

For the last problem, I have included images of the results from the code in this document

$$1) \quad y_k = x_3, x_6$$

(after 1 iteration,  $y_k = x_2, x_4$ )  
closest to:

$$x_1: x_3, x_2, x_5 \quad 4.5$$

$$x_6: x_1, x_4, x_7 \quad 4/3 = 1.\overline{33}$$

(after 2 iterations,  $y_k = x_5, x_7$ )

$$x_2: x_3, x_5 \quad 2.5$$

$$x_4: x_1, x_6, x_7 \quad 1.\overline{33}$$

after converge  $y_k = x_5, x_6$

$$(x_5): x_2, x_3 \quad 2$$

$$(x_7): x_1, x_4, x_6 \quad 3$$

$$(x_5): x_2, x_3 \quad 2$$

$$(x_6): x_1, x_4, x_7 \quad 4/3 = 1.\overline{33}$$

2.

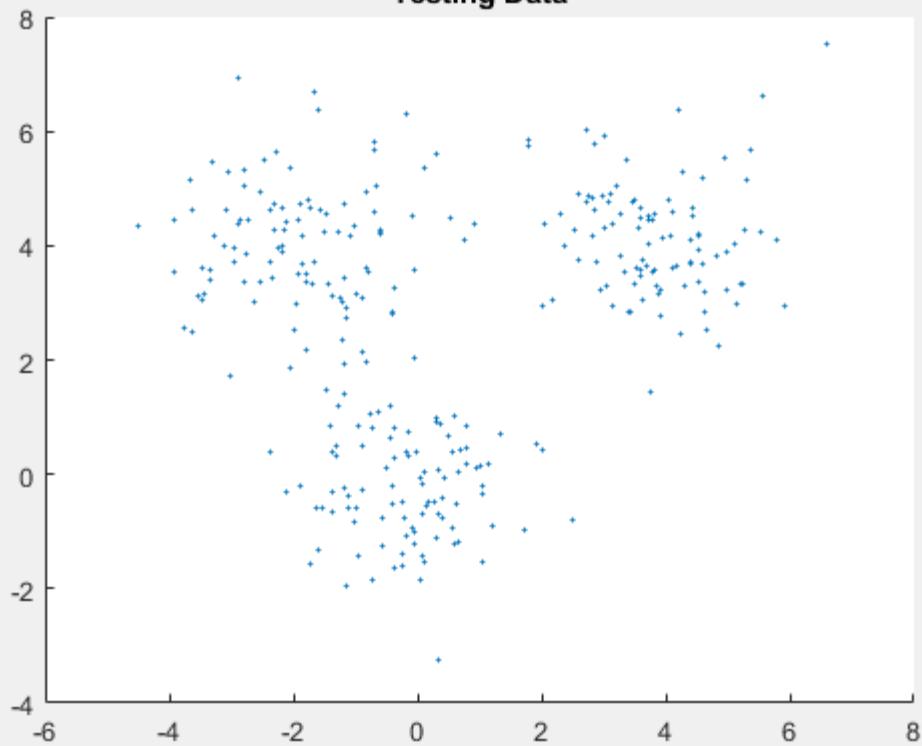
$$\begin{aligned} p(x) &= \sum_z p(z)p(x|z) \\ &= \sum_{k=1}^K \pi_k^{z_k} \mathcal{N}(x|\beta_k, \Sigma_k) \\ &= \sum_{k=1}^K \pi_k \mathcal{N}(x|\beta_k, \Sigma_k) \end{aligned}$$

