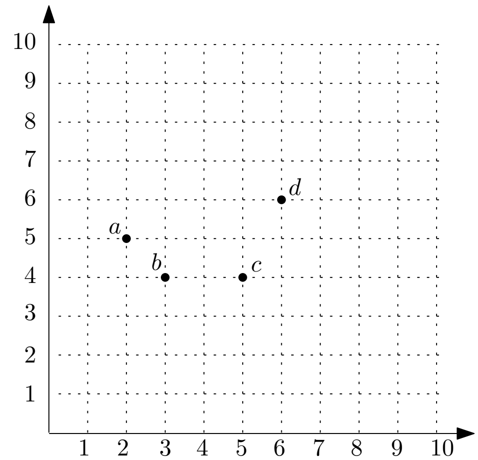
CMSC5724: Exercise List 9

Answer Problems 1-2 based on the following dataset:



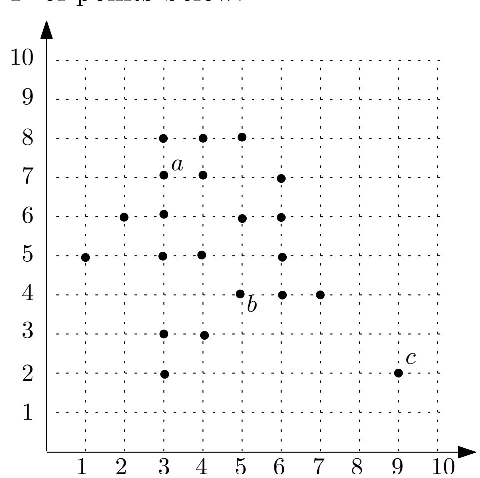
Problem 1. Recall that, in discussing hierarchical clustering, we introduced 3 distance metrics on two sets of points: *min*, *max*, and *mean*. Let $S_1 = \{a, c\}$ and $S_2 = \{b, d\}$. What is the distance between S_1 and S_2 under those three metrics, respectively (assuming that the distance of two points is calculated by Euclidean distance)?

Problem 2. Show the dendrogram returned by the Agglomerative algorithm under the min and max metrics, respectively.

Problem 3. Suppose that we use d_{min} to define the similarity of two clusters C_1, C_2. Give an algorithm to compute the dendrogram on n points in $O(n^2 \log n)$ time. You can assume that the dimensionality is a constant.

Problem 4. Suppose that we use d_{mean} to define the similarity of two clusters C_1, C_2. As discussed in the lecture, $d_{mean}(C_1, C_2) = \frac{1}{|C_1||C_2|} \sum_{(p_1,p_2) \in C_1 \times C_2} dist(p_1, p_2)$. Give an algorithm to compute the dendrogram on n points in $O(n^2 \log n)$ time. You can assume that the dimensionality is a constant.

Problem 5. Consider the set P of points below:



Set $\epsilon = 1$ and $minpts = 3$. Show the clusters output by DBSCAN, assuming that the distance metric is Euclidean distance.

Problem 6. Given a pair of parameters ϵ and *minpts*, describe an algorithm to compute the DBSCAN clusters in $O(n^2)$ time, assuming that the distance metric is Euclidean distance, and that the dimensionality of the data space is a constant.