INTRODUCTION FOR GENERALIZED SNAKE AND LADDER GAME

The game of generalized snake and ladder game is defined by the following.

1. Set of possible positions S={0,1,2,….N-1} ; the game starts at initial position=0

2. A set of snakes and ladders are given by {(u1,v1), (u2,v2),…,(um,vm)} where the number

of positions and the total no of the pairs of snakes and ladders i.e. m are either

given by the player or set default by the game software.

3. Here the default no. of the position is 100 and the no. of pairs is 10.
4. At each step a throw of the die determines the step size Di which takes value j with probability pj. We assume the sides of the die before starting the game.
5. Here we are making the game never ending by making N equivalent to 0.

MOTIVATION

1. Here the input variables i.e. the board size, the number of pairs of snakes and ladders and the number of sides of our die can be either set before the game or is determined by the software itself while playing the game. We are interested in the position vector after some point of the game keeping the input variables fixed over the game or changing as the game proceeds.

2. Moreover as the ith position depends on the previous position we can call forth the concept of Markov Process and construct the transitory probability matrix P (TPM) of the size NxN for a fixed input variables. Here N=board size.

3. We search for stationary distribution by simulating the TPM for nth number of time and see whether it can be characterized by any familiar probability distribution.

4. From the data generated by repeated throwing of die we construct the observed probability distribution and see how much it is consistent with the theoretical distribution computed from the TPM.

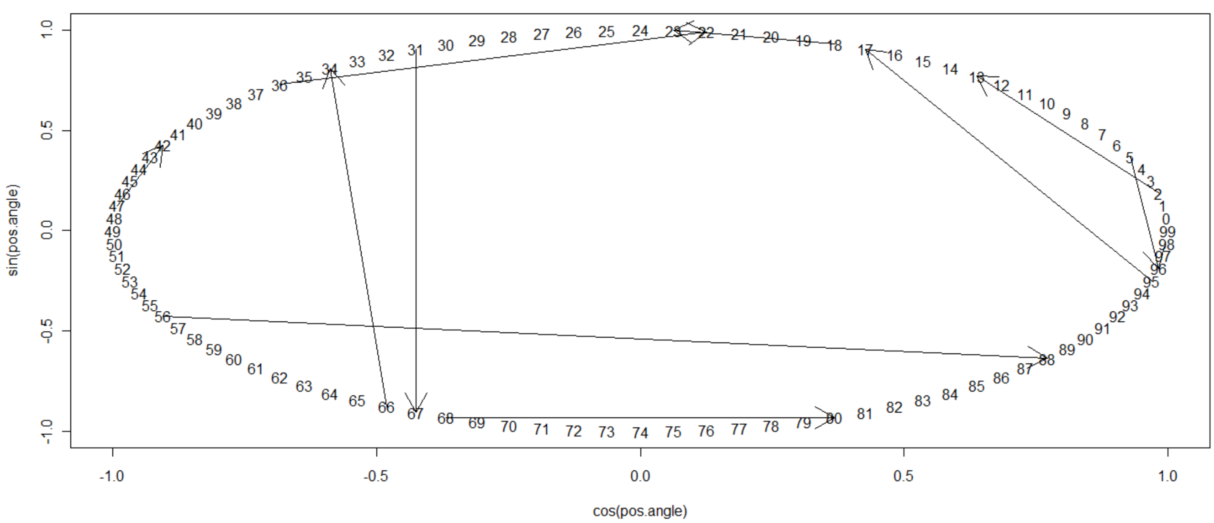
5. We are curious to see after how many steps the positions come in to steady state in both cases i.e. theoretical and observed distributions.

6. Again we can assume each resultant position as time series data and find auto correlation function or a.c.f.

7. The objective is to ascertain the fact whether data in steady state are correlated within themselves or not. Autocorrelation exists when data do not achieve stationary state.

