Indian Institute of Technology Jodhpur
Machine Learning I, Fractal-2
Quiz 1

Date: April 04, 2021, Max Marks: 5

Max Time: 30 min (Including the submission time)

`Attempt all the questions. Best of luck` ☺

1. Let $\mathbf{x}_1 = \begin{bmatrix}1\\0\\1\end{bmatrix}$, $\mathbf{x}_2 = \begin{bmatrix}1\\1\\0\end{bmatrix}$, and $\mathbf{x}_3 = \begin{bmatrix}0\\2\\1\end{bmatrix}$ be three vectors in $\mathbb{R}^3$. Find the length of each vector. Find the Euclidean distances $\|\mathbf{x}_1 - \mathbf{x}_2\|_2$, $\|\mathbf{x}_2 - \mathbf{x}_3\|_2$, and $\|\mathbf{x}_3 - \mathbf{x}_1\|_2$. Determine, which two vectors are closest and which two vectors are farthest. Also, determine the pairwise inner products $\mathbf{x}_1^\top \mathbf{x}_2$, $\mathbf{x}_1^\top \mathbf{x}_2$, and $\mathbf{x}_3^\top \mathbf{x}_1$. [**1.5 Marks**]

2. Let $\left\{\begin{bmatrix}1\\1\end{bmatrix}, \begin{bmatrix}2\\2\end{bmatrix}, \begin{bmatrix}7\\7\end{bmatrix}, \begin{bmatrix}8\\8\end{bmatrix}\right\}$ be a set of four points. Let $\begin{bmatrix}3\\1\end{bmatrix}$ and $\begin{bmatrix}5\\7\end{bmatrix}$ be two initial centers. Perform one iteration of the k-means algorithm. Will it converge in one iteration? Justify your answer. [**2 Marks**]

3. Find the value of the ratio-cut for the below graph with shown cut. [**1.5 Marks**]