Homework 4
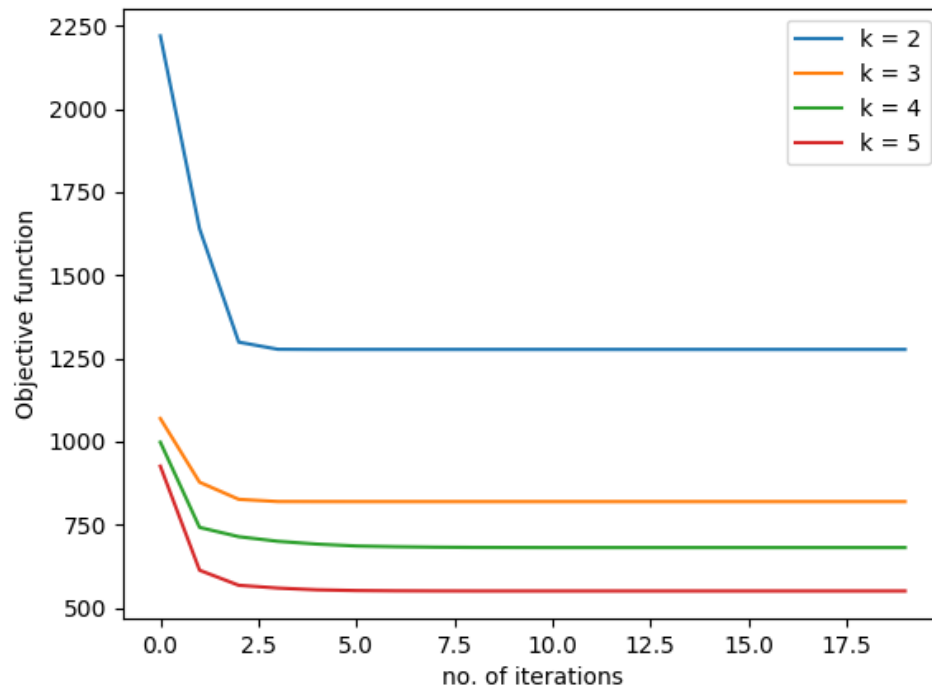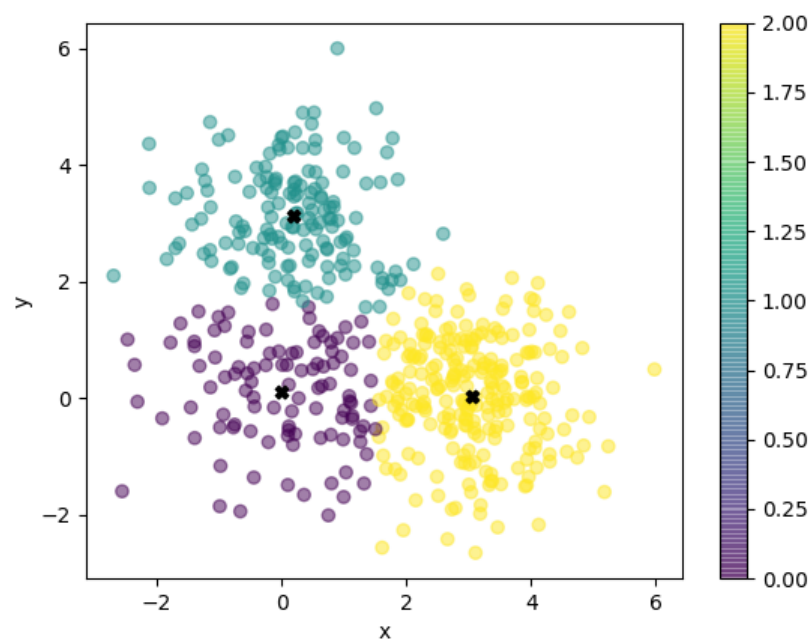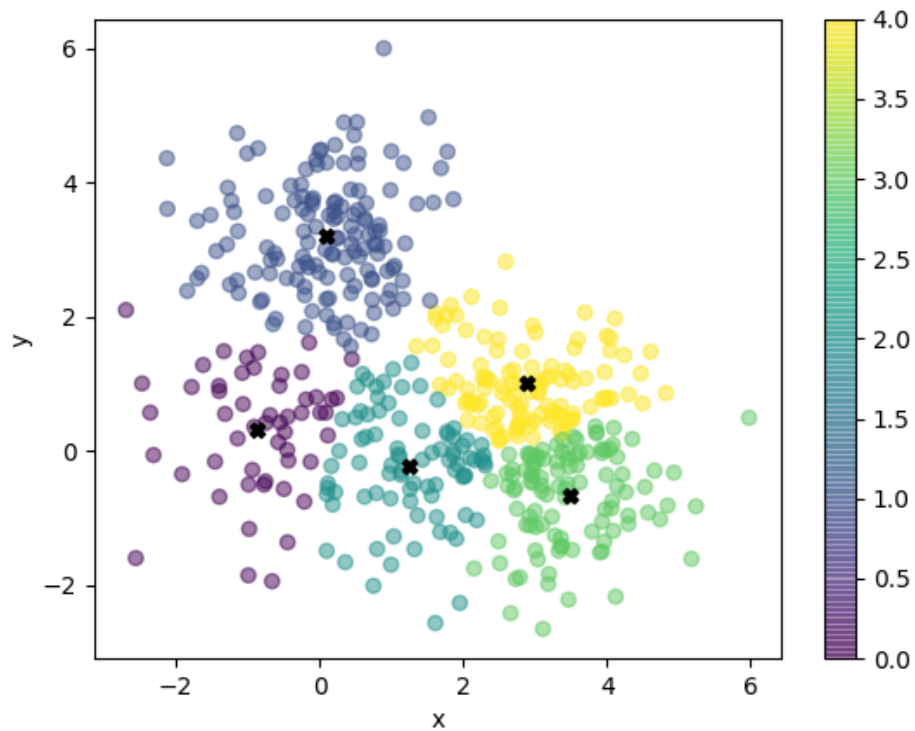**-Vibhuti Mahajan (vm2486)**

