Feedback — Week 2 Quiz

Help Center

Thank you. Your submission for this quiz was received.

You submitted this quiz on **Wed 6 May 2015 9:09 PM PDT**. You got a score of **8.00** out of **10.00**.

Question 1

Given Eps and Minpts, if a point p is density-connected to a point q , which of the following statements are correct?

Your Answer		Score	Explanation
☐ Point p is directly density-reachable from q	✔	0.20	
☑ Point q is density-connected to p	✔	0.20	
☐ Point q is directly density-reachable from p	✔	0.20	
☐ Point p is density-reachable from q	✔	0.20	
☐ Point q is density-reachable from p	✔	0.20	
Total		1.00 / 1.00	

Question Explanation

The following statement is correct:

- Point q is density-connected to p. (Correct since there exists a point o such that both p and q are density-reachable from o.)

The following statements are incorrect since it is possible that neither p nor q is a core-point.

- Point p is density-reachable from q
- Point p is directly density-reachable from q

- Point q is density-reachable from p
- Point q is directly density-reachable from p

Question 2

Suppose Eps = 1cm and Minpts = 1. Randomly select two points p, q from the observed data points. We have dist(p, q) = 4cm. Which of the following statements are correct?

Your Answer		Score	Explanation
☑ Points p and q may be in the different clusters	✔	0.25	
☐ Points p and q must be in different clusters	✔	0.25	
☑ Points p and q may not belong to any clusters	✖	0.00	
☐ Points p and q must be in the same cluster	✔	0.25	
Total		0.75 / 1.00	

Question Explanation

The following statements are correct:

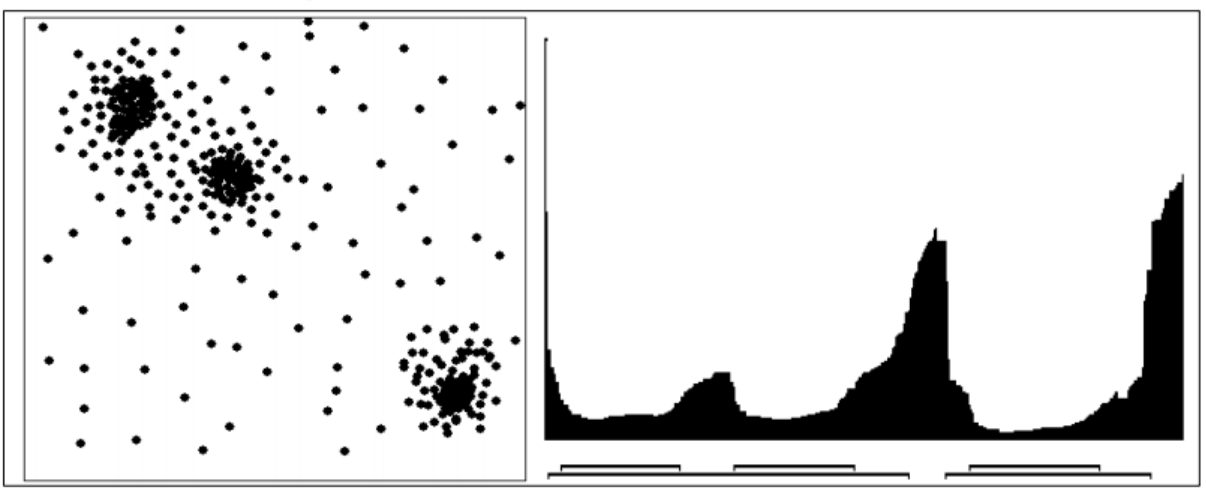
- Points p and q may be in the different clusters. (Correct. For instance, when p and q are the only two points in the dataset, since Minpts = 1, thus p and q form two clusters.)

