0d2b9bee4cf9>:9: FutureWarning: The default of observed=False
is deprecated and will be changed to True in a future version of pandas. Pass
observed=False to retain current behavior or observed=True to adopt the future
default and silence this warning.
  avg_ratings_by_age =
genre_data.groupby('age_group')['rating'].mean().reset_index()
<ipython-input-135-0d2b9bee4cf9>:9: FutureWarning: The default of observed=False
is deprecated and will be changed to True in a future version of pandas. Pass
observed=False to retain current behavior or observed=True to adopt the future
default and silence this warning.
  avg_ratings_by_age =
genre_data.groupby('age_group')['rating'].mean().reset_index()
```



How do user preferences evolve over time? Can we observe any shifts in genre popularity?

[ ]:
```
data['timestamp'] = pd.to_datetime(data['timestamp'], unit='s')
data['year'] = data['timestamp'].dt.year

genre_yearly_ratings = data.explode('genres').groupby(['year',␣
  ↪'genres'])['rating'].mean().unstack().fillna(0)

plt.figure(figsize=(14, 8))
for genre in genre_columns:
    sns.lineplot(data=genre_yearly_ratings[genre], label=genre)
```

```
plt.title('Average Ratings per Genre Over Time')
plt.xlabel('Year')
plt.ylabel('Average Rating')
plt.legend(loc='best')
plt.show()
```