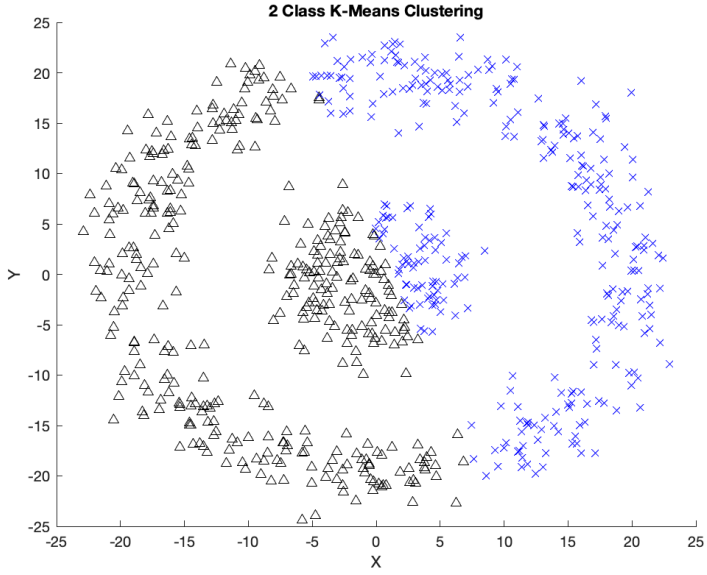
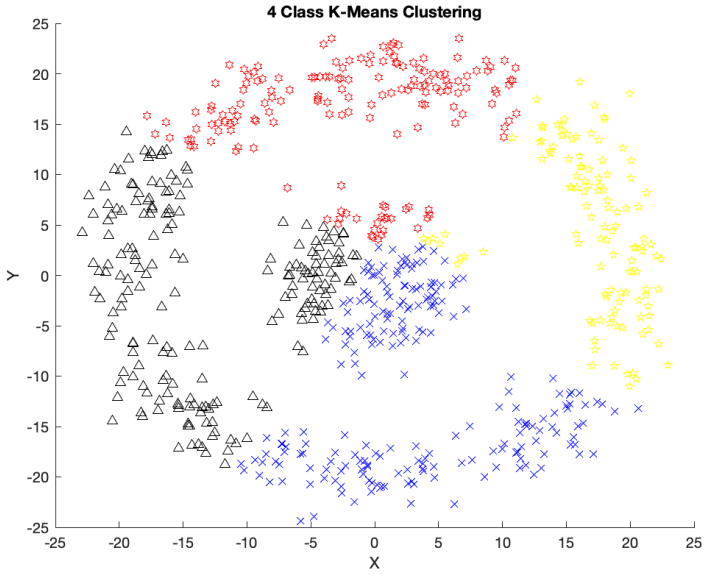
Anirudh Nakra
UID: 118134444