The following statements are incorrect:

- Points p and q must be in different clusters. (Incorrect when there exists a point o from which both p and q are density-reachable. Note that any point in the dataset for Minpts = 1 is a core point.)
- Points p and q must be in the same cluster. (Incorrect. For instance, there are only two points p and q in the dataset.)
- Points p and q may not belong to any clusters . (Since p and q are both core points, it is impossible for them to be noise/outliers, which implies p and q must belong to some clusters.)

Question 3

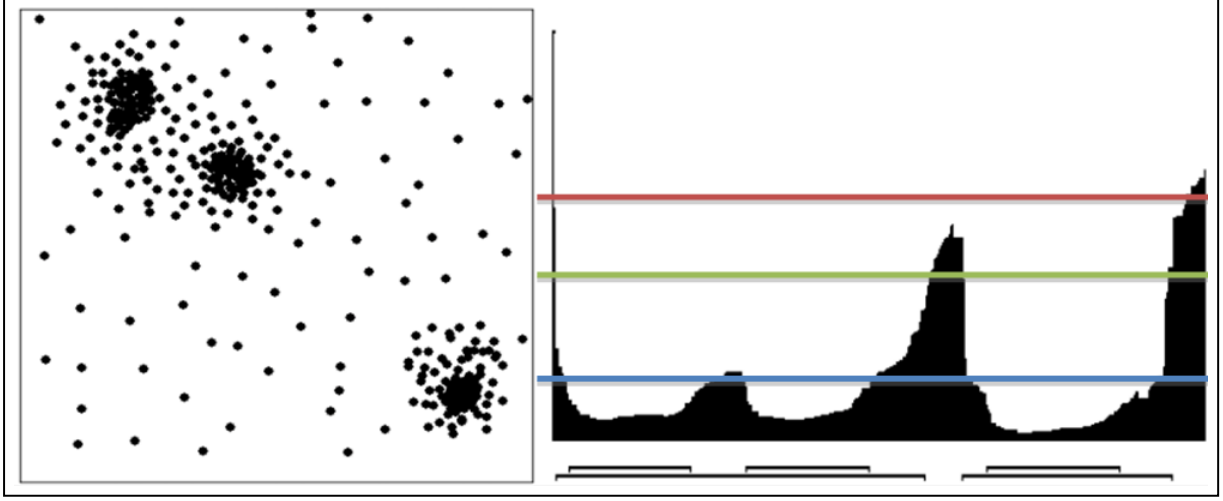
Given the following synthetic data set (left) and the reachability-plot (right), how many clusters might there be by setting different reachability thresholds?



Your Answer		Score	Explanation
☑ 2	✔	0.25	
☑ 1	✔	0.25	
☐ more than 3	✖	0.00	
☑ 3	✔	0.25	
Total		0.75 / 1.00	

