MXB361 Module 2: Prac 2

Computational Structures in DNA: reconstructing curves

Topics:

- Some more on Hilbert curves (Section 2.1);
- Reconstructing curves (Section 2.2);

Recall that all this work is to be done in your allocated groups, and forms the foundation steps of the group project.

2.1 Some more on Hilbert curves

- Complete Prac1.
- Code and implement a 3D version of the Hilbert curve, with iteration level n.
- Compute the number of turning points as a function of n.
- Provide a written explanation as to how the 3D code works. What structure is being replicated and how is it moved and rotated?

2.2 Reconstructing Curves

- For a given set of vertices, you need to carry out the following.
  - Compute the distance matrix.
  - Solve the Distance Geometry problem using both SVD and Schur.
  - Retrieve the set of vertices that represents the reconstructed curve.
  - Plot side by side the original and reconstructed curves.
  - Finally, consider how rotation can be applied to these reconstructed curves.

- The three sets of vertices you should work with are:

Set 1	$(-1,0)$	$(-1,1)$	$(-\frac{1}{2},\frac{1}{2})$	$(0,1)$	$(0,0)$
Set 2	$(-1,0)$	$(-1,1)$	$(-\frac{1}{2},\frac{1}{2})$	$(0,1)$	$(-\frac{1}{4},\frac{1}{4})$
Set 3	$(0,0,1)$	$(0,1,1)$	$(-\frac{1}{2},\frac{1}{2},1)$	$(-1,1,1)$	$(-1,0,1)$
	$(-1,0,0)$	$(-1,1,0)$	$(-\frac{1}{2},\frac{1}{2},0)$	$(0,1,0)$	$(0,0,0)$

- Consider the generalisation of the curve reconstruction to the 2D Hilbert case.