## B.Tech V Semester (2024-25) MC 303: Stochastic Processes

## **Assignment-III**

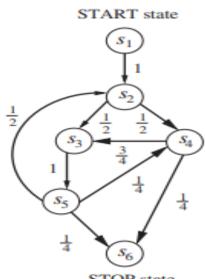
Hint: Ref. Chapter 7, Book Probability and Statistics with Reliability, Queuing and Computer Science Applications By KS Trivedi

- 1. Consider a system with two components. We observe the state of the system every hour. A given component operating at time n has probability p of failing before the next observation at time n+1. A component that was in a failed condition at time n has a probability r of being repaired by time n+1, independent of how long the component has been in a failed state. The component failures and repairs are mutually independent events. Let  $X_n$  be the number of components in operation at time n.  $\{X_n \mid n=0,1,...\}$  is a discrete-time homogeneous Markov chain with the state space  $I=\{0,1,2\}$ . Determine its transition probability matrix P, and draw the state diagram. Obtain the steady-state probability vector, if it exists.
- 2. Assume that a computer system is in one of three states: busy, idle, or undergoing repair, respectively denoted by states 0, 1, and 2. Observing its state at 2 P.M. each day, we believe that the system approximately behaves like a homogeneous Markov chain with the transition probability matrix:

$$P = \begin{bmatrix} 0.6 & 0.2 & 0.2 \\ 0.1 & 0.8 & 0.1 \\ 0.6 & 0.0 & 0.4 \end{bmatrix}$$

Prove that the chain is irreducible, and determine the steady-state probabilities

3. Given the stochastic program flow graph shown in following figure, compute the average number of times each vertex  $s_i$  is visited, and assuming that the execution time of  $s_i$  is given by  $t_i = 2i + 1$  time units, find the average total execution time of the program.



STOP state