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LGM-VIP INTERNSHIP

BEGINNER LEVEL TASK -3

Music Recommendation

1. IMPORT LIBRARY

In [ ]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
warnings.filterwarnings("ignore")
```

1. LOADING DATA

In [ ]:
```
df1 = pd.read_csv("songs.csv")
df2 = pd.read_csv("users.csv")
```

1. UNDERSTANDING THE DATA

In [ ]:
```
df1.head()
```

Out[ ]:

	song_id	title	release	artist_name	year
0	SOQMMHC12AB0180CB8	Silent Night	Monster Ballads X-Mas	Faster Pussy cat	2003
1	SOVFVAK12A8C1350D9	Tanssi vaan	Karkuteillä	Karkkiautomaatti	1995
2	SOGTUKN12AB017F4F1	No One Could Ever	Butter	Hudson Mohawke	2006
3	SOBNYVR12A8C13558C	Si Vos Querés	De Culo	Yerba Brava	2003
4	SOHSBXH12A8C13B0DF	Tangle Of Aspens	Rene Ablaze Presents Winter Sessions	Der Mystic	0

In [ ]:
```
df2.head()
```

Out[ ]:

	user_id	song_id	listen_count
0	b80344d063b5ccb3212f76538f3d9e43d87dca9e	SOAKIMP12A8C130995	1.0
1	b80344d063b5ccb3212f76538f3d9e43d87dca9e	SOBBMDR12A8C13253B	2.0
2	b80344d063b5ccb3212f76538f3d9e43d87dca9e	SOBXHDL12A81C204C0	1.0
3	b80344d063b5ccb3212f76538f3d9e43d87dca9e	SOBYHAJ12A6701BF1D	1.0
4	b80344d063b5ccb3212f76538f3d9e43d87dca9e	SODACBL12A8C13C273	1.0

In [ ]:
```
df1.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1000000 entries, 0 to 999999
Data columns (total 5 columns):
 #   Column       Non-Null Count    Dtype
---  ------       --------------    -----
 0   song_id      1000000 non-null  object
 1   title        999985 non-null   object
 2   release      999995 non-null   object
 3   artist_name  1000000 non-null  object
 4   year         1000000 non-null  int64
dtypes: int64(1), object(4)
memory usage: 38.1+ MB
```

In [ ]:
```
df1.describe()
```

Out[ ]:

	year
count	1000000.000000
mean	1030.325652
std	998.745002
min	0.000000
25%	0.000000
50%	1969.000000
75%	2002.000000
max	2011.000000

In [ ]:
```
df2.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1396836 entries, 0 to 1396835
Data columns (total 3 columns):
 #   Column        Non-Null Count    Dtype
---  ------        --------------    -----
 0   user_id       1396836 non-null  object
 1   song_id       1396835 non-null  object
 2   listen_count  1396835 non-null  float64
dtypes: float64(1), object(2)
memory usage: 32.0+ MB
```

In [ ]:
```
df2.describe()
```

Out[ ]:

	listen_count
count	1.396835e+06
mean	3.039422e+00
std	6.589842e+00
min	1.000000e+00
25%	1.000000e+00
50%	1.000000e+00
75%	3.000000e+00
max	2.213000e+03

1. MODIFYING DATASET COLUMNS

In [ ]:
```
df1["year"] = df1["year"].astype('Int64')
df1.rename(columns={"release": "album", "artist_name": "artist"}, inplace=True)
df1.head()
```

Out[ ]:

	song_id	title	album	artist	year
0	SOQMMHC12AB0180CB8	Silent Night	Monster Ballads X-Mas	Faster Pussy cat	2003
1	SOVFVAK12A8C1350D9	Tanssi vaan	Karkuteillä	Karkkiautomaatti	1995
2	SOGTUKN12AB017F4F1	No One Could Ever	Butter	Hudson Mohawke	2006
3	SOBNYVR12A8C13558C	Si Vos Querés	De Culo	Yerba Brava	2003
4	SOHSBXH12A8C13B0DF	Tangle Of Aspens	Rene Ablaze Presents Winter Sessions	Der Mystic	0

In [ ]:
```
df2["listen_count"] = df2["listen_count"].astype('Int64')
df2.head()
```

Out[ ]:

	user_id	song_id	listen_count
0	b80344d063b5ccb3212f76538f3d9e43d87dca9e	SOAKIMP12A8C130995	1
1	b80344d063b5ccb3212f76538f3d9e43d87dca9e	SOBBMDR12A8C13253B	2
2	b80344d063b5ccb3212f76538f3d9e43d87dca9e	SOBXHDL12A81C204C0	1
