Alexandria University
Faculty of Engineering
Computer and Communications Program

Due : Sunday 10/3/2019
CCE :Pattern Recognition

Sheet#3 Normalized Cut and Kmeans Clustering

Submit a report and the codes used. Report is essential.
Normalized Cut

Kmeans Clustering

1. Use the k-means algorithm and Euclidean distance to cluster the following 8 examples into 3 clusters: A1=(2,10), A2=(2,5), A3=(8,4), A4=(5,8), A5=(7,5), A6=(6,4), A7=(1,2), A8=(4,9). The distance matrix based on the Euclidean distance is given below:

	A1	A2	A3	A4	A5	A6	A7	A8
A1	0	$\sqrt{25}$	$\sqrt{36}$	$\sqrt{13}$	$\sqrt{50}$	$\sqrt{52}$	$\sqrt{65}$	$\sqrt{5}$
A2		0	$\sqrt{37}$	$\sqrt{18}$	$\sqrt{25}$	$\sqrt{17}$	$\sqrt{10}$	$\sqrt{20}$
A3			0	$\sqrt{25}$	$\sqrt{2}$	$\sqrt{2}$	$\sqrt{53}$	$\sqrt{41}$
A4				0	$\sqrt{13}$	$\sqrt{17}$	$\sqrt{52}$	$\sqrt{2}$
A5					0	$\sqrt{2}$	$\sqrt{45}$	$\sqrt{25}$
A6						0	$\sqrt{29}$	$\sqrt{29}$
A7							0	$\sqrt{58}$
A8								0

   Suppose that the initial seeds (centers of each cluster) are A1, A4 and A7. Run the k-means algorithm for 1 epoch only. At the end of this epoch show:
   a. The new clusters
   b. The centers of the new clusters
   c. Draw a 10 by 10 space with all the 8 points and show the clusters after the first epoch and the new centroids.
   d. How many more iterations are needed to converge? Draw the result for each epoch.

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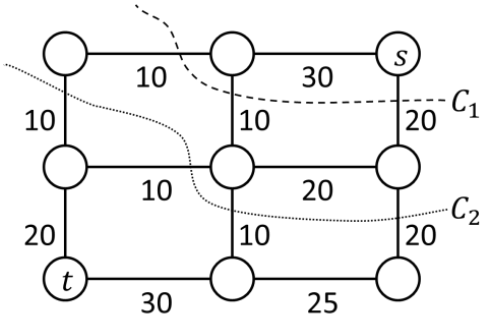
Normalized Cut

1. Given the graph below. The weight on each edge is the affinity between two nodes. Consider the two cuts
2. C_1 and C_2 in the graph. For each cut, compute the values of the graph cut and the normalized cut. Which cut will be favored by each algorithm? What is your explanation**?**



3. **Write your python code** to implement K ways normalized cut k=3
   a) Use RBF kernel with gamma = {0.01,0.1,1,10}. Which of these gamma values produces a connected graph? Plot the normalized eigenvectors using (Y vectors as in pseudo code) **scatter3d**
   b) Use Similarity graph as the 3-NN graph. Where Sim(xi,xj)=1 iff xj is one of the nearest three points to xi (or vise versa). Plot the normalized eigenvectors using (Y vectors as in pseudo code) **scatter3d**