Name: PARMESH YADAV

Roll No: 2020319

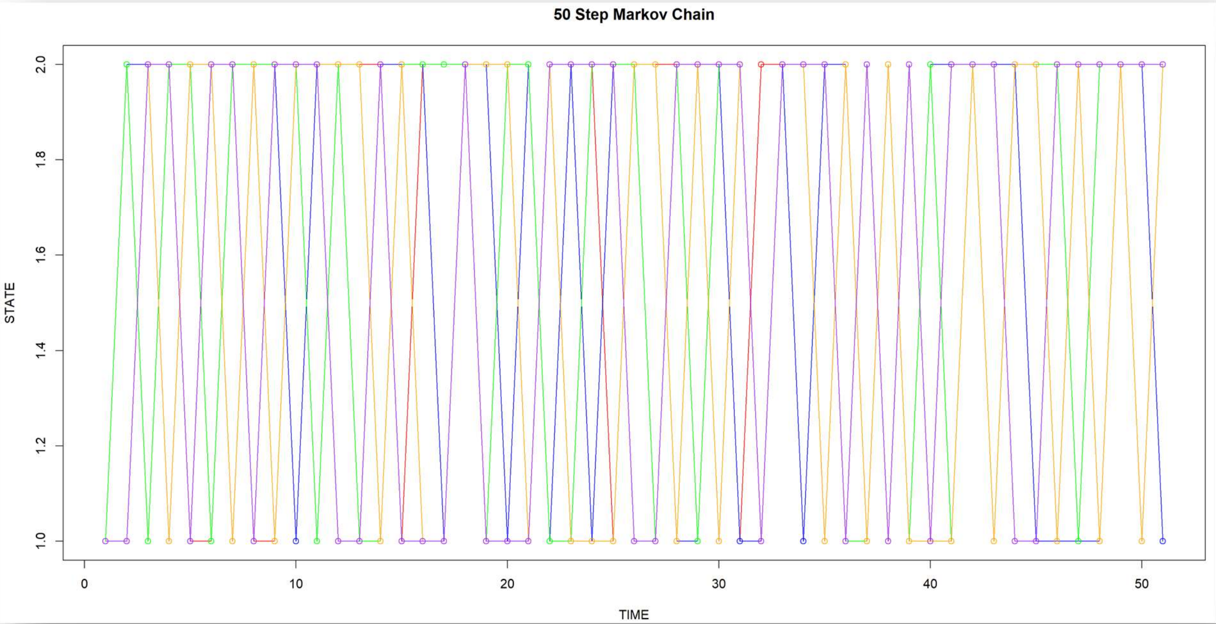
MTH-371 SPA

ASSIGNMENT 2

QUESTION – 1

Simulating a Discrete Time Markov Chain.

(a) Simulate 5 times a 50 step Markov Chain.



The above results were obtained by simulating a Markov Chain 5 times along 50 steps with State Space S = {1,2} with Transition Matrix P = [0.3,0.7,
0.5,0.5].

(b)

Calculate P^{10}, P^{20} and P^{50} for P = [0.3,0.7,
0.5,0.5].

As we can see in the output, we get the same values for P^{10}, P^{20} and P^{50}. This is known as the Stationary Distribution of Markov chain. Since this Markov chain is clearly irreducible and aperiodic, hence, the Stationary Distribution will be equal to the Limiting Distribution.

```
> print(p_10)
          [,1]      [,2]
[1,] 0.4166667 0.5833333
[2,] 0.4166666 0.5833334
> print(p_20)
          [,1]      [,2]
[1,] 0.4166667 0.5833333
[2,] 0.4166667 0.5833333
> print(p_50)
          [,1]      [,2]
[1,] 0.4166667 0.5833333
[2,] 0.4166667 0.5833333
>
```

QUESTION – 2

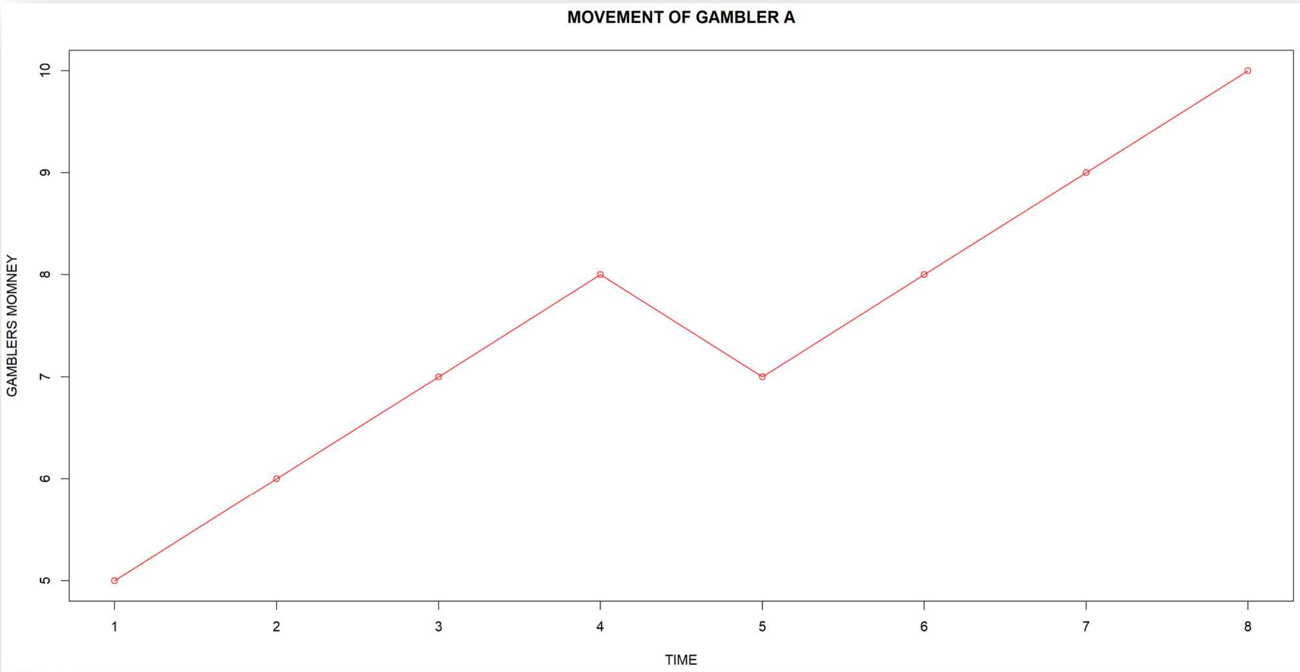
Gambler's Ruin Problem [1-D Random Walk].

2 Gambler's A and B start with 5$.

P = 0.8 ➔Probability of Winning of A

1-p = 0.2 ➔ Probability of Winning of A ➔ Probability of A losing

Plotting the movement of Gambler - A w.r.t Time.



According to the question, the max and min amount of money a player can win or lose in 10$ and 0$ respectively. This gives us the boundaries of the Random Walk. Therefore, we can see in the above simulation that A wins the game by reaching 10$ in 8 units of time.