**PageRank**

PageRank is a model that was developed by Larry Page and Sergey Brin and was the first algorithm used by Google for ranking web pages within search engine results. It is based on the idea that the importance of a given page is determined by the number and quality of the links to that page. This is done by taking a directed graph of elements and converting it to an adjacency matrix. Keeping to the example of a google search, the nodes of the graph represent the individual pages on the search result page, and the edges represent the links between the pages, as shown in the example below.

A diagram of a diagram

Description automatically generatedA number grid with numbers

Description automatically generated

Figure 1: A Directed Graph and its Corresponding Adjacency Matrix

PageRank involves solving the linear system of equations set by , where A is the adjacency matrix, D is the diagonal out-degree matrix, I is the identity matrix, alpha is the damping factor, which was experimentally determined to be 0.85, n is the is the number of nodes in the graph, and e is a vector of all 1s. To derive D, the out-degree diagonal matrix, we sum the out-degrees across each row and assign it to the diagonal node. For example, the diagonal matrix for the graph in figure 1 would be represented as:

Figure 2: Corresponding Diagonal Out-Degree Matrix for the Directed Graph

As we can see from the D matrix, node A has two outward edges, node B has two outward edges, node C has one outward edge, and node D has one outward edge, which lines up with the diagram of the graph in Fig. 1.

The next step to solve this would be to take the transpose of the adjacency matrix and the inverse of the D matrix, and multiply.

Then, solving for x becomes simple using the provided equation and a solver.

From this, we can see that node C has the highest rank, followed by node A, which lines up with the graph, as Node C has an in-degree of 3, and node A has an in-degree of 2.

This can be extended to use on other media, such as music platforms, e.g., Spotify. PageRank can enhance features present on the platform by using the algorithm’s ability to rank nodes within a graph structure, which can be derived based on a given artist’s musical attributes, such as genres, average track lengths, and such. By using PageRank on constructed graphs, music platforms can improve search results, recommendations, playlist suggestions, and social media interactions.