

# Lecture notes - Clustering and Persistence SF2704

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## 1 introduction

The big goal for this lecture series is to understand metrics by searching for a metric between metric spaces. This has been proven to be impossible (ref), but despite the lack of a grand metric of metrics we can still try to search within (common word for ultrametrics, barcodes etc) to at least get a grasp on certain parts.

## 2 notes

### note 1

Skeleton for note 1

### note 2

*Metric space*  $(X, d)$  where  $X$  is a finite set and  $d$  is a distance between the points in this finite set.

$$|X| < \infty \quad (1)$$

$$d(x, x) = 0, d(x, y) = d(y, x), d(x, y) + d(y, z) \leq d(x, z) \forall x, y, z \in X \quad (2)$$

A interesting submetric is the *ultrametric* which has a stronger triangle inequality constraint

$$\max\{d(x, y), d(y, z)\} \leq d(x, z) \forall x, y, z \in X \quad (3)$$

Stated in another way for an ultrametric any 3 points will have the following property

<image of triangle with the sides (a, a, b <= a)>

## **note 9**

Skeleton for note 9.

## **3 exercises**

exercise 1

## **4 code**