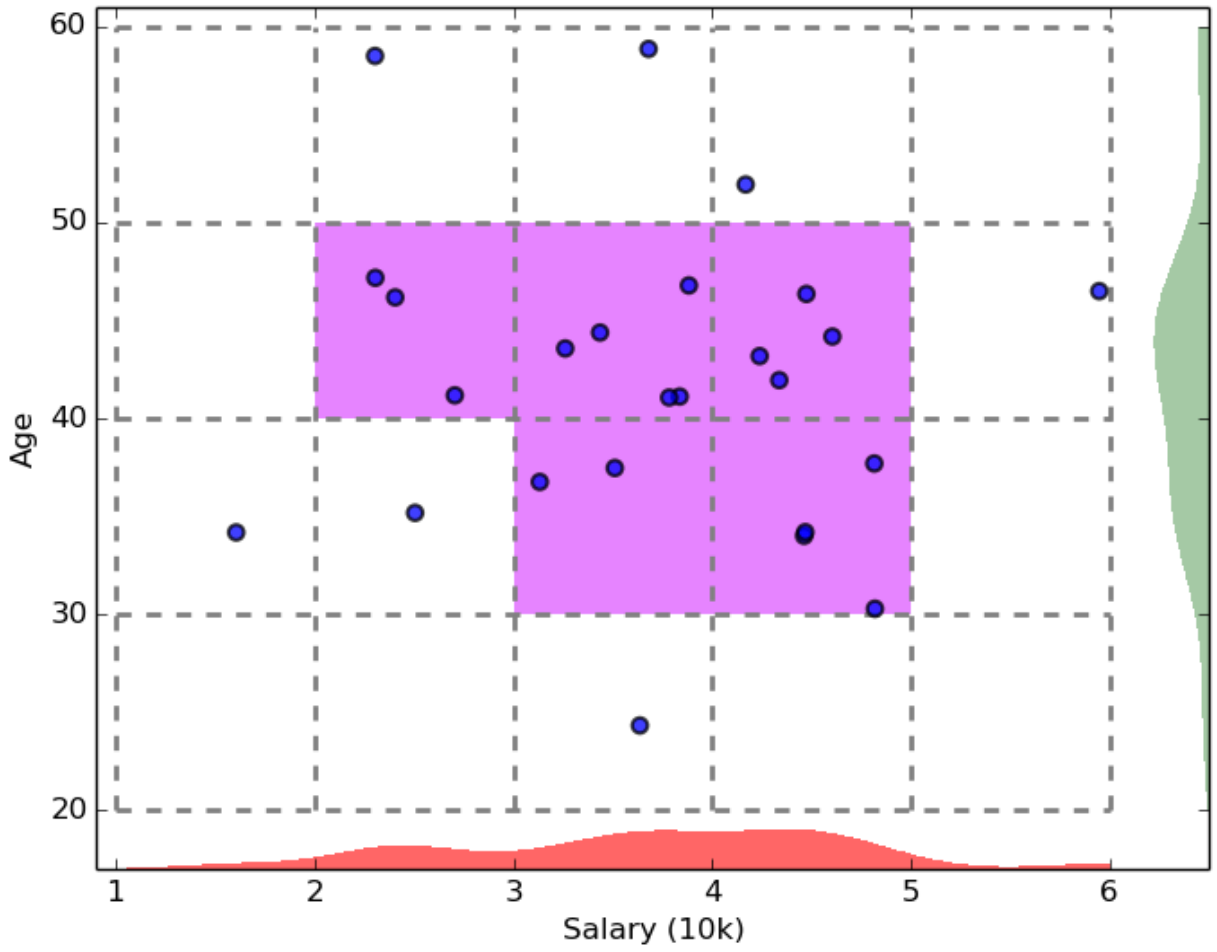
Question Explanation

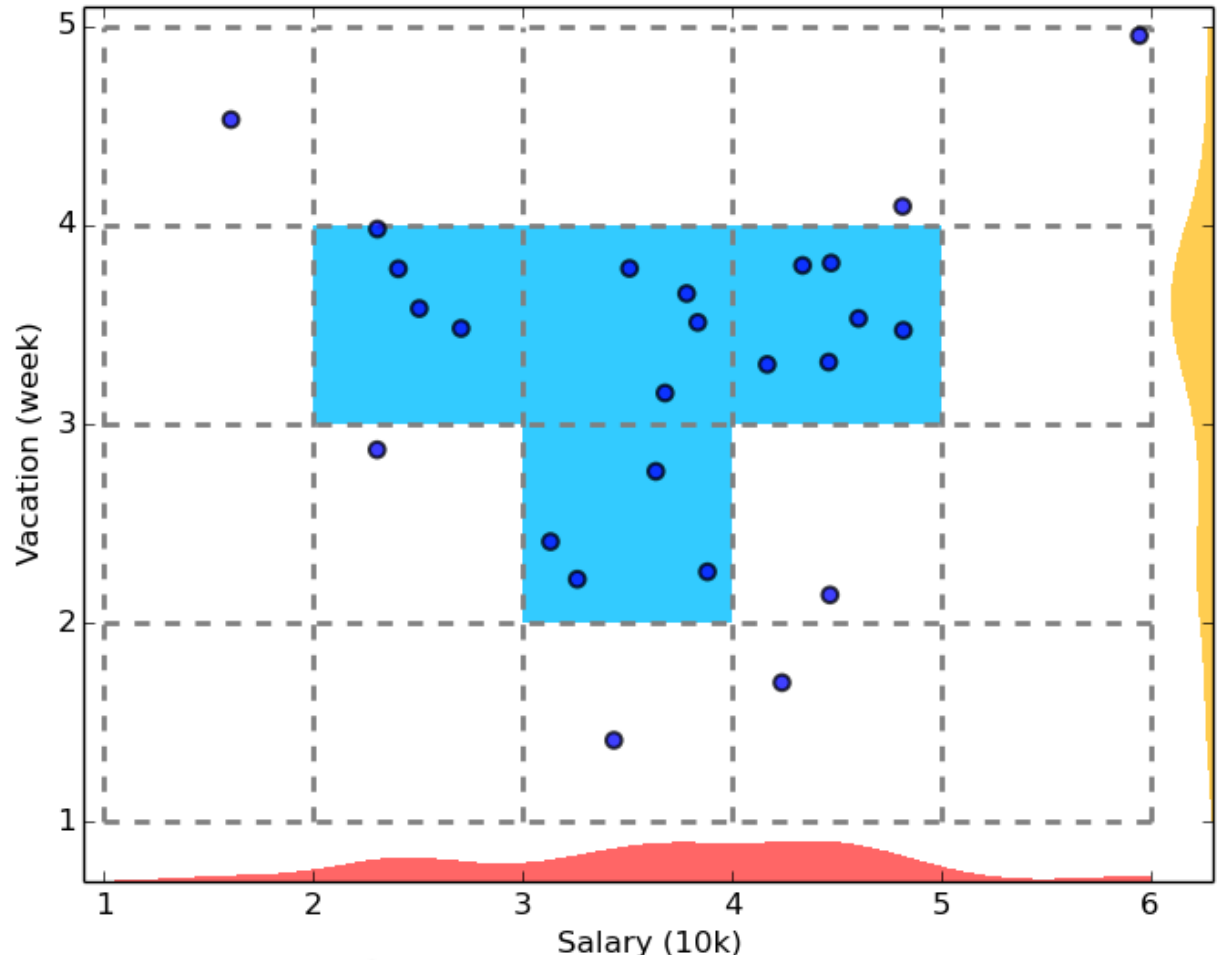
There might be 1, 2, or 3 clusters, which correspond to the red, green and blue lines respectively. If we set Minpts = 1 and Eps to an extremely small value, then every point may form a cluster, i.e., there are more than 3 clusters.