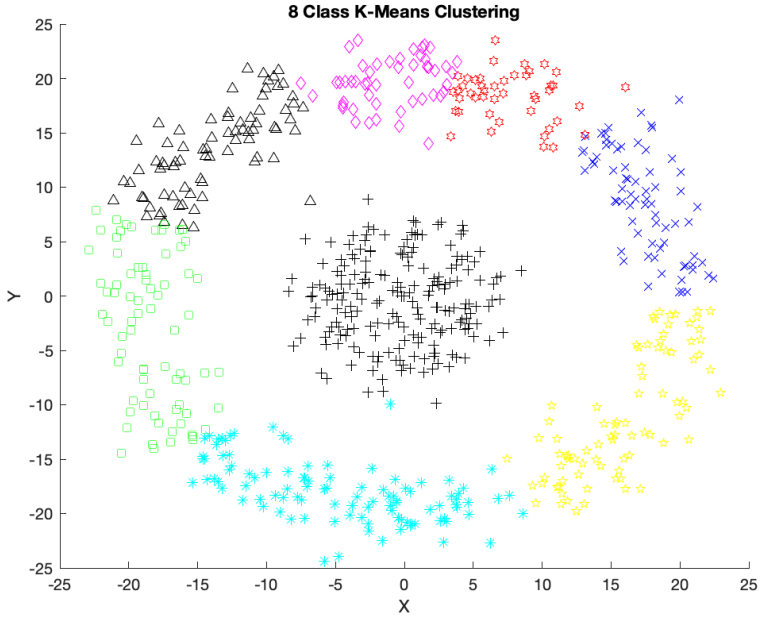
Assignment 6

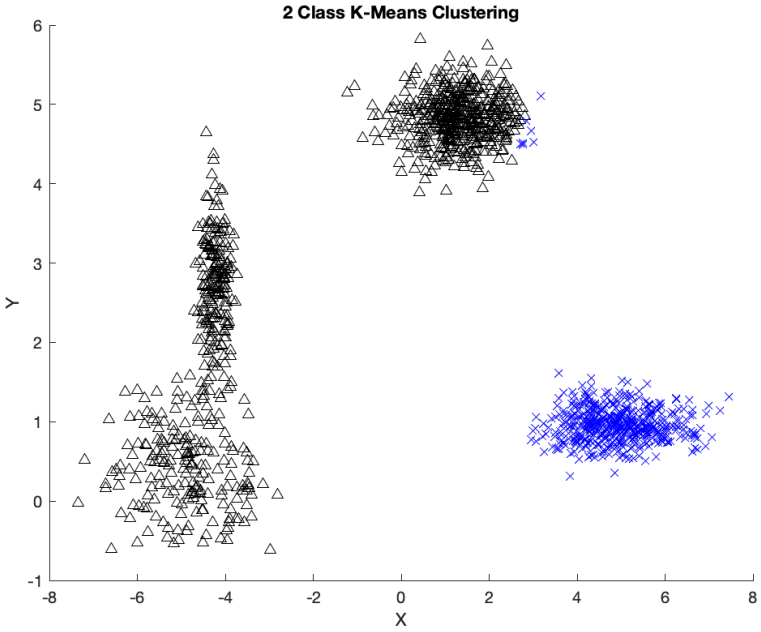
ENEE 633: Statistical Pattern Recognition

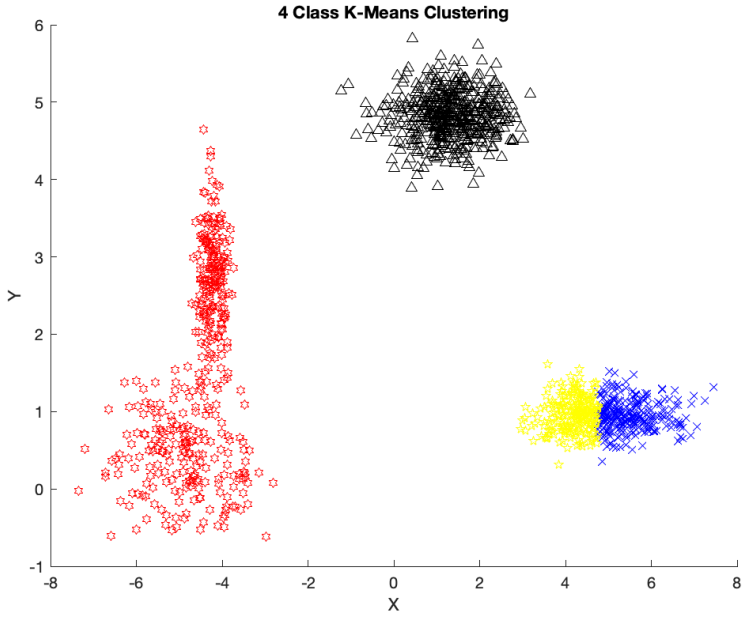
Ans1. a)