3	b80344d063b5ccb3212f76538f3d9e43d87dca9e	SOBYHAJ12A6701BF1D	1
4	b80344d063b5ccb3212f76538f3d9e43d87dca9e	SODACBL12A8C13C273	1

1. MERGING THE TWO DATASETS INTO ONE DATASET

In [ ]:
```
df = pd.merge(df2, df1.drop_duplicates(["song_id"]), on='song_id', how='left')
df['song'] = df['artist'] + ' - ' + df['title']
df = df.drop(['title'], axis=1)
df = df.head(50000)
df.head()
```

Out[ ]:

	user_id	song_id	listen_count	album	artist	year	song
0	b80344d063b5ccb3212f76538f3d9e43d87dca9e	SOAKIMP12A8C130995	1	Thicker Than Water	Jack Johnson	0	Jack Johnson - The Cove
1	b80344d063b5ccb3212f76538f3d9e43d87dca9e	SOBBMDR12A8C13253B	2	Flamenco Para Niños	Paco De Lucia	1976	Paco De Lucia - Entre Dos Aguas
2	b80344d063b5ccb3212f76538f3d9e43d87dca9e	SOBXHDL12A81C204C0	1	Graduation	Kanye West	2007	Kanye West - Stronger
3	b80344d063b5ccb3212f76538f3d9e43d87dca9e	SOBYHAJ12A6701BF1D	1	In Between Dreams	Jack Johnson	2005	Jack Johnson - Constellations
4	b80344d063b5ccb3212f76538f3d9e43d87dca9e	SODACBL12A8C13C273	1	There Is Nothing Left To Lose	Foo Fighters	1999	Foo Fighters - Learn To Fly

1. EXPLORATORY DATA ANALYSIS

In [ ]:
```
print("Number of entries in each column:\n")
df.count()
```

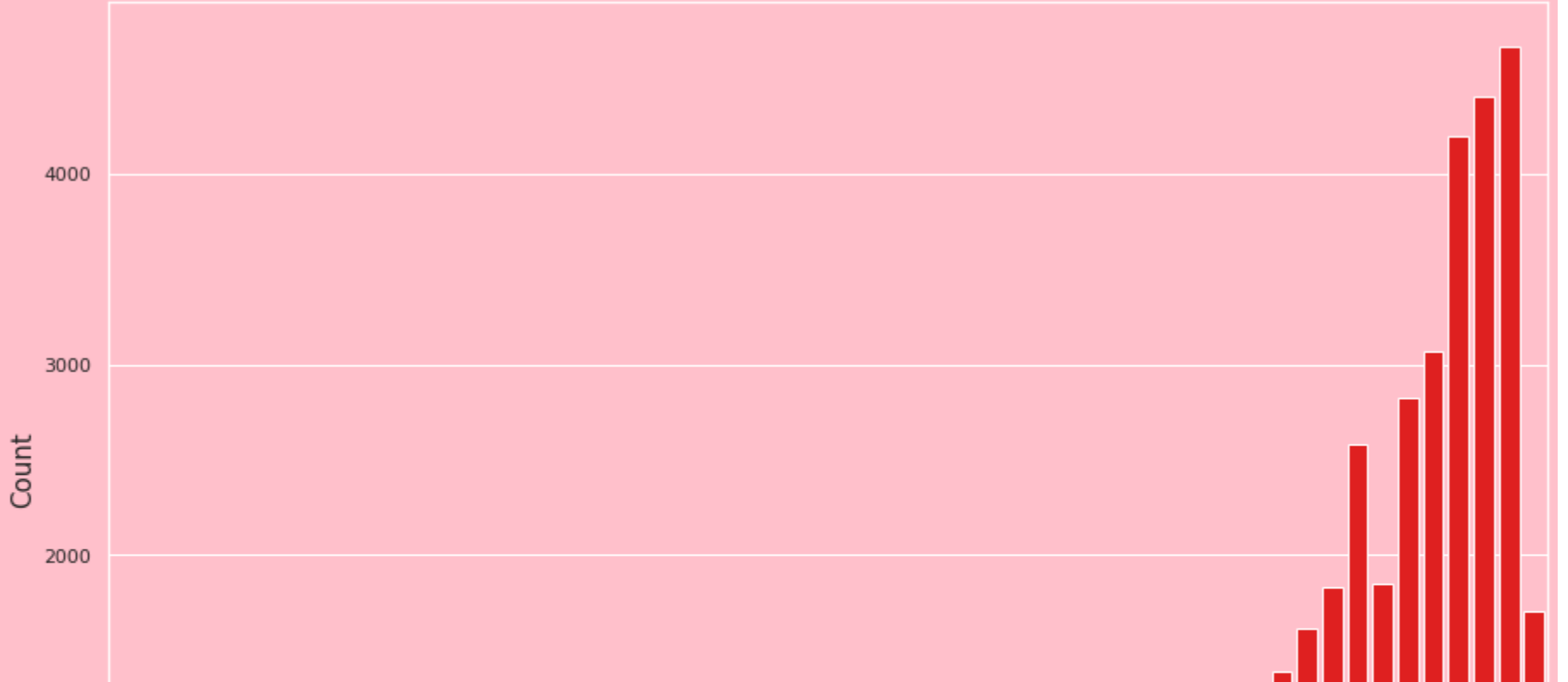
```
Number of entries in each column:
```

Out[ ]:
```
user_id         50000
song_id         50000
listen_count    50000
album           50000
artist          50000
year            50000
song            50000
dtype: int64
```

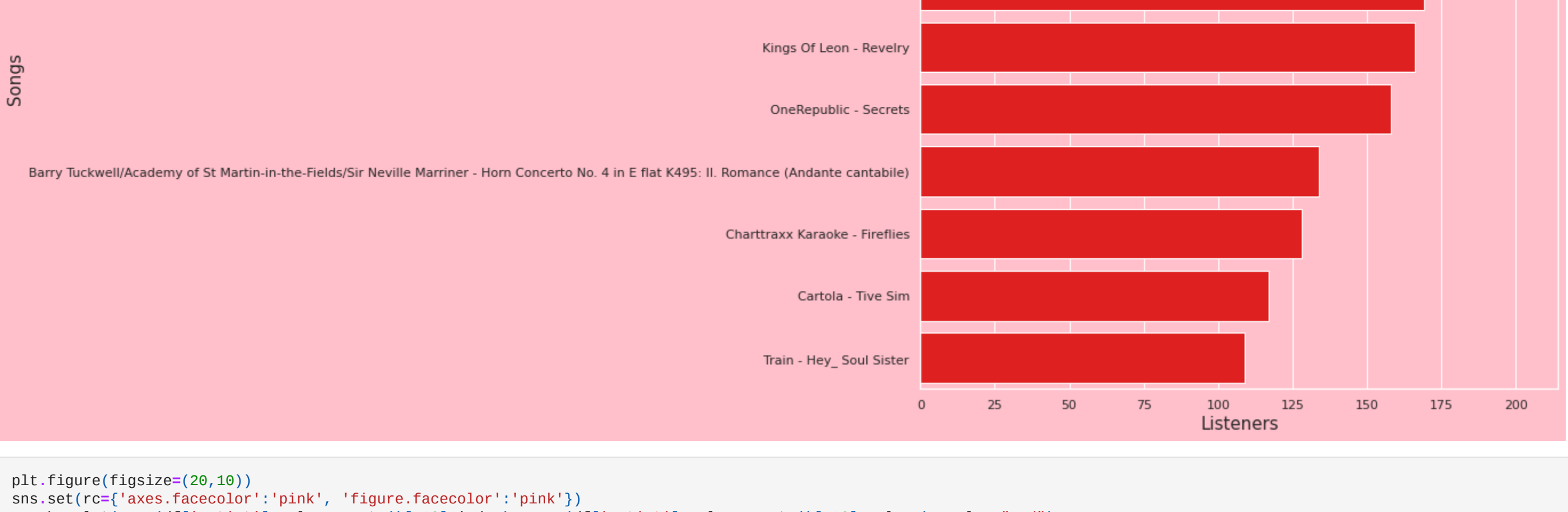
In [ ]:
```
print("Number of unique users: ", df.user_id.nunique(dropna = True))
print("Number of artists: ", df.artist.nunique(dropna=True))
print("Number of songs: ", df.song_id.nunique(dropna=True))
```

