Solution for exercise 4.4.3 in Karlin and Pinsky

The Markov Chain in 4.4.3 is a reversible Markov chain and we can get the following relations

$$\pi_{i-1}p_{i-1} = q_i\pi_i$$

and therefore

$$\pi_i = \prod_{k=0}^{i-1} \frac{p_k}{q_{k+1}} \pi_0 \quad \forall 1 \leq i \leq N - 1$$

$$\pi_N = p_{N-1} \cdot \pi_{N-1} = p_{N-1} \prod_{k=0}^{N-1}$$

$$\pi_0 = \frac{1}{\sum_{i=0}^{N-1} \prod_{k=0}^{i-1} \frac{p_k}{q_{k+1}} + p_{N-1} \prod_{k=0}^{N-1}}$$