Figure 1

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Testing Data



4.1

```
>> problem4_1
Covariance for Distribution 1
  1.0499    0.0517
  0.0517    1.1953

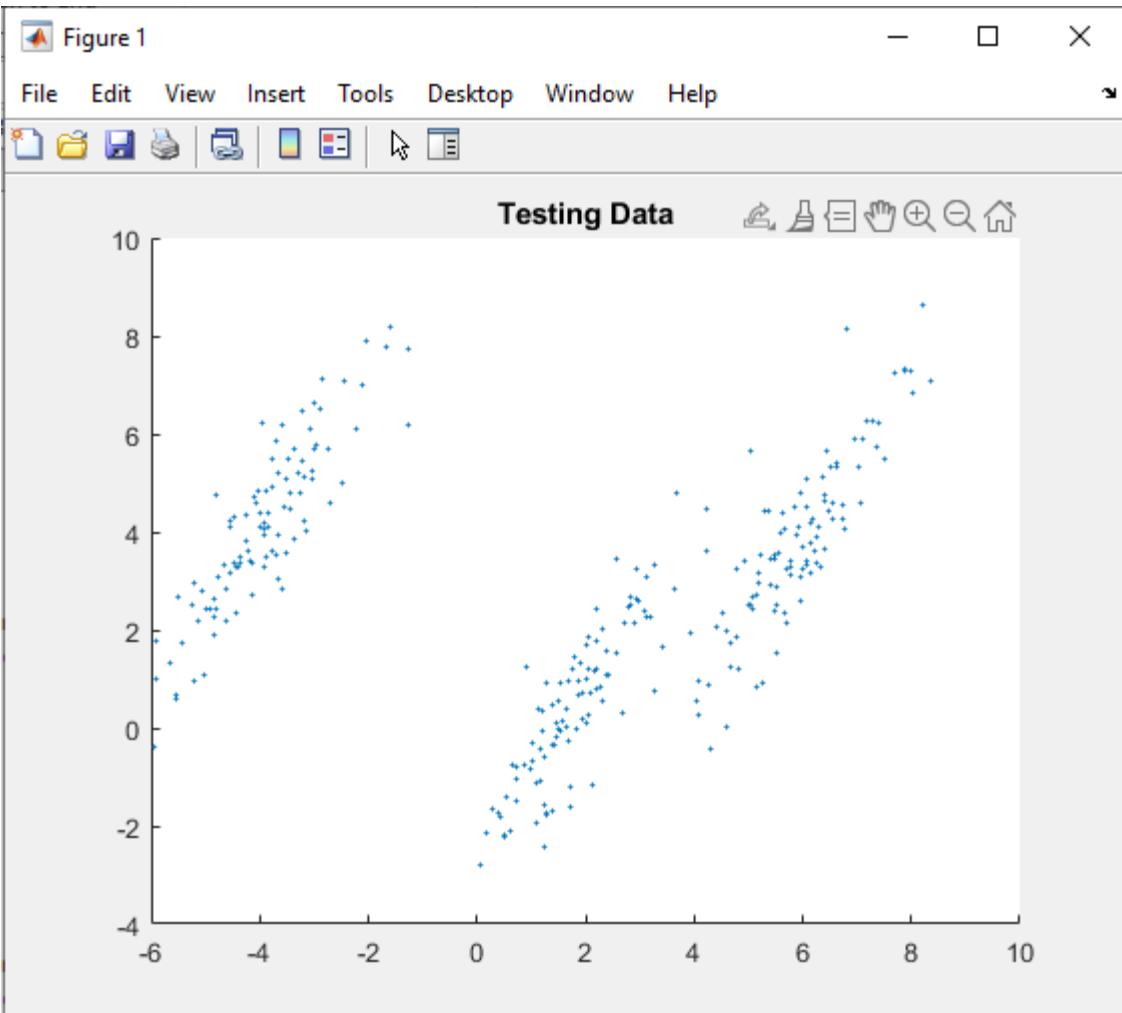
Mean Vector for Distribution 1
 -0.0216    0.1059

Covariance for Distribution 2
  0.9028    0.2377
  0.2377    0.9765

Mean Vector for Distribution 2
  3.9873    4.1155

Covariance for Distribution 3
  1.3276   -0.0177
 -0.0177    1.0517

Mean Vector for Distribution 3
 -1.9394    3.9073
```



