TOPOLOGICAL DATA ANALYSIS

ASSIGNMENT 2
DUE DATE: 15TH FEBRUARY

Write an interactive Python code that does the following job.

(1) Let n be a positive integer bigger equal 3.
(2) Let X_n be the following set of n-tuples of points in $\mathbb{R}^2$

$$X_n = \{(x_1, \ldots, x_n) \in (\mathbb{R}^2)^n \mid ||x_i|| = 1, \forall i, x_n = (0,-1)^T \text{ and } \sum x_i = (0,0)^T\}.$$

Write a piece of code that will genarate, say 200, random points of X_n.
(3) The point cloud generated above is your data set.
(4) Compute the persistent homology of the generated point cloud (in dimensions $0, 1, 2$) and express it in terms of a persistence diagram.
(5) Your submission should be the code (along with intermediate explainatory notes at appropriate places) in a notebook. Also prepare a table of values $n, \beta_0(X_n), \beta_1(X_n)$ and $\beta_2(X_n)$ for n at least 6 or 7.

Date: February 5, 2022.