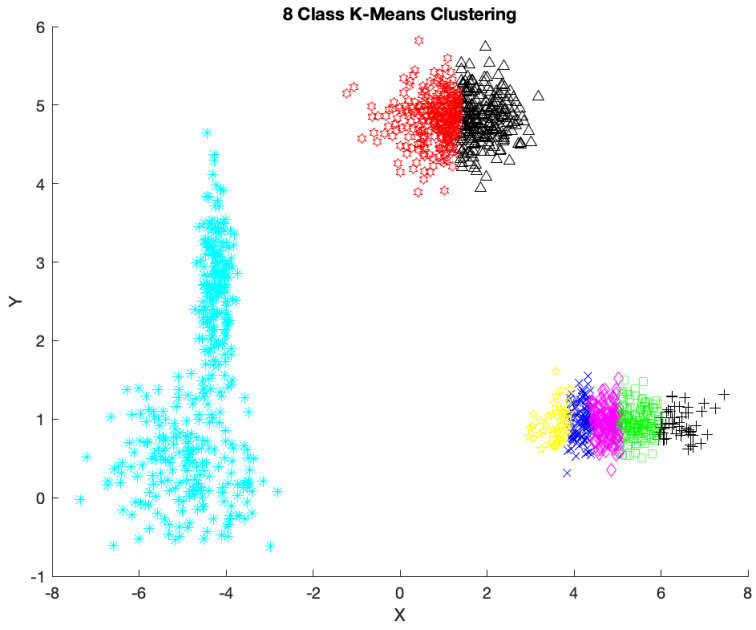




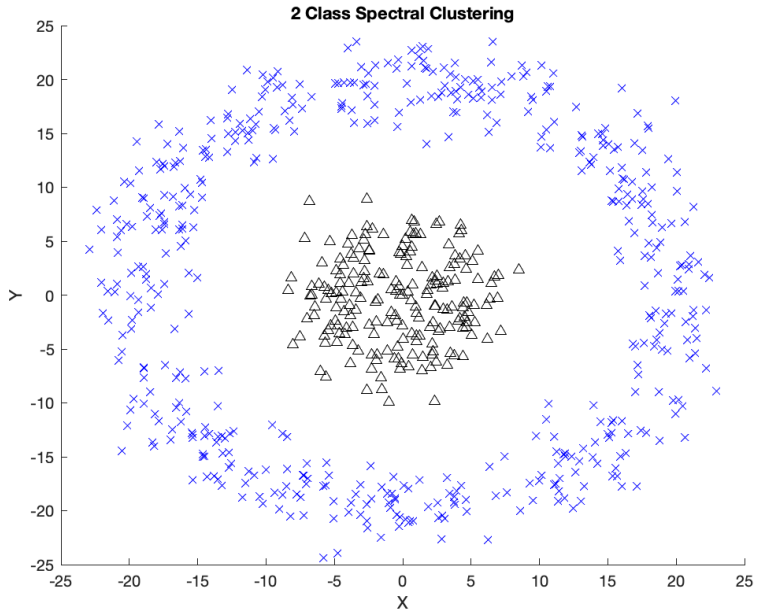

8 Class K-Means Clustering
25
20
15
10
5
0
-5
-10
-15
-20
-25
Y
-25
-20
-15
-10
-5
0
5
10
15
20
25
X

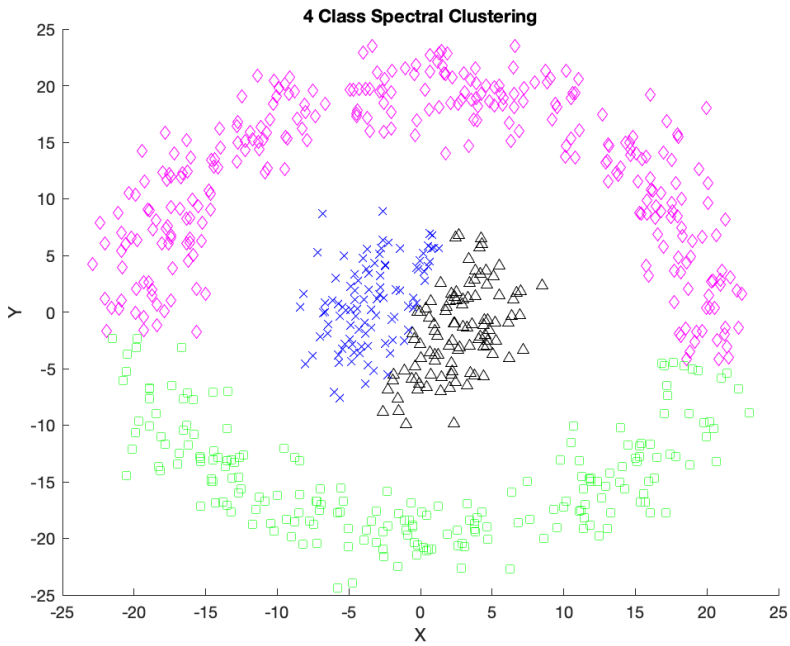

2 Class K-Means Clustering
6
5
4
3
2
1
0
-1
Y
-8
-6
-4
-2
0
2
4
6
8
X

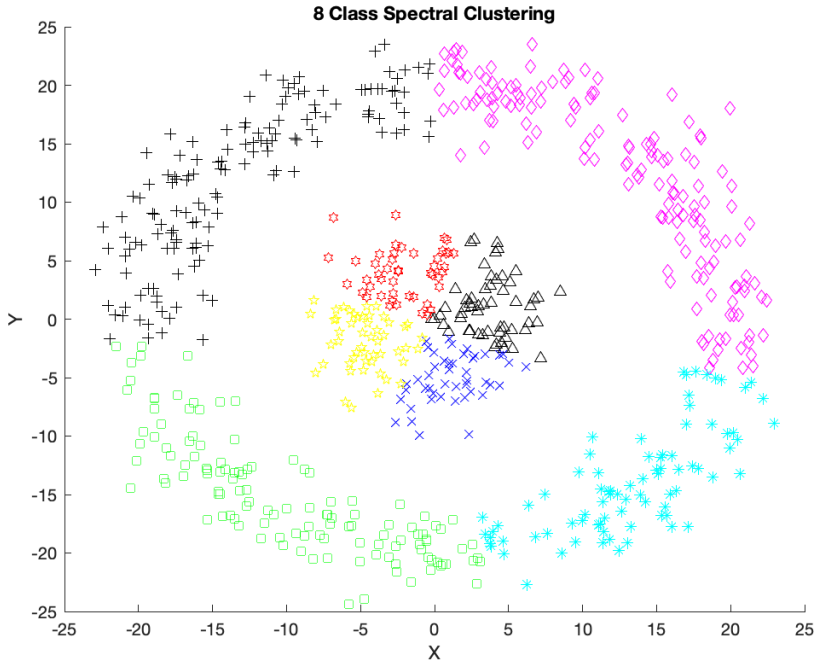

4 Class K-Means Clustering
X
Y


8 Class K-Means Clustering
X
Y

b)