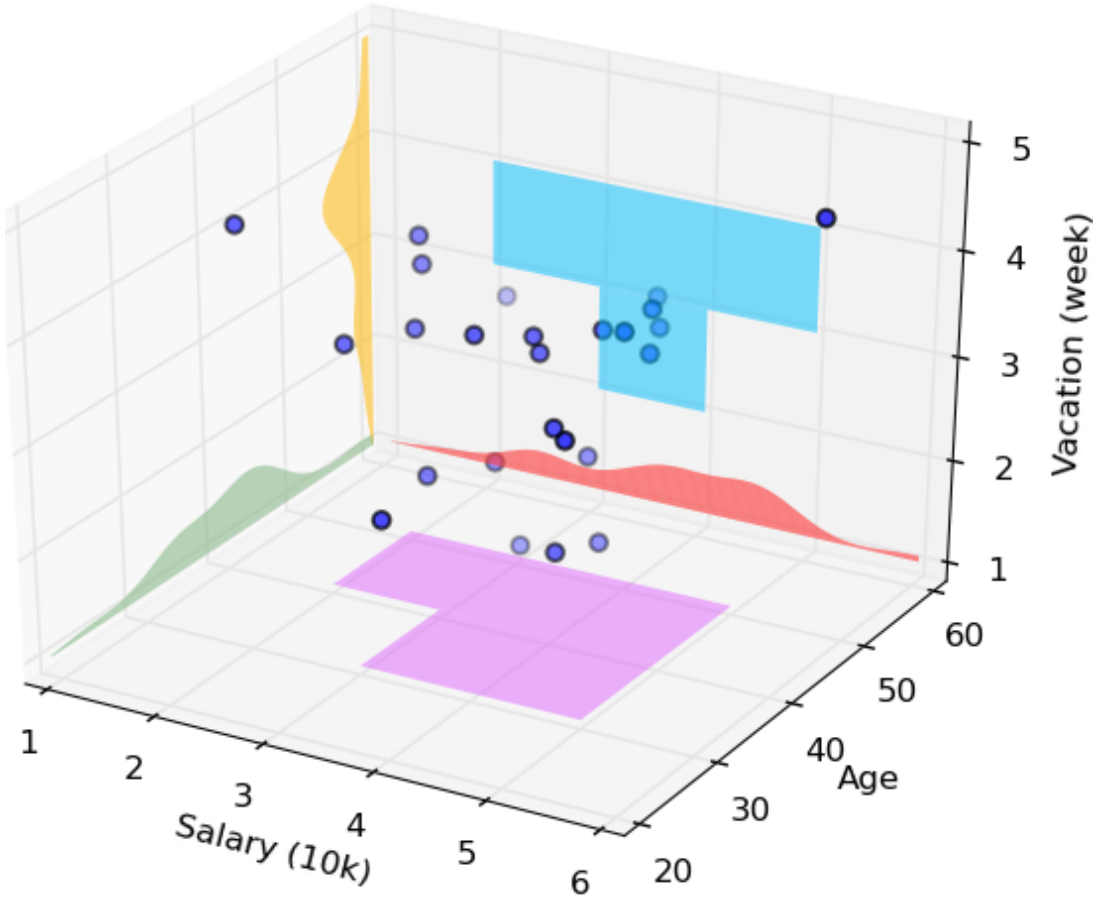


Question 4

Apply the CLIQUE clustering algorithm to the following depicted dataset. Suppose we have found the dense region in 3-D space. Which of the following statements are correct?







Your Answer	Score	Explanation
☐ When projecting the dense region in 3D into the 2-D space of	✔ 0.25	

Salary-Age, the projected area may not be a subspace of the purple region.		
☑ When projecting the dense region in 3D into the 2-D space of Vacation-Age, the projected area must be a subspace of the purple region.	✔	0.25
☐ When projecting the dense region in 3D into the 2-D space of Vacation -Age, the projected area may not be a subspace of the purple region.	✔	0.25
☑ When projecting the dense region in 3D into the 2-D space of Salary-Age, the projected area must be a subspace of the purple region.	✔	0.25
Total		1.00 / 1.00

Question Explanation

For any point to be in a dense region in a higher dimension space, it must be in a dense region in the lower dimensional space.

Question 5

In Gaussian Mixture Model, the random variables are univariate. For i-th cluster, where i = 1… k, the data points are drawn from Gaussian distribution, $x \sim N(\mu_i, \sigma_i)$, i.e., $P(x|C_i) = \frac{1}{\sqrt{2\pi}\sigma_i} e^{-\frac{(x-\mu_i)^2}{2\sigma_i^2}}$. Suppose we have learned two clusters from some dataset with the parameter μ_1=0,σ_1=1,μ_2=-2,σ_2=3,P(C_1)=0.25,P(C_2)=0.75. For the new data point x=1, what is the probability that it belongs to the first cluster, i.e. P(C_1 |x)?

Your Answer	Score	Explanation
○ 0.75		
○ 0.8		

◉ 0.5	✔	1.00
○ 0.25		
Total		1.00 / 1.00

Question Explanation

Please note the texts of this question have been updated.