A BRIEF DESCRIPTION OF THE RESULTS OBTAINED

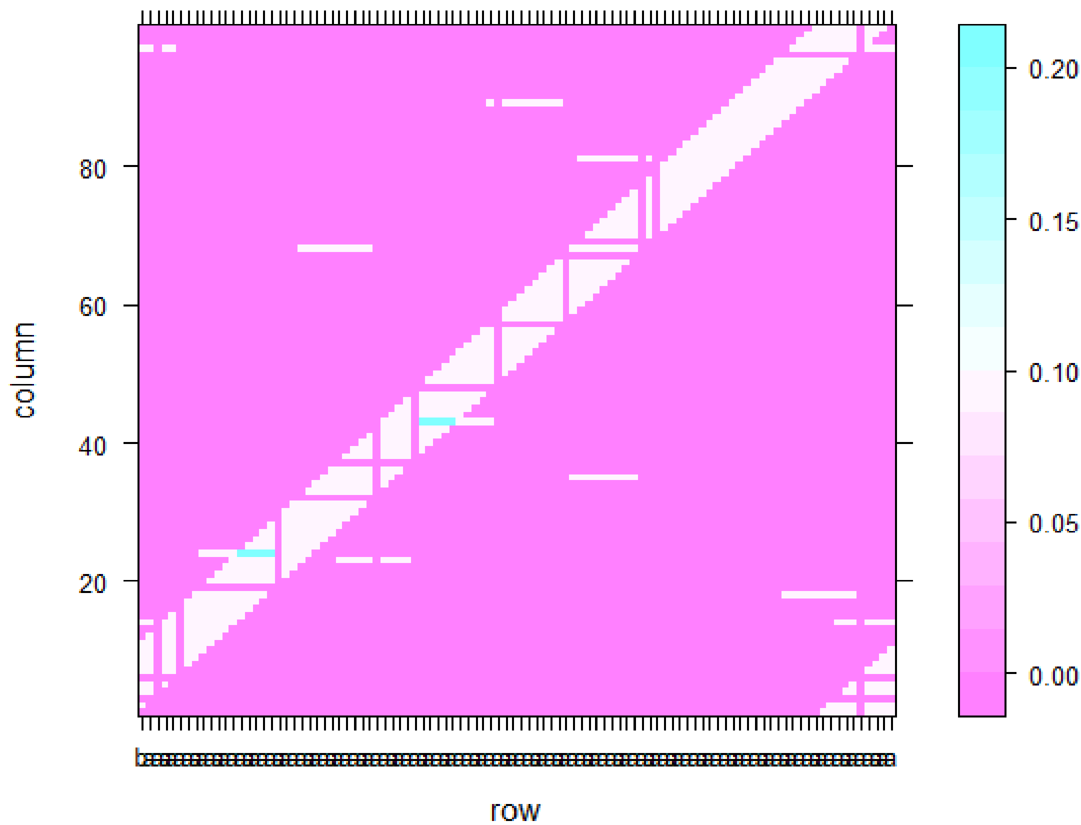
Figure 1: Board Configuration



Here the board size is 100 and no. of pairs of snakes and ladders are 10.

Now for die sides 10 the TPM looks like the below the diagram.