4.2

```
>> problem4_2
Covariance for Distribution 1
1.0485    1.6080
1.6080    3.0725

Mean Vector for Distribution 1
1.5425    0.1606

Covariance for Distribution 2
0.9086    1.4365
1.4365    2.9284

Mean Vector for Distribution 2
6.0446    4.1236

Covariance for Distribution 3
0.8473    1.3290
1.3290    2.7565

Mean Vector for Distribution 3
-3.9571   4.1127
```



```
>> problem4_3
Covariance for Distribution 1
 6.9295    1.8106
 1.8106    0.9736

Mean Vector for Distribution 1
 1.6311    0.0177

Covariance for Distribution 2
 8.5099    2.2434
 2.2434    0.9698

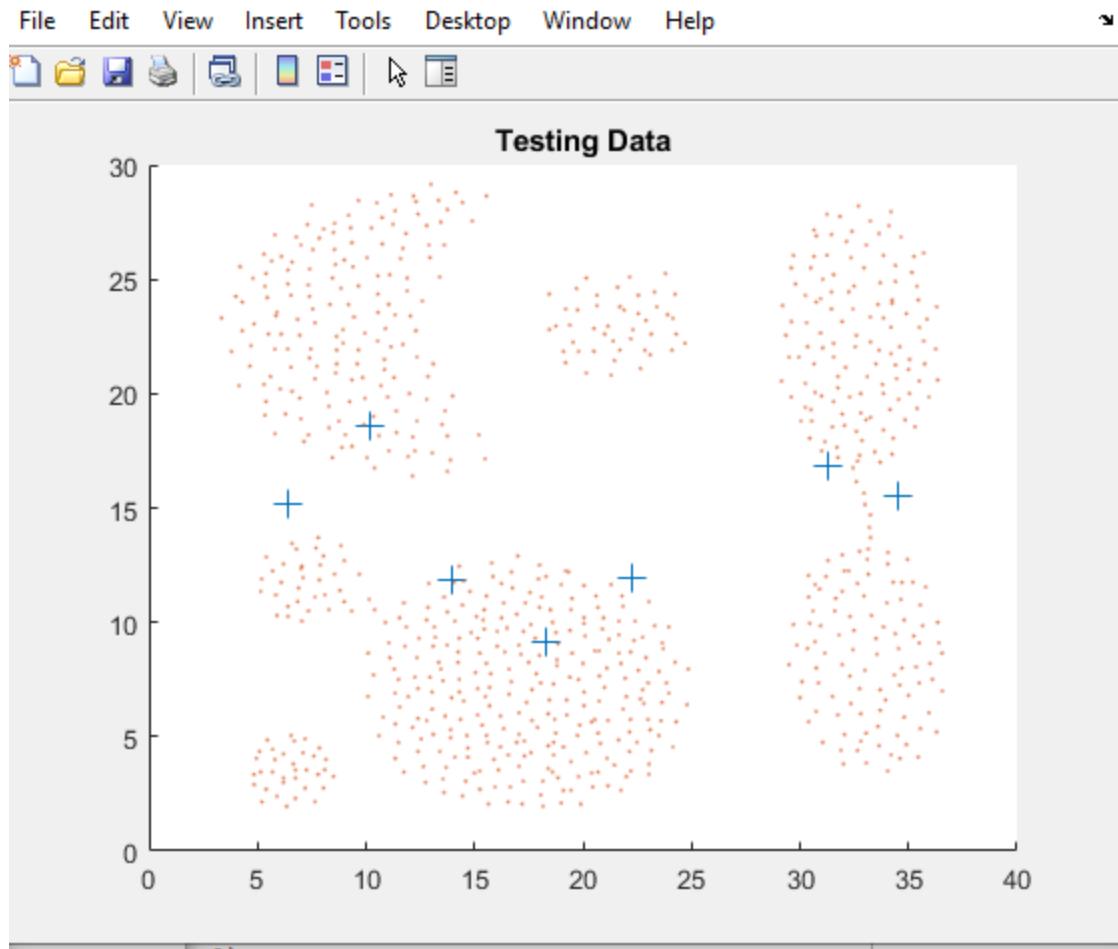
Mean Vector for Distribution 2
 5.9507    3.9530

Covariance for Distribution 3
 6.3657    1.7968
 1.7968    0.9111

Mean Vector for Distribution 3
 -4.0174    4.0730
```