2 Class Spectral Clustering
Y
X
25
20
15
10
5
0
-5
-10
-15
-20
-25


4 Class Spectral Clustering
Y
X
25
20
15
10
5
0
-5
-10
-15
-20
-25


8 Class Spectral Clustering
25
20
15
10
5
0
-5
-10
-15
-20
-25
Y
-25
-20
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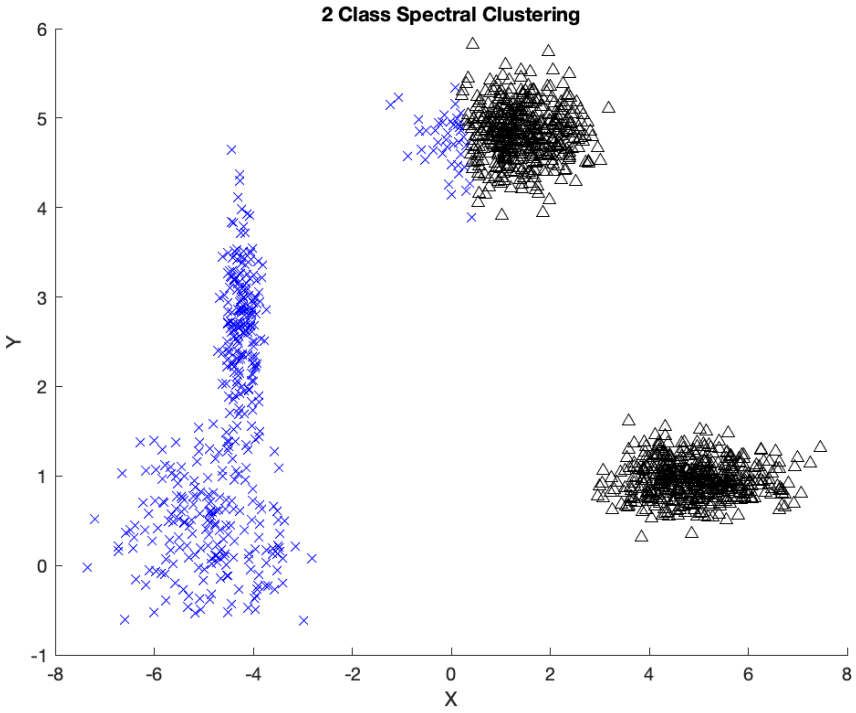
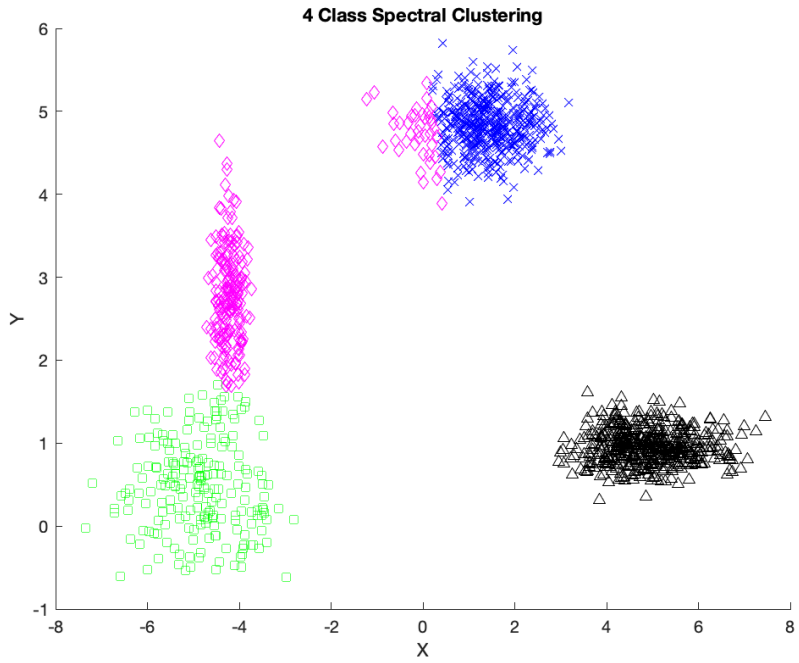
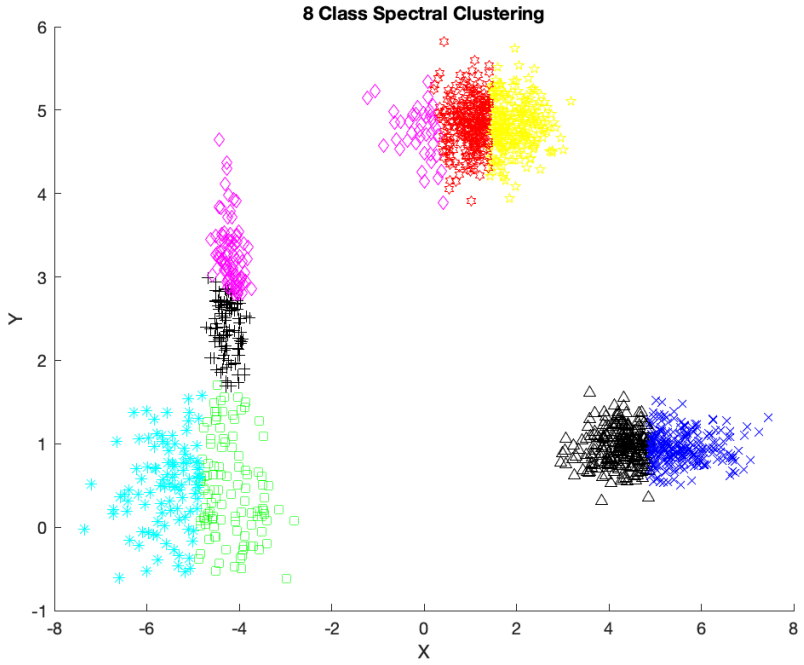
-10
-5
0
5
10
15
20
25
X


2 Class Spectral Clustering
6
5
4
3
2
1
0
-1
Y
-8
-6
-4
-2
0
2
4
6
8
X


4 Class Spectral Clustering
6
5
4
3
2
1
0
-1
Y
-8
-6
-4
-2
0
2
4
6
8
X


8 Class Spectral Clustering
6
5
4
3
2
1
0
-1
Y
-8
-6
-4
-2
0
2
4
6
8
X

c)

Dataset 1:

M=2 KMeans performs better than Spectral clustering

M=4 KMeans performs better than Spectral clustering

M=8 KMeans performs better than Spectral clustering

Dataset 2:

M=2 Spectral clustering performs better than KMeans

M=4 Spectral clustering performs better than KMeans

M=8 Spectral clustering performs better than KMeans

Qualitatively, the clusters formed during spectral clustering are better than the KMeans ones even though the cost function for the spectral clusters is more than the KMeans ones. We can see this in the first dataset. For the two-cluster case, spectral clustering correctly clusters the inner and outside concentric circle-like data patterns whereas K-Means gives the more trivial result with separating the data halfway to the left and the right.

Dataset	Clusters	K-Means Cost	Spectral Cost
1	2	139640	207710
1	4	67204	119080
1	8	23942	42445
2	2	11524	9057.4
2	4	1313	1578.7
2	8	1052.6	924.009