# PageRank with random walkers

- Start random surfers **at all pages** with **equal probability** $\frac{1}{n}$

$$\vec{v}_0 = [1/n, 1/n, \ldots, 1/n] .$$

- **After one step,** the distribution will be

$$\vec{v}_1 = M\vec{v}_0.$$

- **After $k$ steps:**

$$\vec{v}_k = M^k\vec{v}_0.$$

- **Markov process:** The distribution approaches a limiting distribution $\vec{v}$ such that $\vec{v} = M\vec{v}$ if
  - The graph is **strongly connected:** can get from a node to any other node.
  - No **dead ends:** nodes that have no out-links.