Assignment 3

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Question 2

Part 1

If we calculate the distances of all points to the clusters. We get the following:

Point	Distance to Cluster 1	Distance to Cluster 2
X1	$\sqrt{(0-0)^2+(1-0)^2}=1$	$\sqrt{(0-2)^2+(1-1)^2}=2$
X2	$\sqrt{(3-0)^2+(3-0)^2}=4.24$	$\sqrt{(3-2)^2+(3-1)^2}=2.23$
X3	$\sqrt{(1-0)^2+(1-0)^2}=1.41$	$\sqrt{(1-2)^2+(1-1)^2}=1$
X4	$\sqrt{(2-0)^2+(3-0)^2}=3.6$	$\sqrt{(2-2)^2+(3-1)^2}=2$
X5	$\sqrt{(1-0)^2+(0-0)^2}=1$	$\sqrt{(1-2)^2+(0-1)^2}=1.41$
X6	$\sqrt{(0-0)^2+(0-0)^2}=0$	$\sqrt{(0-2)^2+(0-1)^2}=2.23$
X7	$\sqrt{(3-0)^2+(2-0)^2}=3.6$	$\sqrt{(3-2)^2+(2-1)^2}=1.41$
X8	$\sqrt{(2-0)^2+(2-0)^2}=2.82$	$\sqrt{(2-2)^2+(2-1)^2}=1$

With all the distances calculated, the new values of the clusters are calculated from the points associated with them. The new values are:

$C1 = (\frac{0+1+0}{3}, \frac{1+0+0}{3}) = (\frac{1}{3}, \frac{1}{3})$

$C2 = (\frac{3+1+2+3+2}{5}, \frac{3+1+3+2+2}{5}) = (\frac{11}{5}, \frac{11}{5})$

We calculate again all distances for the different points with the new clusters:

Point	Distance to Cluster 1	Distance to Cluster 2
X1	$\sqrt{(0-\frac{1}{3})^2+(1-\frac{1}{3})^2}=0.74$	$\sqrt{(0-\frac{11}{5})^2+(1-\frac{11}{5})^2}=2.5$
X2	$\sqrt{(3-\frac{1}{3})^2+(3-\frac{1}{3})^2}=3.77$	$\sqrt{(3-\frac{11}{5})^2+(3-\frac{11}{5})^2}=1.13$
X3	$\sqrt{(1-\frac{1}{3})^2+(1-\frac{1}{3})^2}=0.94$	$\sqrt{(1-\frac{11}{5})^2+(1-\frac{11}{5})^2}=1.69$

X4	$\sqrt{(2-\frac{1}{3})^2+(3-\frac{1}{3})^2}=3.14$	$\sqrt{(2-\frac{11}{5})^2+(3-\frac{11}{5})^2}=0.82$
X5	$\sqrt{(1-\frac{1}{3})^2+(0-\frac{1}{3})^2}=0.7$	$\sqrt{(1-\frac{11}{5})^2+(0-\frac{11}{5})^2}=2.5$
X6	$\sqrt{(0-\frac{1}{3})^2+(0-\frac{1}{3})^2}=0.4$	$\sqrt{(0-\frac{11}{5})^2+(0-\frac{11}{5})^2}=3.11$
X7	$\sqrt{(3-\frac{1}{3})^2+(2-\frac{1}{3})^2}=3.1$	$\sqrt{(3-\frac{11}{5})^2+(2-\frac{11}{5})^2}=0.82$
X8	$\sqrt{(2-\frac{1}{3})^2+(2-\frac{1}{3})^2}=2.35$	$\sqrt{(2-\frac{11}{5})^2+(2-\frac{11}{5})^2}=0.28$

The points associated to each cluster has now changed, so we need to calculate new values for the clusters:

$C1 = (\frac{0+1+1+0}{4}, \frac{1+1+0+0}{4}) = (0.5, 0.5)$

$C2 = (\frac{3+2+3+2}{4}, \frac{3+3+2+2}{4}) = (\frac{10}{4}, \frac{10}{4})$

We calculate again all distances for the different points with the new clusters:

Point	**Distance to Cluster 1**	**Distance to Cluster 2**
X1	$\sqrt{(0-0.5)^2+(1-0.5)^2}=0.7$	$\sqrt{(0-\frac{10}{4})^2+(1-\frac{10}{4})^2}=2.91$
X2	$\sqrt{(3-0.5)^2+(3-0.5)^2}=3.53$	$\sqrt{(3-\frac{10}{4})^2+(3-\frac{10}{4})^2}=0.7$
X3	$\sqrt{(1-0.5)^2+(1-0.5)^2}=0.7$	$\sqrt{(1-\frac{10}{4})^2+(1-\frac{10}{4})^2}=2.12$
X4	$\sqrt{(2-0.5)^2+(3-0.5)^2}=2.91$	$\sqrt{(2-\frac{10}{4})^2+(3-\frac{10}{4})^2}=0.7$
X5	$\sqrt{(1-0.5)^2+(0-0.5)^2}=0.7$	$\sqrt{(1-\frac{10}{4})^2+(0-\frac{10}{4})^2}=2.9$
X6	$\sqrt{(0-0.5)^2+(0-0.5)^2}=0.7$	$\sqrt{(0-\frac{10}{4})^2+(0-\frac{10}{4})^2}=3.53$
X7	$\sqrt{(3-0.5)^2+(2-0.5)^2}=2.91$	$\sqrt{(3-\frac{10}{4})^2+(2-\frac{10}{4})^2}=0.7$
X8	$\sqrt{(2-0.5)^2+(2-0.5)^2}=2.12$	$\sqrt{(2-\frac{10}{4})^2+(2-\frac{10}{4})^2}=0.7$

All points are associated now the same way as they were in the previous round, so the previous values of the clusters are the most accurate for the given points.