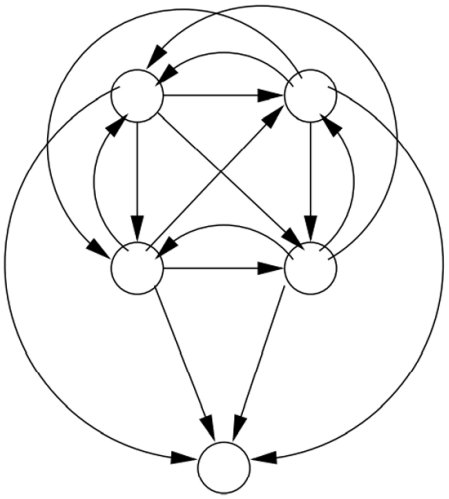
Exercise 3 - Link Analysis

Q1. Cliques and Dead Ends

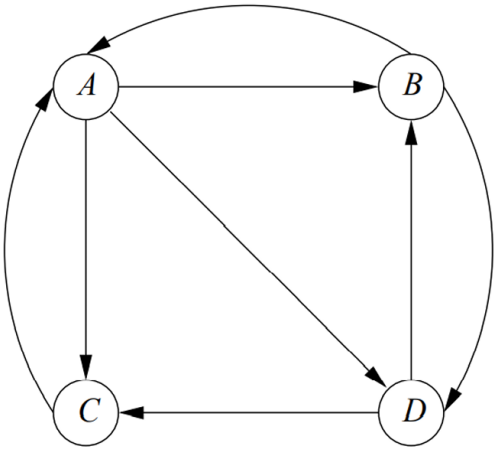
Consider a Web consisting of a *clique* (i.e., a graph such that every two different nodes are adjacent) of n nodes and a single additional node that is a successor of each of the n nodes in the clique. Below shows the Web for $n = 4$.



Determine the PageRank for each page, as a function of n and β, where n is the number of nodes, and β is the probability of following a random out-going link (i.e., $1 - \beta$ is the probability of jumping to a random node).

Q2. Topic-Specific PageRank

Compute the topic-specific PageRank for the graph below. Assume the teleport set is $S = \{A\}$ and the teleport probability $\beta = 0.8$.



Note. While a mathematical derivation is preferred, you are also allowed to use `numpy` or similar numerical linear algebra packages to solve the eigenvalue decomposition and provide numerical results. This will not affect your final score.

Q3. HITS, Hubs and Authorities

Compute the hub and authority vector $\mathbf{h}$ and $\mathbf{a}$ for the graph given below as a function of n, where n denotes the number of nodes in the graph.