1. **Exercise 5.1.1:** Compute the PageRank of each page in Fig. 5.7, assuming no taxation.

	a	**b**	**c**
a	1/3	1/2	0
b	1/3	0	1/2
c	1/3	1/2	1/2

$r = \begin{bmatrix} \frac{1}{3} \\ \frac{1}{3} \\ \frac{1}{3} \end{bmatrix}$

Na T iteraties $r * M$ te berekenen krijgen we $\lambda = \begin{bmatrix} \frac{3}{13} \\ \frac{4}{13} \\ \frac{6}{13} \end{bmatrix}$

2. **Exercise 5.1.2:** Compute the PageRank of each page in Fig. 5.7, assuming $\beta = 0.8$.

$A = \beta * M + (1 - \beta) * \left[\frac{1}{N}\right]_{NxN}$

$$A = 0.8 * \begin{bmatrix} 1/3 & 1/2 & 0 \\ 1/3 & 0 & 1/2 \\ 1/3 & 1/2 & 1/2 \end{bmatrix} + 0.2 * \begin{bmatrix} 1/3 & 1/3 & 1/3 \\ 1/3 & 1/3 & 1/3 \\ 1/3 & 1/3 & 1/3 \end{bmatrix}$$

We voeren vervolgens T keer r * A uit en krijgen $\lambda = \begin{bmatrix} \frac{7}{27} \\ \frac{25}{81} \\ \frac{35}{81} \end{bmatrix}$

3. **Exercise 5.1.3:** Suppose the Web consists of a clique (set of nodes with all possible arcs from one to another) of n nodes and a single additional node that is the successor of each of the n nodes in the clique. Figure 5.8 shows this graph for the case n = 4. Determine the PageRank of each page, as a function of n and β.

Voor iedere node geldt dat deze een connectie heeft naar de andere nodes met een waarde van $\frac{1}{N}$ behalve de successor node, deze heeft in de matrix een kolom die enkel uit nullen bestaat. voor bijvoorbeeld n = 4 zoals figuur 5.8 krijgen we:

$$\beta * \begin{bmatrix} 0 & 1/4 & 1/4 & 1/4 & 0 \\ 1/4 & 0 & 1/4 & 1/4 & 0 \\ 1/4 & 1/4 & 0 & 1/4 & 0 \\ 1/4 & 1/4 & 1/4 & 0 & 0 \\ 1/4 & 1/4 & 1/4 & 1/4 & 0 \end{bmatrix} + (1 - \beta) * \begin{bmatrix} 1/5 & 1/5 & 1/5 & 1/5 & 1/5 \\ 1/5 & 1/5 & 1/5 & 1/5 & 1/5 \\ 1/5 & 1/5 & 1/5 & 1/5 & 1/5 \\ 1/5 & 1/5 & 1/5 & 1/5 & 1/5 \\ 1/5 & 1/5 & 1/5 & 1/5 & 1/5 \end{bmatrix}$$

4. **Exercise 5.2.2 (a):** Using the method of Section 5.2.1, represent the transition matrices of the following graphs: (a) Figure 5.4.

source	**degree**	**destinations**
A	3	B,C,D
B	2	A,D
C	1	E
D	2	B,C

5. **Exercise 5.3.1 :** Compute the topic-sensitive PageRank for the graph of Fig. 5.15, assuming the teleport set is: ($\beta = 0.8$)

$$\begin{bmatrix} 0 & 1/2 & 1 & 0 \\ 1/3 & 0 & 0 & 1/2 \\ 1/3 & 0 & 0 & 1/2 \\ 1/3 & 1/2 & 0 & 0 \end{bmatrix}$$

(a) A only:

$$0.8 * \begin{bmatrix} 0 & 1/2 & 1 & 0 \\ 1/3 & 0 & 0 & 1/2 \\ 1/3 & 0 & 0 & 1/2 \\ 1/3 & 1/2 & 0 & 0 \end{bmatrix} + 0.2 * \begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

start T iteraties beginnende van $\begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \end{bmatrix}$ geeft ons v = $\begin{bmatrix} 3/7 \\ 4/21 \\ 4/21 \\ 4/21 \end{bmatrix}$

