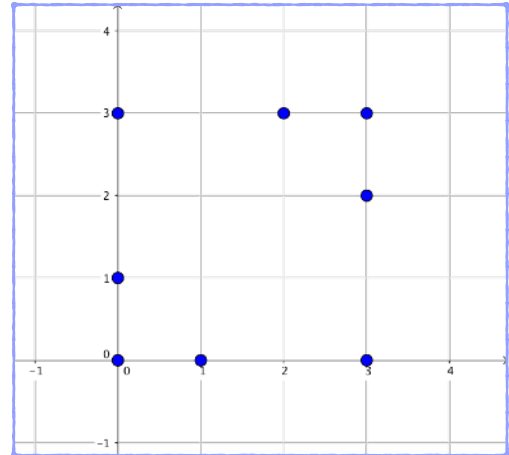


Persistent Homology Algorithm Toolkit

Before starting: Install the Python interface for PHAT following the instructions at <https://fugacci.github.io/home/Installation.pdf>

This Lab Session is devoted to taking a first contact with the Python interface of PHAT.

Purpose of the lab is to compute and to draw the persistent homological information of the toy point cloud depicted on the right.



The following steps should be considered:

1. Construct the **boundary matrix M** associated to the **Vietoris-Rips filtration** of the input point cloud (consider the simplices up to dimension 2)
2. Compute the **persistence pairs of matrix M** (both the “finite” and the “infinite” persistence pairs of M should be retrieved)
3. Retrieve the **persistence pairs of the original filtration** defined for the Vietoris-Rips complex
4. Visualize through a **persistence diagram** the computed persistence pairs

START FROM STEP 2 - (LET STEP 1 BE THE LAST DEVELOPED STEP)

Some comments and suggestions about the above steps:

Step 2.

- Take as input the provided boundary matrix associated to the input dataset (adopted representation: vector_vector): <https://fugacci.github.io/home/MatrixColumns.txt>

Step 3.

- Use as conversion table from total ordering values to filtration values the list provided at <https://fugacci.github.io/home/TotalOrderingToFiltration.txt>

The filtration value of the i^{th} simplex with respect to the total order is the value encoded in the i^{th} position of the provided list

Step 4.

- Feel free to use any visualization tool you know. If you don't know any of them, give a look at **pyplot**: https://matplotlib.org/api/pyplot_api.html

Step 1.

- Any issue in the generation of the simplices spanned by the nodes of the point cloud? Give a look at **intertools**: <https://docs.python.org/3.0/library/itertools.html>