Chem/Stat3240: Homework 7b
Matlab

October 15, 2015

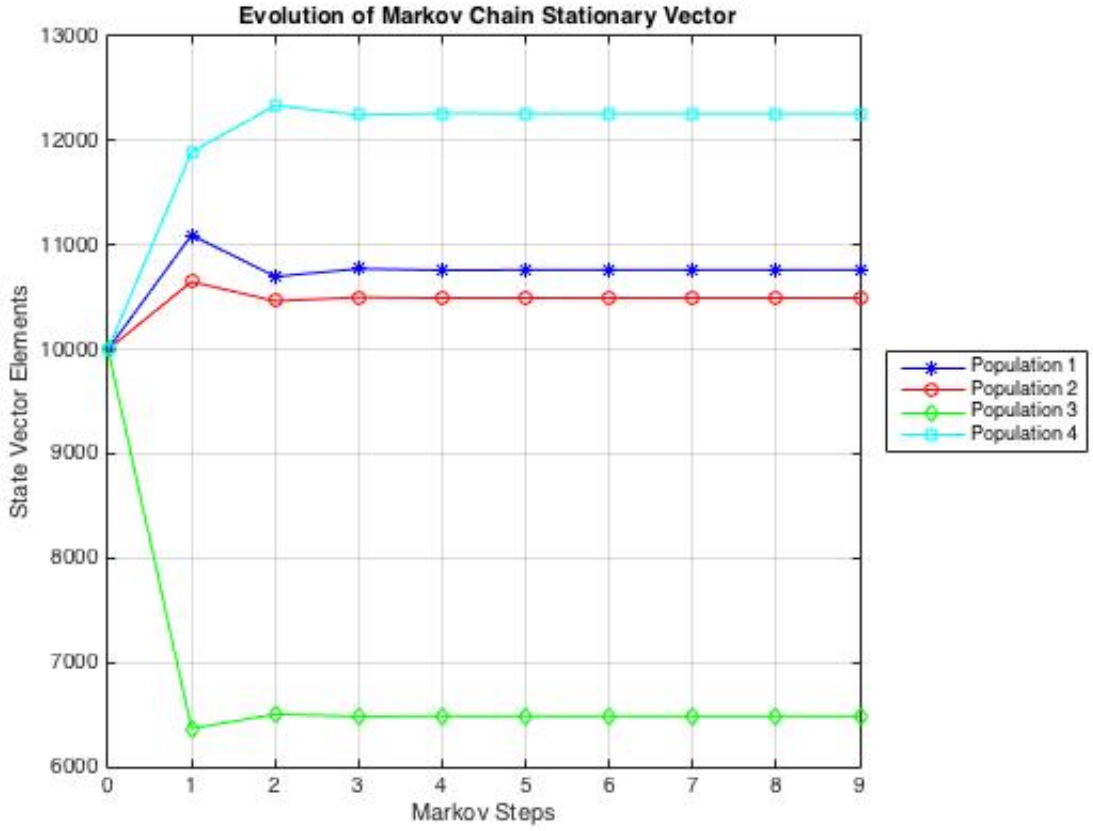
1. If the matrix P is a probability matrix, then the elements in each column of the matrix must sum to 1 since each column corresponds to the transition probabilities for a given element of the state vector x. Write a function `transitionMatrix(n)` that generates a random $n \times n$ transition matrix. Hint: Use the rand command to generate the matrix and then divide the values in each column by an appropriate scalar. The `sum` command can be used here.