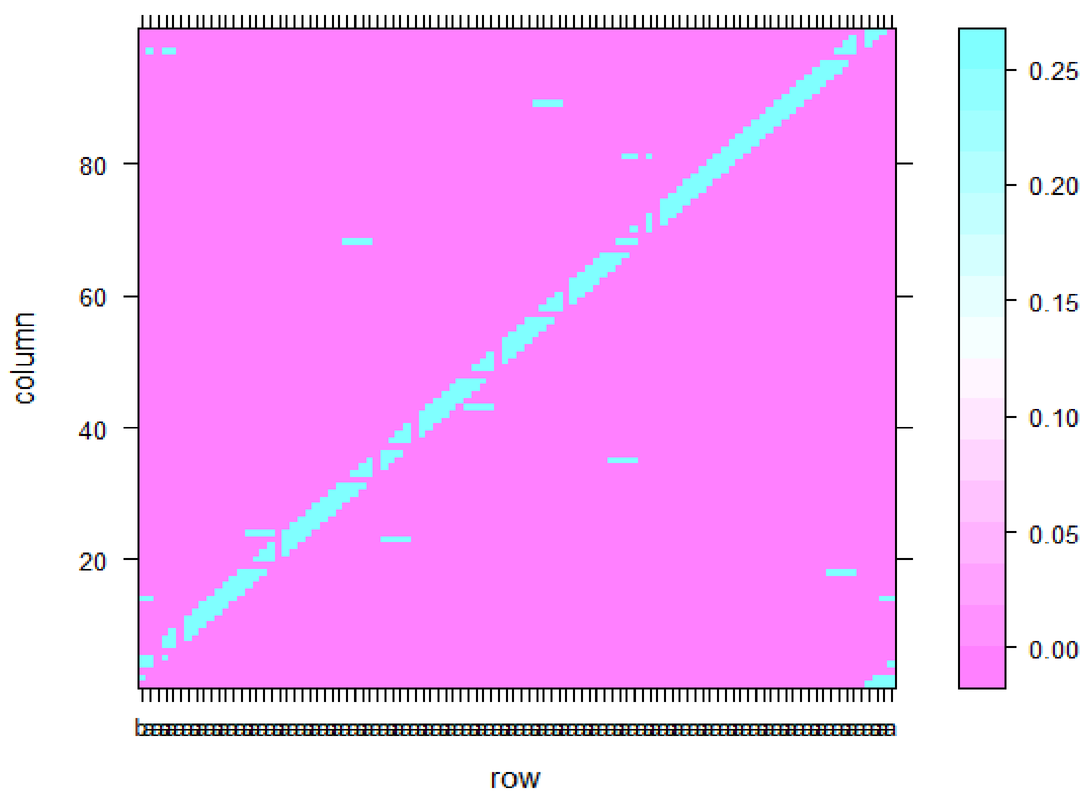
Figure 2



Here the board size=100, no. of snakes and ladders =10, die sides=10

When the die side is 4 we get the following TPM

Figure 3

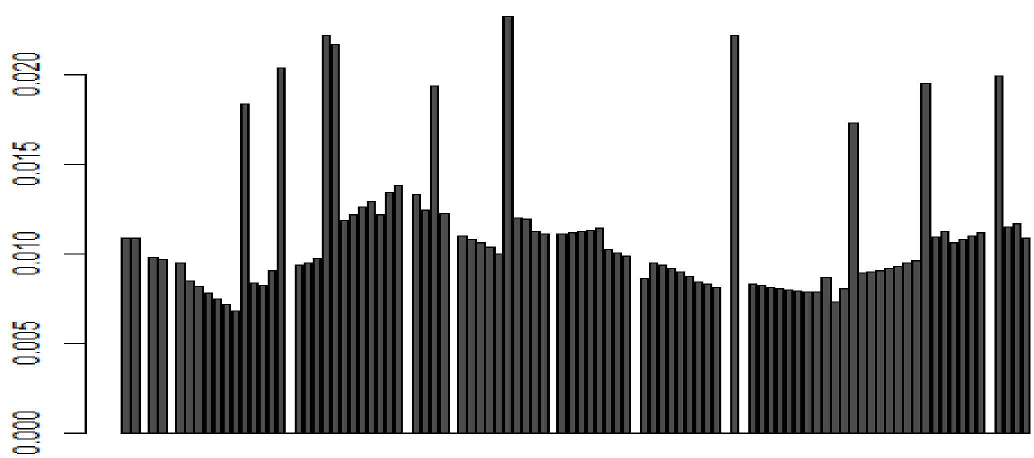


Here the board size=100, no. of snakes and ladders =10, die sides=4

Distributions

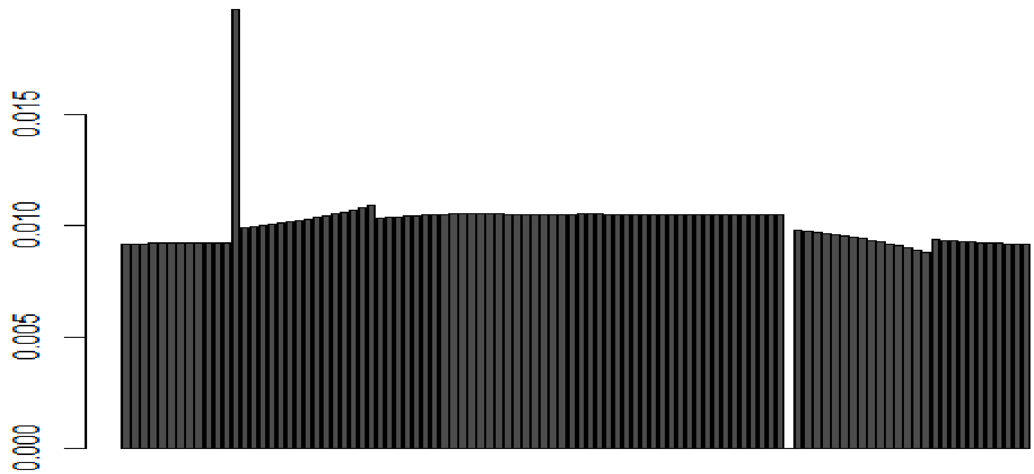
1. As the total number of snakes and ladders w.r.t the board-size decreases, the stationary distribution approaches a uniform distribution.
   We show the comparison when we have a board-size of 100,a single snake from 73 to 12 and with a board size of 100 and no. of snakes and ladders 10 with die sides 10.