$P(C_1|x) \propto P(x|C_1 = N(\mu_1, \sigma_1))P(C_1) = 0.25 * \frac{1}{\sqrt{2\pi}*1} * e^{-\frac{(1-0)^2}{2*1^2}}$. Similarly, $P(C_2|x) \propto 0.75 * \frac{1}{\sqrt{2\pi}*3} * e^{-\frac{(1-(-2))^2}{2*3^2}}$. Because of $\mathrm{P}(\mathrm{C}_1|\mathrm{x}) + \mathrm{P}(\mathrm{C}_2|\mathrm{x}) = 1$, we have $\mathrm{P}(\mathrm{C}_1|\mathrm{x}) = \frac{0.25}{0.25+0.25} = \frac{1}{2} = 0.5$.

Question 6

Which of the following statements about Gaussian Mixture Models (GMM) are correct?

Your Answer		Score	Explanation
☑ GMM assumes the data points are generated by some Gaussian distributions.	✔	0.25	
☐ GMM usually converges much faster than K-means.	✔	0.25	
☐ In GMM, for different initializations, we will always have exactly same the clustering result.	✔	0.25	
☑ In GMM, we have to specify the number of clusters.	✔	0.25	
Total		1.00 / 1.00	

Question Explanation

Please note the texts of this question have been updated.

GMM is sensitive to its initialization. That is, different initializations may lead to different results. GMM usually converges slower than K-means because the parameters evolve more smoothly, as shown in the example in the slides.

Question 7

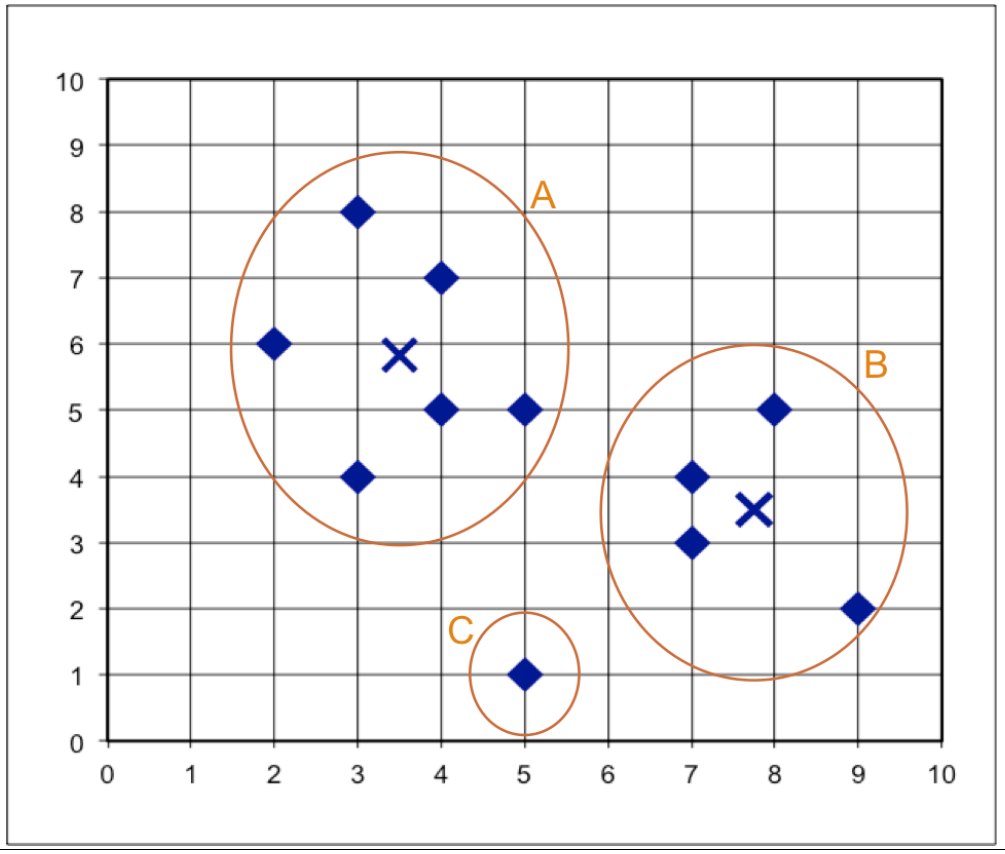
In which ONE of the following scenarios may Gaussian Mixture Models (GMM) not work properly?

