



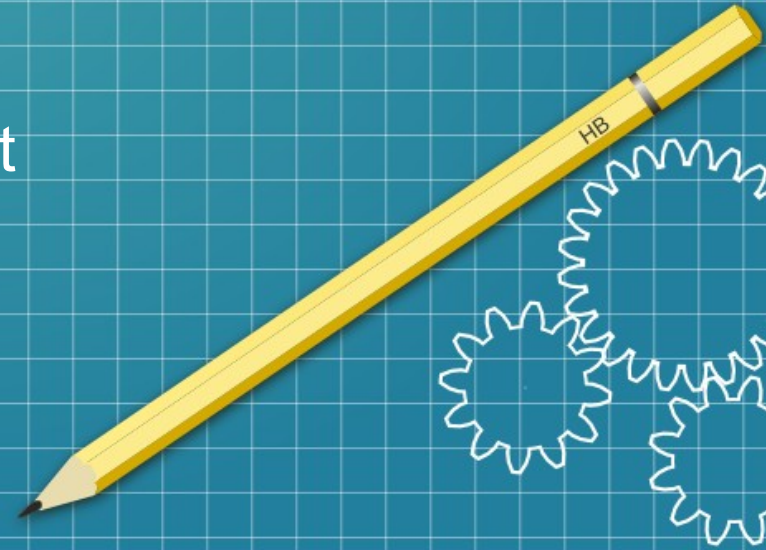
Linear Algebra - Project

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Topic: Investigating the relationship between
eigenvalues and graph properties

Types of Matrices

Related to this project



Adjacency and Affinity Matrix (A)



- The graph (or set of data points) can be represented as an Adjacency Matrix, where the row and column indices represent the nodes, and the entries represent the absence or presence of an edge between the nodes.

Degree Matrix (D)

- A Degree Matrix is a diagonal matrix, where the degree of a node (i.e. values) of the diagonal is given by the number of edges connected to it. We can also obtain the degree of the nodes by taking the sum of each row in the adjacency matrix.

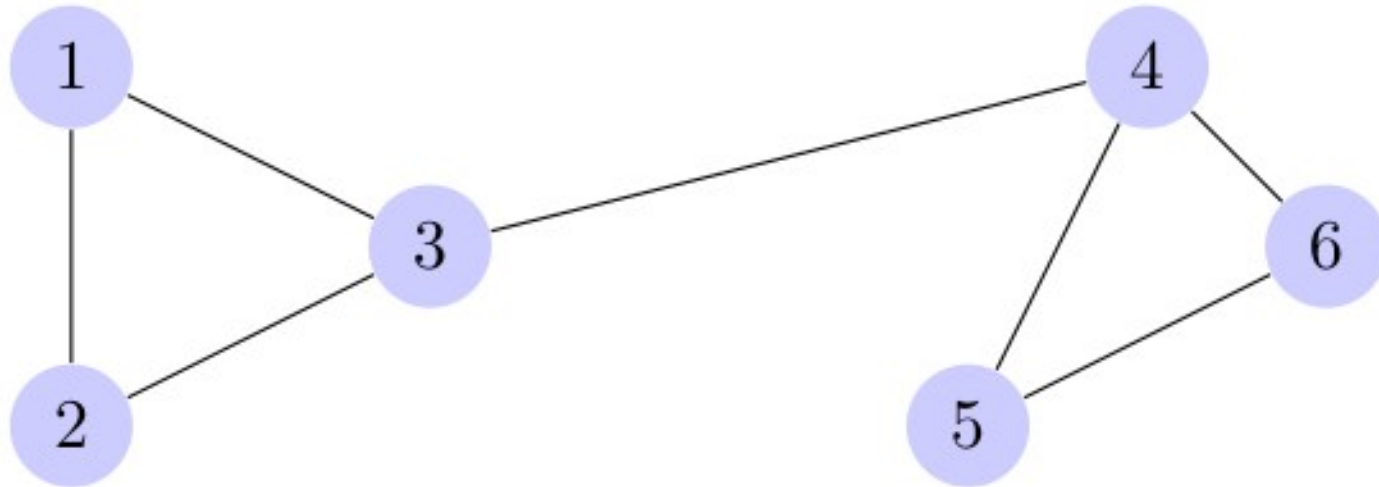


Laplacian Matrix (L)

- Laplacian matrix is obtained by subtracting the Adjacency Matrix from the Degree Matrix (i.e. $L = D - A$).



Example



For the above graph

$$A = \begin{bmatrix} 0 & 1 & 0 & 0 & 1 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 \end{bmatrix}$$

$$D = \begin{bmatrix} 3 & 0 & 0 & 0 & 0 & 0 \\ 0 & 2 & 0 & 0 & 0 & 0 \\ 0 & 0 & 3 & 0 & 0 & 0 \\ 0 & 0 & 0 & 3 & 0 & 0 \\ 0 & 0 & 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 0 & 0 & 3 \end{bmatrix}$$

$$L = \begin{bmatrix} 3 & -1 & 0 & 0 & -1 & -1 \\ -1 & 2 & -1 & 0 & -1 & 0 \\ -1 & -1 & 3 & -1 & 0 & 0 \\ -1 & 0 & -1 & 3 & -1 & -1 \\ 0 & -1 & 0 & -1 & 2 & -1 \\ 0 & -1 & -1 & 0 & -1 & 3 \end{bmatrix}$$

