Problem:

Build a recommender system by using cosine simillarties score.

Import necessary libraries

In [1]:
```
import pandas as pd
import numpy as np

import seaborn as sns
import matplotlib.pyplot as plt

from sklearn.metrics import pairwise_distances
```

In [2]:
```
%matplotlib notebook
```

Load data:

In [3]:
```
book_df = pd.read_csv('book.csv', encoding='latin-1')
```

In [4]:
```
book_df.head()
```

Out[4]:

	Unnamed: 0	User.ID	Book.Title	Book.Rating
0	1	276726	Classical Mythology	5
1	2	276729	Clara Callan	3
2	3	276729	Decision in Normandy	6
3	4	276736	Flu: The Story of the Great Influenza Pandemic...	8
4	5	276737	The Mummies of Urumchi	6

In [5]:
```
book_df.drop('Unnamed: 0', axis=1, inplace=True) # Drop unnecessary column
```

Data understanding

In [6]:
```
book_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10000 entries, 0 to 9999
Data columns (total 3 columns):
 #   Column       Non-Null Count  Dtype 
---  ------       --------------  ----- 
 0   User.ID      10000 non-null  int64 
 1   Book.Title   10000 non-null  object
 2   Book.Rating  10000 non-null  int64 
dtypes: int64(2), object(1)
memory usage: 234.5+ KB
```

In [7]:
```
print("No of unique User ID's  : ", book_df['User.ID'].nunique())
print("No of unique book titles: ", book_df['Book.Title'].nunique())
```

```
No of unique User ID's  :  2182
No of unique book titles:  9659
```

Observations:

- The data set contains information about books purcahased by cuastomers and the ratings assigned by them, probably taken from an e-commerce website like amazon.
- There are 10000 records and three features. All of them are recorded with correct datatypes.
- There are no null values.

UBCF - User based collaborative filtering.

In [8]:
```
## pivot table with User ID's as features and book titles as target. To mak
book_pvt = pd.pivot_table(data=book_df, values='Book.Rating', index='User.I
book_pvt.index = book_df['User.ID'].unique() # To get the right indices.
```

In [9]:
```
book_pvt.head()
```

Out[9]:

Book.Title	Jason, Madison &amp	Other Stories;Merril;1985;McClelland &amp	Repairing PC Drives &amp	'48	'O Au No Keia: Voices from Hawai'I's Mahu and Transgender Communities	...AND THE HORSE HE RODE IN ON : THE PEOPLE V. KENNETH STARR	01 A M Mill
276726	0.0	0.0	0.0	0.0	0.0	0.0	
276729	0.0	0.0	0.0	0.0	0.0	0.0	
276736	0.0	0.0	0.0	0.0	0.0	0.0	
276737	0.0	0.0	0.0	0.0	0.0	0.0	
276744	0.0	0.0	0.0	0.0	0.0	0.0	

5 rows × 9659 columns

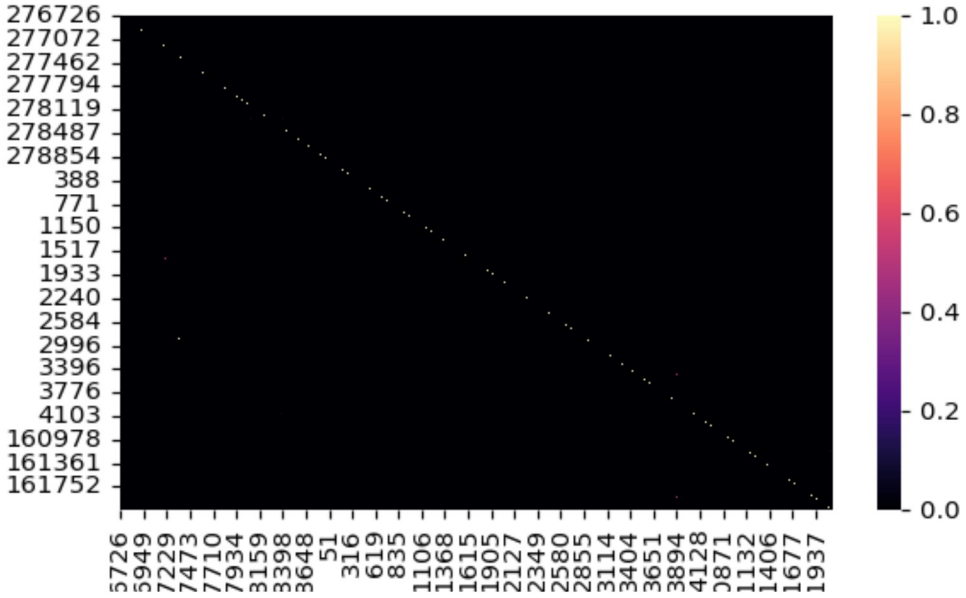
In [10]:
```
# Use cosine as a metric for UBCF.
ubcf_book = 1 - pairwise_distances(X=book_pvt.values, metric='cosine')
ubcf_book = pd.DataFrame(data=ubcf_book)
ubcf_book.index = book_df['User.ID'].unique()
ubcf_book.columns = book_df['User.ID'].unique()
```