```
Number of unique users:  1879
Number of artists:  3215
Number of songs:  9370
```

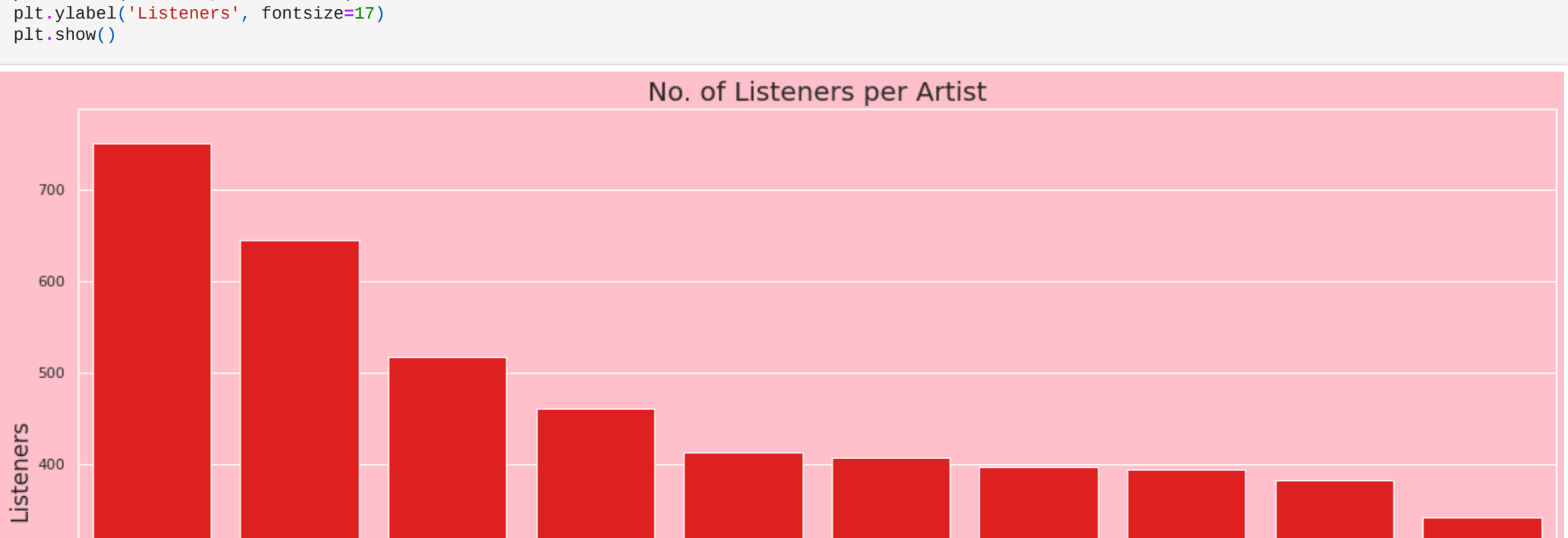
In [ ]:
```
plt.figure(figsize=(15, 10))
sns.set(rc={'axes.facecolor':'pink', 'figure.facecolor':'pink'})
sns.countplot(x='year', data=df[-(df['year']==0)], color="red")
plt.xticks(rotation=90)
plt.title("No. of Songs per Year", fontsize=20)
plt.xlabel("Year", fontsize=15)
plt.ylabel("Count", fontsize=15)
plt.show()
```



In [ ]:
```
plt.figure(figsize=(10,10))
sns.set(rc={'axes.facecolor':'pink', 'figure.facecolor':'pink'})
sns.barplot(x = (df['song'].value_counts()[:10].values), y = (df['song'].value_counts()[:10].index), color="red")
plt.title('Most Popular Songs', fontsize=20)
plt.xlabel('Listeners', fontsize=15)
plt.ylabel('Songs', fontsize=15)
plt.show()
```



In [ ]:
```
plt.figure(figsize=(20,10))
sns.set(rc={'axes.facecolor':'pink', 'figure.facecolor':'pink'})
sns.barplot(x = (df['artist'].value_counts()[:10].index), y = (df['artist'].value_counts()[:10].values), color="red")
plt.title('No. of Listeners per Artist', fontsize=20)
plt.xlabel('Artist', fontsize=17)
plt.ylabel('Listeners', fontsize=17)
plt.show()
```



1. BUILDING A RECOMMENDATION ENGINE

In [ ]:
```
class Engine():
    def __init__(self, data, user_id, song):
        self.data = data
        self.user_id = user_id
        self.song = song
        self.glcm = None

