Solution for exercise 4.4.3 in Karlin and Pinsky

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

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

and therefore

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

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

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