In [11]:
```
ubcf_book.iloc[0:5, 0:5] # View a sample of the computed similarity scores.
```

Out[11]:

	276726	276729	276736	276737	276744
276726	1.0	0.0	0.0	0.0	0.0
276729	0.0	1.0	0.0	0.0	0.0
276736	0.0	0.0	1.0	0.0	0.0
276737	0.0	0.0	0.0	1.0	0.0
276744	0.0	0.0	0.0	0.0	1.0

In [12]:
```
# Visualize the similarity scores using heatmap.
fig, ax = plt.subplots()
ax = sns.heatmap(ubcf_book, cmap='magma')
```



In [13]:
```
# Extracting the list of most Similar Users
ubcf_book_sim = pd.DataFrame(ubcf_book.idxmax(axis=1)).reset_index()
ubcf_book_sim.columns = ['user_id1', 'user_id2']
sim_users = ubcf_book_sim[ubcf_book_sim['user_id1']!=ubcf_book_sim['user_ic
```

In [14]:
```
sim_users
```

Out[14]:

	user_id1	user_id2
427	278160	277945
1101	1782	1775
1235	2203	367
1426	2883	277351
1528	3293	277601
1545	3350	277353
1625	3619	1775
1722	3944	92

	user_id1	user_id2
1976	161361	161343
1985	161390	278620

Observations:

- For the dataset provided, we can hardly make out any similarities between preferences of any two customers. There seems to be no common preferences at all between the majority except a few users. This may not be the case in other datasets.
- The users with similar interests are only a few and they are listed above. Despite this we can prepare a list of books which could be recommended to either of the users in a given pair.

In [15]:
```
# Extracting a list of books that interests either of the users.
common_items = (book_df[(book_df['User.ID']==2203) | (book_df['User.ID']==3
common_items
```

Out[15]:

	User.ID	Book.Title	Book.Rating
2764	367	Diary of a Mad Bride (Summer Display Opportunity)	9
5108	2203	One Hit Wonderland	7
5109	2203	Grift Sense (Tony Valentine Novels)	6

In [16]:
```
# A function to merge the preferences of both the users.
def match_maker(user_1, user_2):
    user_1_df = book_df[book_df['User.ID']==user_1]
    user_2_df = book_df[book_df['User.ID']==user_2]
    recos_2_users = pd.merge(user_1_df,user_2_df,on='Book.Title',how='outer
    return recos_2_users
```

In [17]:
```
# Dictionary to store the preferences of different pairs of users.
users_key = sim_users.index
similar_users = dict.fromkeys(users_key)

num_rows = sim_users.shape[0]
for i in range(num_rows):
    user_id1 = sim_users.values[i][0]
    user_id2 = sim_users.values[i][1]
    similar_users[users_key[i]] = match_maker(user_id1, user_id2)
```

In [18]:
```
# Extracting the row index of similar users table to make it
# convenient to display the preferences of each pair from the dictionary.
similar_users.keys()
```

Out[18]:
```
dict_keys([427, 1101, 1235, 1426, 1528, 1545, 1625, 1722, 1976, 1985, 200
1])
```

In [19]:
```
similar_users[427] # Preferences of the users 278160 and 277945.
```

Out[19]:

	User.ID_x	Book.Title	Book.Rating_x	User.ID_y	Book.Rating_y
0	278160.0	Siva	8.0	NaN	NaN
1	NaN	Shopaholic Takes Manhattan (Summer Display Opp...	NaN	277945.0	6.0
2	NaN	Confessions of a Shopaholic (Summer Display Op...	NaN	277945.0	8.0
3	NaN	The Cider House Rules	NaN	277945.0	6.0
4	NaN	PRIME TIME : PRIME TIME	NaN	277945.0	7.0
5	NaN	Uncle Tungsten: Memories of a Chemical Boyhood	NaN	277945.0	2.0
6	NaN	Family At Last (Love Inspired (Numbered))	NaN	277945.0	7.0
7	NaN	Sons of Texas : Callaway Country	NaN	277945.0	8.0
8	NaN	Nickel and Dimed: On (Not) Getting By in America	NaN	277945.0	7.0
9	NaN	Gingerbread	NaN	277945.0	7.0
10	NaN	Strange Memories The Nancy Drew Files 122 (Nan...	NaN	277945.0	7.0
11	NaN	My Grandfathers Blessings : Stories of Strengt...	NaN	277945.0	7.0
12	NaN	Summer Light	NaN	277945.0	7.0
13	NaN	Smoke in Mirrors	NaN	277945.0	7.0
14	NaN	Table For Two	NaN	277945.0	7.0
15	NaN	Winter Wedding	NaN	277945.0	7.0
16	NaN	Divining Women (Ay Spoken Word - Gibbons)	NaN	277945.0	8.0

Conclusion

Thus, we can access the common preferences of ay pair of users from the list of similar users derived using similarty scores.