By using the given dataset, design a training process of a LVQ network for only one iteration. Each class has only one centroid. Distance measure is Euclidean, learning rate λ=0.5 and at the beginning, the centroid positions are (9, 3) for the class 1 and (0, 8) for the class 2.

X_1	X_2	D
10	3	1
6	1	1
9	6	1
1	9	2
6	7	2
2	4	2

For updating two centers (C_1, C_2), we have to calculate the distance for every sample, then if the closest one is the same class, we will reward and otherwise we will punish it.

The first sample (10, 3)

$D_1 = \|C_1 - X_i\| = \sqrt{(9-10)^2 + (3-3)^2} = 1$

$D_2 = \|C_2 - X_i\| = \sqrt{(10-0)^2 + (3-8)^2} = 5\sqrt{5}$

The closest one is the first center. Since the output of the first sample belongs to the first class, we have to reward it.

$C_1 = C_1 + \beta (X_i - C_1) = (9, 3) + 0.5\|(10,3)-(9,3)\| = (9.5 , 3)$

The second sample (6, 1)

Here we will use the centers which we have updated their values

$D_1 = \sqrt{(6-9.5)^2 + (1-3)^2} = 3.77$

$D_2 = \sqrt{(6-0)^2 + (1-8)^2} = 9.21$

We will give it a gift

$C_1 = (9.5, 3) + 0.5 \|(6, 1) - (9.5, 3)\| = (7.75, 2)$

The third sample (9, 6)

Here we will use the centers which we have updated their values

$D_1 = \sqrt{(9-7.75)^2 + (6-2)^2} = 4.19$

$D_2 = \sqrt{(9-0)^2 + (6-8)^2} = 9.21$

We will give it a gift

$C_1 = (7.75, 2) + 0.5 \|(9, 6) - (7.75, 2)\| = (8.37, 4)$

The fourth sample (1, 9)

Here we will use the centers which we have updated their values

$D_1 = \sqrt{(1-8.37)^2 + (9-4)^2} = 8.88$

$D_2 = \sqrt{(1-0)^2 + (9-8)^2} = 1.4$

We will give it a gift

$C_2 = (0, 8) + 0.5\ ||(1, 9) - (0, 8)|| = (0.5, 7.5)$

The fifth sample (6, 7)

Here we will use the centers which we have updated their values

$D_1 = \sqrt{(6-8.37)^2 + (7-4)^2} = 3.88$

$D_2 = \sqrt{(6-0.5)^2 + (7-7.5)^2} = 5.5$

We will punish it

$C_1 = (8.37, 4) - 0.5\ ||(6, 7) - (8.37,4)|| = (9.55, 2.5)$

The sixth sample (2, 4)

Here we will use the centers which we have updated their values

$D_1 = \sqrt{(2-9.55)^2 + (4-2.5)^2} = 7.68$

$D_2 = \sqrt{(2-0.5)^2 + (4-7.5)^2} = 3.8$

We will give it a gift

$C_1 = (0.5, 7.5) + 0.5\ ||(2, 4) - (0.5, 7.5)|| = (1.25, 5.75)$