    def get_song_history(self, user):
        user_data = self.data[self.data[self.user_id] == user]
        return list(user_data[self.song].unique())

    def get_users(self, item):
        item_data = self.data[self.data[self.song] == item]
        return set(item_data[self.user_id].unique())

    def get_all_songs(self):
        return list(self.data[self.song].unique())

    def get_glcm(self, user_songs, all_songs):
        users = []
        for i in range(0, len(user_songs)):
            users.append(self.get_users(user_songs[i]))
        glcm = np.matrix(np.zeros(shape=(len(user_songs), len(all_songs))), float)

        for i in range(0,len(all_songs)):
            songs_i_data = self.data[self.data[self.song] == all_songs[i]]
            users_i = set(songs_i_data[self.user_id].unique())

            for j in range(0,len(user_songs)):
                users_j = users[j]
                users_intersection = users_i.intersection(users_j)

                users_union = users_i.union(users_j)
                glcm[j,i] = float(len(users_intersection))/float(len(users_union))

        return glcm

    def generate_recommendations(self, user, glcm, all_songs, user_songs):
        sim_scores = glcm.sum(axis=0)/float(glcm.shape[0])
        sim_scores = np.array(sim_scores)[0].tolist()

        sort_index = sorted(((e,i) for i,e in enumerate(list(sim_scores))), reverse=True)
        columns = ['UserID', 'Song', 'Score', 'Rank']
        df = pd.DataFrame(columns=columns)

        rank = 1
        for i in range(0,len(sort_index)):
            if ~np.isnan(sort_index[i][0]) and all_songs[sort_index[i][1]] not in user_songs and rank <= 10:
                df.loc[len(df)]=[user,all_songs[sort_index[i][1]],sort_index[i][0],rank]
                rank = rank+1

        print("Music Recommendations: \n")
        return df.drop(['UserID'], axis=1)

    def get_recommendations(self, user):
        user_songs = self.get_song_history(user)
        all_songs = self.get_all_songs()
        glcm = self.get_glcm(user_songs, all_songs)
        return self.generate_recommendations(user, glcm, all_songs, user_songs)

    def get_similar_songs(self, item_list):
        user_songs = item_list
        all_songs = self.get_all_songs()
        glcm = self.get_glcm(user_songs, all_songs)
        return self.generate_recommendations("", glcm, all_songs, user_songs)
```

1. GETTING SONG HISTORY OF USER AT INDEX 1001

In [ ]:
```
eng = Engine(df, 'user_id', 'song')
song_history = eng.get_song_history(df['user_id'][1001])
```

In [ ]:
```
print("User Song History: \n")
for song in song_history:
  print(song)
```

```
User Song History:

Muse - Uprising
Weezer - No One Else
Yeah Yeah Yeahs - Runaway
The Killers - Losing Touch
The Rural Alberta Advantage - Don't Haunt This Place
Florence + The Machine - Dog Days Are Over (Radio Edit)
Bright Eyes - At The Bottom Of Everything
Jason Mraz & Colbie Caillat - Lucky (Album Version)
Weezer - Island In The Sun
Tiny Vipers - They Might Follow You
Fleet Foxes - Innocent Son
Linkin Park - Bleed It Out [Live At Milton Keynes]
Frightened Rabbit - Yawns
Weezer - El Scorcho
Coldplay - Clocks
Adam Lambert - Whataya Want From Me
Justin Bieber - Somebody To Love
Katy Perry - Waking Up In Vegas (Calvin Harris Remix Edit)
Emmy The Great - Mia
Weezer - My Name Is Jonas
Darwin Deez - Radar Detector
Rihanna - Rehab
Camera Obscura - Teenager
Lily Allen - Not Big
Timbaland / Justin Timberlake / Nelly Furtado - Give It To Me
The New Pornographers - Falling Through Your Clothes
Ray LaMontagne - Trouble (Album Version)
Yeah Yeah Yeahs - Soft Shock
Bright Eyes - Old Soul Song
Deer Tick - These Old Shoes
Plain White T's - Hey There Delilah
Harmonia - Sehr kosmisch
Amy Winehouse - Fuck Me Pumps
Ray LaMontagne - Shelter
Vampire Weekend - A-Punk (Album)
Weezer - Susanne
Justin Timberlake;Justin Timberlake featuring will.i.am - Damn Girl
Florence + The Machine - Kiss With A Fist
Weezer - Pork And Beans
The New Pornographers - Execution Day
Yeah Yeah Yeahs - Little Shadow
Bon Iver - re:stacks
The Kills - Superstition
Bon Iver - Flume
Kings Of Leon - Manhattan
Beirut - The Penalty
Amy Winehouse - Me & Mr Jones
Amos Lee - Soul Suckers
Cage The Elephant - Ain't No Rest For The Wicked (Original Version)
Stone Temple Pilots - Plush (Acoustic)
Coldplay - The Scientist
Dixie Chicks - Not Ready To Make Nice
The Killers - Somebody Told Me
Montell Jordan - This Is How We Do It
Charttraxx Karaoke - Fireflies
Damien Rice - Amie
LMFAO - Yes
Kelly Clarkson - The Trouble With Love Is
Yeah Yeah Yeahs - Hysteric
Ray LaMontagne - Hold You In My Arms
Soltero - Ghost At The Foot Of The Bed
Discovery - So Insane
Fleet Foxes - White Winter Hymnal
Modest Mouse - Float On
The Rolling Stones - Angie (1993 Digital Remaster)
Weezer - Say It Ain't So
The All-American Rejects - My Paper Heart
Death Cab for Cutie - I Will Follow You into the Dark (Album Version)
Radiohead - Creep (Explicit)
Iron And Wine - Boy With The Coin
Radiohead - (Nice Dream)
Alicia Keys - If I Ain't Got You
Vampire Weekend - Cousins
Beyoncé - Dangerously In Love
Benjy Ferree - Fear
Steppenwolf - Magic Carpet Ride
Lady GaGa - Alejandro
Tokyo Police Club - Tessellate
Lily Allen - Chinese
Miley Cyrus - Goodbye
Kings Of Leon - Revelry
Bon Iver - Skinny Love
Interpol - Public Pervert
Damien Rice - Delicate
Edward Sharpe & The Magnetic Zeros - Home
Train - Marry Me
Taylor Swift - Love Story
The Avett Brothers - The Weight Of Lies
John Mayer - Heartbreak Warfare
Miley Cyrus - The Climb
M.I.A. - Paper Planes
The Strokes - You Only Live Once
Lil Wayne / Eminem - Drop The World
Kanye West - Late
Kanye West - Hey Mama
Weezer - Only In Dreams
Miley Cyrus - Party In The U.S.A.
LL Cool J - Doin' It
Kings Of Leon - Use Somebody
Modest Mouse - Heart Cooks Brain
Foals - The French Open
Coldplay - Fix You
Yeah Yeah Yeahs - Gold Lion
The Avett Brothers - Shame
MGMT - Time To Pretend
The Pussycat Dolls - When I Grow Up
Weezer - The World Has Turned And Left Me Here
Mariah Carey - Bye Bye
Kings Of Leon - Joe's Head
MGMT - Electric Feel
The Verve - Bitter Sweet Symphony
Yeah Yeah Yeahs - Heads Will Roll
Amy Winehouse - Take The Box
Gwen Stefani - Hollaback Girl
Kings Of Leon - Ragoo
Coldplay - Trouble
The All-American Rejects - Swing_ Swing
Amy Winehouse - He Can Only Hold Her
```

1. GETTING RECOMMENDATIONS FOR USER AT INDEX 1001

In [ ]:
```
eng.get_recommendations(df['user_id'][1001])
```

```
Music Recommendations:
```

Out[ ]:

	Song	Score	Rank
0	Usher featuring will.i.am - OMG	0.045576	1
1	Kid Cudi / MGMT / Ratatat - Pursuit Of Happine...	0.045071	2
2	Beyoncé - Halo	0.043027	3
3	Paramore - The Only Exception (Album Version)	0.042851	4
4	Train - Hey_ Soul Sister	0.042728	5
5	OneRepublic - Secrets	0.042554	6
6	Florence + The Machine - Cosmic Love	0.041469	7
7	The Script - Breakeven	0.038114	8
8	La Roux - Bulletproof	0.037494	9
9	Linkin Park - In The End (Album Version)	0.037255	10

RETRIEVING SIMILAR SONGS WITH RESPECT TO A SPECIFIC SONG

In [ ]:
```
eng.get_similar_songs(['La Roux - Bulletproof'])
```

```
Music Recommendations:
```

Out[ ]:

	Song	Score	Rank
0	Usher featuring will.i.am - OMG	0.191781	1
1	Lady GaGa / Colby O'Donis - Just Dance	0.178571	2
2	Lady GaGa - Alejandro	0.177778	3
3	Charttraxx Karaoke - Fireflies	0.171271	4
4	Train - Marry Me	0.165644	5
5	Kid Cudi / MGMT / Ratatat - Pursuit Of Happine...	0.165468	6
6	Paramore - The Only Exception (Album Version)	0.165354	7
7	Florence + The Machine - Dog Days Are Over (Ra...	0.162896	8
8	Kings Of Leon - Use Somebody	0.162338	9
9	DJ Dizzy - Sexy Bitch	0.162162	10