(b) A and C

$$0.8 * \begin{bmatrix} 0 & 1/2 & 1 & 0 \\ 1/3 & 0 & 0 & 1/2 \\ 1/3 & 0 & 0 & 1/2 \\ 1/3 & 1/2 & 0 & 0 \end{bmatrix} + 0.2 * \begin{bmatrix} 1/2 \\ 0 \\ 1/2 \\ 0 \end{bmatrix}$$

start T iteraties beginnende van $\begin{bmatrix} 1/2 \\ 0 \\ 1/2 \\ 0 \end{bmatrix}$ geeft ons v = $\begin{bmatrix} 19/50 \\ 17/100 \\ 27/100 \\ 17/100 \end{bmatrix}$

6. **Exercise 5.4.1 :** In Section 5.4.2 we analyzed the spam farm of Fig. 5.16, where every supporting page links back to the target page. Repeat the analysis for a spam farm in which:

   (a) Each supporting page links to itself instead of to the target page.

   (b) Each supporting page links nowhere.

   (c) Each supporting page links both to itself and to the target page.

7. **Exercise 5.4.2 :** For the original Web graph of Fig. 5.1, assuming only B is a trusted page:

   (a) Compute the TrustRank of each page.

$$0.8 * \begin{bmatrix} 0 & 1/2 & 1 & 0 \\ 1/3 & 0 & 0 & 1/2 \\ 1/3 & 0 & 0 & 1/2 \\ 1/3 & 1/2 & 0 & 0 \end{bmatrix} + 0.2 * \begin{bmatrix} 1/2 \\ 0 \\ 1/2 \\ 0 \end{bmatrix}$$

start T iteraties beginnende van $\begin{bmatrix} 0 \\ 1 \\ 0 \\ 0 \end{bmatrix}$ geeft ons v = $\begin{bmatrix} 27/100 \\ 9/25 \\ 4/25 \\ 21/100 \end{bmatrix}$

(b) Compute the spam mass of each page.

$$0.8 * \begin{bmatrix} 0 & 1/2 & 1 & 0 \\ 1/3 & 0 & 0 & 1/2 \\ 1/3 & 0 & 0 & 1/2 \\ 1/3 & 1/2 & 0 & 0 \end{bmatrix} + 0.2 * \begin{bmatrix} 1/4 & 1/4 & 1/4 & 1/4 \\ 1/4 & 1/4 & 1/4 & 1/4 \\ 1/4 & 1/4 & 1/4 & 1/4 \\ 1/4 & 1/4 & 1/4 & 1/4 \end{bmatrix}$$

T iteraties geeft ons v = $\begin{bmatrix} 3/9 \\ 2/9 \\ 2/9 \\ 2/9 \end{bmatrix}$

spam mass formule = $\frac{pagerank - trustrank}{pagerank}$

node	**spam mass**
a	0.19
b	-0.62
c	0.28
d	0.055

8. **Exercise 5.5.1 :** Compute the hubbiness and authority of each of the nodes in our original Web graph of Fig. 5.1.

$$L = \begin{bmatrix} 0 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 \\ 1 & 1 & 0 & 0 \end{bmatrix}, L^T = \begin{bmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 \end{bmatrix}$$

in de slides staat dat we h en a moeten initialiseren op $1/\sqrt{N}$, maar in het boek staat initialiseer op 1. Na het berekenen van h en a moet men steeds normaliseren, de maximum waarde in de kolom is 1.
$h = La$
$a = L^T h$

$$h = \begin{bmatrix} 0,2891 \\ 1 \\ 1 \\ 0.8136 \end{bmatrix}$$

$$a = \begin{bmatrix} 1 \\ 0.3919 \\ 0.1027 \\ 0.7108 \end{bmatrix}$$