my\_kmeans

Figure 1



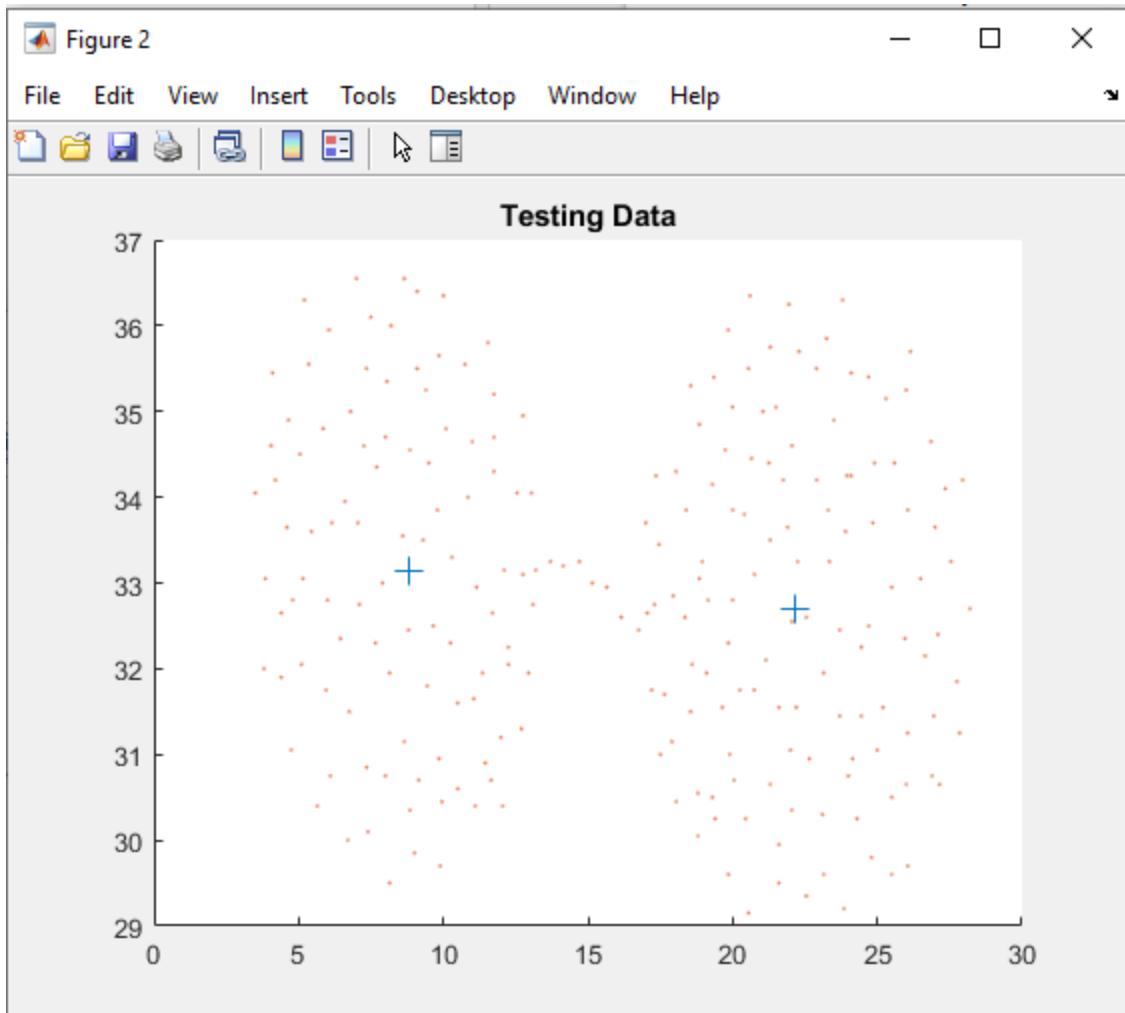


Figure 3