2. It appears from the output displayed in the output of Eg7_1 that the state vector tends to a fixed value. Complete the following function so that it performs as specified:

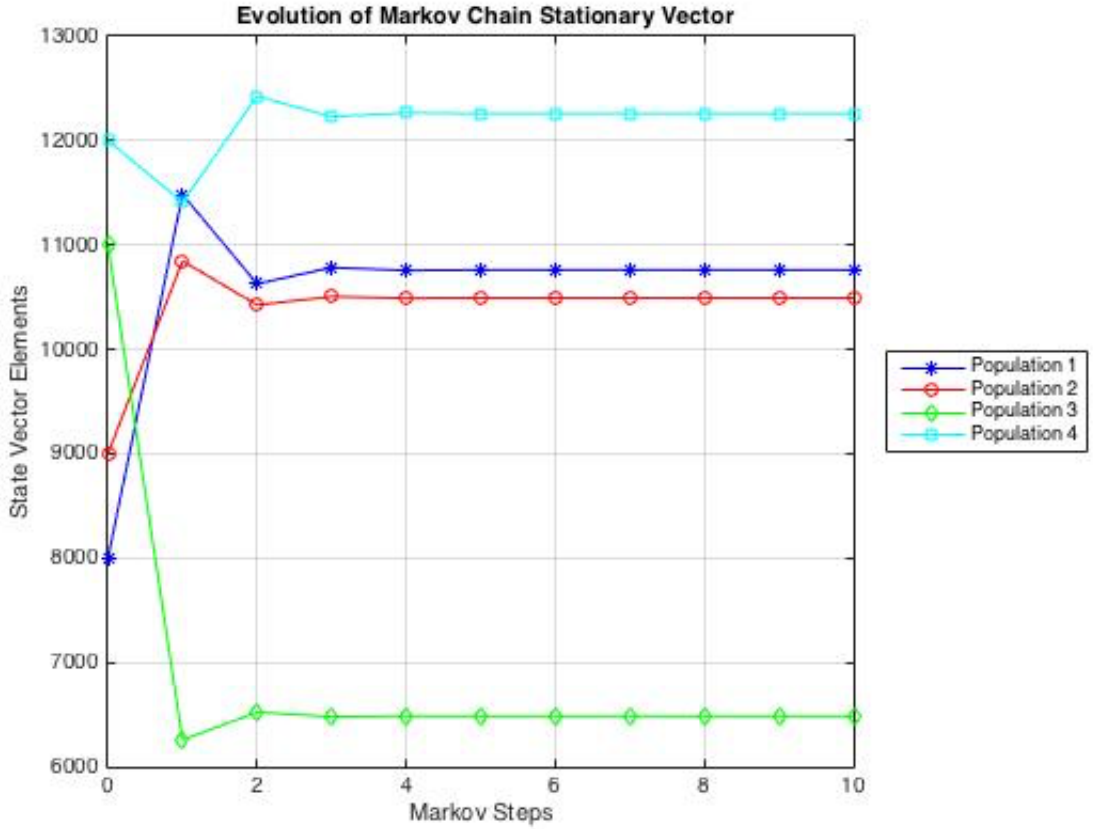
```
function y = stationary(P,x0,tol,itMax)
% P is an n-by-n probability matrix
% x is an n-by-1 initial state vector
% tol is a positive real number
% itMax is a positive integer
% Let x be the state vector after M Markov steps.
% If there is an M <= itMax
% such that sum(abs(P*x - x)) <= tol, then y=x.
% Otherwise, y is the
% state vector after itMax steps.
```

Use your function transitionMatrix to create a $n \times n$ transition matrix P and make the initial state vector a $n \times 1$ column vector with each element equal to 10,000. Let tol=1e-2, and itMax=1e2. Use a matrix multiplication operation to compute the new state vector rather than the `Transition` function. If $n = 4$, the function `stationary`

should plot how the state vector changed as it iterated to determine the stationary vector as shown in the plot below. This will involve concatenating each newly computed state vector x to a matrix of state vectors. Note also that the zero-th Markov step corresponds to the initial state vector x.



Now set the initial state vector to [8000,9000,11000,12000] and confirm the final state vector is approximately the same, as shown in the plot below.



Submit the functions `transitionMatrix` and `stationary` to Cody and the course collab site, and the pdfs of the two plots of the iteration to the stationary vector to the course collab site.