Your Answer		Score	Explanation
Build 2 clusters from 2000 10-dimensional data points randomly generated from 10 Gaussian distributions.	✔	1.00	
Build 10 clusters from 2000 10-dimensional data points randomly generated from 10 Gaussian distributions.			
Total		1.00 / 1.00	

Question Explanation

Setting the number of clusters in GMM is a little tricky.

Question 8



Consider the three clusters A, B, and C shown in Figure 1. Using Euclidean distance as the similarity measure, which two clusters would be merged first in agglomerative clustering using single link?

Your Answer		Score	Explanation
◉ A and B	✔	1.00	
○ B and C			
○ A and C			
○ All three options above are tied			
Total		1.00 / 1.00	

Question Explanation

A and B. The closest point in A to B is (5,5). The closest point in A to C is (3,4). The closest point in B to A is (7, 4). The closest point in B to C is (7, 3). Single link between clusters is defined as the similarity between the most similar members. At each step, we want to merge two clusters with the smallest single link distance. Since (5,5) and (7,4) have the smallest distance between them of all possible pairs, A and B should be merged first.

Question 9

Recall from Lecture 4-8 that the objective of learning generative models is to find the parameters that maximize the likelihood of the observed data. Suppose we have a set of points D drawn from Gaussian distribution. For D = {-1, 0, 1}, which of the following set of parameters (μ, σ) produces the maximum L(N(μ, σ2): D)?

Your Answer		Score	Explanation
◉ μ = 0, σ = 2	✖	0.00	
○ μ = 1, σ = 0			
○ μ = 2, σ = 0			
○ μ = 0, σ = 1			

Total	0.00 / 1.00

Question Explanation

μ = 0, σ = 1. The maximum likelihood estimator for μ in a Gaussian distribution is the sample mean, and the maximum likelihood estimator for σ2 is the sample variance. Something similar in spirit is done in the M-step of the k-means algorithm, where the average of all points in a cluster becomes the new centroid in order to minimize the sum of distance.

Question 10

Consider the three hierarchical clustering algorithms introduced in Lecture 4, BIRCH, CURE, and CHAMELEON. Which of the following statements about these algorithms is TRUE? (Select all that apply)

Your Answer		Score	Explanation
☑ CHAMELEON requires a graph as the input.	✖	0.00	
☑ All three algorithms can only work with Euclidean distance as the similarity metric.	✖	0.00	
☑ BIRCH and CHAMELEON both use a divisive method to partition the objects into small groups first before merging them back to form the final clusters.	✔	0.25	
☑ CHAMELEON and CURE are better at capturing irregular shaped clusters than BIRCH	✔	0.25	
Total		0.50 / 1.00	

Question Explanation

CHAMELEON and CURE are better at capturing irregular shaped clusters than BIRCH (True. By merging graphlets, CHAMELEON is able to capture complex shapes. CURE forms complex shapes by merging small disks. BIRCH tends to produce spherical clusters as limited by the diameter and radius parameters.)

BIRCH and CHAMELEON both use a divisive method to partition the objects into small groups first before merging them back to form the final clusters. (True. BIRCH uses the CF Tree to

divide the dataset into micro-clusters, whereas CHAMELEON breaks up the kNN graph into small graphlets. Both then merge these small units into larger clusters.)

All three algorithms can only work with Euclidean distance as the similarity metric. (False. They can work with any similarity metric.)

CHAMELEON requires a graph as the input. (False. CHAMELEON constructs the kNN graph from a set of objects by measuring the distance between objects and linking each to the k nearest neighbors.)