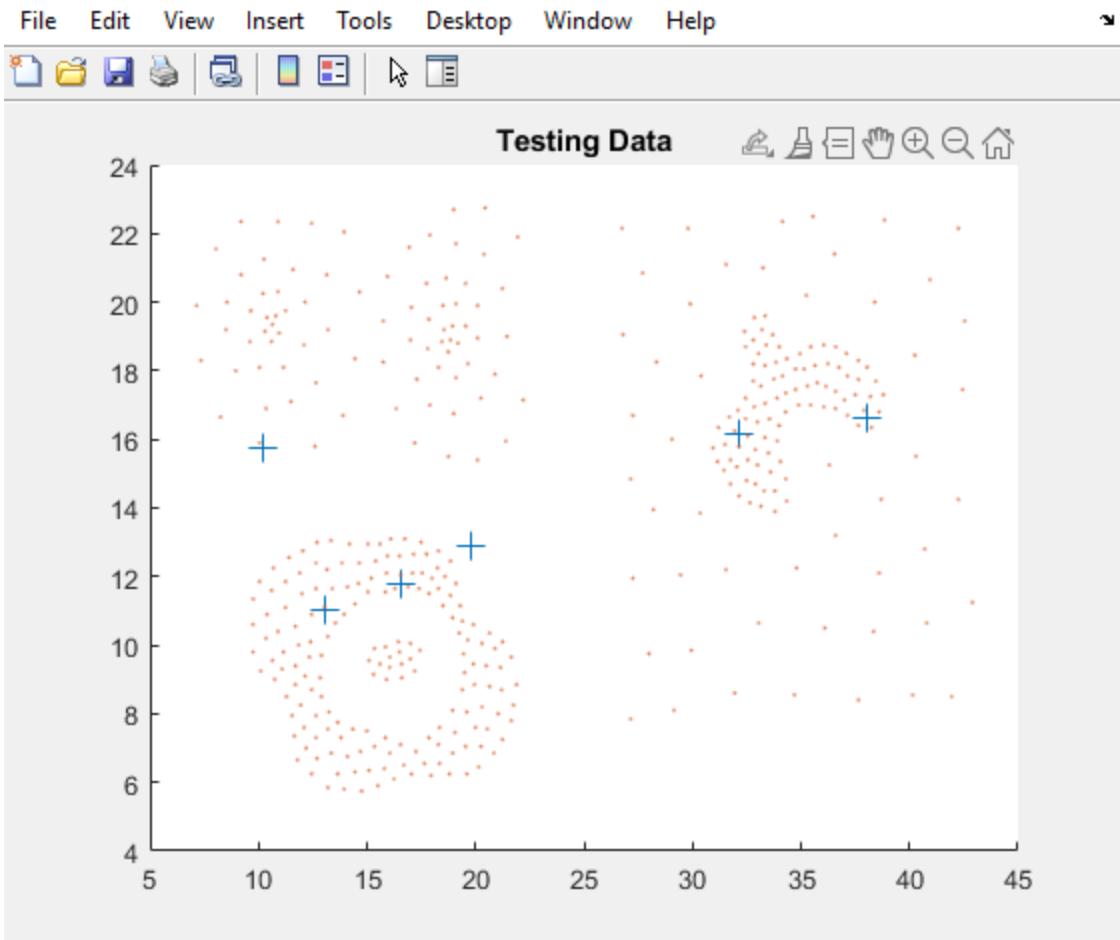
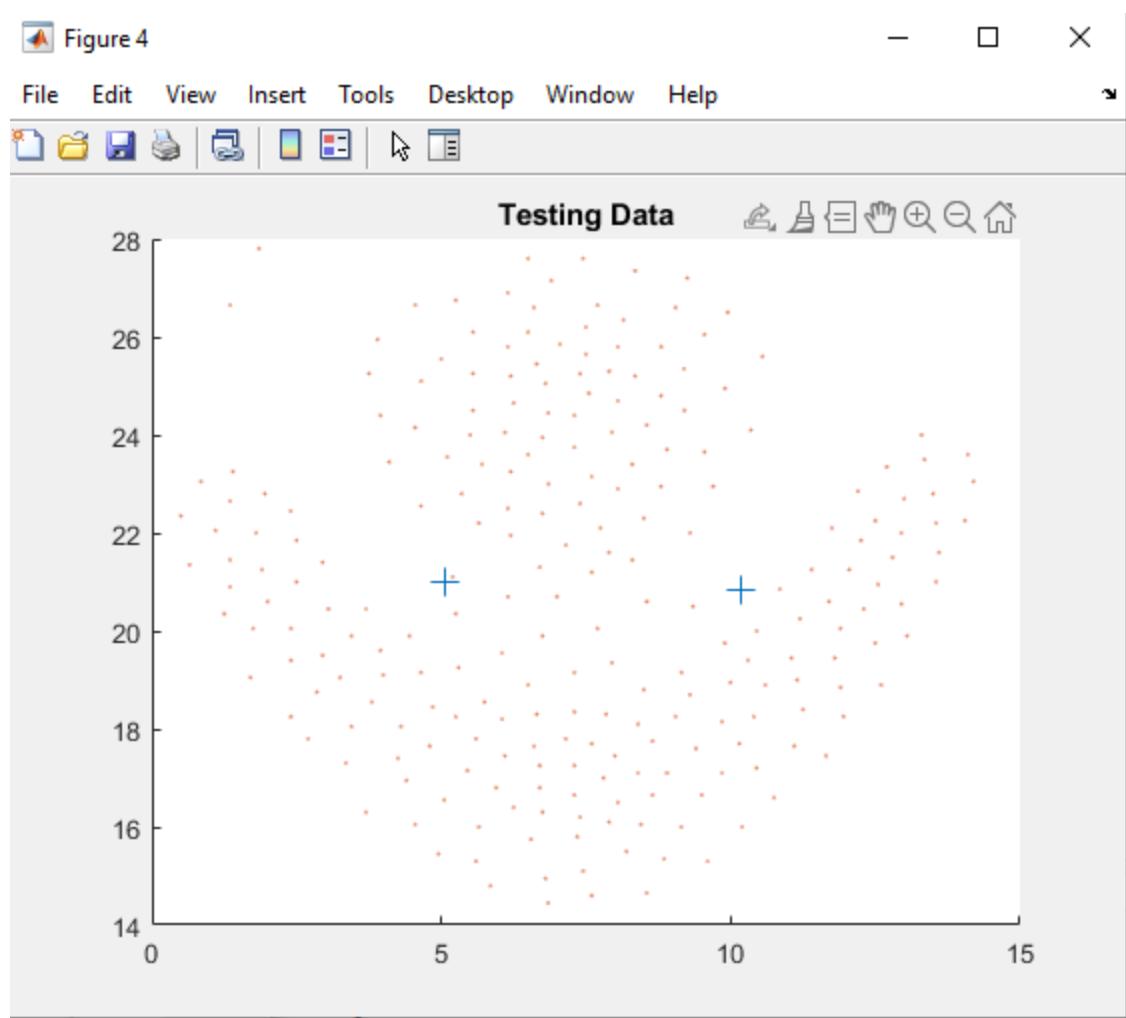