Problem 1 : K-Means

   a) Objective function over iterations in the K-means algorithm, for k = 2, 3, 4, 5. The algorithm definitely converges before completing 20 iterations for all values of the considered k.
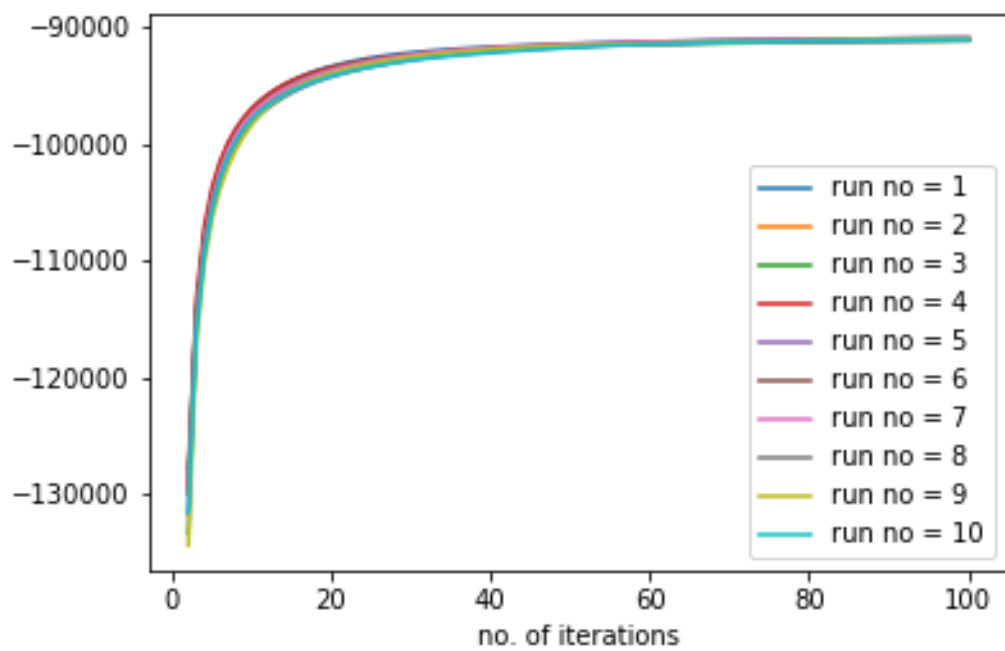

   b) Clusters for K=3:

Clusters for K=5:

Problem 2 : Matrix Factorization

a) Joint Log-likelihood for collaborative recommendarion algorithm over the number of iterations:

Objective function and calculated RMSE values:

Run No	Objective Value	RMSE
6	-90931.963	1.1315
1	-90941.723	1.1348
7	-90947.103	1.081
9	-91014.975	1.1071
4	-91015.480	1.1059
8	-91023.208	1.1093
10	-91071.846	1.1162
2	-91115.808	1.1168
5	-91123.012	1.1157
3	-91115.808	1.476

b) I obtained the highest objective value for run 6. Using the corresponding movie representations, the nearest movies are:

Query Movie: Star Wars (1977)

Movie Name	Euclidean Distance
Empire Strikes Back, The (1980)	0.306019790
Raiders of the Lost Ark (1981)	0.516990919
Return of the Jedi (1983)	0.602678053
Indiana Jones and the Last Crusade (1989)	0.83136067
Manon of the Spring (Manon des sources) (1986)	0.936444485
Wrong Trousers, The (1993)	0.947303646
Searching for Bobby Fischer (1993)	0.948300542
Back to the Future (1985)	0.964951258
Sting, The (1973)	0.965921864
Lawrence of Arabia (1962)	0.994810937

Query Movie: My Fair Lady (1964)

Movie Name	Euclidean Distance
Sound of Music, The (1965)	0.803767118
Mary Poppins (1964)	0.859546907
Gone with the Wind (1939)	0.924956796
Cinderella (1950)	0.997274941
Alice in Wonderland (1951)	1.026096455
Snow White and the Seven Dwarfs (1937)	1.038104821
Dumbo (1941)	1.048446573
All About Eve (1950)	1.07677467
Parent Trap, The (1961)	1.078594741
Wizard of Oz, The (1939)	1.112023832

Query Movie: GoodFellas (1990)

Movie Name	Euclidean Distance
Casino (1995)	0.617066532
Full Metal Jacket (1987)	0.618757857
Good, The Bad and The Ugly, The (1966)	0.681944104
Godfather: Part II, The (1974)	0.707230578
Once Upon a Time in the West (1969)	0.816613524
Godfather, The (1972)	0.90843606
Platoon (1986)	0.911277968
Cool Hand Luke (1967)	0.926439232
Bonnie and Clyde (1967)	0.987452413
Patton (1970)	0.99109978