Roll No:

Date:

Formative assessment 4
ME-781, Aug 11, 2023

Max Marks: 10, Total time: 15 minutes

- No explanation for any question would be provided.
- Please make any assumptions as you see fit and solve the questions.
- This is an open-notes exam.
- You need not derive anything from scratch if it was derived in the class.
- You are not allowed to use a computer or calculator.

3x2

1. On a flat ground, several flags have been hosted on poles. Each flag has an (x, y) co-ordinate location and a height z. Hence, this arrangement of flags leads to a data set of an ordered triplets (x, y, z). If there are n such flags, then it leads to a nx3 matrix. Each row of the nx3 data matrix corresponds to the feature row vector of the data set or data point X_k k = 1,…., n.
   i) Which Data Scales do the three variables of the ordered triplets (x, y, z) belong to?
   X and y are interval scale, z is ratio scale.
   ii) If a norm is used as a dissimilarity measures to quantify dissimilarity between two flags, then comment on the meaning of the following two norms:
   (a) $\|X_i - X_j\| = \sqrt{(X_i - X_j)\mathrm{A}(X_i - X_j)^{\mathrm{T}}}$, where $A_1 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$
   (b) $\|X_i - X_j\| = \sqrt{(X_i - X_j)\mathrm{A}(X_i - X_j)^{\mathrm{T}}}$, where $A_2 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1000 \end{bmatrix}$

   a) We are measuring Euclidian distance of the top of the pole.
   b) We are measuring Euclidian distance of the top of the pole, but are giving 1000 times more weightage to z. This could be because of some system requirement or difference in units.

4

2. The average age of a person in a country is 50 years. What is the maximum probability that you randomly meet 4 persons and all happen to be older than 100 years.

Prob (x≥100) ≤ E(x)/100 = 0.5

If we randomly meet 4 persons and all are above 100, then the probability is the product of each
i.e.
Prob (age of all 4 random persons ≥100) = (Prob (x≥100))^4 ≤ (0.5)^4 =0.0625