Figure 4



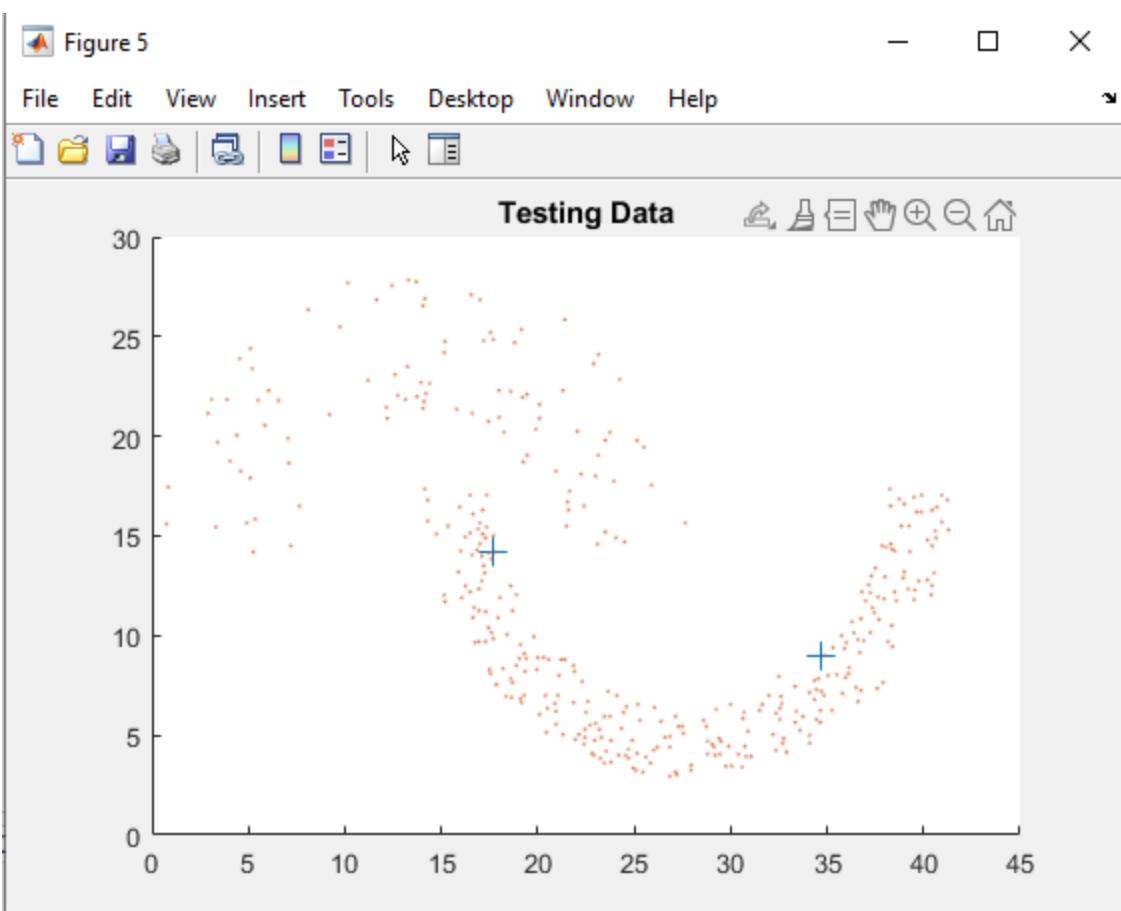


