WST312 Stochastic Processes 2018
Practical 3

Consider the following stochastic matrix with state space $S = \{1,2,3,4\}$

$$P = \begin{bmatrix} 0 & 0.2 & 0.5 & 0.3 \\ 0.45 & 0.2 & 0.1 & 0.25 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}.$$

a) Write a program to determine which states are accessible from each state and which states communicate. Your program should run though each state to see which state it is accessible from and which states communicate. It should also output the results.

b) Write a program to determine the period of a state. (Hint: Calculate P^n for $n = 1,2,3,...N$ for some N and determine the smallest n such that each diagonal entry is non-zero. Give the final periods obtained. Test your code on the transition probability matrix above. Also test Theorems 3.3.3 – 3.3.5 on this matrix and comment.

Consider the stochastic matrix

$$P = \begin{bmatrix} 0.15 & 0.85 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0.1 & 0.4 & 0.5 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0.25 & 0.5 & 0.25 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.3 & 0.4 & 0.3 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.5 & 0.2 & 0.3 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0.45 & 0.25 & 0.3 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0.5 & 0.3 & 0.2 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0.7 & 0.2 & 0.1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.75 & 0.05 & 0.2 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.05 & 0.95 \end{bmatrix}.$$

Write a program using proc iml to find the smallest integer N such that P^N has only non-zero elements. Include your output.

For all code mentioned above the question should be done using SAS proc iml as well as in R.