Exercise 2

a All nodes in the clique have the same number of outgoing links. This means that each link has the same number of votes. The nodes in the clique also all have the same number of ingoing links, meaning the sum of the votes of their ingoing links is the same, thus their PageRank score is the same.

b Google Matrix: $A = \beta M + (1 - \beta)[\frac{1}{N}]_{N \times N}$
Modified: $A' = \beta MA + (1 - \beta)\frac{e}{n}$
e is a vector solely consisting of 1s, n is the number of pages. βMA is the probability of following an outgoing link, and the rest is the probability of a random teleport. Therefore, if the probability of a random teleport is 1.0, we get the following matrix: $A' = (1 - \beta)\frac{e}{n}$.

c Therefore, if the probability of a random teleport is 1.0, we get the following matrix: $A' = (1 - \beta)\frac{e}{n}$.

d Teleports solve the spider trap problem, because the probability of a random teleport is larger than 0, therefore in a finite number of steps, a random teleport is practically guaranteed. This leads to the user exiting the spider trap. For dead-ends, there is no possibility other than to randomly teleport, as there are no outgoing links. We set the probability of random teleports to 1.0, meaning that without fail everytime a dead-end is encountered, a random teleport takes place and the user leaves the dead-end.