 Figure 6

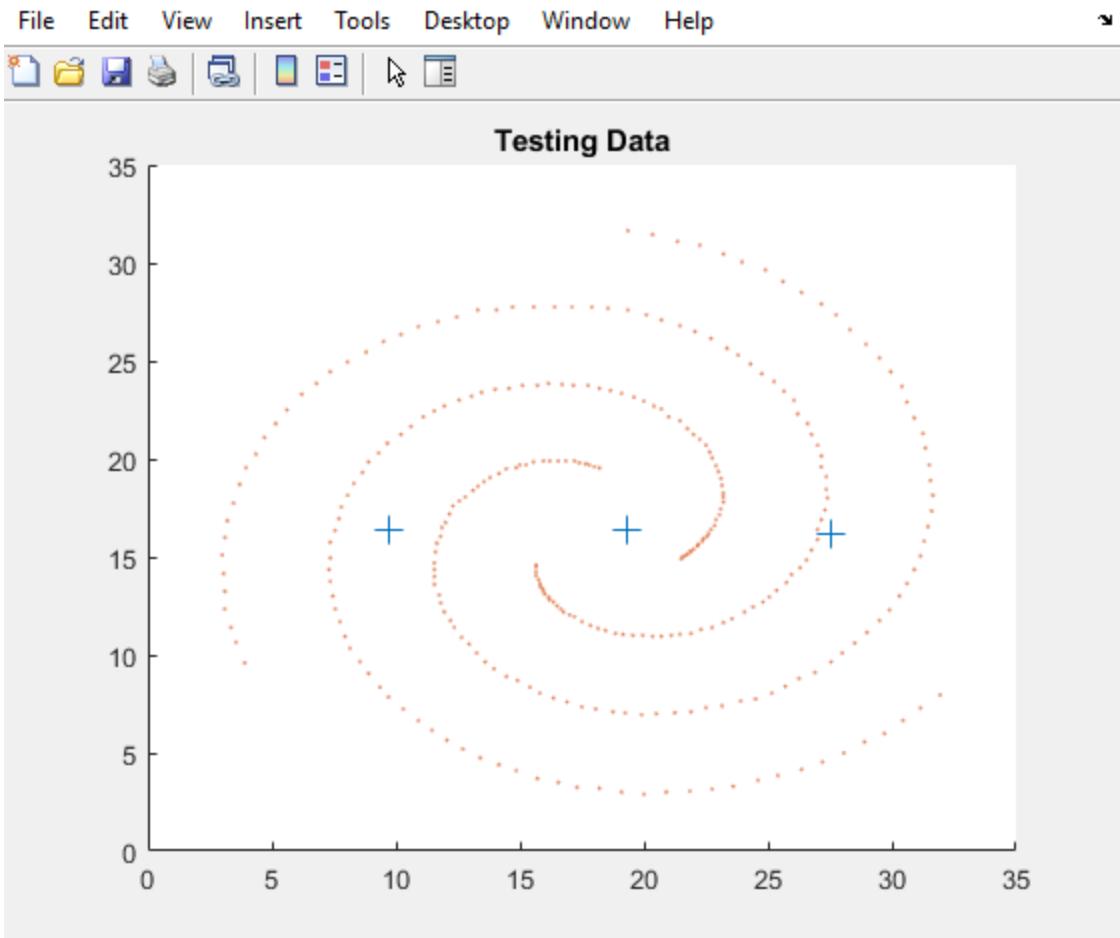


Figure 7