Figure 4



Here the no. of snakes and ladders are 10.

Figure 5

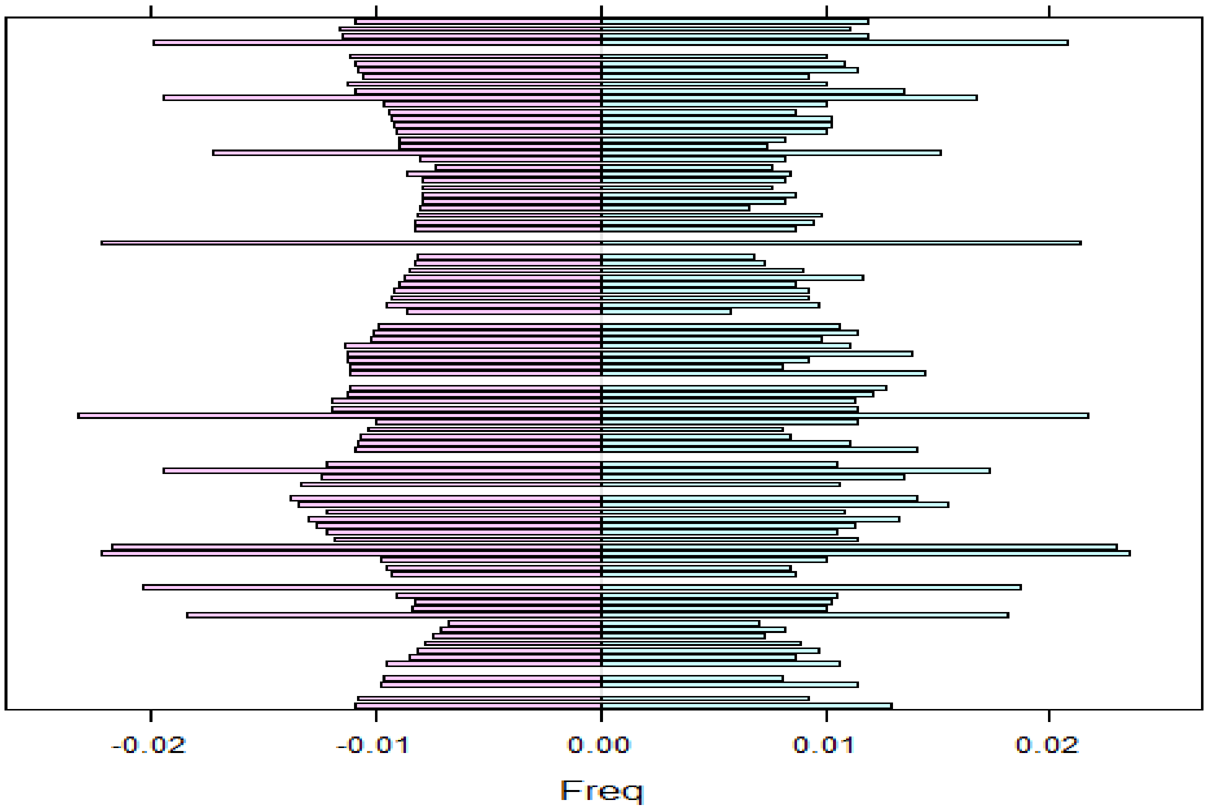


Here the no. of snakes and ladders are 1.

COMMENTS..

1. Also we have noticed the fact that if the configuration of board get changed the stationary distribution is also changed.
2. Theoretically as the number of sides of the die became smaller w.r.t the board-size, time required to achieve stationary state should decrease.
3. The differences between theoretical frequency distribution and observed frequency distribution diminish as time increases as the Figure 6 shows.

Figure 6



Red bars are theoretical frequency distribution and green bars are observed frequency distribution.

4. While checking for autocorrelation our data show insignificant a.c.f. As the following diagram shows.

Figure 7