1. Consider the Markov chain shown in Figure 1:
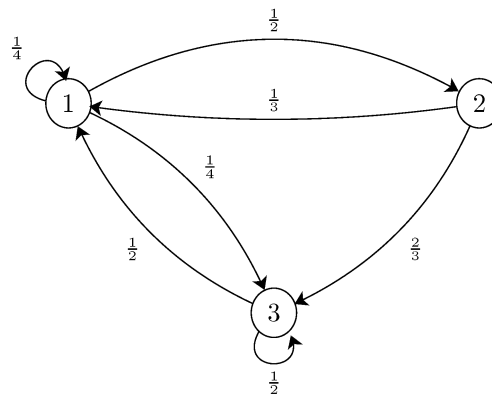

Figure 1

Let $X_0 = 1$ (i.e., the initial state of the chain is 1), and let R be the first time that the chain *returns* do 1. Find the expectation value of R.

2. Consider the Markov chain shown in Figure 2:
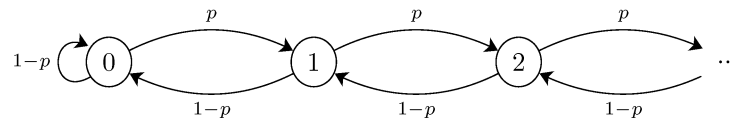

Figure 2

where

(a) $0 < p < \frac{1}{2}$

(b) $p = \frac{1}{2}$

(c) $\frac{1}{2} < p < 1$

Does this chain have a limiting distribution in any of these cases? If the answer is positive, find this distribution.